Bang&Olufsen

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BANG & OLUFSEN

# PRODUCT DESCRIPTION BEOSYSTEM 5000

Beosystem 5000 consists of separate units – radio, tape recorder, record player and compact disc – and a Master Control Panel.

This product description includes the products that are marketed in the seasonal start:

Master Control Panel 5000
Beomaster 5000
Beocord 5000
Beogram 5000

At a later time we will make a similar description of the Compact Disc, Beogram CD 50.

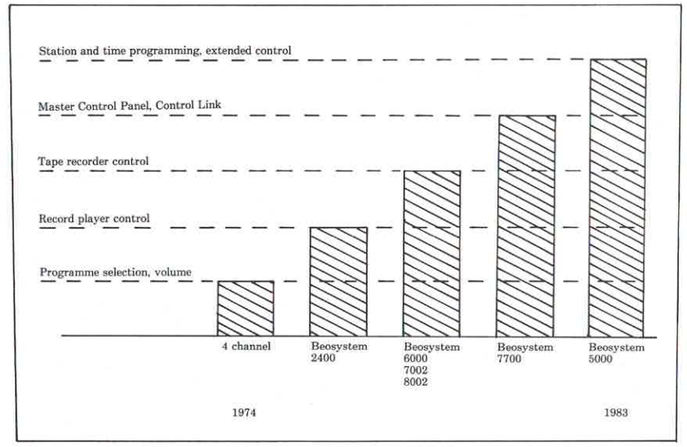
**Contents**



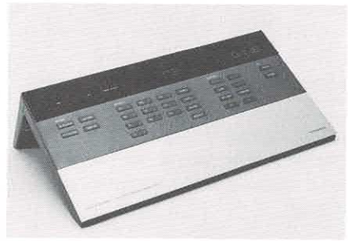


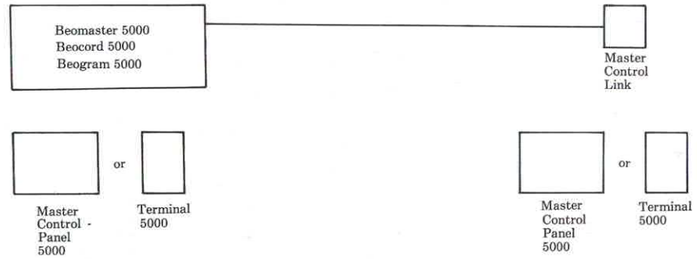
## MASTER CONTROL SYSTEM

The Beosystem 5000 employs the most advanced remote control system developed by Bang & Olufsen so far.




Originally, remote control meant a supplementary function, in which the primary functions could be operated from somewhere else in the room.
In the Beosystem 5000, nearly all operations and control of the entire hi-fi system are concentrated in a Master Control Panel.
And this Control Panel can also be placed in other rooms, as well as in the same room as the hi-fi unit.
The Beocenter 7700 was the first product with a Master Control Panel, and in the Beosystem 5000 the control options have been extended even further.
The term remote control no longer suffices, so we have chosen to use the following definitions:





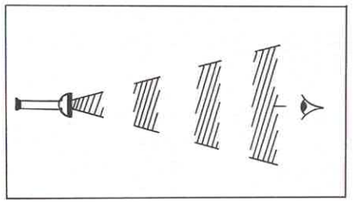

**Bang & Olufsen's Master Control.** This means that a system can be operated, no matter where you happen to be in the house.

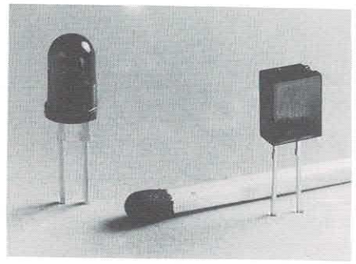
**Master Control Panel.** Operating unit with display on which you can select, control and program all functions and check that your instructions are carried out.

**Terminal.** Unit for controlling primary operations, without display. Can also be used with Master Control Links in other rooms.

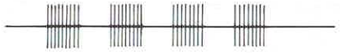
**Master Control Link.** Link to other rooms where you want speakers and to be able to use the central hi-fi unit.

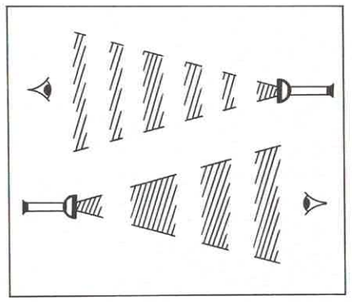
This operating system can be built up to meet individual requirements.





Transmitter Receiver





### Technology

The following technological processes are put to advanced uses in the Master Control system:

- Infra-red light for transmitting digital signals.
- Digital signals for control and feedback information.

### Infra-red light

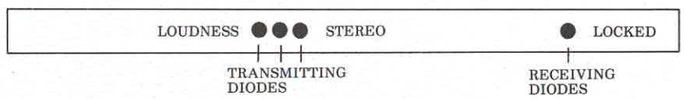
There is nothing new in using infra-red light for remote control. The first B&O audio product to do so was the Beocenter 7700, while earlier designs, such as the Beomaster 2400, used ultrasound.
Infra-red transmission has a number of advantages over ultrasound: many more signal combinations can be built in, which provides an (in theory, unlimited) increase in operating options. The electronic circuits take up less space, and power consumption is lower.
The transmission of signals can be illustrated as follows: We have a light source and an eye which picks up the ray from the light source. If we flash the light, the eye picks up a signal or series of signals.

We now replace the light source with a light-emitting diode, a small electric component which emits invisible infra-red light when we send a current through it.
And instead of the eye we use a photo-sensitive diode which can pick up these rays and convert them to electric potential.

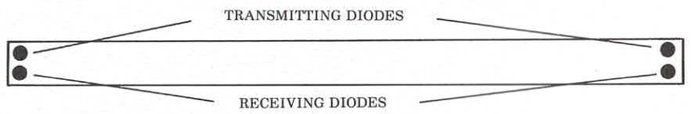
The ray is not constant; it is transmitted in pulses arranged in a certain pattern.
This is the principle behind one-way communication, as in the case of a Terminal.

Each button activates its own unambiguous pulse pattern from the Terminal which cannot be mistaken for any other pulse pattern from the Terminal.

If we also set up infra-red transmission in the opposite direction, we get two-way communication, and this is the principle used in the Master Control Panel.
From the Control Panel we send an instruction saying what we want the hi-fi unit to do, just like a Terminal. And information is sent from the hi-fi unit telling the Control Panel what to indicate on its display, as confirmation that the instruction has been carried out.

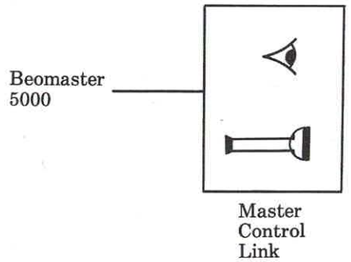


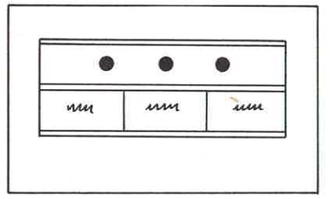

In the Beomaster 5000 the diodes are on the uppermost front panel, between the LOUDNESS and STEREO indicator lights.

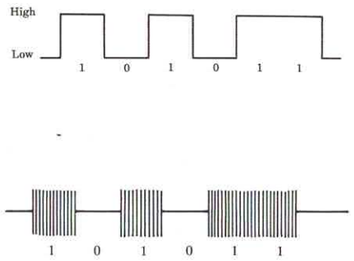


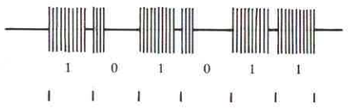

The Control Panel has two pairs of transmitting and receiving diodes, one in each corner on the front face.
This means that the positioning of the Control Panel in relation to the Beomaster 5000 is relatively non-critical.

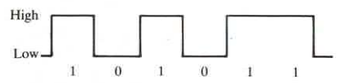







### Infra-red light and Master Control Link

The invisible infra-red light rays cannot penetrate soled materials any more than visible light rays can and therefore cannot go through walls or doors.
So if we want to use the Master Control Panel from another room we have to insert a link between the Control Panel and the radio receiver.
This is done with an »extra eye« or photo-sensitive diode, and a light emitting diode, both of which are placed in the other room.
This extra transceiver – transmitter/receiver – is connected to the hi-fi unit by a cable.

The infra-red diodes are placed behind the top panel on the Master Control Link box.

### Digital signals

The control signals which are sent backwards and forwards between the Master Control Panel and the hi-fi unit, and between the hi-fi unit's individual elements (Beomaster, Beocord and Beogram), are digital signals. These are based on the binary system of numbers, in which only two values, low and high, 0 or 1, appear in various combinations, e.g. 101011:

Electrically, this particular combination looks like this.

With infra-red transmission, the same signal looks like this as far as the Beocenter 7700 and previous Beocenter and Beomaster models are concerned. High levels correspond to a 40 kHz modulation of the infra-red ray, while there is no emission for low values.
Each pulse train is repeated 4 times to ensure correct transmission.

### More advanced system in Beomaster 5000

A different method of infra-red transmission is used in the Beosystem 5000. 1 and 0 are both modulated, 1 for a longer period (75%) of a certain time interval than 0 (25%).
This modulating method has several advantages:

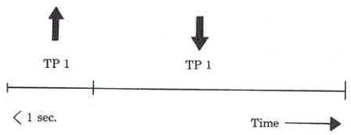
- Increase discrimination in rejecting wrong signals.
- Less sensitive to other light sources.
- Better equipped to transmit long (multi-digit) pulse trains.
- Renders repetition of every single pulse train superfluous.

### From Control Panel to Beomaster 5000

When we press a button on the Control Panel a 16-digit signal is sent to the Beomaster 5000 via infra-red transmission. The Beomaster's micro-computer converts this code to a pure high/low digital signal without 40 kHz modulation, and this is used in the Beomaster itself and transmitted via data-link cables to the Beocord and Beogram.

### From Beomaster to Control Panel

When the Beomaster 5000 has accepted the instruction, it sends an infra-red signal back to the Control Panel with information to light the appropriate figures and symboles on the display. The number of digits can vary from 16 to 56 depending on the instruction.
For example, a VOLUME adjustment only needs a short response, whereas a change of programme or STATUS information needs to be more extensive.




### The display on the Control Panel

This entire transmission and feedback process takes place in less than one second. The display on the Control Panel is activated as soon as we press a button, so that we can see straight away which instruction is being transmitted. A second later the display shows the feedback from the Beomaster. Normally we don't notice the change because the same information is displayed in both cases.
If the display switches from TP1, for example, to NO TAPE, it is the Beocord 5000 which sends a code signal via the Beomaster 5000 that there is no cassette in the holder.
On the other hand, if it switches to NO TRANSMISSION, it can be because something is preventing infra-red transmission, in which case it is the Control Panel's own micro-computer which triggers the display.

### Beomaster 5000

All digital signals go through the Beomaster 5000's micro-computer, including those which only involve another part of the system, e.g. starting fast forward on the Beocord 5000.
In other words, the Beomaster 5000's micro-computer is the master for the entire hi-fi system.

This micro-computer is responsible for a variety of functions, the most important of which are:

- Time programming.
- Infra-red communication.
- Data-link communication with the Beocord and Beogram.
- FM and AM frequency synthesis.
- Volume, bass, treble and balance adjustment.
- Protecting the output amplifier from overload by reducing the volume.

The micro-computer's external store is used for:

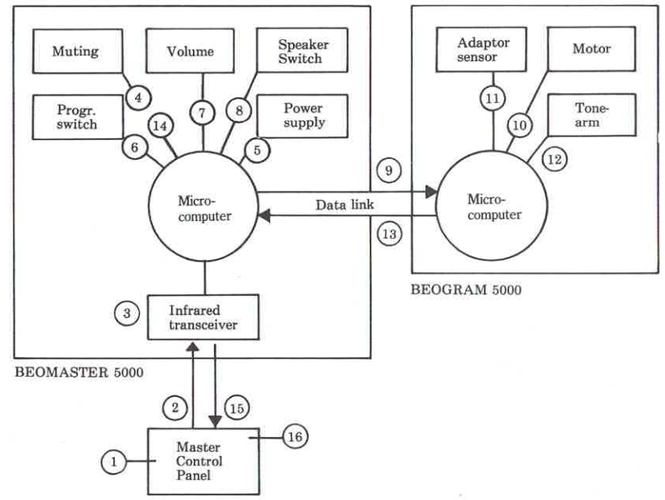
- Storing programmed stations.
- Storing time programmes.
- Storing volume and tone adjustments.
- Storing the clock and day of the week.

### Hardware and software

In the description of the Master Control system so far, we've seen how the digital signals or pulse trains are transmitted between the micro-computers of the various elements in the system.
This is the structure which allows the micro-computers to operate – known as hardware.
What goes on inside the micro-computer – the work program – is a result of the philosophy behind the Beosystem 5000: this is known as software, and constitutes a major part of the development process.

A micro-computer is therefore a very special component.
The manufacturer naturally provides certain general specifications, such as capacity, on the basis of which the various types of micro-computer which satisfy the various criteria are chosen. But Bang & Olufsen's own engineers design the program for each type, and the manufacturer integrates this software program into the component.



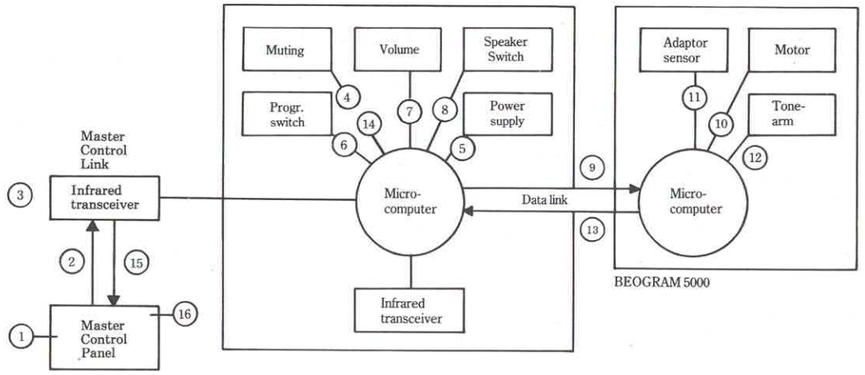



### An example: PHONO

Let's say we want to hear a record on the Beogram 5000 and press PHONO on the Master Control Panel.

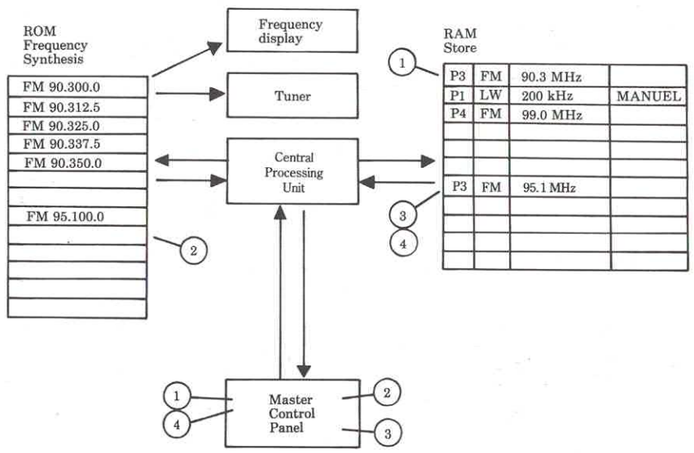
1. The Control Panel's micro-computer sends a digital signal to the infra-red transmitter. The display confirms the instruction.
2. The pulse train is emitted as invisible light.
3. The infra-red transceiver in the Beomaster 5000 picks up the rays, removes the 40 kHz modulation frequency and feeds the information to the micro-computer.
4. The Beomaster 5000's internal muting circuit cuts in, so that during the subsequent operations no sound comes out of the speakers.
5. The power unit is activated.
6. The programme selector switches to PHONO.
7. Volume is adjusted to the preset level.
8. The speakers are cut in.
9. The instruction to start is sent to the record player's micro-computer via the data-link to the Beogram 5000.
10. The power supply starts the motor at 33 rpm.
11. The adaptor sensor checks that there is a record on the platter and whether it is a 30 or 17 cm record.
12. If there is no record on the platter, the message NO DISC is fed back via the data-link to the Beomaster 5000 and relayed to the Control Panel's display.
13. A magnetic coil system activates the mechanisms which cue the tonearm and lower the pick-up onto the start groove.
14. The internal muting circuit cuts the amplifier in so that we can hear the sound through the speakers.
15. Information is fed back to the Control Panel via the infra-red transceiver.
16. The Control Panel display switches to show that the instruction has been carried out. The display switches off automatically after 5-6 seconds.

This is a simplified version of what really happens. In fact the micro-computers perform several other functions, e.g. checking the digital signals to prevent spurious operations.
In this example we have confined ourselves to the micro-computer's own fixed memory, ROM (Read Only Memory), which already »knows« what has to be done.
We cannot re-program this memory; it is designed soley to carry out and monitor the instructions we give the hi-fi unit.




### Via Master Control Link

We can also start our PHONO example via a Master Control Link. The only difference is that the micro-computer receives and transmits signals through a cable to the extra infra-red transceiver in the other room, rather than through the built-in units.




### Example: tuning and programming, FM

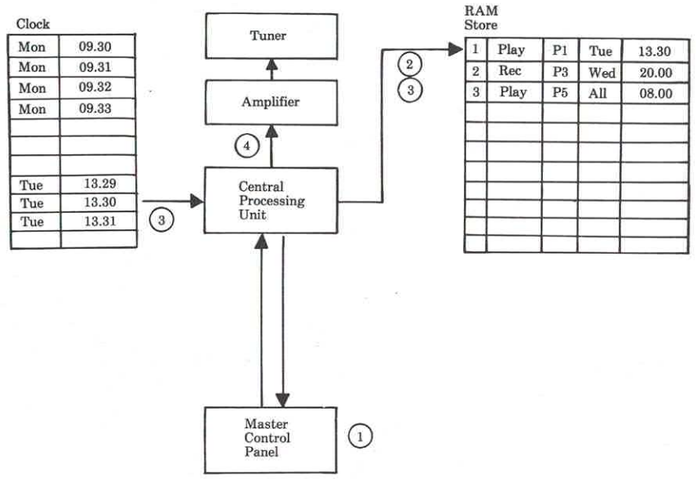
Here is an example of how we utilize the micro-computer's Random Access Memory (RAM) to program information for subsequent use, or change an existing program:
We wish to re-program P3 to 95.1 MHz. Up until now P3 has been programmed to 90.3 MHz.

1. We start by pressing P3 on the Master Control Panel.
   There is a line in the micro-computer's RAM store with a digital code for P3 FM 90.3 MHz, and this controls the tuner in the Beomaster 5000 through the frequency synthesizer.
   If there is a station transmitting on this frequency, we hear it played back through the speakers and the LOCKED indicator lights up, indicating that the tuner is locked to the stations's carrier wave.
2. We now press ADVANCE, searching for a station on a higher frequency. The frequency synthesizer starts moving up in steps of 12.5 kHz. If it encounters a station, say on 92.8 MHz, it stops automatically. However, we are not interested in this particular station, so we press ADVANCE again. The frequency synthesizer moves on and stops at 95.1 MHz, and LOCKED lights up.



   This is all done by using the ROM store along with several other components in the micro-computer. For instance, the frequency steps on FM are fixed at 12.5 kHz, but we can take these steps more rapidly by using the FAST button on the Beomaster 5000 in connection with MANUAL tuning.
3. We now press CONTROL, STORE and P3. The digital code in the frequency synthesizer is now entered in the RAM store and the previous P3 line is automatically erased.
4. From now on, pressing P3 will recall the new line from the RAM store, directing the tuner's frequency synthesizer to the new station.

The LOCKED function, locking the tuner to the station, is not stored in the Random Access Memory, as this would mean that the tuner could not adjust to the station's frequency. But a MANUAL tuning adjustment can be stored in the RAM, which is particularly usefull in the case where one tunes slightly off-station on LW to avoid interference from a neighbouring station.




### Time programming

The built-in electronic clock is used as reference in time programming.

1. We want to hear programme 1 tomorrow, Tuesday, at 13.30 and key the instruction on the Master Control Panel.
2. The instruction is entered on a line in the RAM store of the Beomaster 5000's micro-computer. The 12 lines available for this function can be allocated different days of the week, up to one week ahead.
3. The built-in clock, which is controlled by the mains frequency, 50 og 60 Hz, changes every minute and also shows the day of the week. When the clock reaches the programmed time, Tuesday 13.30, the same codes are in both stores.
4. This activates both the Beomaster 5000's amplifier and tuner, and the frequency synthesizer adjusts the tuner to the station frequency already programmed as P1. This will also be the case when the hi-fi system is in the middle of another programme, unless it is recording on tape.

## BEOMASTER 5000

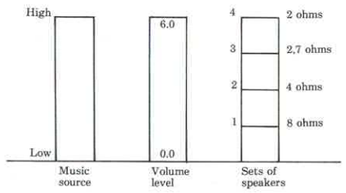
### Amplifier section

Compared to previous Beomasteres, the Beomaster 5000's amplifier has several new innovations:

- Automatic Power Handling Control, a system which reduces the volume when the output amplifier is overloaded.
- Active cooling of the output amplifier.
- An extensive connection panel, with both multiwire sockets with data link and phono plugs.

### Automatic Power Handling Control

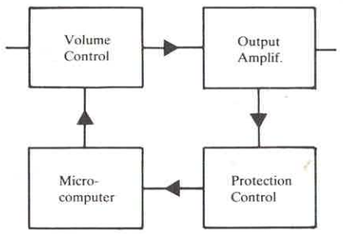
An output amplifier will be overloaded, i.e. loaded beyond its specified capacity, if it is subjected to the following conditions simultaneously:




- A low total load impedance, e.g. with 4 pairs of speakers cut in at the same time.
- The highest dynamic level from a programme source, as when an orchestra plays very loud, continuously.
- The volume is turned up full.

Most modern amplifiers have built-in electronic protection circuits which monitor the current and potential at the output stage or measure the temperature of the cooler element. When a certain limit is exceeded for a prolonged period of time, the amplifier is coupled out and falls silent.

The Beomaster 5000 has a new system, which automatically reduces the volume when the amplifier is overloaded.

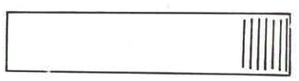



The amplifier in the Beomaster 5000 is specified to 2 x 50 watts at 8 ohms. An electronic circuit monitors the critical parameters in the output amplifier, and the micro-computer automatically adjusts the volume to a lower level as soon as these parameters exceed prescribed limits. This reduces the output power, and if the output is now below the critical level, that's all that happens.
Once the volume is recuded by the micro-computer it cannot be turned up again with the volume buttons until the music stops or moves to a quieter passage; or until some speakers are coupled out.
In other words, the Beomaster 5000 decides for itself how high an output it can handle, depending on how many speakers are coupled in.
The new Automatic Power Handling Control system provides the following advantages:

- Sound reproduction continues, without exceeding the distortion limit. In practice, the automtaic adjustment is imperceptible.
- The output amplifier is completely protected.

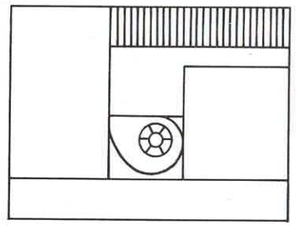
### Active cooling

The output transistors produce heat, which has to be diffused. This is normally done by using cooler elements. In Beomasters 6000 and 8000 these cooler elements, which are relatively large, are on the back of the unit.



The Beomaster 5000 is more compact, and the cooler element is integrated in the cabinet itself.





As a supplement to the cooler element, a low-noise ventilator has been built in, with a variable speed motor. When the cooler element reaches 50° Centrigrade the motor starts up at low speed; it operates at top speed at approximately 95° C. The air flow circulates past the cooler element and all components in the amplifier.
The ventilator rarely starts up in normal use. The amount of heat generated depends on how loud the music is played and for how long.

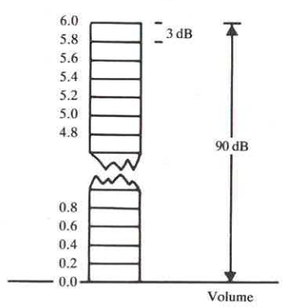
### Output amplifier

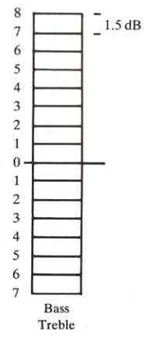
The Beomaster 5000's output amplifier has been designed on the same principles as its predecessors, Beomaster 8000, 6000 and 4400:

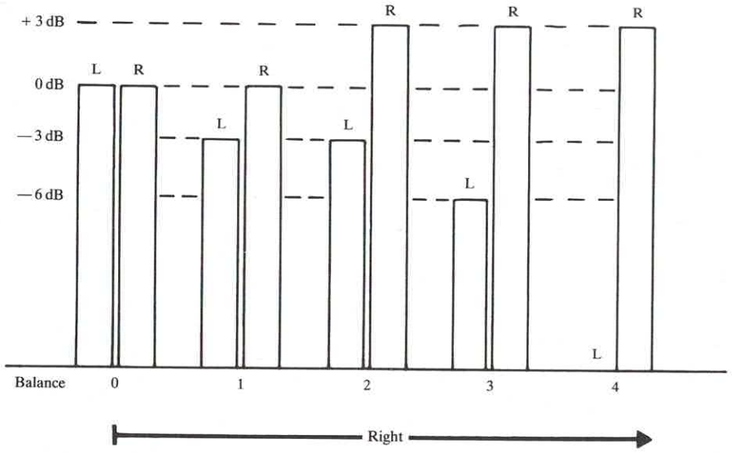
- Class AB output stage, providing optimum relationship between output power and waste hear.
- 2 x 50 watts output power at 8 ohms load.
- Cross-over and harmonic distortion minimized by using double negative feedback circuits amongst other things.
- Intermodulation distortion minimized by designing the ampliier so that it can handle large and fast voltage oscillations (high slew rate, high V/µs value, volts per microsecond).
- Transient Intermodulation Distortion (TID) minimized by using filters to limit the frequency range.
- Output transistors rated and connected so that the speakers's variable load has minimal effect on output.

### Sound, adjustment and programming

All the amplifier's sound adjustmetns – volume, bass, treble and balance – are electronic and can be controlled on the Master Control Panel.
These adjustments can be programmed so that they switch on at preset levels every time the amplifier is switched on.
VOLUME is adjusted in 30 3 dB steps and indicated on the Beomaster 5000's display.
The Master Control Panel display uses symbols and not numbers.
Bass and treble are adjusted with reference to a 0 value (corresponding to linear reproduction). There are 8 steps upwards and 7 down, which with 0 gives 16 1.5 dB steps, +12 dB and -10.5 dB.



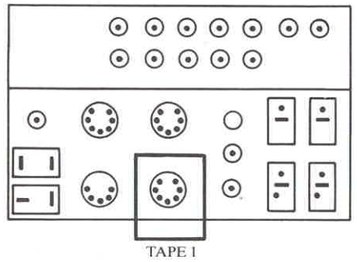




All these steps are handled as binary digit combinations when adjusted on the Master Control Panel, and stored in the memory store of the Beomaster 5000's micro-computer.
The volume buttons are on both the Control Panel and the Beomaster 5000 and have the same functions in both cases.

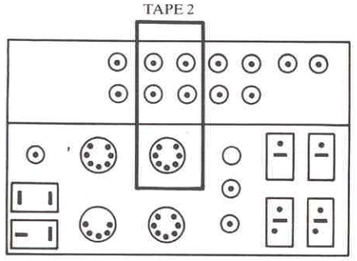
## Connections

All the connecting plugs are to be found on a panel placed out of sight on the back of the Beomaster 5000.
The measurements for the various plugs are specified according to the IHF standard.


TAPE 1

| | | |
|---|---|---|
| TAPE 1 | Beocord 5000<br>7-pin | |
| INPUT<br>PLAY | 25 mV/100 kohms<br>+ data link | |
| OUTPUT<br>RECORD | 400 mV/2 kohms | |

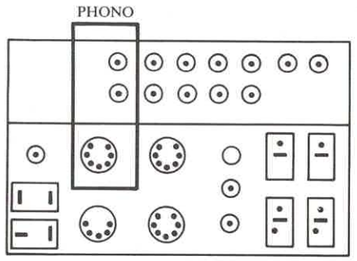
TAPE 2



| | | |
|---|---|---|
| TAPE 2 | Beocord LINE<br>7-pin | Other tape recorders<br>Phono Plugs |
| INPUT<br>PLAY | 25 mV/100 kohms<br>+ data link | 25 mV/100 kohms |
| OUTPUT<br>RECORD | 400 mV/2 kohms | 400 mV/2 kohms |

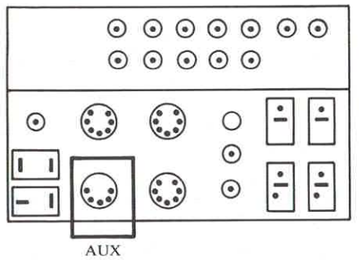
The immediate impression, that there are such widely divergent signal levels for INPUT and OUTPUT, is misleading. Nominally, both levels are 500 mV, but the specifications are different because of different measuring procedures: 25 mV input sensitivity is the signal voltage which has to be fed to the Beomaster 5000 during tape playback in order to get a 1 watt output with the sound turned up to maximum volume.
The 500 mV output voltage to the tape recorder is measured synchronously with an input of 5 mV to the PHONO input. This signal is adjusted downwards inside the tape recorder by RECORD LEVEL.
A Beocord model which has a data link can in principle be connected to either TAPE 1 or TAPE 2. Operation from the Master Control Panel will depend on which functions the particular Beocord is equipped with.

PHONO



| | | |
|---|---|---|
| PHONO | Beogram 5000<br>7-pin | Other record players<br>Phono plugs |
| INPUT | 0.29 mV/47 kohms<br>+ data link | 0.29 mV/47 kohms |

The input sensitivity applies to an output of 1 watt.

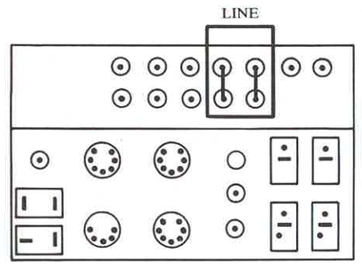

AUX

| | | |
|---|---|---|
| AUX | Compact disc<br>7-pin | |
| INPUT | 25 mV/100 kohms<br>+ data link | |

Programme sources other than a Compact Disc record player can be connected to the AUX socket: e.g. a Beovision receiver's sound channels, mono or stereo.

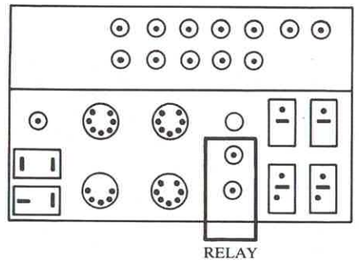


LINE



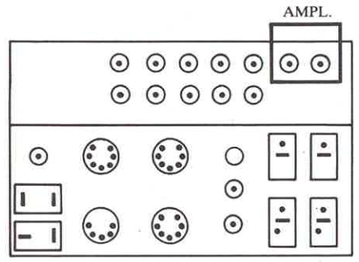
| | |
|---|---|
| LINE | Equalizer etc.<br>Phono plugs |
| INPUT | 23 mV/10 kohms |
| OUTPUT | 400 mV/1 kohm |

LINE IN-OUT is designed for connecting up an extra unit, such as an equalizer, noise reduction unit or mixer panel. The extra unit can be used with all programme sources, but does not affect recording on a tape recorder connected to the Beomaster. VOLUME and the built-in tone controls come after the LINE plugs.
Again, both signal levels are in fact identical: 400 mV. The input sensitivity is specified as 23 mV because of the method of measurement, which uses 1 watt output power.


RELAY

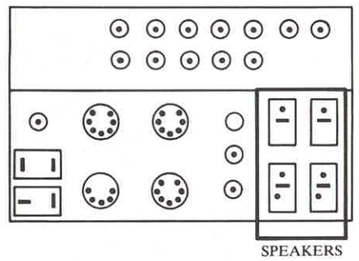
Relay box, 1 and 2, for switching other units (such as an equalizer) on and off.

AMPL.



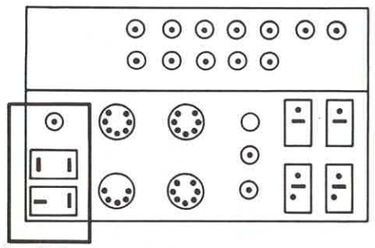
| | |
|---|---|
| PRE-AMPLIFIER | Power amplifier<br>Phono Plugs |
| OUTPUT | Max. 4.2 V/3 kohms |

Output to a separate power amplifier. VOLUME and tone controls affect the signal.


SPEAKERS

| SPEAKERS | In same room | In other rooms |
|---|---|---|
| | Speakers 1 | Speakers 2<br>Master Control Link |

Switching on the Beomaster 5000 activates the SPEAKERS 2 sockets, intended for speakers in other rooms.
SPEAKERS 1, for the speaker in the same room as the Beomaster 5000, are only cut in when one switches on in that room.


ANT.

FM aerial, 75 and 240 ohms
AM aerial.

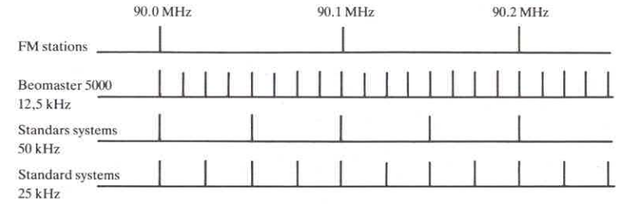
### FM-AM frequency synthesizer

Part of the Beomaster 5000's micro-computer program is used as a frequency synthesizer. The principle is the same as in the Beomaster 8000, but is has been extended in a number of ways:

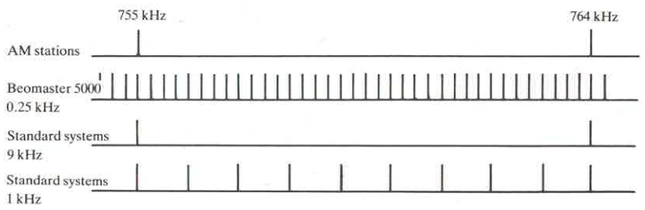
- Both FM and AM ranges.
- Automatic search, ascending or descending in frequency, FM and AM.
- Manual search, FM and AM.
- Automatic Station Lock, FM and AM.
- 9 stations can be programmed, FM or AM.
- The following features can be controlled with the Master Control Panel:
  Programmed station selection.
  Ascending or descending frequency search.
  Switching between FM, LW and MW.
  Station programming.

### What is frequency synthesis?

Frequency synthesis is an electronic tuning system based on digital technology. A quartz crystal, with an exceptionally high stability, is used as reference.
The quartz crystal's fundamental frequency is 8,867 MHz, on the basis of which two lower raster frequencies are generated, each displaying the same precision as the fundamental frequency.
This system »zeroes in« on the station much more accurately than most standard tuning systems.




The Beomaster 5000's FM raster frequency is 12.5 kHz. Other makes of receiver/tuner normally use 50 or 25 kHz.




The AM raster frequency is 0.25 kHz or 250 Hz.
Other manufacturers normally use 9 kHz or 1 kHz.
The most important reason why we can use these low raster frequencies in our Beomaster models, and thus increase the number of steps across the station dial, is that Bang & Olufsen decides these specifications itself in the course of the micro-computer's software program's development phase.
Other manufacturers often use »ready-made« frequency synthesis systems.

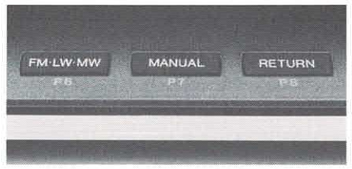

### Automatic station search

The search across the station dial is carried out completely electronically in the above mentioned steps on FM and AM. One can search upwards or downwards in frequency depending on which button one presses on the Master Control Panel or Beomaster 5000.
The search stops automatically when it comes to a station which provides reasonably noiseless reception. There is silent tuning while the search is in progress, i.e. no sound from the speakers.



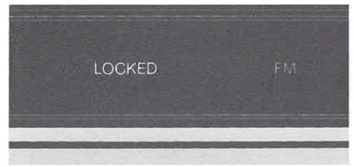

### Digital readout

During search, the frequency is displayed on the Beomaster 5000: on FM, in MHz to one decimal point, and on AM in whole kHz.



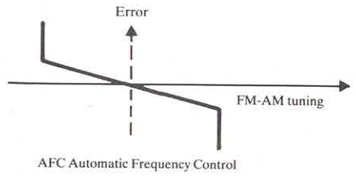

### Manual search

In manual search the button is kept pressed down, either upwards or downwards in frequency, and sound comes from the speakers.



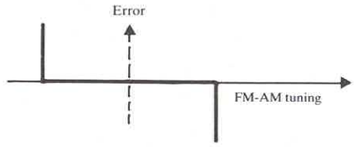

### Automatic Station Lock

This function is a refinement of AFT, Automatic Fine Tuning, which we introduced in the Beomaster 8000.
When the LOCKED indicator lights up, it means that the tuning system has disengaged from the frequency synthesizer and locked onto the stations's frequency. This ensures optimum reception of the station at all times, even if the station's carrier frequency fluctuates slightly.
The Beomaster 5000 has station locking on both FM and AM.
Automatic Station Lock performs the same function as AFC, Automatic Frequency Control, but does so with much greater precision and without AFC's drawbacks. And usually there is no AFC in a conventional AM tuner as this requires an extension of the detector circuit.
Automatic Station Lock is an electronic servo-circuit which supplements the frequency synthesizer by constantly monitoring the tuner's adjustment in relation to the station's central frequency.
This correction is so effective that there is a nominal tuning error of 0 kHz.
The maximum error is
less than 1 kHz on FM, and
less than 25 Hz on AM.



AFC Automatic Frequency Control

In comparison, an AFC circuit has a much lower degree of correction and this depends on how the receiver is tuned to the station initially.
Furthermore, the AFC's holding range is wider than its catch range, which makes it difficult to tune out from a station, or tune in to a weak station which has a stronger station next to it on the dial.

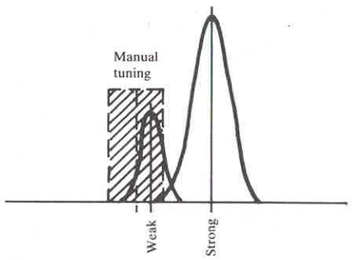


Automatic Station Lock

Automatic Station Lock has none of these drawbacks. The holding and catch ranges are identical can the entire system functions more logically and precisely.

### Centre indicator superfluous

A station indicator to indicate that the receiver is properly tuned to the station is completely superfluous in the case of the Beomaster 5000's automatic tuning, as it will always indicate 0 when LOCKED is lit up. Such an indication is only required if the receiver is fine-tuned manually after stopping at a station.

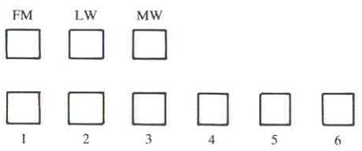



### Manual tuning

Disengaging the LOCK function can sometimes be a help when tuning to an FM or AM station.
For instance, a weak station can suffer from interference from a powerful station on a slightly lower or higher frequency, in which case tuning off-centre, without locking onto the stations's carrier (central) frequency, may produce the best result. Interference from the neighbouring station will be minimized.
Manual tuning is with the sound cut in (i.e. no silent tuning), enabling one to get the optimum result by tuning by ear.
Not all makes of synthesizer tuners have a listen-in function during turning, as their synthesizer circuits generate too much noise.

### Why is there no PLL?

Other manufacturers often use the term PLL, Phase Lock Loop, sometimes incorporated in »Quartz PLL Synthesizer«. This means that the tuner locks onto the quartz crystal in the frequency synthesizer both as regards frequency and phase.
This is also the case in the Beomaster 5000's MANUAL function, in which the tuner locks onto a raster frequency step, 12,5 kHz on FM and 0,25 kHz on AM. If the PLL function cannot be disengaged, it is impossible to tune accurately to a station which does not coincide with the raster frequency's steps. And this is the case in a number of countries which have FM stations on e.g. 90.72 MHz, 91.53 MHz, 93.20 MHz etc. This requires 10 kHz steps and therefore does not fit in with a 50, 25 or 12.5 kHz raster frequency.
The same sort of problem arises if the station's carrier frequency deviates from its designated frequency, so that it is out of step with the raster frequency.
These problems do not arise with the Beomaster 5000 when the LOCKED indicator is lit up.




### Station programming

The programming of pre-selected radio stations can be designed on the basis of several different principles. A number of tuner/receiver manufacturers design their station memory store so that an FM, a LW and a MW station can all be programmed to the same button, e.g. P3, making it possible for the user to store a large number of stations, e.g. 18 on 6 buttons.
One of the disadvantages of such a system is that the user has to make two button selections – FM/LW/MW and P1-P6.
It is also debatable whether one really needs that many pre-set stations, and whether one can remember which is which without writing them all down.
The Beomaster 5000 has 9 programme buttons, each of which can be programmed to a single station, FM LW or MW.
On the other hand, each programming covers the following items of informations:

- Range: FM, LW or MW.
- The station's frequency in that range.
- Whether MANUAL has been used in tuning to the station.
- Whether FM MONO has been pressed after tuning.

This means that »difficult« stations are also heard at their best when subsequently selected with a programme button.
Programming is carried out on the Master Control Panel, by pressing CONTROL, STORE and e.g. P1, or alternatively on the Beomaster 5000 with STORE and P1.
A digital signal is sent from the micro-computer to a separate memory component where the information is retained, even in the event of a power cut, with the help of a lithium back-up battery (see page 18).



### FM tuner

The FM receiver uses the latest technology and is based on the same principle as the Beomaster 8000.

- High sensitivity to weak signals.
- Can handle extremely powerful signals.
- Suppresses spurious signals.
- Effective damping of neighbouring stations.
- Low distortion.
- Automatic stereo/mono transition.
- Switch for FM mono.

The RF stage can operate with high amplification because the frequency mixer and oscillator are suspended on gimbals and prefectly symmetrical.
The IF stage has 3 ceramic resonators and ensures high selectivity with respect to neighbouring stations.
The quadrature detector ensures low distortion for FM reproduction and controls the AFT function at the same time.
The stereo decoder provides smooth transition between stereo and mono reproduction: channel separation gradually increases as the strength of the aerial signal increases.
The receiver can be switched manually to FM MONO for picking up very weak FM stations.

### AM tuner

The AM receiver section is new compared to the Beocenter 7002 and Beomaster 1700. The following features have been improved:

- Better adapted to any AM aerial.
- Higher sensitivity to weak stations.
- Better signal handling capacity for powerful stations.
- Lower distortion.

### AM aerial input

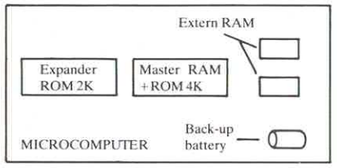
An AM aerial and its input to a receiver are not defined as precisely as is the case with FM. An FM aerial is tuned to the middle of the FM waveband and its characteristic impedance of, for example, 75 ohms is optimally connected via a screened cable to the receiver's FM socket.
With LW and MW the frequency range is much wider, 147 kHz to 1610 kHz, and therefore it is more difficult to use a tuned aerial.
In practice, some very different types of aerial are used: a few metres of cable behind a bookcase, a ferrite rod aerial or a 10-15 metre high vertical aerial. If a screened down-lead is used to reduce the noise contribution inside the building, then an aerial transformer usually has to be inserted to ensure a reasonable impedance adaption to the receiver socket.
The Beomaster 5000 has a very low input impedance and is thus non-critical with respect to the type of aerial connected. A coaxial cable as down-lead from a vertical aerial or just a few metres of cable, both are prefectly suitable and can be used according to one's requirements and wishes.

### High sensitivity, high signal handling capacity

High sensitivity in itself is no good if powerful stations cause the tuner to be overloaded.
The Beomaster 5000 uses balanced circuits in both the RF amplifier and frequency mixer, which makes high amplification possible and ensures good intermodulation distortion characteristics.

### Low distortion

After RF amplification comes a balanced full wave detector which has the special characteristic that it can emit a low frequency signal with very little distortion.




### Memory during power cut

The Beomaster 5000 has a lithium battery which ensures that a section of the micro-computer's memory store continues to function during a power cut, and when the receiver is unplugged from the mains.
This section of the memory store is situated in two separate ICs, which have a very low power consumption.
The external RAM contains all the necessary progamming information:

- Station programming.
- Time programming.
- Programmed volume.
- Programmed bass, treble and balance adjustments.
- STATUS of the Beosystem 5000.

The life of the back-up battery is approximately 10 years and it is replaced as part of Bang & Olufsen's service.



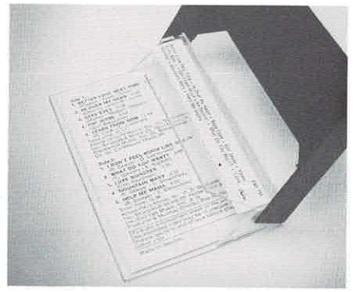
## BEOCORD 5000

### Automatic search system

The Beocord 5000 has a new tape-search system, based on finding the pauses between the individual pieces of music on the tape.

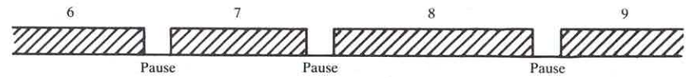
- Automatic search for pauses.
- Searching in both directions.
- The search function can find a piece of music up to 8 pieces away in either direction.
- The search function is activated either with the Master Control Panel or on the Beocord itself.

Earlier Beocord models have a search system based on tape counter readings. A memory function in connection with first the mechanical, later the electronic counter, makes it possible for these Beocords to find a certain place on the tape.
A much more advanced system was introduced with the Beocord 8000, in which the search is based on measuring real time in minutes and seconds.
But the basic principle still uses the tape counter as reference, irrespective of the material on the tape.



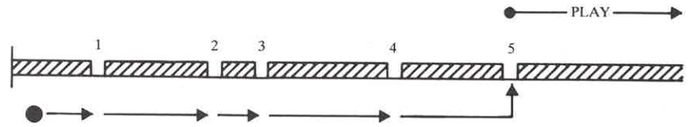
### Choose the piece of music

With the Beocord 5000, our philosophy is that as far as the user is concerned, the most natural procedure must be to select a piece of music on the cassette according to its number in the series.
And this applies both to pre-recorded cassettes and to tapes recorded at home.



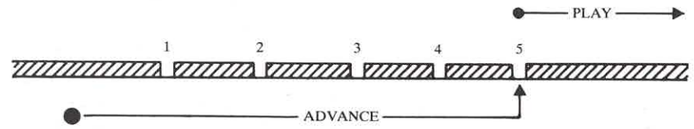

### Pauses

The new system is based on the fact that there is a pause between one piece of music and the next.
The Beocord 5000 »listens« for these pauses during its search (which takes place at winding/rewinding speed) and starts playback at the pause.



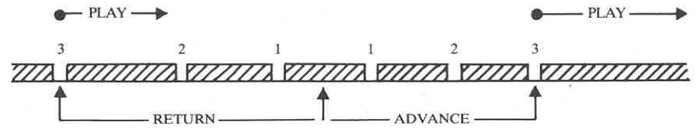

### Several pauses away

The Beocord 5000 can find a piece of music several pauses further on. The micro-computer registers the number of times ADVANCE is pressed and thus knows how many pauses it has to go through before starting playback.




### Search from a random tape position

The tape search does not have to start from the beginning of the tape. For example, if music piece no. 3 is playing and we want to hear no. 8 instead, we simply press ADVANCE five times. The Beocord 500 finds the fifth pause further on and starts playback.



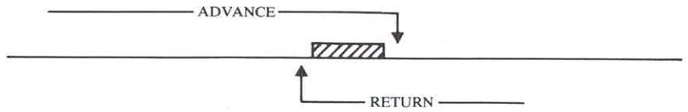

### Both directions

The Beocord can search in either direction. Pressing ADVANCE or RETURN starts the search, forwards or backwards.

### What is a pause?

A pause can be one of a number of things. For example:

- Between the pieces of music on pre-recorded cassettes.
- The 4 second recording-pause which is automatically introduced when one records individual pieces of music on the Beocord 5000 or on another Beocord.
- Between LP tracks. These pauses will also be on the tape and can be used in tape searching. However, in exceptional cases, where there is a lot of surface noise from the record during the pause, the search system will wind past the pause. If the pause is distinct, but too short, playback will start slightly after the beginning of the piece of music.
- Speech pauses (e.g. a recital on FM radio) recorded on tape. In this case the search system may identify a speech pause as a signal to stop. In practice, this is not a major problem, as there is much greater call for tape search in the case of music.




### Long pauses

The search system finds the place where the pause starts, not where the music begins. With a tape which has long pauses and very short pieces of music, pressing ADVANCE will wind the tape past the first piece of music. If we then press RETURN, the Beocord searches back to the pause at a place just before the beginning of the piece of music and then starts playback.
In this way we can check very quickly whether anything is recorded on an apparently blank tape.

### How does the system work?

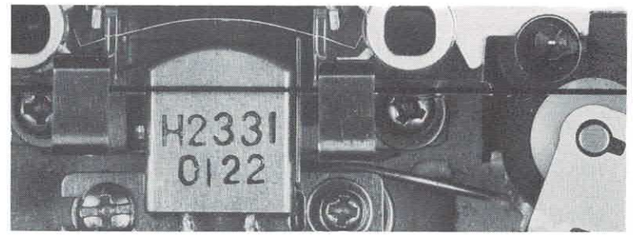
The new search system's technology is comprised of:

- A new tape transport mechanism, with 3 positions of the tape head bridge.
- An electronic measuring circuit.
- A block of the micro-computer program.

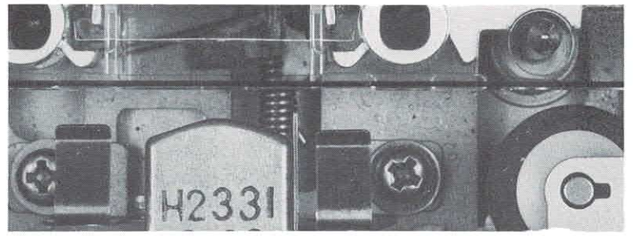
### New transport mechanism

A conventional cassette tape transport mechanism has only two tape head bridge positions. (The bridge is the part on which the tape head, erase head and tension roller with rubber pad are mounted).

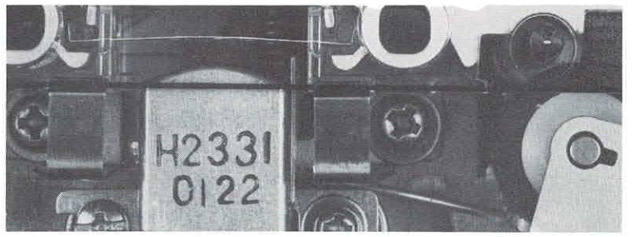




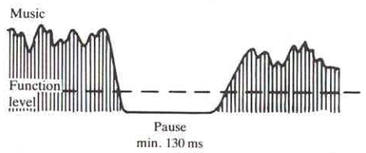

During playback and recording, both heads are pressed into the cassette and the tension roller presses the tape against the capstan to ensure uniform tape speed.




During stop, forward wind and rewind, all these parts are retracted.




The Beocord 5000 also has an in-between position, in which the tape head touches the tape without the tension roller pressing the tape against the capstan.
This position is used, for instance, during tape search, where the tape is rapidly wound backwards or forwards. This means that the search system can monitor the tape in either direction when we press ADVANCE or RETURN.




### Electronic circuit

The electronic element in the search system consists of a measuring circuit which registers the pauses in the music.
As our starting point we have decided that the length of a pause must be at least 4 seconds. This is the same as the interval automatically erased when STOP is pressed in recording.
However, the measuring circuit does not have a 4 second pause to register during fast forward or rewinding; it has a 130 ms or 0,13 sec. pause (approx.), depending on how fast the tape passes the tape head (from 130 ms to 400 ms). This in its turn depends on whether it is near the beginning or the end of the tape. The signal to the measuring circuit is taken out prior to the Dolby circuit to ensure maximum reliability, and makes the system independent of the choice of Dolby function.

### Micro-computer

Part of the micro-computer's program is used for controlling the transport mechanism: starting and stopping forward tape motion and fast forward/rewinding, and controlling the 3 tape head bridge positions.
The micro-computer also has a memory store for the number of pauses the search system has to go through, up to 8 in both directions.
For example, if ADVANCE has been pressed 3 times, 3 pulses from the measuring circuit have to be picked up before winding stops and playback starts.

### Tape counter

There is a 4-digit digital tape counter on the front of the Beocenter 5000.
When a cassette is inserted the counter starts at 0000 irrespective on the tape position, and the counter counts backwards in rewinding past 0000.
The counter is reset to 0000 with C.COUNT, Clear Counter.

### START GO

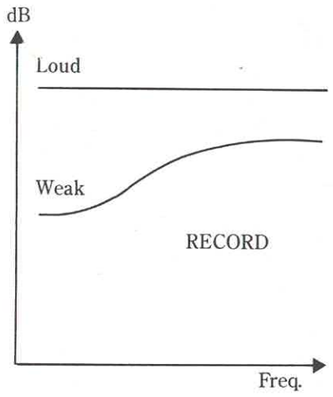
This button activates two functions:
Rewinding the tape to the beginning before starting playback.
Automatically resetting the tape counter to 0000 when playback starts.

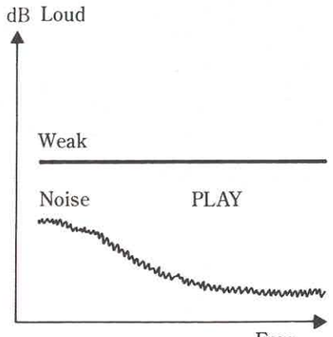
### MEMO

MEMO SET keys in the counter reading for the search system to find again.
This can be done anywhere on the tape, whether there is a pause or not.
MEMO GO winds or rewinds the tape to this point automatically.
The MEMO point is retained even if the counter is reset with C.COUNT in the meantime.

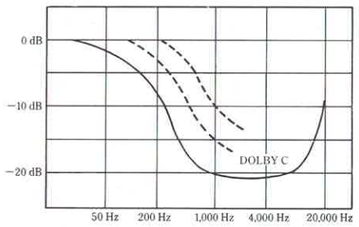
### Dolby C

The Beocord 5000 incorporates Dolby C, a 20 dB noise reduction system which operates on the sliding band principle.
The Beocord can be switched between Dolby C, Dolby B (10 dB system) and OFF, and is thus fully compatible with tapes recorded with Dolby B. Similarly it can record tapes for playback on other decks with Dolby B.
In recording, the treble dynamics are compressed. The loudest treble notes maintain their original levels while the treble content at low volume is boosted.
The boosted treble is fed to the tape head with the rest of the audio signal and recorded on the tape.




The process is reversed in playback, i.e. there is a corresponding expansion of the treble range.
This is done by reducing the weak treble passages to their original levels and thus restoring the original dynamic range.
And the most important thing is that there is a corresponding reduction in tape hiss in the weak treble passages, because the hiss is not boosted in recording; it first shows up in playback.




### Sliding band

Dolby is a sliding band noise reduction system. In other words the frequency range subject to compression depends on the volume and frequency content of the signal.
The unbroken curve shows the maximum noise reduction with Dolby C and applies to weak signals, approximately 10 dB at 200-300 Hz. In comparison, Dolby B provides 5 dB at about 800 Hz.

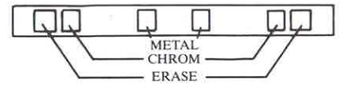
### Dolby C and tape adjustment

Dolby C is only employed correctly when the tape types to which the Beocord 5000 is adjusted are used:
Ferro, IEC I, e.g. Basf LH I
Chrom, TDK-SA
Metal, IEC IV, e.g. TDK-MA
If tapes with other sensitivity characteristics are used, the Dolby C circuit registers a change in signal level and this affects frequency linearity.
Variations in volume become audible, also in the medium frequency range.
In principle, this also applies to Dolby B, but the variations are less audible.
This is because there is less compression and because the range which is compressed does not extend to such low frequencies as in the case of Dolby C.



### Metal tape, automatic

Switching between ferro, chrom and metal is fully automatic in the Beocord 5000, in both recording and playback.




New metal tape cassettes are coded with holes on their rear edge, and a sensor in the cassette holder automatically adjusts for correct bias and equalizing. The earliest metal tapes on the market only had chrom coding. These will be played back optimally on the Beocord 5000 as they have the same equalizing.value, 70 µs. Recording on the other hand will be affected by the bias being about 4 dB too low.

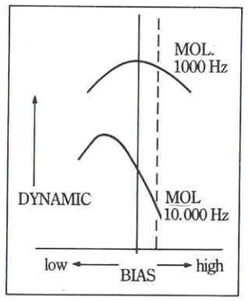
### Sensors

4 sensors check the rear edge of the cassette for:
- Protection against erasure and recording.
- Equalizing 70 µs, chrom and metal.
- Whether a cassette has in fact been inserted (NO TAPE indicator on Control Panel).
- Metal bias.

### HX PRO

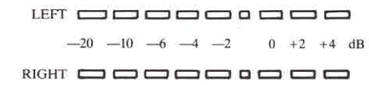
The Beocord 5000 has Headroom Extension Professional, a recording system developed by Bang & Olufsen, to a certain extent in co-operation with Dolby Laboratories.
HX PRO extends the signal capacity in the treble range for every type of tape. The improvement is most marked with ferro and chrom tape.
HX PRO's functions can be summarized under three headings:
- Active bias, continuously optimizes the bias with reference to the audio signal at any given instant.
- Ensures constant tape sensitivity at low frequencies when there are powerful treble notes at the same time.
- Non-critical with respect to tape type and signal level.

In a conventional tape deck. bias and powerful treble notes both contribute to the total bias, thus shifting the tape's characteristics away from the pre-adjusted levels. This impairs the performance of the tape in question.
HX PRO automatically adjusts the self-bias so that total bias is maintained at the pre-adjusted, optimum level. As a result, the tape's MOL characteristics are improved in the treble range and the rest of the audio range remains unaffected by powerful treble notes.
HX PRO only functions in recording. This means that tapes recorded on the Beocord 5000 can be played back on tape decks without HX PRO, with the same improvement in sound quality.
HX PRO is completely independent of the choice of noise reduction system in recording, Dolby C or B.




### Peak Program Meter

The Beocord 5000's signal level indicator is very simple; it uses green and red light indicators




The PPM's characteristic follows the tape's characteristic (inverse MOL curve) so that the reading is highest in the treble range at a given level.

This means that the recording level can be adjusted to the tape according to the music's content:
In recording music with a small treble content REC LEVEL can be turned up higher than in recording music with powerful treble.
The PPM is a peak indicator with a fast reaction and a slower fall-back time. It indicates the correct recording level at all times, i.e. also with Dolby C or Dolby B cut in.
The PPM also functions during playback and follows the same characteristic curve as in recording: highest readings in the treble range.

### M & X tape head

M&X is a new, exceptionally hard permalloy. It has a high saturation level which makes it particularly suitable for recording on chrom and metal tape. Its characteristics approximate those of a Sendust head. The Beocord 5000 has a 6-layer Canon combination-head with a 1,8 µm gap.

### Signal cable to Beomaster 5000

The connection between the Beocord and Beomaster is by way of a fixed cable with a 7-point plug.
The audio signal is transferred on LINE level.
Data-link signals are transferred through two separate plug pins to permit control via the Master Control system.
To connect the Beocord 5000 to another make of receiver which uses phono plugs, a DIN/phono connector type 7229017 is inserted and the two data-link pins are unscrewed.

### Microphone input

Stereo input with DIN socket.

### AUX input

The DIN socket can be used as an extra input, e.g. for copying.

### MPX

The Beocord 5000 does not have a multiplex filter as the signal is filtered in the Beomaster 5000 immediately after the FM stereo-decoder.

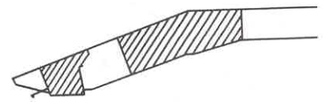
### Tape transport mechanism

The Beocord 5000 has a single capstan transport mechanism, driven by a DC motor with a built-in servo-system. The transport mechanism has been specially designed for Bang & Olufsen. It has two cam-lifting wheels and four magnet coils for cutting the winding functions in and out and operating the tape head bridge.

### Shelf system

A separate motor for the shelf system is controlled bv the micro-computer and activated by pressing OPEN on the front bar.





1.6 gram

## BEOGRAM 5000

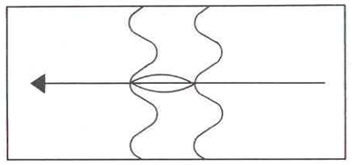
### New radial tonearm

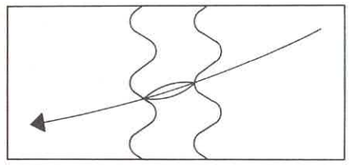
The new MMC pick-up series offered an opportunity for developing new radial tonearms for the Beogram and Beocenter models.
The new MMC cartridge only weighs 1.6 gramme, as against the MMC20's 4 grammes. This is a significant difference, especially as far as tonearm resonance is concerned.

The new tonearm differ from the earlier arms in the following respects:
- Lower distortion contribution (tracking error).
- Arm resonance at a higher frequency.
- New counterweight.
- New bearings.

### Distortion

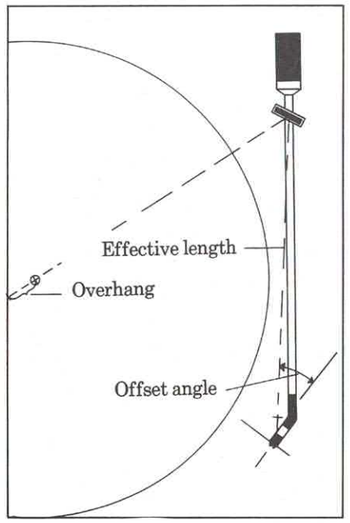
In this connection the word distortion covers a number of distinct factors:
- Harmonic distortion.
- The phase relationship between the two channels, for obtaining a stable stereo image.
- Transient response.





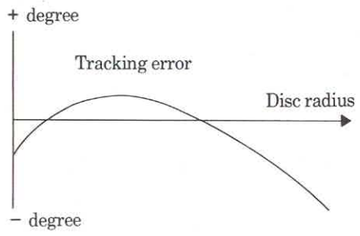
### Tracking error

The ideal situation is where the stylus moves in a straight line towards the centre of the record.
As we all know, this condition is satisfied with a tangential tonearm.
With a radial arm, which pivots on one particular point, the stylus traces an arc as it moves across the record. This means that, in places, the stylus will be at an angle to the groove. This is called tracking error.

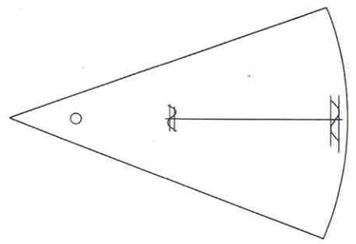



Tracking error is determined by three factors:
- The tonearm's effective length, measured from pivot to stylus tip.
- The offset angle, the angle the cartridge is offset from the straight line between the pivot and the stylus tip.
- The overhang, the distance between the stylus and the centre of the record, in a straight line from the pivot.

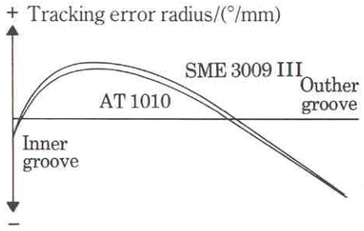
These three factors have to have a particular internal relationship in order to minimize the tracking error. A basic rule is that the greater the tonearm's effective length, the smaller the tracking error attainable, and the smaller we can make the offset angle and the overhang values.
However, there are limits to how long the tonearm can be in practice. In most cases the length will be determined by the dimensions of the record player; besides which, a long tonearm means low arm resonance and the risk of internal vibrations as a result of twisting.



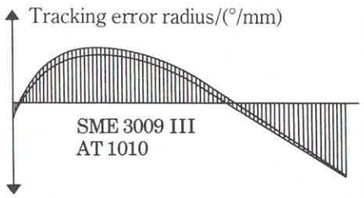

There are a number of ways of optimizing the three factors to each other, depending on which result we want.
Quite simply, it can be done by stipulating that the tracking error must not exceed a fixed value at any point.
However, the low tracking error requirement is affected by the stylus' position on the record.



At the beginning of the record the groove modulation for a given note will be relatively long. At the end of the record the same note will be represented by a much shorter groove modulation, because the circumference of the groove is smaller (by a factor of 2.5 for a standard 30 cm reord).
This means that a given tracking error will contribute 2.5 times as much distortion at the end of the record as it will at the beginning, other things being equal.
This means that a larger tracking error can be tolerated at the beginning of the record than at the end, without distortion exceeding a stipulated level.



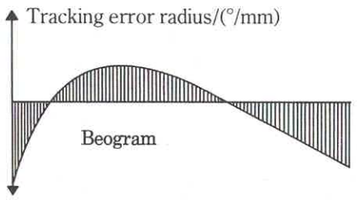

This is the principle adopted by most tonearm manufacturers. Here are two examples, the SME 3009 III and the Audio Technica 1010. Both aim at getting a small tracking error at the end of the record. Up until now the same principle has applied to Bang & Olufsen radial arms. (+ and – tracking errors are equally significant).




**New philosophy**

The new radial arm has been designed in accordance with a new philosophy:
● Low total distortion throughout the entire playing time of the record.

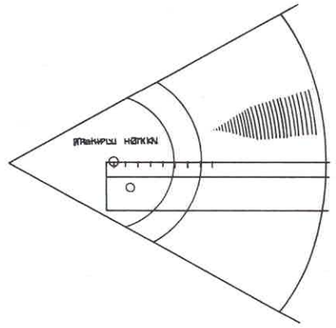
Here are the same two examples of tonearms optimized to a low tracking error at the end of the record (radius 50 mm). As we see, the tracking error area is relatively large, especially for the middle part of the record.



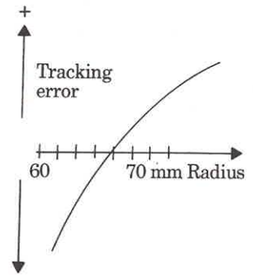

The new tonearm is calculated from the weighted value for tracking error which means that each measured value for tracking error is raised to the secondth power before it forms part of the calculations. The result appears as a smaller total area that is more evenly distributed over the playing time of the record.



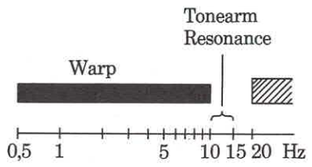
| | Weighted tracking error | Effective length |
|---|---|---|
| Beogram 5000 | 0.665 °/mm | 220 mm |
| AT 1010 | 0.742 °/mm | 240 mm |
| SME 3009 III | 0.792 °/mm | 231.19 mm |



Here the arms are compared nummerically.
Note that the Beogram 5000 has a smaller error area than the others, despite its shorter effective arm length.
The distortion contribution is directly dependent on this valus; the lower the figure, the lower the distortion. A direct conversion is however rather complicated, as a number of other factors are involved: the shape of the stylus, the vertical tracking force and the degree of modulation on the record.
According to the norm for 30 cm records, the groove can be modulated in to a radius of 58 mm from the centre. In our experience very few manufacturers make records which are modulated this far in. Try measuring a number of records for yourself.
The distortion level also depends on how powerfully the end of a piece of music is recorded. We examined a number of classical recordings and found the final crescendo passages lay 65-70 mm from the centre of the record.

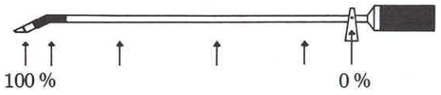



Here we have enlarged a section of the tracking error curve for the new tonearm. Note that the region from 66 to 70 mm has an angle of error which is very close to 0°.




**Optimized arm resonance**

The tonearm's inherent resonance has to lie in a range where there is no modulation to generate unwanted oscillations.
Below 10 Hz there can be oscillations from warped records. Acoustic feedback and external vibrations through the base of the record player also lie under 10 Hz.
Above 20 Hz we have the modulation in the record groove, and in some cases, e.g. electronic music, there can be frequencies slightly below 20 Hz.
Therefore arm resonance should lie between 10 and 15 Hz.
In the new radial tonearm the inherent resonance is 14 Hz measured on the vertical plane and 12 Hz on the horizontal plane.
These measurements hold true for a pick-up compliance of 25 µm/mN. With a higher compliance the resonance will be lower and with a lower compliance the resonance will be higher.

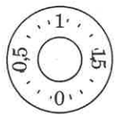



The cartridge contributes its full weight to the effective arm mass, as it is furthest away from the point on which the tonearm pivots. With just 1.6 gramme on the end, the rest of the weight can be distributed in the best possible way. Therefore the tube in the new radial arm is made of stainless steel, which is a very stiff and relatively heavy material and at the same time it is non-magnetic. The effective mass is approx. 6.8 grammes.

### Flexing

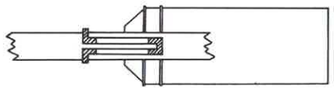
Flexing – vibration in the tonearm caused by bending or twisting – is usually due to a lack of rigidity in the arm tube.

The new ultra-stiff steel tube reduces flexing to the absolute minimum. In comparison, an aluminium or brass tube of the same dimensions would cause flexing which would show up as measurable resonance around 300 Hz.

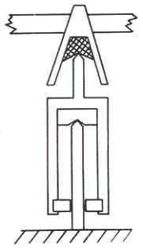



### New counterweight

The counterweight's job is to maintain the static balance in the tonearm. The new counterweight is heavier, because the tube itself is heavier.
Adjusting the static stylus pressure has been made easier, because the engraved scale now displays the entire adjustment range, 0-2 grammes, in a single revolution.



The counterweight is mounted on rubber bushes in order to damp tonearm flexing.



### New bearings

The tonearm suspension has a knife-edge bearing for vertical movements. Rubber damping is built in to eliminate flexing and internal vibrations.

| Friction | Vertical | Horizontal |
|---|---|---|
| | <5 mg | <10 mg |


### Anti-skating

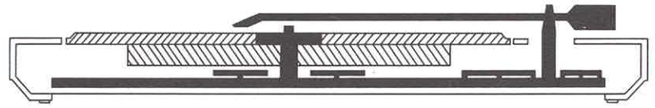
The skating effect is the force which, when the record rotates, causes the stylus to press harder against the inner groove wall (L) than against the outer wall (R). This is true for all radial arms and is due to the fact that the friction between the groove and the stylus tip is in a different direction (= the offset angle) than the straight line from the stylus tip to the point on which the arm pivots.



The new radial arms' skating compensation is placed underneath the tonearm's vertical bearing, so it is not immediately visible. A thin coiled spring presses the arm slightly outwards, so that it compensates for the skating effect, depending on the stylus' position on the record. The user does not need to worry about adjusting the anti-skating, as this is done at the factory. It is adjusted to minimum distortion at the recommended stylus pressure, using a powerfully modulated test record.

### New pendulum suspended chassis

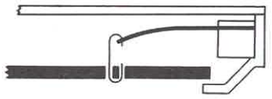
The Beogram is less susceptible to external vibrations and acoustic feedback.



The separate chassis is a totally new construction:

- The chassis is larger and heavier.
- The centre of gravity is lower.
- The pendulums provide better damping.

The chassis is set above a large steel plate and its total weight is 2.5 kg as against 1.45 kg previously. The two bearings for the platter and tonearm, together with all the mechanical and electrical parts, are placed on top of the chassis.
The steel plate itself is fitted so far down that it acts as the base of the record player.
The three pendulum mountings are utilized more effectively than they were previously. The flat springs are mounted on the outer casing and the chassis suspended on the pendulums.



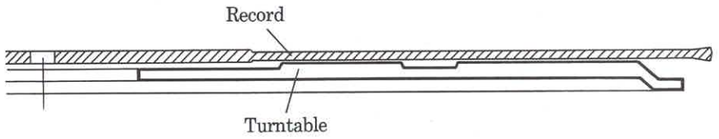
The inherent resonance in the separate chassis is 5 Hz, well away from the tonearm resonance of 14 Hz.

The motor and the mains transformer, both of which can cause vibration, are mounted with the casing, top plate and dust cover.

### New platter

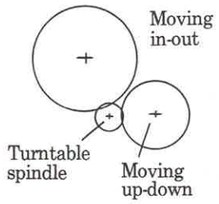
The new platter has been altered in a number of ways:

- New design.
- Effective discharge of static electricity.




The new platter profile provides excellent contact with the recorded part of the record. The six black rings are made of nextell, which is a mixture of tiny rubber balls and varnish. The large metal surfaces ensure high electrical capacitance between the record and the metal, effectively earthing static charges.
The platter is a lightweight model, 400 grammes, facilitating a quick start.

### New movement control mechanism




In previous radial record players a single cam-wheel has been used to control tonearm movements.
The Beogram 5000 uses two cam-wheels, each with a separate function:

- One for moving the arm in and out, including switching from 30 cm to 17 cm records.
- One for raising and lowering the arm.

Both cam-wheels are cut in by the electronic system, using magnet coils. The advantage of this construction is that the CUE function (raising and lowering when finding a different passage on the record) is much faster than in previous models, because only one cam-wheel needs to be activated.

### New motor

The new motor is lower and its speed of rotation is higher. It is a servo-controlled DC motor. The integrated servo-generator has been changed to a ring magnet, with a series of north and south poles which rotate across an element sensitive to magnetism (Hall generator).

Power is transmitted to the belt wheel and platter via a thin, flat rubber belt (neoprene).
The belt's compliance acts as a mechanical filter and prevents vibrations from the motor reaching the record and stylus.

### New operating functions

Briefly, the Beogram 5000 is operated as follows:

- PLAY and STAND BY are activated by pressing the righthand side of the front bar, also when the dust cover is down.
- OPEN, opening the dust cover is by pressing the lefthand side of the front bar.

Opening the dust cover gives access to four buttons:

- CUE, pause and moving to other music passages, rapid raising and lowering of tonearm.
- REP, automatic repeat when the record is finished, max. 4 times.
- 33 and 45, manual record speed switching.