The Lexin Group

Lexin Comfort Heating

Technical Documentation

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Introduction

This document describes the Lexin Comfort Heating, a product of The Lexin Group.

The Lexin Comfort Heating is a main heating system based on infrared warmth and knows various applications:

1. Residential heating.
2. Office heating.
3. Veranda heating.
4. Garden House heating.

Lexin doesn't only specialize in heating systems; we also produce various other heating products:

1. Lexin Sauna Heating
   Sauna heating.

2. Lexin Agricultural Heating
   Heating stables.

3. Lexin Industrial Heating
   Applicable in the Industrial Sector: wood drying, drying paint, regulating relative air humidity etc.

4. Lexin Medical Heating
   Applications in the Medical Sector: physiotherapy, fat burning, improved saturation of the skin, deacidifying of the body etc, hereby relying on and profiting from the beneficial aspects inherent to biogenetic infrared.

For further specific information, please contact your Lexin agent.

Infrared heat

What is infrared heat?

Lexin infrared is best compared to the warmth of the sun. The vast amount of energy emitted by the sun is transported to the surface via electromagnetic beams that are divided into different wavelengths. The unit for this subdivision is nanometre. (1 nm= 1 millionth of a millimetre)

Each wavelength transports a certain amount of energy. The faster the frequency of these waves, the shorter the wavelength and the shorter the wavelength the more energy it can carry or in other words: the higher the frequency, the shorter the wavelength, the higher the energy level.

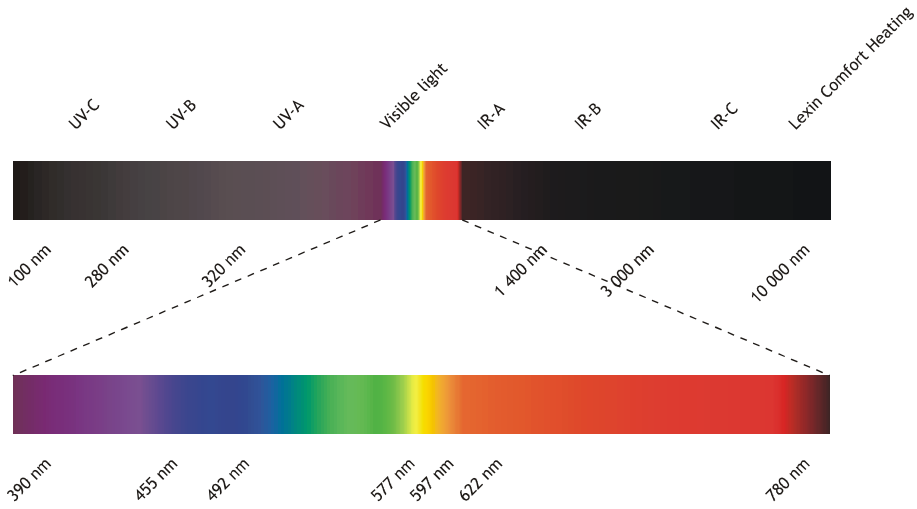
The radiation emitted by the sun is partly absorbed by the atmosphere only a small portion reaches earth.

Beams that do reach the surface contain a number of wavelengths ranging from Ultraviolet light (UV) via the visible light to Infrared Radiation (IR).

Ultraviolet light has a high frequency and thus a short wavelength that possesses a large amount of energy. This energy can cause our skin to burn or even develop cancer after prolonged exposure.
Visible light has a lower frequency containing less energy.
Infrared light has the lowest frequency of all and therefore also the lowest energy level.

Wavelengths can be classified as follows:

Light	Wavelength
UV-C	100 – 280 nm
UV-B	280 – 320 nm
UV-A	320 – 390 nm
Violet	390 – 455 nm
Blue	455 – 492 nm
Green	492 – 577 nm
Yellow	577 – 597 nm
Orange	597 – 627 nm
Red	627 – 780 nm
IR-A	780 – 1 400 mm
IR-B	1 400 – 3 000 nm
IR-C	3 000 – 10 000 nm



Electromagnetic spectrum

Lexin Infrared Heat

The Lexin screens emit "far or biogenetic infrared", infrared light with a wavelength of 10 000 nm that has beneficial effects on the human body.

In contrast to other infrared appliances e.g. infrared lamps that can reach temperatures up to 2 200 °C, Lexin screens have a relatively low surface temperature of 150 °C.

Conduction, Convection or Infrared Heating

There are several ways to transport heat:

Conduction — Material as transport medium. E.g. the stew pan: The bottom of the stewing pan is heated by a gas jet that heat is then conducted to the inside of the pan.

Convection — In most cases of convection the air is used as a medium for heat transport.

This particular way of heating is widely applied in the residential sector. A radiator transports warm air that rises up to the ceiling as cold air is being sucked in at the base and heated, creating an airflow which heats the entire residence.

Infrared — Infrared Heating requires no extra medium to transport warmth. Only the specific spot where the infrared light (heat) generated by one source hits the object is heated. This is also known as direct heating or the same sort of heating we experience through the sun.

When an object has a higher temperature than its surroundings it will generate the same infrared light heating other objects in turn. This is also called indirect heating.

Lexin Comfort Heating

Introduction

This chapter describes the properties of the Lexin Comfort Heating and its impact on energy consumption and health.

Advantages with respect to convection heating

An enumeration of the advantages of the Lexin Comfort Heating with respect to conventional convection heating is given below:

Lexin Comfort Heating	Convection Heating
Objects are heated directly IR.	Objects are heated through surrounding air.
Air is NOT heated causing NO airflows and therefore NO dust circulation.	Air is heated causing airflows and causing dust to circulate.
Surrounding air makes for a good isolator which allows the surrounding temperature to be lower. The lack of airflow causes the wind-chill to be higher.	The surrounding air is constantly circulating making it a poor isolator. The surrounding temperature has to be higher to obtain the same wind-chill.
The difference between floor and ceiling temperature is negligible (maximum 2° C).	The difference between floor and ceiling temperature is significant (approximately 8 °C) because hot air rises.

Health aspects

Scientific research has shown that infrared warmth with a wavelength of 10.000 nm also known as biogenetic or far infrared stimulates the growth and health of cells. Biogenetic infrared does more than activate water molecules in your body, it also causes them to resonate and ionises them. This in turn stimulates and improves not only your blood circulation but also your metabolism.

Beneficial effects:
1. Improves oxygen content in blood.
2. Disintegrates body fat, cholesterol, chemicals and waste products.
3. Reduces the pH value (milk acid).
4. Improves the perspiration system.
5. Prevents bacteria from growing.
6. Reduces muscular pain.
7. Accelerates cell regeneration.

From above enumeration the following applications are derived:
1. Controlling rheumatic pains.
2. Reducing fat- and cholesterol levels.
3. Diminishing lactic acid during the cooling down period (infrared sauna).
4. Physiotherapy: heating and loosening muscles.
5. Removing waste products through infrared sauna sessions (infrared saunas remove up to 25 % of waste products through perspiration, perspiration caused by hot air sauna's consists of 95 to 97 % water).

People suffering from rheumatism are very sensitive to air circulation and relative air humidity. The Lexin Comfort Heating offers relief for people suffering from asthma and rheumatism by keeping air conditions homogenous.

Objects are directly heated so there is no more dust circulation through indirect heating that can cause irritation to the airways or eyes (contact wearers).

The Lexin Comfort Heating runs silently because there are no moving parts or flowing masses.

Side effects:
Lexin infrared heat has no detrimental effects on the human body. (View TAUW report)

Make up of the Lexin Comfort Heating?

A combination of several elements:

Screens	Screens produce IR-light and heat the room they are placed in.
Controls	Controls measure the room temperature and the intensity of the IR-light. Screens are switched on and off according to the desired room temperature.
Thermostats	Thermostats measure the room temperature and send this information back to the controls.

Safety

1. Heated screens have a higher surface temperature than radiators; however the surface is not dangerous to the touch. Glass is a notorious poor conductor that brings down the surface temperature to an acceptable level.
2. The maximum temperature is limited, ruling out overheating or fire hazard.
3. The screens have been tested and deemed save by TAUW, an independent inspection agency.
4. Biogenetic infrared has no detrimental effects on the human body.

Maintenance

Maintenance is negligible. The Lexin Comfort Heating has no moving parts, except for the safety thermostat that will not switch under normal circumstances guaranteeing a long life span.

Unplug your screens and let them cool down to room temperature before you clean them (30 minutes)
Use a moist towel to clean your screen; avoid using aggressive cleaning products that can harm your screens.

Energy consumption

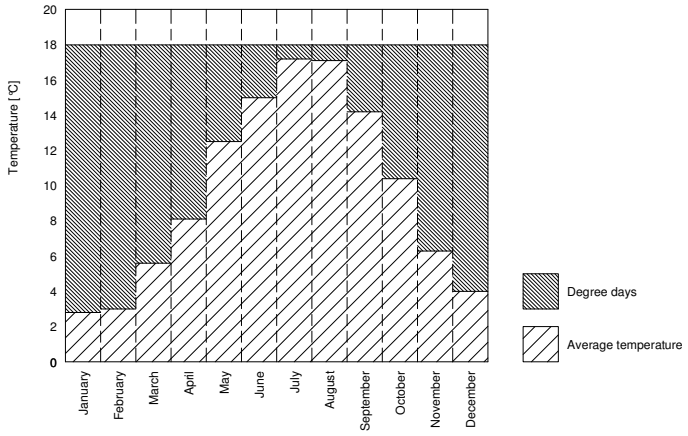
Lexin screens reduce cost because:
1. Electricity is converted into infrared without loss of energy.
2. One screen (CH12060) suffices to heat an entire room of 20 to 25 m^2 (main heating).
3. Linked to a control and a room thermostat a screen will only consume 40 to 60 % of its installed capacity.
4. There is no loss of heat through transport.
5. Compared to a convection system the infrared system has a relatively lower room temperature.
6. There is no need for an extra distribution system.
7. The air is not heated keeping ventilation losses at a minimum.
8. Walls and window surfaces are kept free of hot airflows.
9. The Lexin system can be used as zone-heating.

Degree days calculation

Degree days allow us to calculate your energy consumption. Keep in mind however that it is a mere estimate as it is subject to variables that can influence your consumption both in a positive and a negative way.

The calculation is based on the average day temperature measured by different national weather stations. The number of degree days in one day equals 18 °C or the average day temperature and equals 0 when the average day temperature is higher or lower than 18 °C.

Degree days link the external temperature to your energy consumption but do not take other weather influences like wind and the direct warmth of the sun into account. To compensate we multiply degree days with a weight coefficient dependent on the season.



Period	Weighing coefficient
Apr – Sep	0.8
Mrt, Okt	1.0
Nov – Feb	1.1

Degree days calculated according to the average month temperature. This example is valid for Holland, other regions may vary.

Month	Average temperature	Difference to 18 °C	Number of days per month	Degree days	Weighing coefficient	Weighed degree days
January	2.8	15.2	31	471.2	1.1	518.3
February	3.0	15.0	28	422.8	1.1	465.1
March	5.6	12.4	31	384.4	1.0	384.4
April	8.1	9.9	30	297.0	0.8	237.6
May	12.5	5.5	31	170.4	0.8	136.3
June	15.0	3.0	30	90.0	0.8	72.0
July	17.2	0.8	30	24.8	0.8	19.8
August	17.1	0.9	31	27.9	0.8	22.3
September	14.2	3.8	30	114.0	0.8	91.3
October	10.4	7.6	31	235.6	1.0	235.6
November	6.3	11.7	30	351.0	1.1	386.1
December	4.0	14.0	31	434.0	1.1	477.4
Total						3 046.1

Ask for your local degree days at the national meteorological weather centres to calculate your approximate energy consumption.

$$\textit{Energy consumption} = \textit{Installed capacity} \times \frac{\textit{Weighed degree days}}{3.125}$$

Energy consumption	Estimated energy consumption in kWh.
Installed capacity	Installed screen capacity in kW.
Weighed degree days	Number of annually weighed degree days.

Total cost of the estimated energy consumption

Your total cost is the product of your energy consumption and the cost of 1 kWh.

You can cut costs by asking for a double rate if your Lexin Comfort Heating consumes more energy than other electrical appliances and by an adjusted programming of your digital thermostat. Raise your temperature during the cheaper night rate to accumulate warmth in walls and floors and lower it during the day to benefit from your accumulated warmth.

Screens

Product description

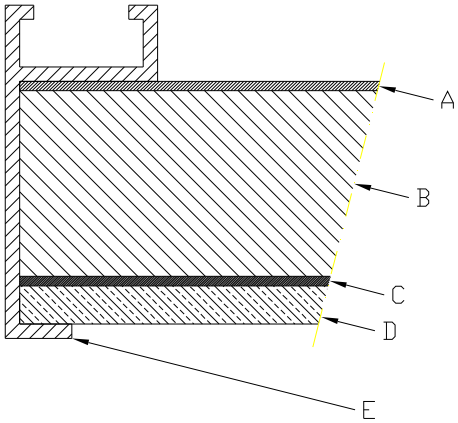
Screens are best described as flat, rectangular 'lamps' with a matt glass surface and a semiconductor layer applied on the inside of the glass plate. Electricity brings the infrared emitting atoms present in the semiconductor layer to a higher vibration level creating IR light. Lexin screens convert electricity into IR-light with a wave length of 10 000 nm (emitted in an angle of 170°) without loss of energy.

The screens are isolated at the back, fitted in aluminium casings and can easily be hung up using brackets fixed on to the screens.

Screens operated by controls have a temperature hysteresis creating a stable on/off control that will shut a screen down once it has reached its maximum temperature and will switch it back on after the temperature has dropped again.

The cooperation of the room thermostat and the hysteresis will set the modulation process in motion. In contrast to other electrical heating systems, Lexin screens do not consume electricity constantly but with regular intervals (40 to 60 % of the time) or only 40 to 60 % of their installed capacity.
The 20 % margin is due to variable factors such as: type of screen, control and external weather conditions.

Screens weigh 5 to 10 kilos and are easily manageable (largest screen is: 1 195 x 595 x 35 mm). They can be placed anywhere on the ceiling allowing an optimal heat distribution.



Cross section of a screen:
A: Background plate
B: Isolation
C: IR-light generator
D: Glass
E: Aluminium frame

Heated screens are not dangerous to the touch (glass is a notorious poor conductor that reduces high temperatures to acceptable levels).

Screen placement

We recommend 3 different areas to place your screens:

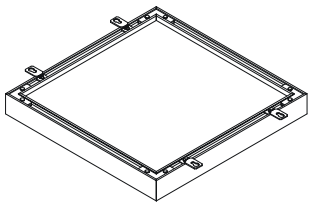
1. Ceiling
   Perfect for the Lexin system as a main heating system.

2. Wall
   When placement on the ceiling is not possible or as a decorative element.

3. Zone
   Excellent for heating a specific area.

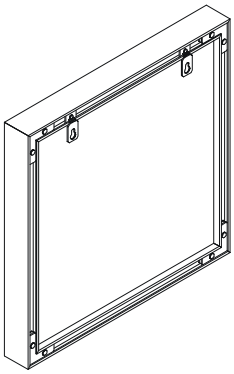
Ceiling

There are 3 main reasons for placing your screens on the ceiling.
First of all ceiling placement ensures an optimal heat distribution; secondly the surface temperature is able to preserve its heat better (less exposure to cold airflows) and thirdly; ceiling placement is ideal for rooms (offices) where floors and walls are to be kept clear of heating elements.
The largest type of screen fits perfectly into a system ceiling where the framework of the ceiling will act as support.
Attention: always check how much weight your system ceiling can carry, extra ceiling support can compensate if necessary.



Screens can be built into the ceiling or attached to it by means of a simple bracket system.
The maximum suspension height is 2.5 – 3.0 m; if you exceed this height screens can be lowered down and suspended via steel cables or chains.

Wall



If you can't place your screens on the ceiling just hang them on the wall like you would a painting. Lexin screens are all about being creative and about aesthetics. In addition to optional RAL colours you can paint on your screens or have them screen-printed with any picture or logo you desire, turning them into a decorative element.

Zone

The nature of infrared heat (heating objects not air) make Lexin screens ideally suited for heating specific areas or zones.
Make sure you place your screens in such a way that the IR-light covers the entire area you wish to heat.

Installation

The screens can be incorporated entirely into your ceiling or wall. Please make sure that there is room to ventilate the screens at the back (1.5 cm from the rear to the ceiling or wall is required) and at the front 50 cm.
Also make sure your thermostat isn't placed too close to your screens to rule out false temperature read-outs.

The maximum suspension height is 2.5 – 3.0 m.
For a detailed description on screen placement, see 'Placing your screens' on page 25.

Wet rooms

Regulations for screen placement in a wet room differ from country to country.
Please contact your Lexin installer for further information.
Lexin screens are splash proof.

Colours

Standard colours are black and white.
Other RAL-colours, logos and pictures are optional.

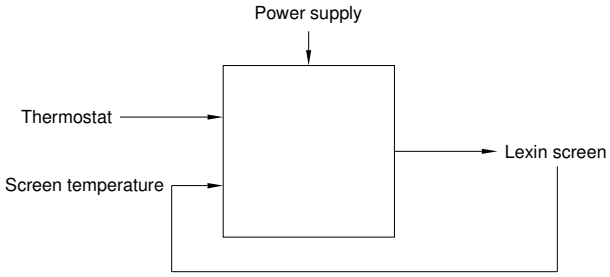
Controls

Introduction

The controls make sure that the screens only switch on and off when absolutely necessary. They are an essential part of the Lexin energy-saving system.

The functioning

The room thermostat measures a room's temperature and sends this information back to the control. The control receives and processes this information while reading the surface temperature of the main screen (=intensity of the IR-light). A "too cold" signal will alarm the controls to switch the screens on (IR-light intensifies) while a "too hot "signal will shut the screens back down again.
A great deal of energy is conserved because of this constant on and off switching system.



Main screen

Has a built-in temperature sensor, the surface temperature of this screen is measured by the control. To avoid screens from overheating please make sure that the main screen is directly linked to the control.

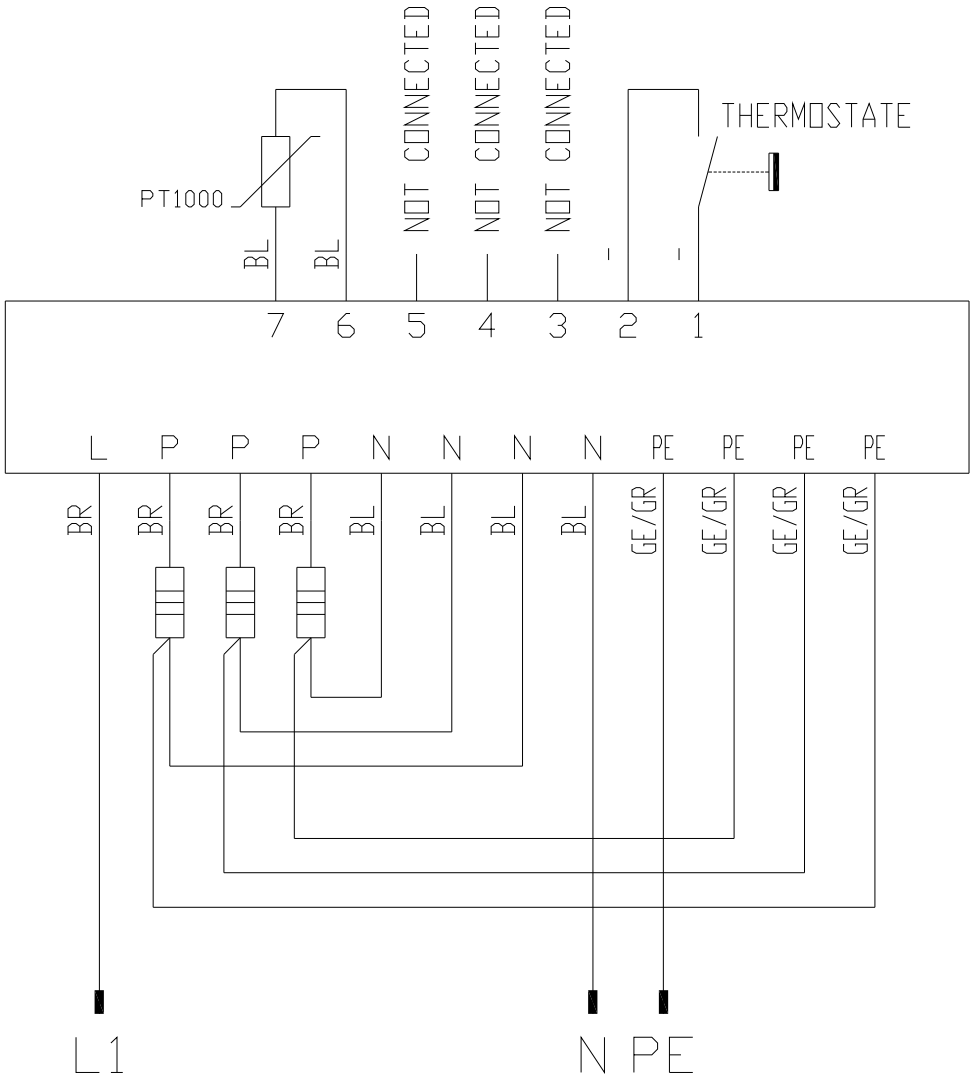
Main room

Room where you've placed your room thermostat e.g. living room. Its room temperature is defining for other rooms that are connected to the same thermostat.

The different types of controls

Two types of controls are available:
1. KeCoTec 100. 1 phase control able to switch up to 3 680 W.
2. KeCoTec 300. 3 phase control able to switch up to 11 040 W.

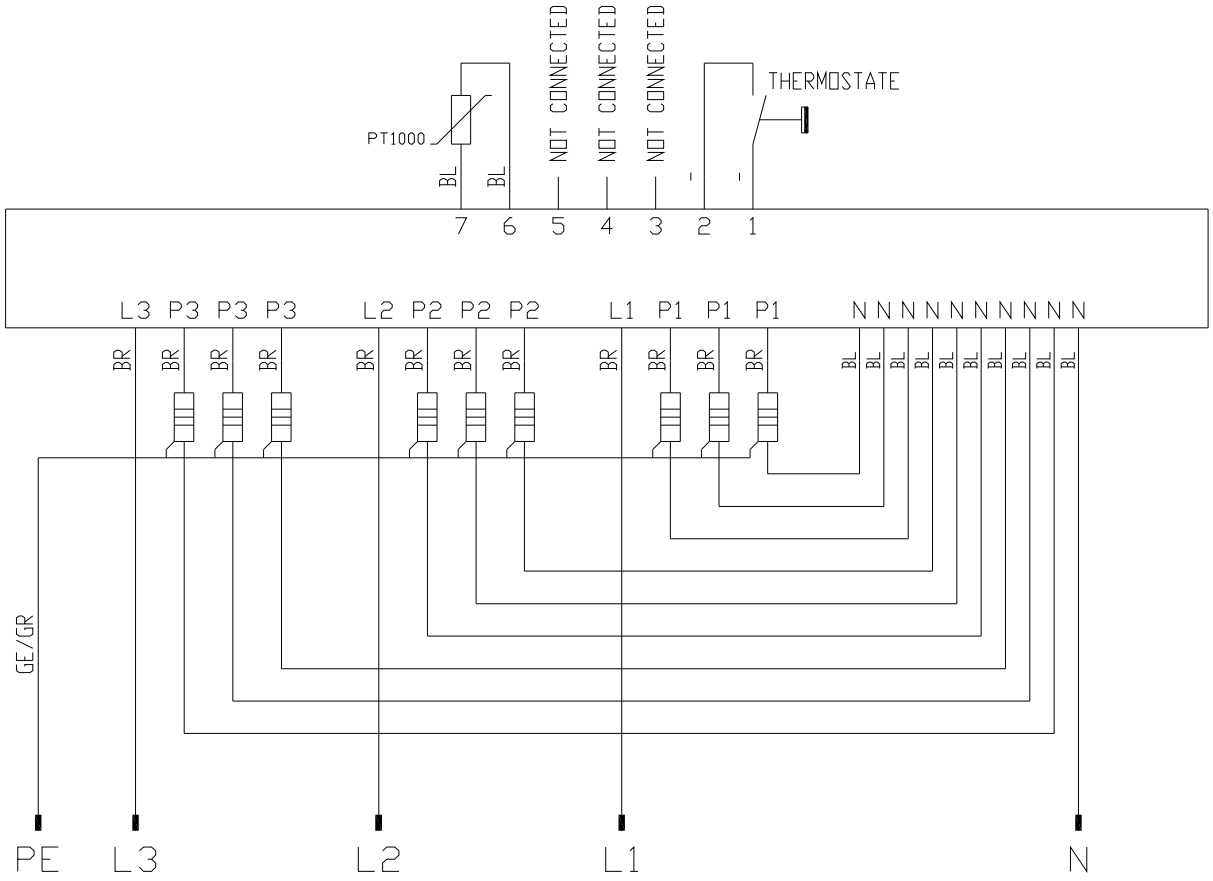
The KeCoTec 100



Colour, Kleur, Couleur, Farbe
BR: Brown, Bruin, Brun, Braun
BL: Blue, Blauw, Bleu, Blau
GE/GR: Yellow/Green, Geel/Groen, Jaune/Vert, Gelb/Grün

Pin	Description
1,2	Main room thermostat. Potential free contact. Open: room too warm. Closed: room too hot.
6,7	Main screen temperature sensor.
L	Phase connection 230VAC / 16A.
P	Switched phase for screen feed.
N	Neutral connection, internally connected.
PE	Earth connection, internally connected.

The KeCoTec 300



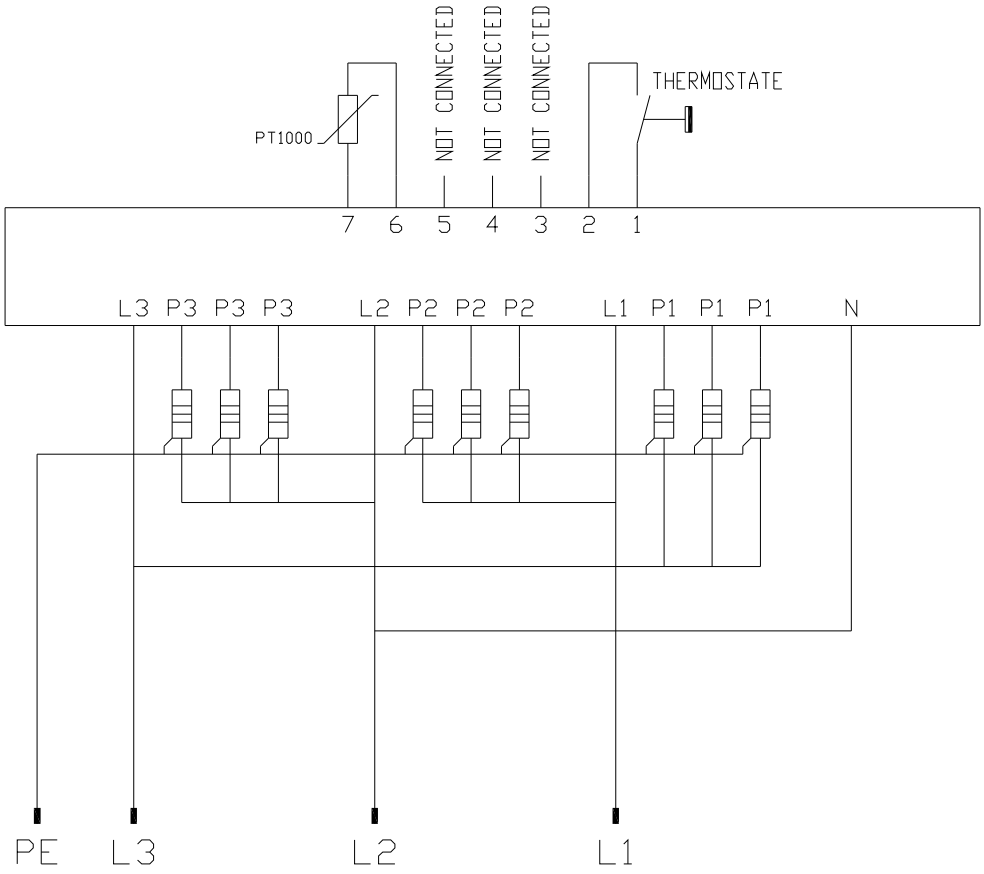
Colour, Kleur, Couleur, Farbe
BR: Brown, Bruin, Brun, Braun
BL: Blue, Blauw, Bleu, Blau
GE/GR: Yellow/Green, Geel/Groen, Jaune/Vert, Gelb/Grün

Always connect L1!!!

Pin	Description
1,2	Main room thermostat. Potential free contact. Open: room too warm. Closed: room too hot.
6,7	Main screen temperature sensor.
L1	First phase connection 230 VAC/ 16A. L1 is also the controls' feed; always connect.
P1	1st switched phase for screen feed.
L2	2nd phase connection 230 VAC/16 A.
P2	2nd switched phase for screen feed.
L3	3rd phase connection 230 VAC/16A.
P3	3rd switched phase for screen feed.
N	Neutral connection, internally connected.

If there is no neutral

Please hook up your KeCoTec 300 as shown below when there is no neutral and the tension between two phases is 230 VAC.



Screens are connected in delta. Hook up 230 VAC between L1-N for a feed to the control.

Installation

Hook up your screens and controls with cables (3) that have a diameter of 2.5 mm² in e.g.: YMVK 3G2.5. Use a shielded cable when the distance between control and screens exceeds 50 m.
The main screen temperature sensor and the main room thermostat can be hooked up with cables of 0.75 mm² in diameter (2) e.g.: VMVS 2GO.75

There's no need to connect each screen with a separate cable, just hook up the cable to the connecting point of the nearest screen.

See annexes for diagram examples.

Thermostats

Introduction

The room thermostat and the control define your room temperature.
We recommend the thermostats given below but virtually any thermostat with a potential free plug is compatible with the controls.

Theben Ram 812 Top

Digital room thermostat with 2 fixed and 1 free annual program.

Application:	Wall thermostat for living area and bathroom.
Power supply:	230 V (no batteries)
Connection:	230–250 V, 6 A
Temperature range:	6–30 °C
Dimensions:	143 x 95 x 30 mm

AEG030

Analogue room thermostat.

Application:	Wall thermostat for bedrooms.
Connection:	230–250 V, 16 A
Temperature range:	5–30 °C
Dimensions:	75 x 75 x 25 mm

RTR030

Analogue room thermostat.

Applcation:	Wall thermostat for bedrooms.
Connection:	230–250 V, 16 A
Temperature range:	5–30 °C
Dimensions:	70 x 70 x 25 mm

RTR3311

Analogue room thermostat with extension cord and plug with sokcet.

Application:	Wall thermostat for living area and bathroom.
Connection:	230–250 V, 16 A
Temperature range:	5–30 °C
Dimensions:	70 x 70 x 40 mm
Cord length:	2 m
Remark:	A control is not required; the room thermostat switches the screen on or off. The screen heats the room at full capacity.

Transmission calculation

The described transmission calculation can only be applied to heating of houses, offices, etc.

The figures derived from this transmission calculation only represent the energy consumption of the Lexin Comfort Heating and not that of any other heating system.

Introduction

The transmission calculation stipulates the number, the type and the location of your screens.

Temperature differences per room:

Room	External temperature	Room temperature	Temperature difference
Living room	−10 °C	22 °C	32 °C
Bed room	−10 °C	18 °C	28 °C
Bath room	−10 °C	24 °C	34 °C
Hall	−10 °C	16 °C	26 °C
Kitchen	−10 °C	20 °C	30 °C

These temperature differences are calculated into the minimum required capacity by the climate factor.

Transmission calculation: a few steps

1. *Calculating the minimum required heating capacity.*
   Floor area, the windows, doors and the climate factor are determinant factors when calculating the minimum required heating capacity.

2. *Screen placement.*
   Screens have a certain heating range. In some cases, depending on the shape of the room the minimum required capacity will not suffice.
   This can be compensated by placing additional screens.

Minimum required heating capacity

The floor and surface area of doors and windows are determining factors. Surface area of windows and doors are compensated for with a correction factor, the minimum required heating capacity is then corrected by a climate factor.

$$Heating\ capacity = Climate\ factor \times \left\{ \begin{array}{l} Floor\ area + \\ \sum Correction\ factor \times Window\ surface\ area + \\ \sum Correction\ factor \times Door\ surface\ area \end{array} \right\}$$

1. $Floor\ area$

   Calculate your floor area in m² (= minimum required heating capacity) without taking into account doors or windows. Do not compensate for large objects, only the size of your room is important.

2. $\sum Correction\ factor \times Window\ surface\ area$

   Figure out the surface areas of your windows and multiply it with one of the factors mentioned below. The result of your calculation is the extra heating capacity needed to compensate for your windows.

   a. Single glazing: 2.8 (K-value = 5.8).
   b. Double glazing: 1.8 (K-value = 1.4).
   c. Windows with other K-values:

K-value	Factor	K-value	Factor	K-value	Factor	K-value	Factor
7.0	2.91	2.5	2.19	1.6	1.88	1.1	1.69
6.0	2.82	2.0	2.02	1.5	1.84	1.0	1.66
5.0	2.70	1.9	1.99	1.4	1.80	0.9	1.63
4.0	2.54	1.8	1.95	1.3	1.76	0.8	1.60
3.0	2.33	1.7	1.91	1.2	1.73	0.7	1.58

3. $\sum Correction\ factor \times Door\ surface\ area$

   Figure out the surface areas of your doors and multiply it with one of the factors mentioned below. The result of your calculation is the extra heating capacity needed to compensate for your doors.

   a. Inner door: 1.0 (independently from the K-value).
   b. Outside door: 2.5 (independently from the K-value).

4. $\left\{ \begin{array}{l} Floor\ area + \\ \sum Correction\ factor \times Window\ surface\ area + \\ \sum Correction\ factor \times Door\ surface\ area \end{array} \right\}$

   Add the different required heating capacities.

5. $Heating\ capacity = Climate\ factor \times \{...\}$

   Multiply the required capacity with one of the climate factors mentioned below.
   After you've received the external temperature statistics for your area from your national weather centre you can figure out the difference in temperatures.

Temperature difference between ex- and internal temperatures	Climate factor
40 °C	1.20
35 °C	1.10
30 °C	1.00
25 °C	0.90
20 °C	0.85

6. You can derive how many screens and which type of screen you need from the heating capacity you need to install.
   a. Use the largest screens as often as possible.
   b. Use the same type of screen for one room whenever possible.
   c. Always round up the number of screens.

Screen type	Heating capacity
CH12060, CH12261	25.0
CH10050	17.6
CH07550	12.2
CH12030	10.0
CH06060, CH06161	10.0

Screen placement

Every screen has a maximum range (the IR-intensity decreases as distance increases); this range can be compared to half a sphere fixed on to the front of the screen.

Where you place your screens is essential! Make sure that the range of your screens covers every inch of your room.

Guidelines:

Follow these guidelines as closely as possible.

1. General guideline: distribute your screens equally over a room.

2. Place your screens closer to doors and windows that need to be compensated for.

3. Compensate for large unheated areas by placing additional screens.

4. Make sure the range of your screens also covers your walls so you can profit from accumulated warmth.

5. Reduce the chance at interference by placing the main screen as close as possible to the control.

Ceiling or wall placement?

Ceiling or wall placement has no effect on heating range but there is a difference in energy consumption. Screens placed on the wall will consume more energy because their surface cools down more rapidly.

High spaces

Infrared heat has a limited heating range of 3.0 – 3.5 m.
Keep this in mind when placing your screens.

My ceiling is higher than 2.75 m.
- Place your screens on the wall and not the ceiling.

My ceiling is higher than 2.75 m and I have no walls within range.
- Use chains or steel cables to lower your screens within range.

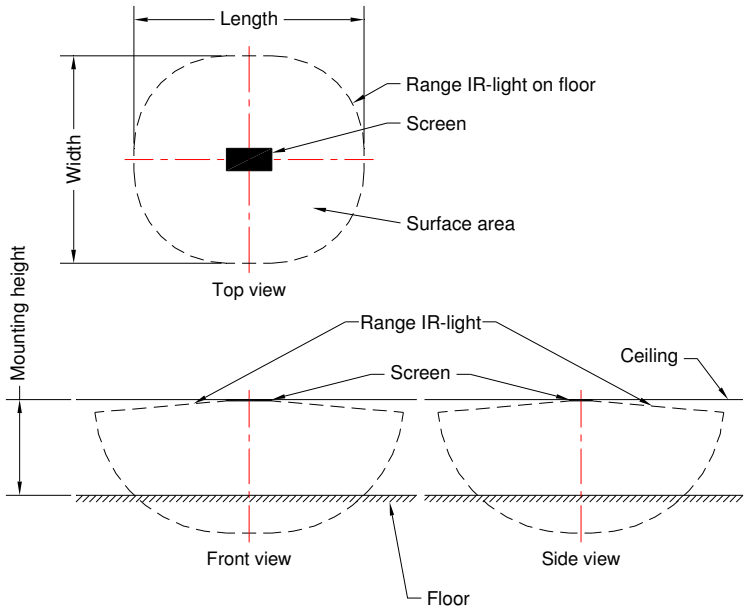
Wall placement

Make sure there is a distance of at least 50 cm between your screen and, for instance, a bench in front of it.

Heating range

These next chapters describe both heating range of the different screen types and the dimensions of the heated floor area, dependent on the suspension height.

Heating range explained

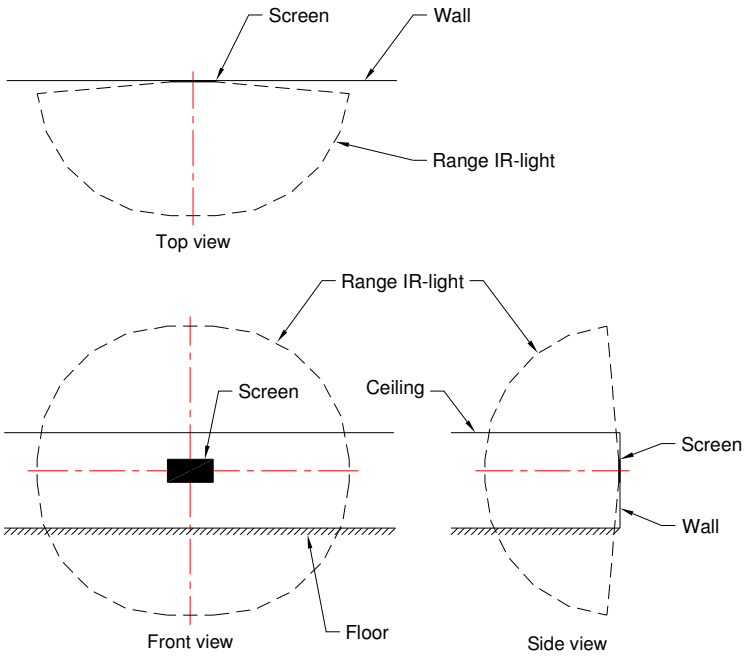


To the left the heating range is drawn when the screens are mounted onto the ceiling.
The dashed lines indicate the heating range.

In the tables below, the length, width and surface area are indicated as a function of the suspension height.

To the right, the heating range is drawn when the screens are mounted onto a wall.

The heating range depends on the screen type and is mentioned below.



CH12060 / CH12261

Heating range: 3.5 m.

Suspension height	Length	Width	Surface area
1.75 m	7.3 m	6.7 m	40.5 m²
2.00 m	6.9 m	6.3 m	37.0 m²
2.25 m	6.6 m	6.0 m	33.0 m²
2.50 m	6.1 m	5.5 m	28.4 m²
2.75 m	5.5 m	4.9 m	23.2 m²

CH10050

Heating range: 3.25 m.

Suspension height	Length	Width	Surface area
1.75 m	6.5 m	6.0 m	32.3 m²
2.00 m	6.1 m	5.6 m	28.8 m²
2.25 m	5.7 m	5.2 m	24.8 m²
2.50 m	5.2 m	4.7 m	20.3 m²
2.75 m	4.5 m	4.0 m	15.1 m²

CH07550

Heating range: 3.1 m.

Suspension height	Length	Width	Surface area
1.75 m	5.9 m	5.6 m	27.3 m²
2.00 m	5.5 m	5.2 m	23.9 m²
2.25 m	5.0 m	4.8 m	20.0 m²
2.50 m	4.4 m	4.2 m	15.5 m²
2.75 m	3.6 m	3.4 m	10.4 m²

CH12030

Heating range: 3.0 m.

Suspension height	Length	Width	Surface area
1.75 m	6.1 m	5.2 m	26.3 m²
2.00 m	5.7 m	4.8 m	22.8 m²
2.25 m	5.2 m	4.3 m	18.7 m²
2.50 m	4.5 m	3.6 m	14.0 m²
2.75 m	3.6 m	2.7 m	8.5 m²

CH06060 / CH06161

Heating range: 3.0 m.

Suspension height	Length	Width	Surface area
1.75 m	5.5 m	5.5 m	24.9 m²
2.00 m	5.1 m	5.1 m	21.4 m²
2.25 m	4.6 m	4.6 m	17.5 m²
2.50 m	3.9 m	3.9 m	13.0 m²
2.75 m	3.0 m	3.0 m	7.8 m²

Placing your thermostats

Where you place your thermostats is very important; make sure they cannot be influenced by external factors.

Guidelines:

1. Keep a distance of minimum 2 m and a distance of maximum 5 m between screens and thermostat.

2. Don't place them in the vicinity of windows, keep a distance of minimum 2 m.

3. Make sure the thermostats cannot be influenced by the direct warmth of the sun.

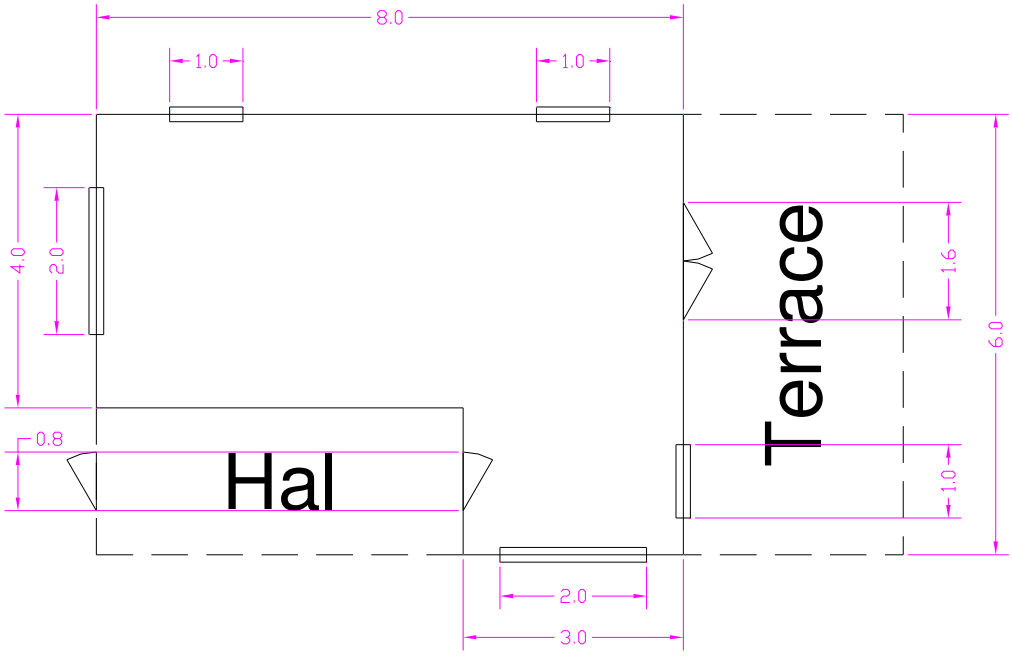
4. Place your screens between 1.5 and 2.0 m from the floor.

Calculation examples

The following examples were calculated with a climate factor of 1.0 (The Netherlands, Belgium or Germany).

Living room

The living room is L-shaped with two large and 3 smaller windows; there is a door to the hall and a double door to the terrace.



Minimum required capacity

Description	Length	Width	Correction factor	Capacity
Floor	8.0 m	4.0 m	1.0	32.00
Floor	3.0 m	2.0 m	1.0	6.00
Double glazing	2.0 m	1.6 m	1.8	5.76
Double glazing	1.0 m	1.6 m	1.8	2.88
Double glazing	1.0 m	1.6 m	1.8	2.88
Double glazing	1.0 m	1.6 m	1.8	2.88
Double glazing	2.0 m	0.8 m	1.8	2.88
Inner door	2.5 m	0.8 m	1.0	2.00
Inner door	2.5 m	1.6 m	2.5	10.00
			Subtotal minimum required capacity	67.28
			Climate factor	1.00
			Minimum required capacity	67.28

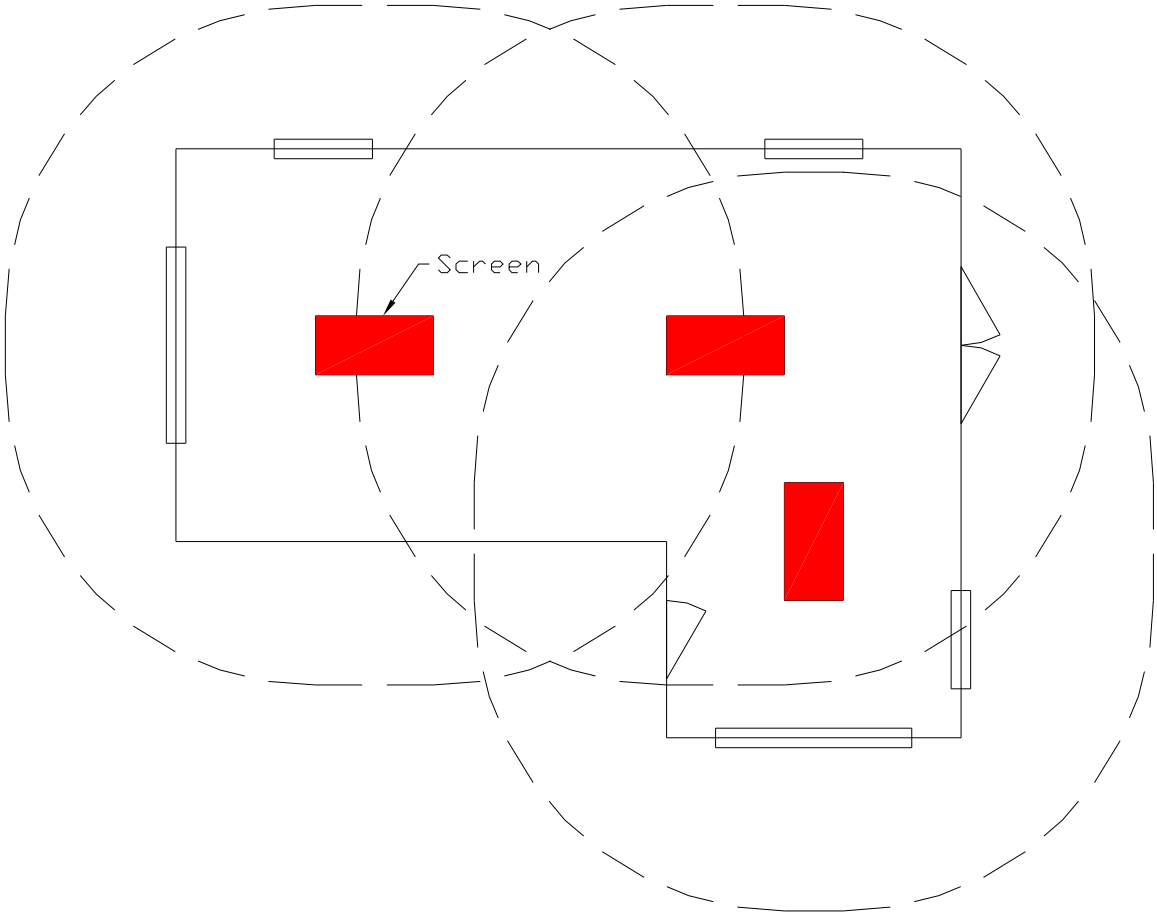
We've established that the room is large enough for CH12060-screens. We'll continue using this type of screen.

The heating capacity of the CH12060 is 25.0 and our minimum required capacity is 67.28. This means we need 67.28 / 25.0 = 2.7 screens. We've figured out through this simple calculation that we need 3 screens (always round your number of screens, upwards).

Screen placement

We recommend using a graphic method to check your heating range.

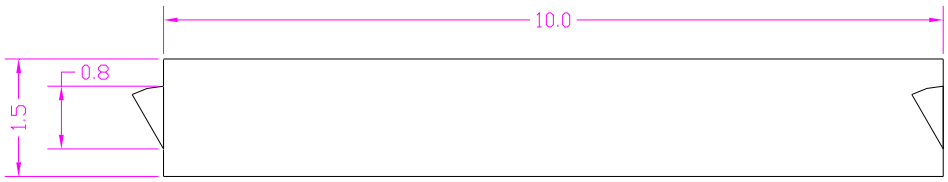
An accurate distribution with screens suspended at a height of 2.5 m would have the following result:



The screens (type CH12060) are represented by the rectangles; the dotted ovals show the directly heated floor area.
The ovals overlap signifying that both floor and walls are heated.

Long narrow corridor

A long narrow corridor with 2 doors, no windows.



Minimum required capacity

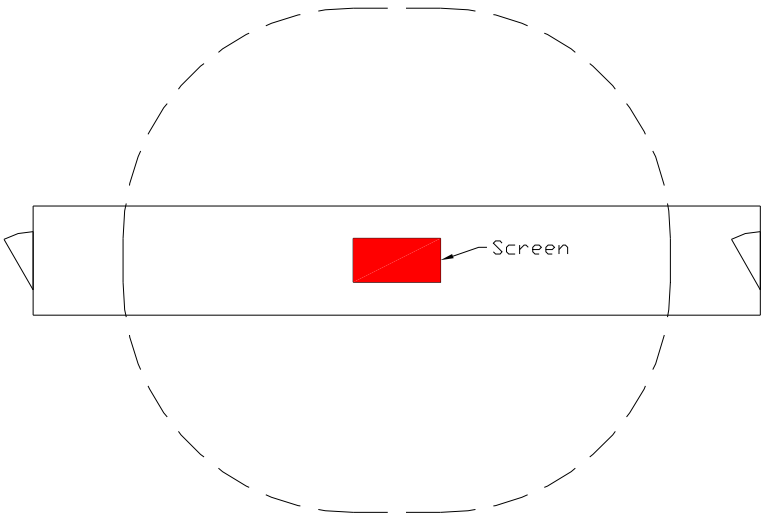
Description	Length	Width	Correction factor	Capacity
Floor	10.0 m	1.5 m	1.0	15.00
Inner door	2.5 m	0.8 m	1.0	2.00
Inner door	2.5 m	0.8 m	1.0	2.00
			Subtotal minimum required capacity	19.00
			Climate factor	1.00
			Minimum required capacity	19.00

We've established that the room is large enough for CH12060-screens.

The heating capacity of the CH12060 is 25.0 and our minimum required capacity is 19.00.
➜ 19.00 / 25.0 = 0.8 screens or 1 screen.

Screen placement

This would give following result:



The graphic method clearly shows that the outer ends of the corridor cannot be heated.

There are two ways to correct this:

1. Place an additional CH12060 screen.

2. Heat the corridor with a different type of screen.

The CH12060 has enough heating capacity to cover the entire room but it doesn't range far enough. If we were to place an additional CH12060 screen or combine another type of screen with the CH12060 we'd be installing too much heating capacity.
This brings us to the 2nd possibility; a different type of screen.

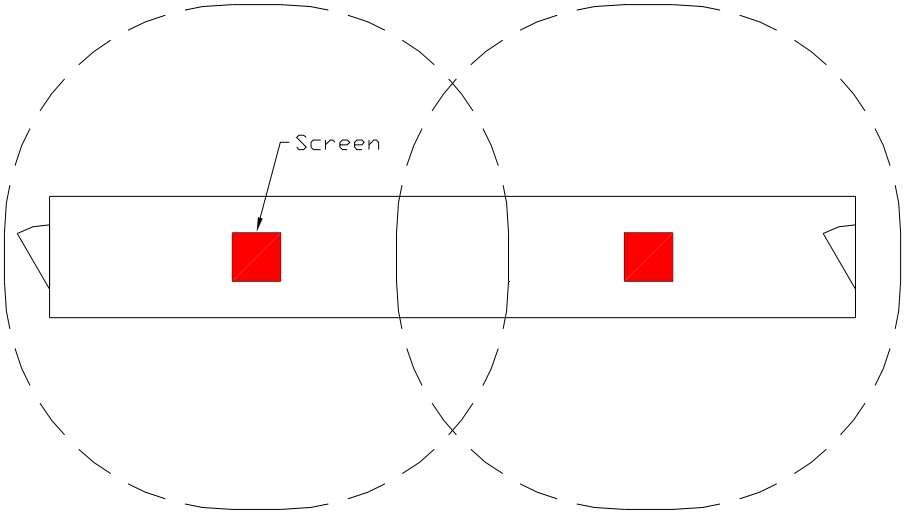
A different type of screen

We encounter the same difficulty with the CH10050; the heating capacity does more than suffice but it lacks in range. There are two possibilities left: the CH06060 and the CH07550; the client's preference would be decisive here.

The heating capacity of the CH06060 is 10.0 and our minimum required capacity is 19.00.
➜ 19.00 / 10.0 = 1.9 screens or 2 screens.

Placing screen type CH06060

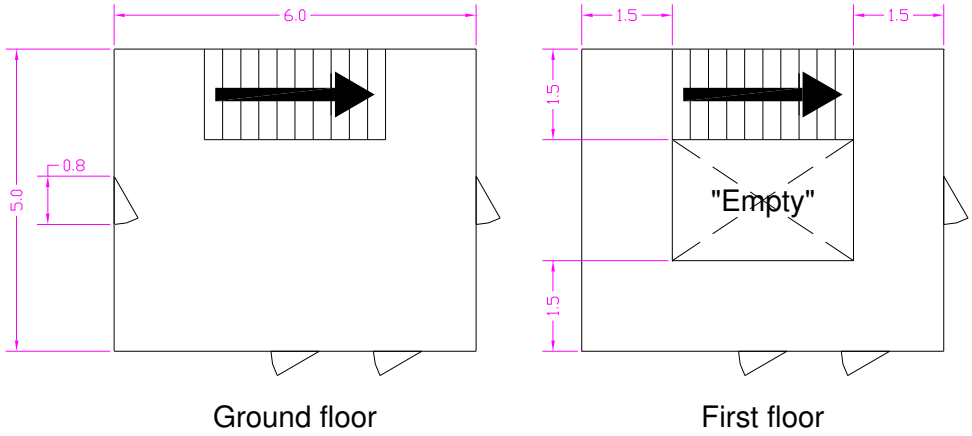
An accurate distribution with screens suspended at a height of 2.5 m would have the following result:



The CH06060's range easily covers every spot of the corridor.

Hall

The hall covers two stories. The first floor has an outside door and 3 inner doors.
The second floor has a hole in the floor creating a gallery with 3 inner doors.
Complying with the client's wishes, the screens are placed on the wall.



Minimum required capacity

You don't have to compensate for the hole in the floor into account. Lexin heats objects and not the air. This can be calculated per floor.

Ground floor				
Description	Length	Width	Correction factor	Capacity
Floor	6.0 m	5.0 m	1.0	30.00
Outside door	2.5 m	0.8 m	2.5	5.00
Inner door	2.5 m	0.8 m	1.0	2.00
Inner door	2.5 m	0.8 m	1.0	2.00
Inner door	2.5 m	0.8 m	1.0	2.00
			Subtotal minimum required capacity	41.00
			Climate factor	1.00
			Minimum required capacity	41.00

We've established that the room is large enough for CH12060-screens.

The heating capacity of the CH12060 is 25.0 and our minimum required capacity is 41.00
➜ 41.00 / 25.0 = 1.6 screens or 2 screens.

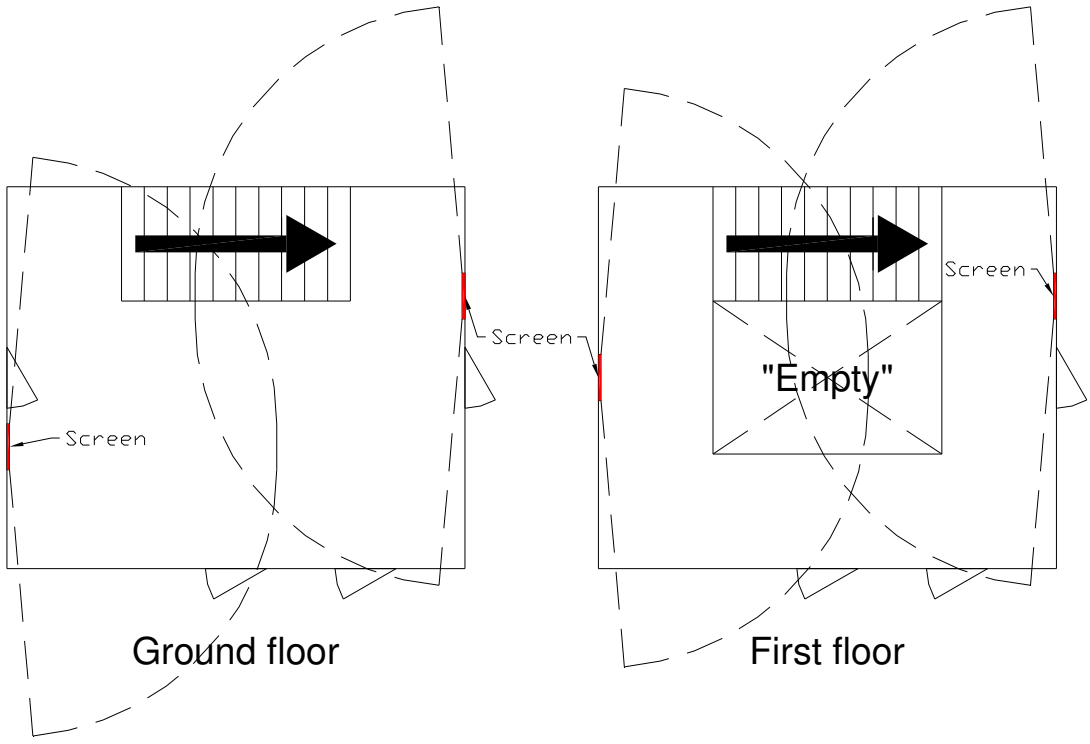
First floor				
Description	Length	Width	Correction factor	Capacity
Floor	6.0 m	5.0 m	1.0	30.00
Inner door	2.5 m	0.8 m	1.0	2.00
Inner door	2.5 m	0.8 m	1.0	2.00
Inner door	2.5 m	0.8 m	1.0	2.00
			Subtotal minimum required capacity	36.00
			Climate factor	1.00
			Minimum required capacity	36.00

We've established that the room is large enough for CH12060-screens.

The heating capacity of the CH12060 is 25.0 and our minimum required capacity is 36.00.
➜ 36.00 / 25.0 = 1.4 screens or 2 screens.

Screen placement

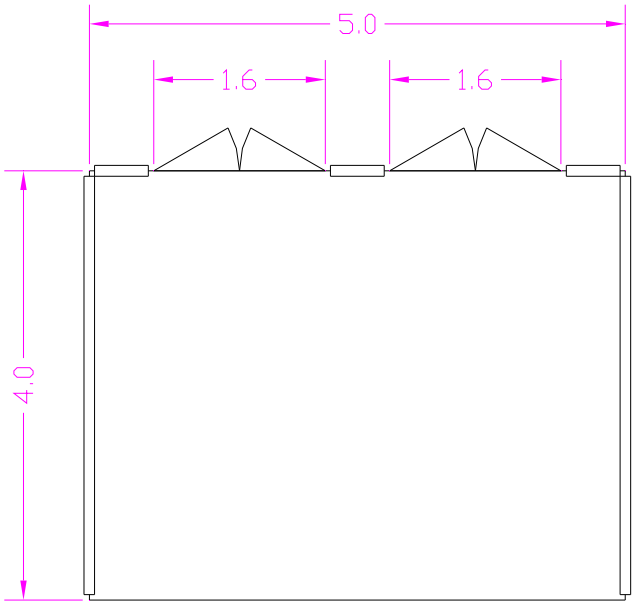
Placing your screens on the wall would have the following result:



The small areas that fall out of the IR-range will be heated through walls and floors, indirectly. Only place additional screens when you have large unheated areas.

Veranda

A veranda with glass on 3 sides and 2 large doors to the garden.



Minimum required capacity

Description	Length	Width	Correction factor	Capacity
Floor	5.0 m	4.0 m	1.0	20.00
Double glazing	4.0 m	2.5 m	1.8	18.00
Double glazing	4.0 m	2.5 m	1.8	18.00
Double glazing	5.0 m	2.5 m	1.8	22.00
Double glazing (-doors)	1.6 m	2.5 m	1.8	-7.00
Double glazing (-doors)	1.6 m	2.5 m	1.8	-7.00
Outside door	2.5 m	1.6 m	2.5	10.00
Outside door	2.5 m	1.6 m	2.5	10.00
			Subtotal minimum required capacity	84.00
			Climate factor	1.00
			Minimum required capacity	84.00

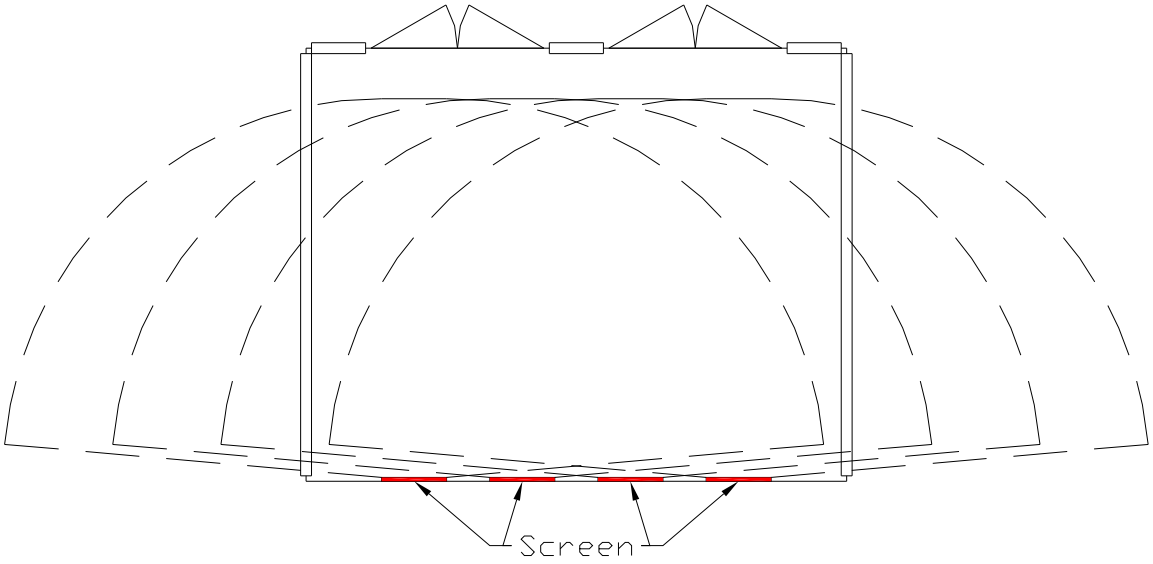
We've established that the room is large enough for CH12060-screens.

The heating capacity of the CH12060 is 25.0 and our minimum required capacity is 84.10.
This means we need 84.10 / 25.0 = 3.4 screens or 4 screens

Screen placement

We can only place the screens on the back wall of the veranda. IR-light has a maximum range of 3.5 m leaving the front area of the veranda unheated.
Again this can be compensated through indirect heating.

Placing your screens on the wall would have the following result:



FAQ's

Miscellaneous

✓ *Are Lexin screens durable products or will the intensity of the IR-light wane after a certain time? Can the wavelength of the IR-light alter?*

No, the screens have been tested extensively and are not subject to wear and tear even when used intensively.

✓ *Do you test every screen that leaves the production facility extensively?*

Yes, we produce our screens according to the "Quality at the source" concept. We personally guarantee the quality of our product.

✓ *Have you encountered any technical difficulties so far? What sort of technical trouble can I expect?*

The only known technical hitches were due to poor installations. There should be no technical problems as long as the transmission calculation is followed to the letter.

✓ *Can I decorate the screens myself?*

Yes, they can be decorated with heat-proof paint that doesn't block IR-light. However we cannot guarantee a self-decorated screen.
We recommend letting us take care of it so that it can be done in a safe and correct manner.

Comfort

✓ *What does "the Lexin Comfort Heating keeps conditions homogeneous" mean?*

It means that Lexin in addition to creating temperature stable surroundings (it doesn't use the air as a medium to transport warmth) it also keeps the humidity in a room constant.

✓ *What is the ideal air humidity?*

A level of 40 to 50% air humidity is ideal for man and beast.

✓ *Does IR-light shine right through windows? What about energy losses?*

Yes, a certain amount of IR-light passes through windows and has to be compensated for by a correction factor.
However this amount is limited because a heat bridge is created that will reflect most of the IR-light back into the room.

✓ *If I place my screen on the ceiling will it mainly heat my head?*

No, screens emit IR-light in an angle of 170°, heat will be distributed equally through a room.
Also see "Heating range" on page 27.

✓ *Can I get burned touching a heated screen?*

No, glass is too poor a conductor to transport enough energy (heat) to the surface to get burned.

✓ *The cold period for my area only represents a very short period of time. Can I leave it out when calculating my climate factor?*

No, the lowest temperature of the year is a defining element in your climate factor.

Energy consumption

✓ *According to the degree days a CH12060 consumes 975 kWh per year. Do these figures apply to a stand-alone system or to a control linked screen?*

These figures apply to screens linked to a control and a room thermostat (Lexin Comfort Heating).

✓ *Is there a difference in energy consumption between a stand-alone screen and the Lexin Comfort Heating?*

Yes, stand-alone screens consume 1.7 to 2.5 times more than a regulated screen (they will emit IR-light constantly and at their maximum level in colder periods).
Your energy consumption will vary between 1 625 and 2 438 kWh per year depending on the desired room temperature, the exterior temperature and whether you use a room thermostat or not.

✓ *Is there a difference in energy consumption between ceiling and wall placement?*

Yes, the difference occurs because screens placed on the wall will consume more energy because their surface cools down more rapidly.

Place your screen on the ceiling for an optimal heat distribution and a lower energy consumption.

Installation

✓ *Will a standard electricity connection suffice to operate the Lexin Comfort Heating?*

This depends on the size of your installation. An average house would require an estimated 3 groups of screens or 25 Amps.

✓ *Are the Lexin screens compatible with my old thermostat?*

Lexin screens are compatible with most thermostats although we do recommend using the extensively tested thermostats mentioned in this technical guide.

✓ *Is there a difference between heating a stone and a prefab house (timber frame), does this have an effect on my energy consumption?*

Yes, there is a difference, wood will accumulate warmth more quickly than stone but stone has a vaster accumulating capacity.
The 2 properties cancel each other out making the energy consumption difference negligible.

✓ *Can the IR-light interfere with the movement sensors of my alarm system?*

No, the screens emit infrared of a very long wave length that is undetectable to your infrared movement sensors ruling out any danger of false alarm.

✓ *Is there a possibility to enlarge the connection capacity of the KeCoTec300 when my required capacity exceeds 11 kW?*

Yes, in theory you can even link an unlimited number of KeCoTec 300's but in practice we'll simply enlarge your connection capacity with power relays.

✓ *How long does it take to warm a house? Is there a difference between heating a house with a lot of moisture and a dry house?*

Yes, residences that are moist will take longer to heat. How long exactly depends on the level of moisture in your residence.

✓ *Can I place a curtain in front of a screen?*

Yes, you can place a curtain in front of your screen without affecting your heating capacity. The indirect heat will compensate for the loss of direct heat. However when placing your curtain make sure you keep a distance of at least 50 cm between the front of the screen and the curtain.

✓ *Can I heat a larger room; say 11 x 11 m, by placing my screens on the wall? Will the screens' heating range suffice?*

In this particular case we place the screens on the walls across of one another. We know IR-light is effective within a radius of 3.5 m making our direct heating range 7.0 m.
Indirect heating stretches that range to about 10 m without there being any "colder areas".
The Lexin Comfort Heating can only be used as a zone-heating system for rooms larger than 10 m.

✓ *Is it possible to set my temperature for each room separately with one thermostat?*

This is possible with the right thermostat, one that can separate the room temperature from the controls.

Please contact your Lexin Agent for the availability of this product.

Glossary

Earth leakage circuit breaker	A switch that guarantees the safety of your electrical installation. The switch will switch off from the moment it's touched preventing any possible injury.
Direct heating	A heat source that doesn't use the air as transport medium but heats objects directly.
Weighted degree days	Indicator for the average exterior temperature taking into account certain seasonal influences.
Main room	Where you place your screen with the built-in thermostat.
Main thermostat	Defines the controls (S1 on page ?).
Indirect heating	A directly heated object will accumulate warmth that will then use this accumulated warmth to warm another object in its vicinity.
Circuit breaker	Electrical device that can interrupt the flow of electrical current when it overloads.
Metabolism	All the chemical processes in your body, especially those that cause food to be used for energy and growth.
Nanometer	One billionth of a meter.
Secondary thermostat	Only switches 1 or 2 screens on and off, for rooms that require a different temperature; for example: bedroom, bathroom etc. (S2-S7 on page ?).
Transmission calculation	Defines the type and number of screens needed in your home.
Emission angle	Angle of 170° in which the screens emit their IR-light.
Heating range	The maximum distance from the screen that can be directly heated.
Heating capacity	The area that can be heated by a single screen.
Weighing factor	Used in the weighted degree days calculation to compensate for weather influences such as: wind and direct sunlight.

Electrical tension, current and resistance

Quantities such as electrical tension and current can easily be explained by comparing them to a hose with water running through.
The water that runs through your hose is like electrical current in your wiring. The water pressure difference making the water flow in one direction is like the electrical tension pushing the current one way. The water will flow more rapidly if the pressure difference increases but when the hose is squeezed the resistance of the water builds up, decreasing the water flow. The same applies for the known electrical quantities.

The quantity for electrical tension (U) is Volt or V, e.g.: U = 230 V.
The quantity for electrical current (I) is Ampere or A, e.g.: I = 4.8 A.
The quantity for electrical resistance (R) is Ohm or Ω, e.g.: R = 50 Ω.

The connection between these 3 quantities is known as Ohm's law:

$$Resistance\,(R) = \frac{Tension\ (U)}{Current\ (I)}$$

Electric power

The electric power of an appliance equals the amount of energy it consumes. Most of this energy converts into heat.

The unit for Power (P) is Watt, or W.; e.g. P = 1 000 W.

This electric power is given by the formula: $Power\,(P) = Tension\ (U) \times Current\,(I)$

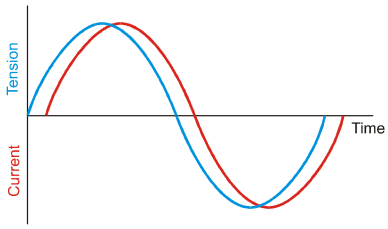
We can also use this formula to calculate the amount of energy an appliance has absorbed.
E.g. P = 1 000 W and U = 230 V. The absorbed power is 1 000 W / 230 = 4.3 A.

Finally this formula allows you to calculate the maximum power that can be connected to 1 group. In most cases this is 16 A. Logically this means that with a tension of 230 V your maximum power is 3 680 W per group (230 * 16 = 3 680 W) or 3 screens of 1 000 W or 7 screens of 500 W.

Cos φ

Most sockets offer current whose sign changes 50 times per second also known as alternating current.

This constant altering can create phase shifting. Phase shifting in electricity can be defined as the absorbed alternating current running out of synchronisation with the alternating tension (see illustration).



The unit for this phenomenon is cos φ (or cosine Phi), its value can vary from 0.0 to 1.0 where 1.0 indicates that no phase shifting occurs and 0.0 shows that the maximum phase shift is -90° or 90°.

The most common cos φ for electrical appliances is 0.9 – 1.0 (= not purely resistive).

Electric potential and cos f allow you to define your energy consumption.

Unlike other appliances screens have a pure resistive load (cos φ is 1.0).

Electric energy consumption

What you are eventually going to consume and pay for it is off course of great relevance.
Your energy supplier can determine exactly how much energy you've consumed with a kWh meter.

The unit for energy (E) is kWh; e.g. E = 25 kWh.

Put into practice this entails that a screen of 1 000 W will consume 1 kWh per hour and a screen of 500 W will consume 0.25 kWh per ½ h.

The price you pay for 1 kWh depends on several things: your location, your energy supplier and your subscription but will usually vary between € 0.05 and € 0.20.

Let your screens work at will when only paying the standard rate but5 use them selectively if you have a double rate for you electricity bill.
Raising the temperature of your screen at night allows you to accumulate warmth during the cheaper rate and benefit from it during the more expensive day rate.
With the right thermostat you can even program this selective usage of your screens.

Also see" Energy consumption" on page 9.

Document revisions

6 June 2005	Changed logo and wedaddress.
29 November 2004	First release of the English technical documentation.

Index

Annexes

Screens: technical data

Article number	CH12060	CH12030	CH10050	CH07550	CH06060	CH12261	CH06161
Dimensions	1195x595x35 mm	1195x295x35 mm	1001x501x35 mm	752x501x35 mm	595x595x35 mm	47,6x23,6x1,4 in	23,6x23,6x1,4 in
Housing (standard)	White aluminium profile						
Weight	10 kg	5 kg	8 kg	7 kg	5 kg	22 lb	11 lb
Power	1 000 W	500 W	800 W	600 W	500 W	1 000 W	500 W
Supply voltage	230 VAC, 50 Hz					110 VAC, 60 Hz	
Nominal current	4,3 A	2,2 A	3,5 A	2,6 A	2,2 A	9,1 A	4,5 A
Cord	3x 1,5 mm^2, 1,5 m						
Connection	Earth connection plug					Earth connection plug	
CE conformity	Low tension guideline 73/23/EEG en 93/68/EEG						
UL conformity	Pending						
Protection class	IP54						
Glass colour (standard)	White (RAL 9010), Black (RAL 9005)						
Glass colour (option)	Other RAL colours, custom-made design						
IR-light intensity sensor	Optional						
Heating capacity	250	100	176	122	100	250	100
IR-light range	3.5 m	3.0 m	3.25 m	3.1 m	3.0 m	11.5 ft	9.8 ft
Max. heating range	7.3 x 6.7 m	6.1 x 5.2 m	6.5 x 6.0 m	5.9 x 5.6 m	5.5 x 5.5 m	24.0 x 22.0 ft	18.0 x 18.0 ft
Max. heating surface	40.5 m^2	26.3 m^2	32.3 m^2	27.3 m^2	24.9 m^2	435.9 ft^2	268.0 ft^2

Article code of Lexin screens

General format
<Type> <Length> <Width> - <Colour> - <Temperature sensor> - <Housing> - <Glass surface> - <Safety film> - <Voltage>

Type

CH	Comfort Heating.
CHHP	Comfort Heating (High Power).
SN	Sauna Heating.
DR	Industrial Drying of IR-curing and Water-based Inks.
AGPF	Agricultural Heating of Poultry Farms.
AGCW	Agricultural Heating of Cowsheds.
AGGH	Agricultural Heating of Greenhouses.

Length and Width
Three digits are reserved for Length.
Two digits are reserved for Width.

05050	Outside dimension: 501 x 501 x 35 mm.
06060	Outside dimension: 595 x 595 x 35 mm.
06161	Outside dimension: 23,6 x 23,6 x 1,4 in.
07550	Outside dimension: 752 x 501 x 35 mm.
10050	Outside dimension: 1.001 x 501 x 35 mm.
12030	Outside dimension: 1.195 x 295 x 35 mm.
12060	Outside dimension: 1.195 x 595 x 35 mm.
12261	Outside dimension: 47,6 x 23,6 x 1,4 in.

Colour
According to the RAL colour standard.

9005	Black.
9010	White.
XXXX	Custom-made design.

Sensor

S	PT1000 temperature sensor installed.
0	No temperature sensor installed.

Housing

HA	Aluminium frame.
HW	Water and acid proof synthetic housing.

Glass surface

GT	Textured.
GF	Float.

Safety film
Glass surface must be float when safety film is applied.

SF	Safety film applied.
ST	Textured safety film applied.
0	No safety film applied.

Voltage

110	110 VAC.
230	230 VAC.

Default values
If a default value is used, it may be omitted.

Type	Colour	Sensor	Housing	Glass surface	Safety film	Voltage
CH, CHHP (metric)	**9010**	**0**	**HA**	**GT**	**0**	**230**
CH, CHHP (imperial)	**9010**	**0**	**HA**	**GT**	**0**	**110**
SN	**9005**	**0**	**HA**	**GF**	**0**	**230**
DR	**9005**	**0**	**HA**	**GF**	**0**	**230**
AGPF, AGCW	**9005**	**0**	**HW**	**GF**	**0**	**230**
AGGH	**9010**	**0**	**HW**	**GF**	**0**	**230**

Examples

CH12060	Comfort Heating, 1.000 W, 120x60 cm, white, no sensor, aluminium frame, textured glass, no safety film, 230 VAC.
CH12060-9010-0-HA-GT-0-230	Comfort Heating, 1.000 W, 120x60 cm, white, no sensor, aluminium frame, textured glass, no safety film, 230 VAC.
CHHP12060-9005-S-GF	Comfort Heating, 1.200 W, 120x60 cm, black, with sensor, aluminium frame, float glass, no safety film, 230 VAC.
CH12261-XXXX	Comfort Heating, 1.000 W, 47,6x23,6 in, custom-made design, no sensor, aluminium frame, textured glass, no safety film, 110 VAC.
SN12060-SF	Sauna Heating, 1.100 W, 120x60 cm, black, no sensor, aluminium frame, float glass, with safety film, 230 VAC.
AGPF12060-SF	Agricultural Heating of Poultry Farms, 1.050 W, 120x60 cm, black, no sensor, water proof housing, float glass, with safety film, 230 VAC.

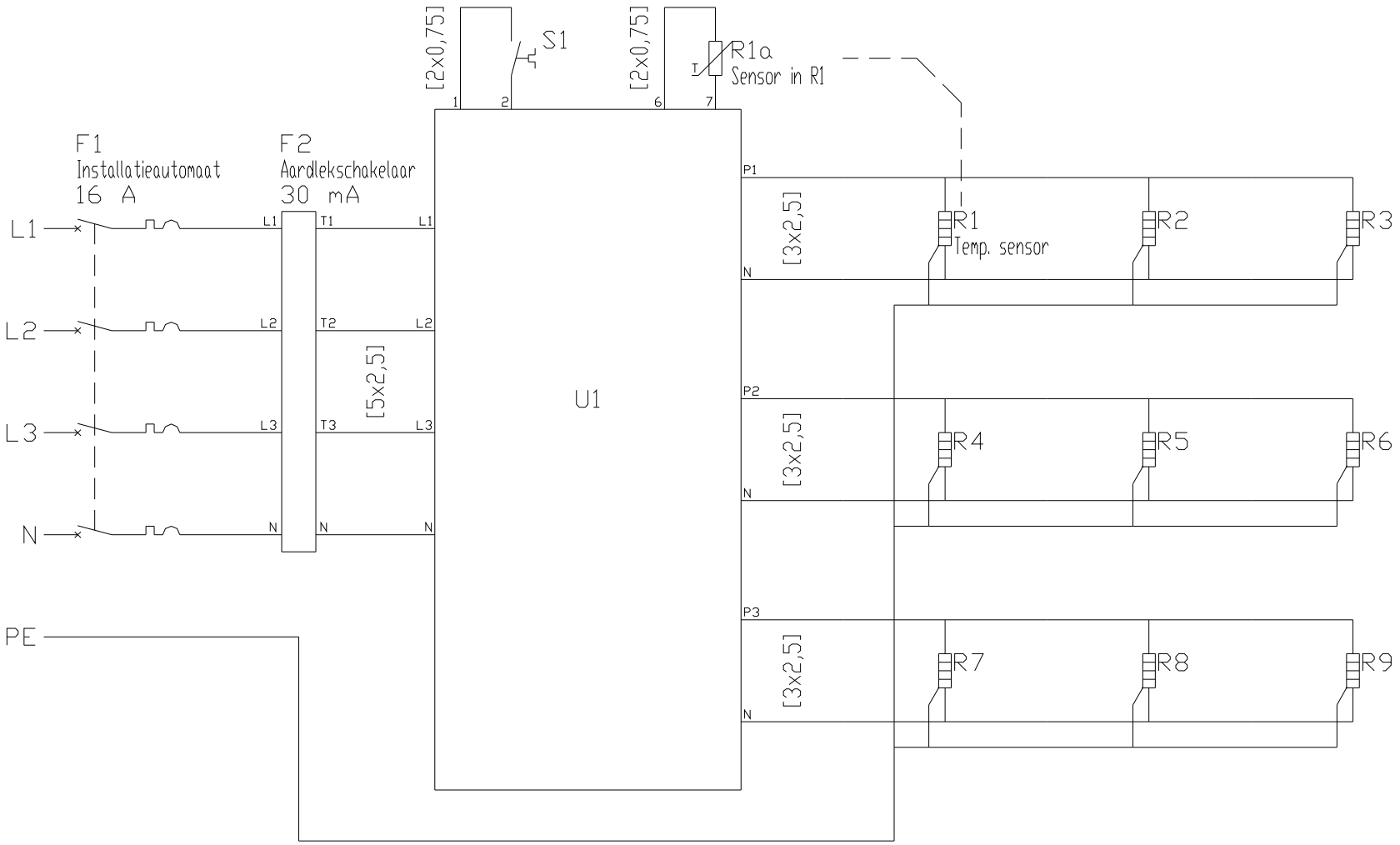
Controls: technical data

	KeCoTec 100	KeCoTec 300
Maximum capacity	230 V, 16 A, 3.680 W	230 V, 3x 16 A, 11.040 W
Number of phases	1	3
Thermostat input	Potential free contact, NO	
Temperature range main screen	80 – 150 °C	
Measuring the main screens' temperature	PT1000	

Thermostats: technical data

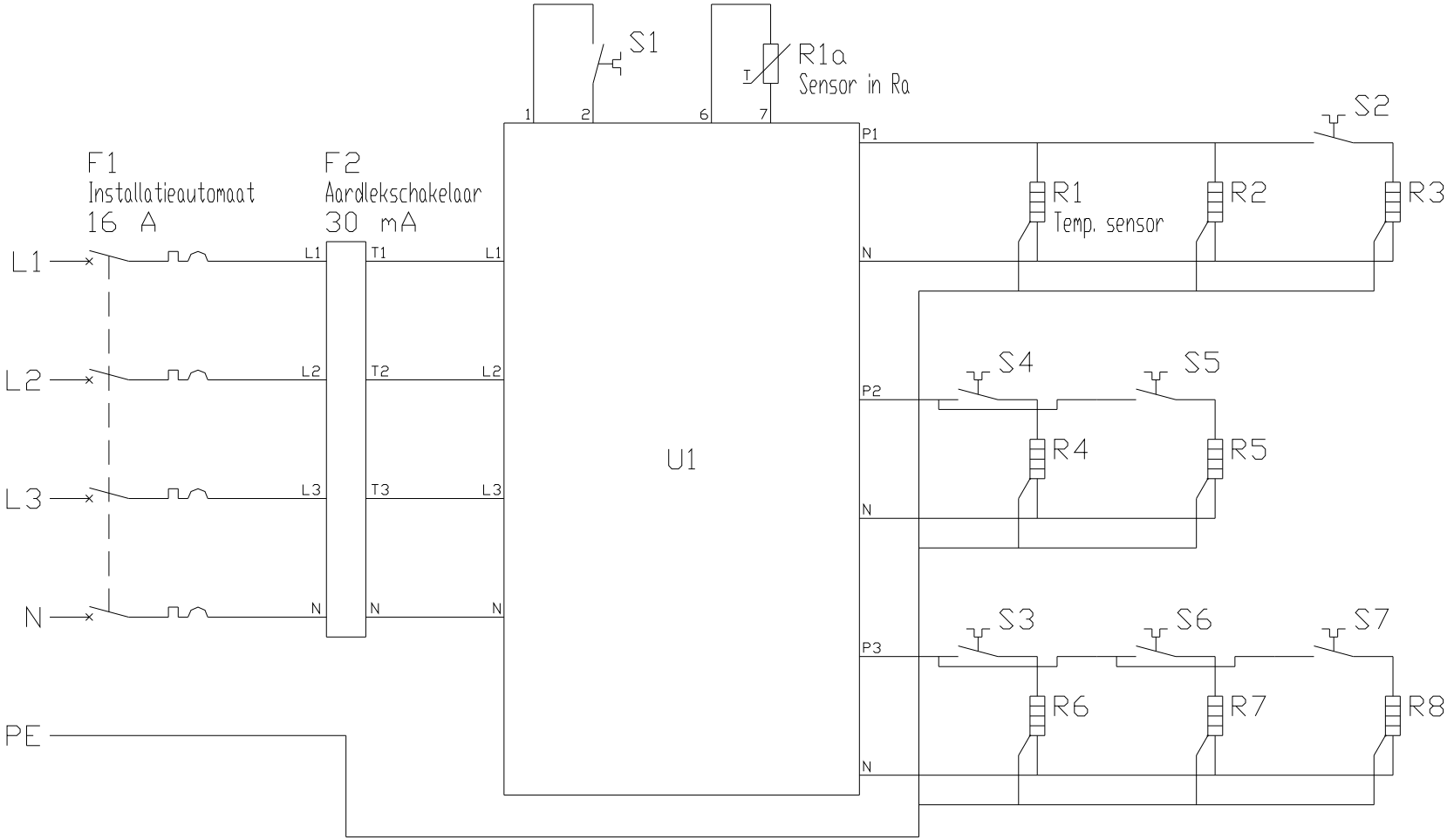
	Theben Ram 812 Top	AEG030	RTR030	RTR3311
Maximum capacity	230 – 250 V, 6 A	230 – 250 V, 16 A		
Power supply	230 V	Not applicable		
Temperature range	6 – 30 ˚C	6 – 30 ˚C		
Adjustable temperature range	No	Yes	No	
Dimensions	143 x 95 x 30 mm	75 x 75 x 25 mm	70 x 70 x 25 mm	70 x 70 x 40 mm
Cord length	Not applicable			2 meter

KeCoTec 300 with earth leakage circuit breaker and installation automat

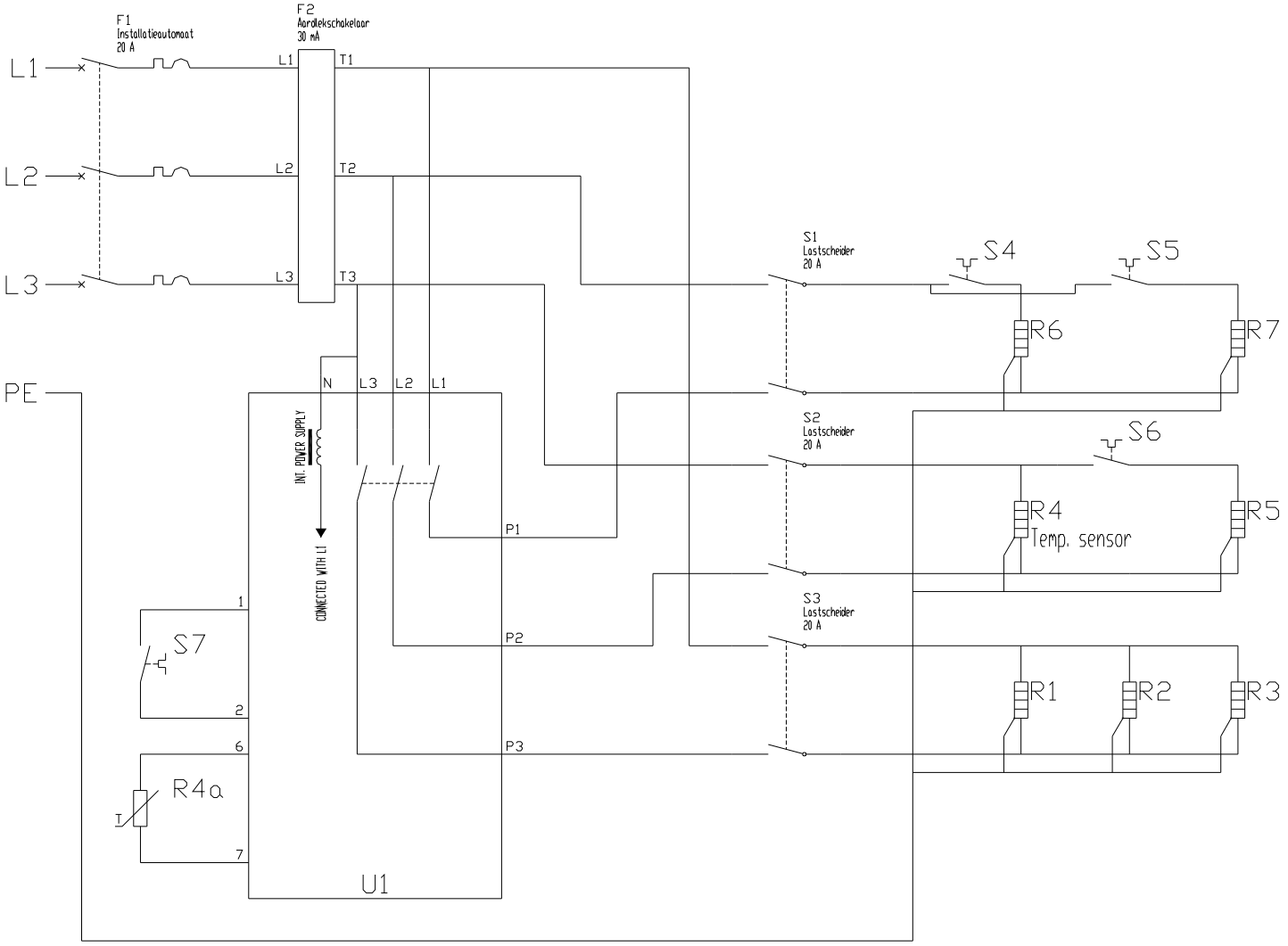


KeCoTec 300 for an entire residence

Every room with screen (R) is equipped with a thermostat (S). The 2 main screens (R1, R2) are not equipped with a thermostat but are directly linked to the control; the control in turn is defined by the room thermostat (S1). The main screen with built-in thermostat is placed in the main room (living room).



KeCoTec 300 for an entire residence connected in delta



Conversion tables

Temperature ˚C → ˚F	
-30 ˚C	-22 ˚F
-25 ˚C	-13 ˚F
-20 ˚C	-4 ˚F
-15 ˚C	5 ˚F
-10 ˚C	14 ˚F
-5 ˚C	23 ˚F
0 ˚C	32 ˚F
5 ˚C	41 ˚F
10 ˚C	50 ˚F
15 ˚C	59 ˚F
20 ˚C	68 ˚F
25 ˚C	77 ˚F
30 ˚C	86 ˚F
35 ˚C	95 ˚F
40 ˚C	104 ˚F
45 ˚C	113 ˚F
50 ˚C	122 ˚F
55 ˚C	131 ˚F

Temperature ˚F → ˚C	
-30 ˚F	-34.3 ˚C
-20 ˚F	-28.9 ˚C
-10 ˚F	-23.3 ˚C
0 ˚F	-17.8 ˚C
10 ˚F	-12.2 ˚C
20 ˚F	-6.7 ˚C
30 ˚F	-1.1 ˚C
40 ˚F	4.4 ˚C
50 ˚F	10.0 ˚C
60 ˚F	15.6 ˚C
70 ˚F	21.1 ˚C
80 ˚F	26.7 ˚C
90 ˚F	32.2 ˚C
100 ˚F	37.8 ˚C
110 ˚F	43.3 ˚C
120 ˚F	48.9 ˚C
130 ˚F	54.4 ˚C
140 ˚F	60.0 ˚C

Length mm → in	
5 mm	0.20 in
10 mm	0.39 in
15 mm	0.59 in
20 mm	0.79 in
25 mm	0.98 in
30 mm	1.18 in
35 mm	1.38 in
40 mm	1.57 in
45 mm	1.77 in
50 mm	1.97 in
55 mm	2.17 in
60 mm	2.36 in
65 mm	2.56 in
70 mm	2.76 in
75 mm	2.95 in
80 mm	3.15 in
90 mm	3.54 in
100 mm	3.94 in

Length in → mm	
0.1 in	2.5 mm
0.2 in	5.1 mm
0.3 in	7.6 mm
0.4 in	10.2 mm
0.5 in	12.7 mm
0.6 in	15.2 mm
0.7 in	17.8 mm
0.8 in	20.3 mm
0.9 in	22.9 mm
1.0 in	25.4 mm
1.5 in	38.1 mm
2.0 in	50.8 mm
2.5 in	63.5 mm
3.0 in	76.1 mm
3.5 in	88.9 mm
4.0 in	101.6 mm
4.5 in	114.3 mm
5.0 in	127.0 mm

Length m → ft	
0.1 m	0.33 ft
0.2 m	0.66 ft
0.3 m	0.98 ft
0.4 m	1.31 ft
0.5 m	1.64 ft
0.6 m	1.97 ft
0.7 m	2.30 ft
0.8 m	2.62 ft
0.9 m	2.95 ft
1.0 m	3.28 ft
1.5 m	4.92 ft
2.0 m	6.56 ft
2.5 m	8.20 ft
3.0 m	9.84 ft
3.5 m	11.48 ft
4.0 m	13.12 ft
4.5 m	14.76 ft
5.0 m	16.40 ft

Length ft → m	
0.5 ft	0.15 m
1.0 ft	0.30 m
1.5 ft	0.46 m
2.0 ft	0.60 m
2.5 ft	0.76 m
3.0 ft	0.91 m
3.5 ft	1.07 m
4.0 ft	1.22 m
4.5 ft	1.37 m
5.0 ft	1.52 m
6.0 ft	1.83 m
7.0 ft	2.13 m
8.0 ft	2.44 m
9.0 ft	2.74 m
10.0 ft	3.05 m
11.0 ft	3.35 m
12.0 ft	3.66 m
13.0 ft	3.96 m