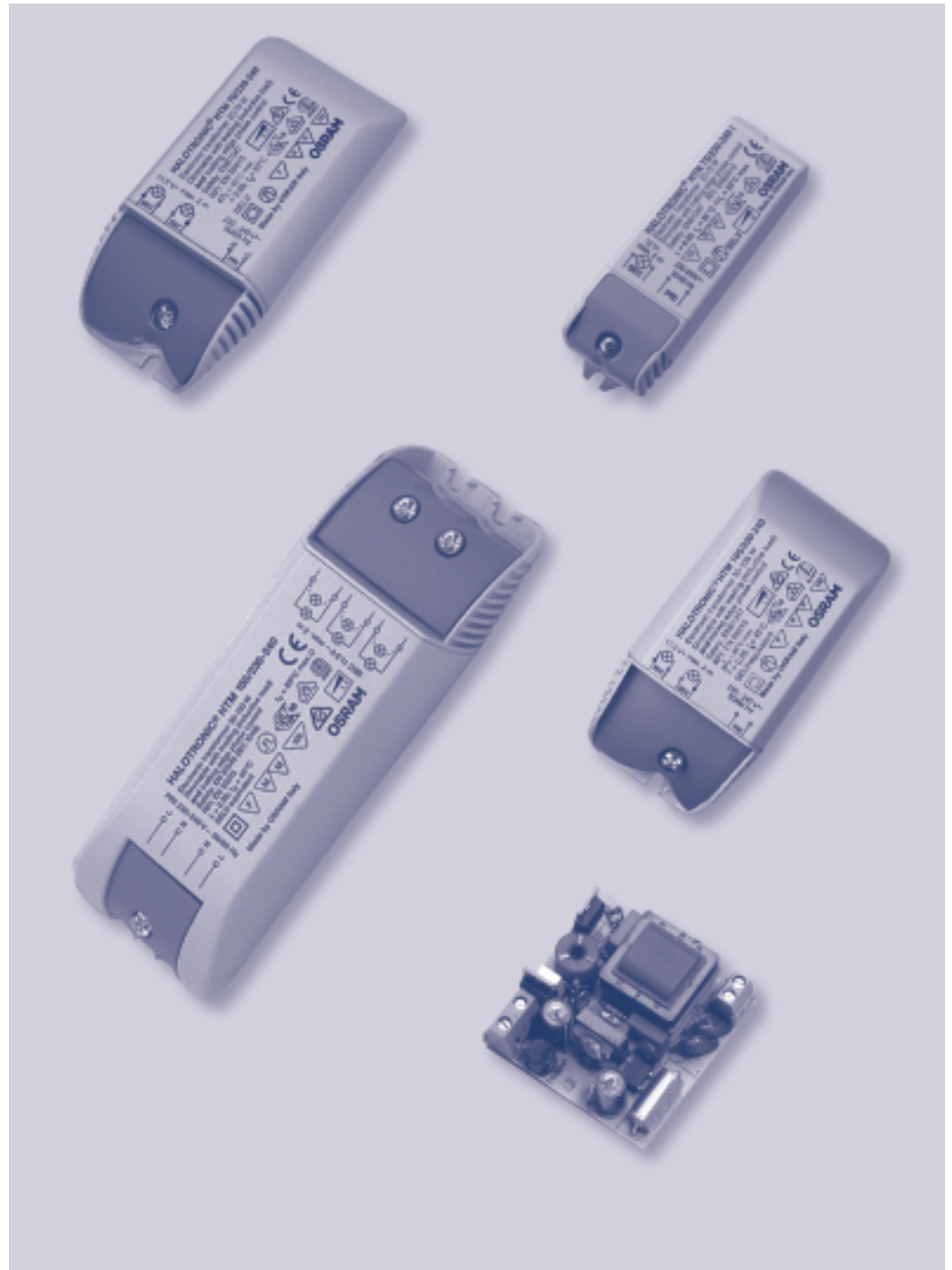


HALOTRONIC

Technical Guide

January 2006

**Electronic
transformers
for low-voltage
halogen lamps**



**Units for lighting
systems**

**Units for installation
in luminaires**

SEE THE WORLD IN A NEW LIGHT



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1. Design and mode of operation

HALOTRONIC® transformers are electronic transformers which replace conventional transformers for operating 12 V tungsten-halogen lamps.

They have about 60 % of the volume, 15 % of the weight and 30 % of the power loss of conventional transformers.

The diagram below shows the way in which the HALOTRONIC® transformer works. The mains voltage is rectified, converted into a high-frequency voltage in the chopper, converted back into an ac voltage and fed to an output converter which converts it into a 12 V ac-voltage. A filter ensures that radio interference standards are met and helps make the unit immune to interference.

Block diagram

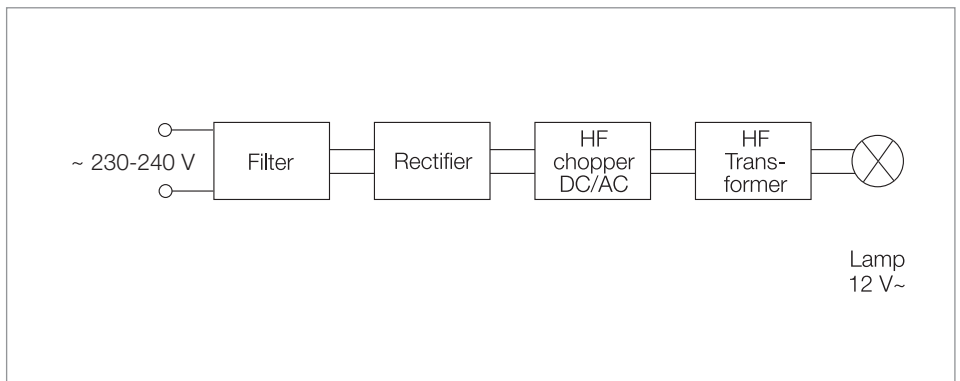


Fig. 1

Because HALOTRONIC® transformers have such a low power loss, they generate much less heat than conventional transformers. In partial load operation, HALOTRONIC® transformers do not produce overvoltages so even in this mode of operation there is no reduction in the life of the lamp.

Electronic transformers are not suitable for any other load than low voltage halogen lamps.

2. Range and technical data

HALOTRONIC® is available in different versions, with and without casings, for wattages between 20 W and 210 W.

- For separate installation (stand alone units with casing and cable clamp):
 - with long casing (L)
 - with low-profile casing (LF)
 - compact for standard application (HTM)
 - for particularly small spaces (HTN)
- For installation in luminaires

Units in different shapes and wattage levels, with and without casings:

- with casing without cable clamp (S)
- board model (B)

All stand alone units can also be installed in luminaires.

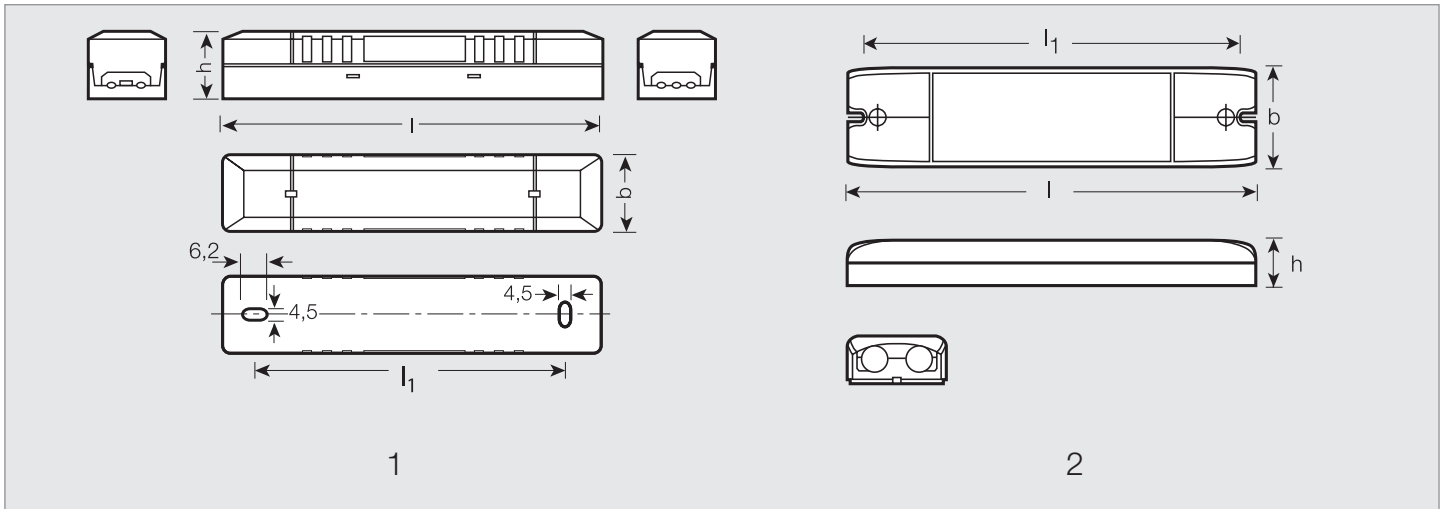


Fig. 2

HALOTRONIC®

Design	Long with casing	Long with casing	Long with casing	Long with casing	Low-profile with casing
Reference	HT 70/230/12 L	HT 105/230/12 L	HT 150/230/12 L	HT 210/230/12 L	HT 120/230-240/12 LF
Nominal mains voltage	230 V	230 V	230 V	230 V	230 - 240 V
Voltage range	207 - 244 V	207 - 244 V	207 - 244 V	207 - 244 V	207 - 254 V
Mains frequency	0/50 Hz	0/50 Hz	0/50 Hz	0/50 Hz	50 Hz
Operating frequency	Approx. 45 kHz	Approx. 32 kHz	Approx. 35 kHz	Approx. 35 kHz	Approx. 50 kHz
Mains current	0.29 A	0.46 A	0.65 A	0.9 A	0.48 A
Power factor	0,95	0,95	0,95	0,95	0,95
Max. lamp wattage	70 W	105 W	150 W	210 W	120 W
Power loss	3 W	6 W	7 W	9 W	6 W
Partial load range	20 - 70 W	20 - 105 W	50 - 150 W	50 - 210 W	35 - 120 W
Secondary voltage	11.6 V (70 W) 12.0 V (20 W)	11.6 V (105 W) 12.0 V (20 W)	11.6 V (150 W) 12.0 V (50 W)	11.6 V (210 W) 11.8 V (50 W)	11.3 V (120 W) 11.5 V (35 W)
Temperature range	- 20 °C to + 60 °C	- 20 °C to + 50 °C	- 20 °C to + 55 °C	- 20 °C to + 50 °C	- 20 °C to + 45 °C
Terminal pairs primary/secondary	2/3	2/3	2/3	2/3	2/2
Dimming	Trailing-edge phase dimmer	Trailing-edge phase dimmer	Trailing-edge phase dimmer	Trailing-edge phase dimmer	Trailing-edge phase dimmer
Short circuit protection	Electronically reversible ¹⁾	Electronically reversible ¹⁾	Electronically reversible ¹⁾	Electronically reversible ¹⁾	Electronically reversible
Overload protection	Electronically reversible ¹⁾	Electronically reversible ¹⁾	Electronically reversible ¹⁾	Electronically reversible ¹⁾	Electronically reversible
Over-temperature protection	Electronically reversible ¹⁾	Electronically reversible ¹⁾	Electronically reversible ¹⁾	Electronically reversible ¹⁾	Electronically reversible
Approval marks					
Radio interference suppression	EN 55015	EN 55015	EN 55015	EN 55015	EN 55015
Harmonics	EN 61000-3-2	EN 61000-3-2	EN 61000-3-2	EN 61000-3-2	EN 61000-3-2
Immunity	EN 61547	EN 61547	EN 61547	EN 61547	EN 61547
Length l	175 mm	175 mm	220 mm	220 mm	172 mm
Length l1	140 mm	140 mm	180 mm	180 mm	164 mm
Width b	42 mm	42 mm	46 mm	46 mm	42 mm
Height h	34 mm	34 mm	44 mm	44 mm	20 mm
Weight	170 g	200 g	270 g	300 g	170 g
EAN	4050300 297453	4050300 299662	4050300 332123	4050300 462257	4050300 461342
Fig.	1	1	1	1	2

¹⁾ Reversible protection only if powered by ac voltage

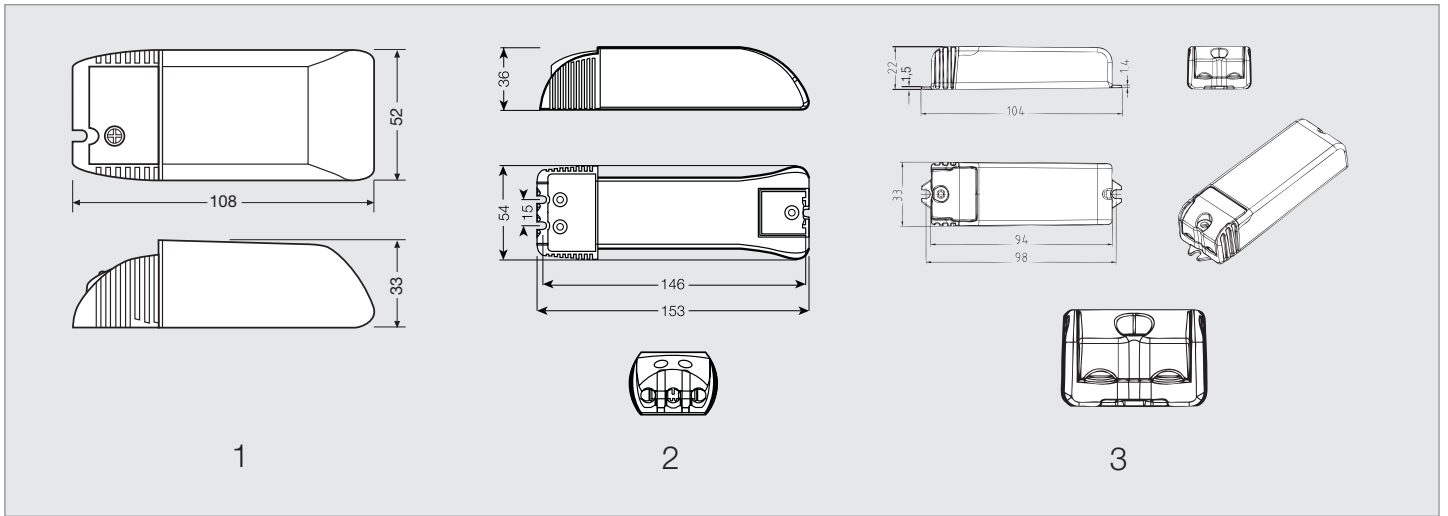


Fig. 3

HALOTRONIC®

Design	Compact (Mouse)	Compact (Mouse)	Compact (Mouse)	Very small
Reference	HTM 70/230-240	HTM 105/230-240	HTM 150/230-240	HTN 75/230-240 I
Nominal mains voltage	230 V - 240 V	230 V - 240 V	230 V - 240 V	230 V - 240 V
Voltage range	207 - 254 V	207 - 254 V	207 - 254 V	207 - 254 V
Mains frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Operating frequency	Approx. 48 kHz	Approx. 40 kHz	Approx. 40 kHz	Approx. 48 kHz
Mains current	0.27 A	0.42 A	0.57 A	0.32 A
Power factor	0.95	0.95	0.95	0.95
Max. lamp wattage	70 W	105 W	150 W	75 W
Power loss	max. 4 W	max. 6 W	max. 7 W	max. 4 W
Partial load range	20 - 70 W	35 - 105 W	50 - 150 W	20 - 75 W
Secondary voltage	11.2 V (70 W)	11.3 V (105 W) 11.5 V (35 W)	11.4 V (150 W) 11.5 V (35 W)	11.5 V (75 W) 11.5 V (50 W)
Temperature range	0 °C to + 50 °C	0 °C to + 45 °C	0 °C to + 45 °C	0 °C to + 50 °C
Terminal pairs primary/secondary	1/2	1/2	2/3 (6)	1/1
Dimming	Leading-edge or trailing-edge phase dimmer	Leading-edge or trailing-edge phase dimmer	Leading-edge or trailing-edge phase dimmer	Trailing-edge phase dimmer
Short circuit protection	Electronically reversible	Electronically reversible	Electronically reversible	Electronically reversible
Overload protection	Electronically reversible	Electronically reversible	Electronically reversible	Electronically reversible
Over-temperature protection	Electronically reversible	Electronically reversible	Electronically reversible	Electronically reversible
Approval marks				
Radio interference suppression	EN 55015	EN 55015	EN 55015	EN 55015
Harmonics	EN 61000-3-2	EN 61000-3-2	EN 61000-3-2	EN 61000-3-2
Immunity	EN 61547	EN 61547	EN 61547	EN 61547
Length l	108 mm	108 mm	153 mm	104 mm
Width b	052 mm	052 mm	054 mm	033 mm
Height h	033 mm	033 mm	036 mm	022 mm
Weight	110 g	120 g	200 g	70 g
EAN	4050300 442310	4050300 442334	4050300 581415	4008321 073037
Fig.	1	1	2	3

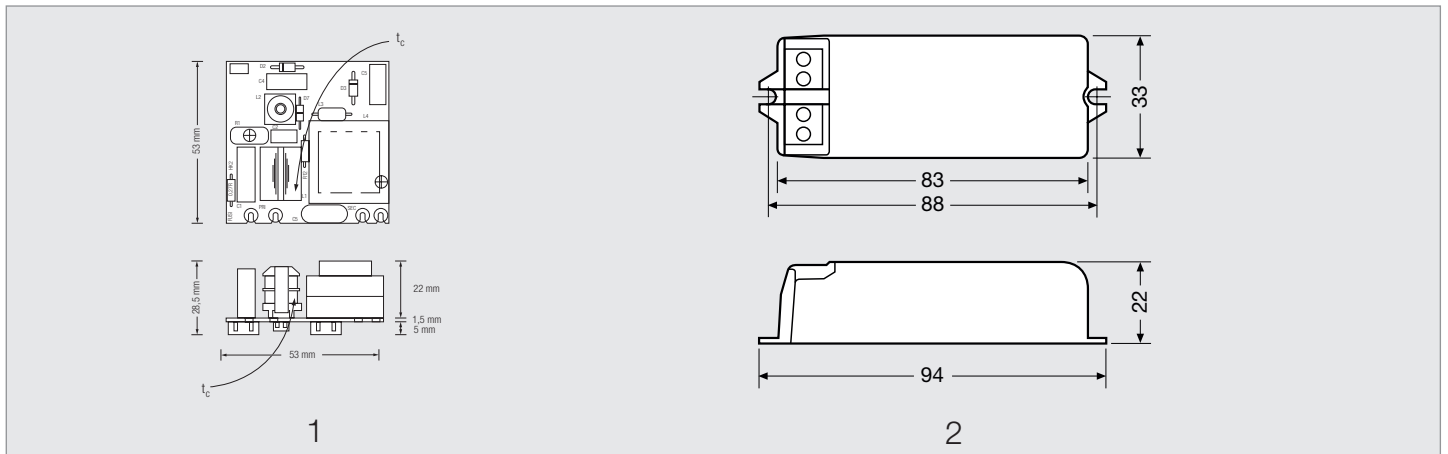


Fig. 4

HALOTRONIC® for installation in luminaires

Design	Square Board	
Reference	HT 50/230-240/12 SB	HTN 75/230-240 S
Nominal mains voltage	230 V - 240 V	230 V - 240 V
Voltage range	207 - 254 V	207 - 254 V
Mains frequency	50/60 Hz	50/60 Hz
Operating frequency	45 kHz	ca. 48 kHz
Mains current	0.22 A	0,32 A
Power factor	0.95	0,95
Max. lamp wattage	50 W	75 W
Power loss	2.5 W	max. 4 W
Partial load range	20 - 50 W	20 - 75 W
Secondary voltage	11.5 V (50 W) 11.4 V (20 W)	11.5 V (75 W) 11.7 V (20 W)
Temperature range	0 °C to + 70 °C	0 °C to + 50 °C
t _c	100 °C	85 °C
Terminal pairs		
primary/secondary	-	1/1
Dimming	Trailing-edge phase dimmer	Trailing-edge phase dimmer
Short circuit protection	Electronically reversible	Electronically reversible
Overload protection	Electronically reversible	Electronically reversible
Over-temp. protection	Electronically reversible	Electronically reversible
Approval marks	CE D'E ENEC	D'E ENEC EMC
Radio interf. suppressior	EN 55015	EN 55015
Harmonics	EN 61000-3-2	EN 61000-3-2
Immunity	EN 61547	EN 61547
Length l	53 mm	94 mm
Width b	53 mm	33 mm
Height h	28.5 mm	22 mm
Weight	52 g	70 g
EAN	4050300 861678	4008321 909329
Fig.	1	2

3. Performance

3.1 Electrical and photometric data as a function of mains voltage and lamp wattage

HALOTRONIC® is designed for a 230 V or 230 – 240 V supply depending on the model.

The diagram on the left below shows the situation for a conventional 100 VA transformer not suitable for partial load operation. When operating a 20 W lamp for example, the high secondary voltage (> 13.5 V) causes lamp life to be sharply reduced. This increase in the operating voltage of the lamp of more than 10 % leads to a reduction of about 60 % in the life of the lamp.

HALOTRONIC® on the other hand operates lamps reliably over the entire partial load range.

One advantage of partial load operation is that the failure of one lamp in a multi-lamp luminaire will not lead to the premature failure of the remaining lamps.

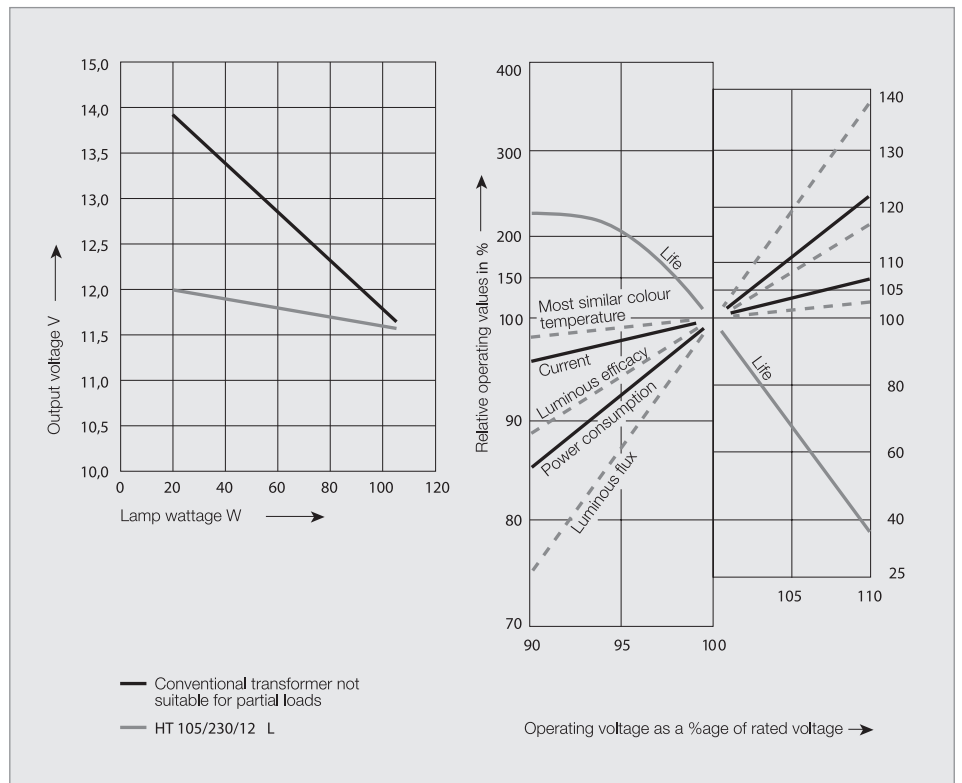


Fig. 5

3.2 Permissible mains voltage range

For a 230 (240) V ac supply, the nominal supply voltage is 230 V_{rms} (240 V_{rms}). Overvoltages of up to 6 % are permissible. If the voltage is more than 6 % higher correct operation cannot be guaranteed and HALOTRONIC® may be damaged beyond repair.

Every HALOTRONIC® transformer is protected (to EN 61547 or IEC 61547) against transient mains overvoltages (these occur, for example, when inductive loads such as fluorescent lamps operated with conventional control gear are switched off).

3.3 Operation on dc supplies The models indicated by the symbol \approx or 0 Hz in the technical data can be operated on a dc supply and are therefore suitable for use in emergency lighting to VDE 0108. Lamps connected to HALOTRONIC® transformers emit the same luminous flux whether an ac or dc supply is used. The permissible dc voltage range is 154 V to 244 V¹⁾.

3.4 Permissible temperature range HALOTRONIC® transformers operate reliably within the temperature range specified for each particular model (see technical data). Excessive temperatures will cause electronic components to fail prematurely and the transformer will not be able to achieve its specified life expectancy.

Model Separate converters	ta	tc
HT 70/230/12 L	60 °C	75 °C
HT 105/230/12 L	50 °C	80 °C
HT 150/230/12 L	55 °C	80 °C
HT 210/230/12 L	50 °C	80 °C
HT 120/230-240/12 LF	45 °C	80 °C
HTN 75/230-240/12 I	50 °C	85 °C
HTM 70/230-240	50 °C	80 °C
HTM 105/230-240	45 °C	85 °C
HTM 150/230-240	45 °C	80 °C

Built-in converters

HT 50/230-240/12 SB	70 °C	100 °C
HTN 75/230-240 S	50 °C	85 °C

t_a: maximum permissible ambient temperature

t_c: maximum permissible temperature at the control point of the transformer

Table 1

¹⁾ Below 207 V the safety protection in case of overload (e.g. additional lamp load) is not provided anymore.

When installing HALOTRONIC® outside a luminaire, make sure that it is not placed too near a heat source (such as the lamp itself), otherwise overheating may occur.

When installing HALOTRONIC® inside a luminaire, the measuring point temperature on the casing (t_c) is the crucial factor.

If units without a casing are installed in a luminaire, temperature t_c must be measured on certain electronic components. The limit temperatures on the components specified for the particular model must not be exceeded. (see Fig. 6).

HT 50/230-240/12 SB

$t_c = 100\text{ }^\circ\text{C}$

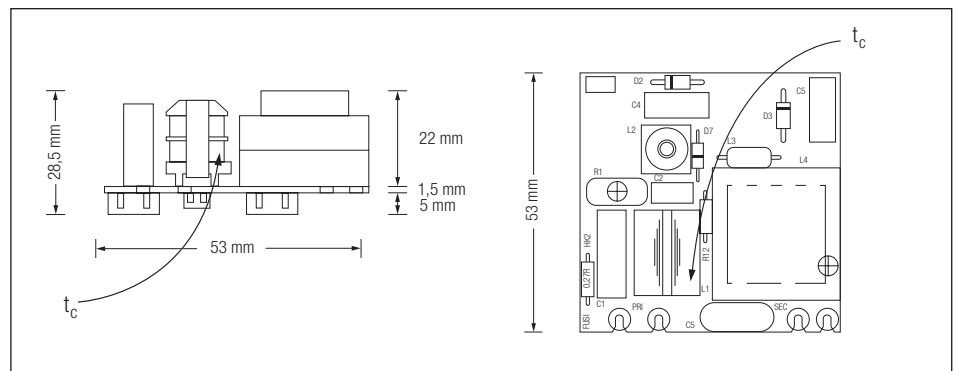


Fig. 6

3.5. Minimum load

HALOTRONIC® transformers must be operated with a lamp wattage which corresponds at least to the minimum load (see technical data). If this minimum load is not reached, harmonics and/or radio interference values may exceed the permissible thresholds and output voltage will fall considerably (see Fig. 7). The unit is unlikely to be damaged, however. Fig. 7 shows the output voltage curve as a function of lamp load for HT 105/230/12 L.

HALOTRONIC®

Output voltage – Lamp load

HT 105/230/12 L

$U_e = 230\text{ V } \sim$

Load line: 15 cm

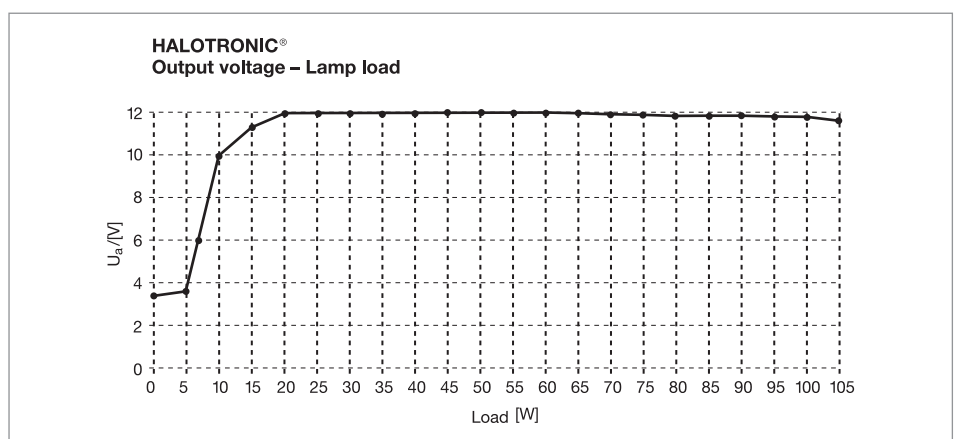


Fig. 7

3.6 Dimming

HALOTRONIC® can be controlled with various dimmers depending on the model.

		Phase control dimmer (leading edge)	Phase control dimmer (trailing edge)
HT	70/230/12 L		x
HT	105/230/12 L		x
HT	150/230/12 L		x
HT	210/230/12 L		x
HT	120/230-240/12 LF		x
HTN	75/230-240 I a. S		x
HTM	70/230-240	x	x
HTM	105/230-240	x	x
HTM	150/230-240	x	x
HT	50/230-240/12 SB		x

Table 2

3.7 Short-circuit protection

HALOTRONIC® transformers protect themselves against the effects of a short-circuit on the secondary side.

All the units have electronic cut-outs. These ensure that the units will not be destroyed by a short-circuit¹⁾. The units will be fully operational again once the cause of the short-circuit has been eliminated.

3.8 Overload/overtemperature protection

HALOTRONIC® units are equipped with electronic overload protection. Even if the overload persists, there will be no damage to the unit. The output power is either reduced or automatically disconnected. For a 2 m long cable, the overload protection circuit will be triggered at around twice the maximum permissible load¹⁾.

If external heat source cause the temperature at the unit to exceed the specified maximum, they will automatically reduce their output to protect themselves¹⁾. The user will notice a drop in the luminous flux of the lamps supplied by the transformers.

3.9 Safety, electrical isolation

HALOTRONIC® transformers meet the requirements relating to safety transformers for safety extra-low voltage²⁾.

The dielectric strength (electrical isolation) between the primary and secondary sides is tested on each unit at a voltage of 4 kV.

The transformers are also constructed and approved in accordance with EN 61347-1 & EN 61347-2-2 (Electronic Converters, Safety).

¹⁾ Applies only if supplied with 50 Hz ac voltage (the HT ... L family is suitable for dc or ac voltage)

²⁾ SELV or SELV equivalent

3.10 Radio interference suppression

For stand alone units (separate converters, with strain relief):
The units comply with the limit values for radio interference voltage in accordance with EN (IEC) 55015. The length of 12 V cables must be less than 2 m (this means that luminaires can be installed within a radius of 2 m around the electronic transformer).

For units installed in luminaires (all types):
A high-quality internal filter ensures that the unit complies with the radio interference values specified in EN 55015. No additional radio interference measures are expected if the unit is installed in luminaires of protection class II.

If the units are installed in protection class I luminaires, radio interference increases as a result of the higher earth capacitances. Then it may be necessary to include an additional mains filter with an earth connection.

In both cases, the luminaire manufacturer is responsible for checking the radio interference levels of the complete luminaire since these levels are affected by the installation of transformer units. The locations of the primary and secondary lines in particular can have a significant effect (see also 5.3).

3.11 Mains harmonics

HALOTRONIC® transformers comply with the approval requirements for mains harmonics specified in EN 61000-3-2 (IEC 61000-3-2; VDE 0838 T2).

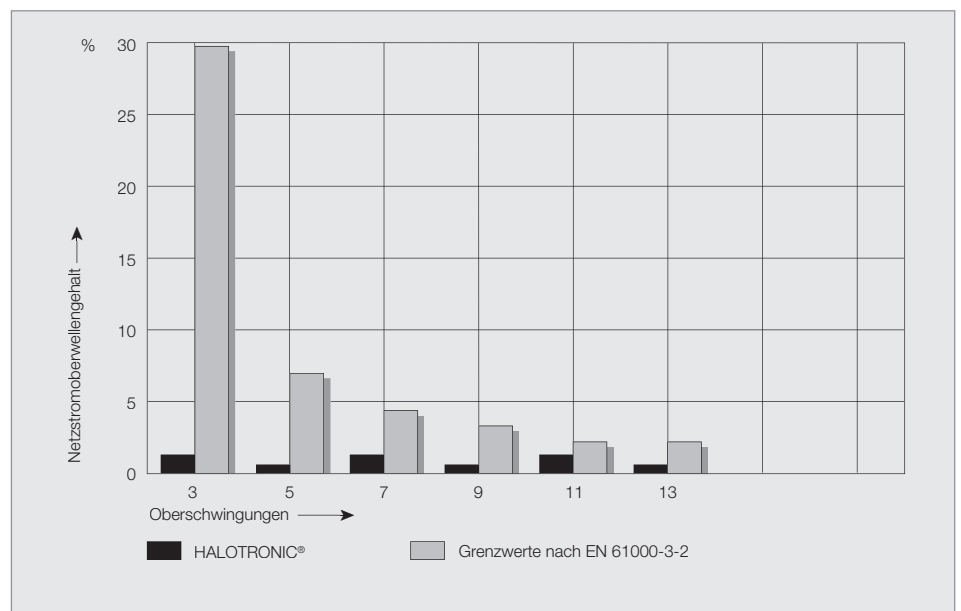


Fig. 8

3.12 Immunity to interference

The units comply with the immunity requirements laid down in EN (IEC) 61547. This means that they are protected against the external influences of high-frequency fields, discharge of static electricity and transient overvoltages in the mains supply, as defined in EN 61547.

3.13 Noise emission

HALOTRONIC® units are almost silent in operation. In a dimmed mode noise could occur if e.g. mounted on a resonant part. In general a trailing edge dimmer should be preferred for a quiet operation. E.g. under worst case conditions (mounted on a wooden board), HT 70 L emits a sound power level LWA of less than 10 dB (A) in undimmed mode. Even in dimmed mode with a trailing edge dimmer in the least favourable dimmer setting, the sound power level is normally less than 20 dB (A)¹⁾.

By comparison, acceptable sound pressure levels are as follows:

- for a quiet living room: 35 dB (A)
- for an office: 35 dB (A)

3.14 Parallel/series connections

HALOTRONIC® units can be connected in parallel on the primary side. In the case of the HT ... L, HT ... LF and HTM 150 models, the second pair of terminals can be used on the primary side. The maximal current must not exceed 16 A. In professional applications, several units can therefore be connected to a single dimmer.

In contrast to conventional transformers, however, HALOTRONIC® transformers cannot be connected in parallel on the secondary side because they would be overloaded.

Series connection to operate 24 V lamps is not permitted. Switching or dimming on the secondary side is also not allowed.

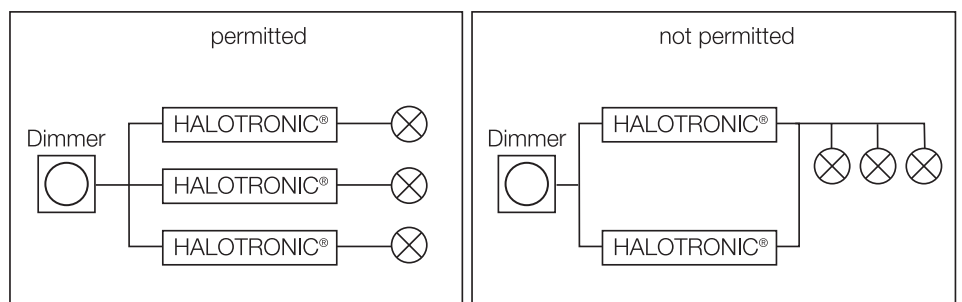


Fig. 9

¹⁾ Test set-up: dimmer located outside the room, measurements taken on one unit, operation at maximum rated load.

3.15 Start-up current

The table 3 shows the peak values for the maximum start-up current \hat{I}_{\max} (time: 10 ms, half sine wave) for a cold lamp.

	HTM 70	HT 70 L	HTN 75	HTM 105	HT 105 L	HT 120 LF	HTM 150	HT 150 L	HT 210 L
Einschaltstrom \hat{I}_{\max} [A]	0,6	0,7	0,6	0,7	2,4	2,4	2,0	3,5	7,4

Table 3

3.16 Automatic circuit-brakes

The following table indicates the maximum number of HALOTRONIC® transformers that can be connected to automatic circuit breaker:

Leitungsschutzschalter		HTM 70	HT 70L	HTN 75 I u. S	HTM 105	HT 105L	HT 120LF	HTM 150	HT 150L	HT 210L
Auslösecharakteristik B	B10	37	37	33	23	19	16	16	14	7
	B16	59	59	53	38	31	21	26	22	11
	B20	74	74	66	47	39	27	33	28	14
	B25	92	92	83	59	49	34	42	35	17
Auslösecharakteristik C	C10	37	37	33	23	23	20	16	16	11
	C16	59	59	53	38	37	32	26	26	18
	C20	74	74	66	47	47	40	33	33	23
	C25	92	92	83	59	58	50	42	41	29

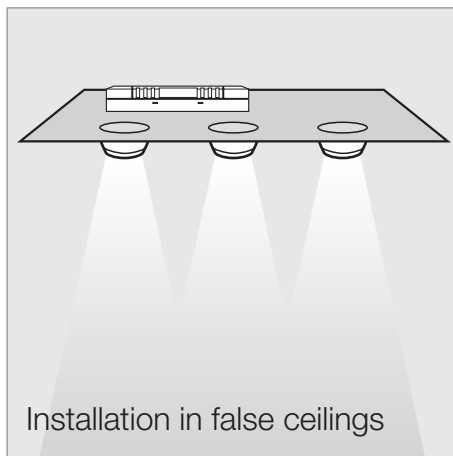
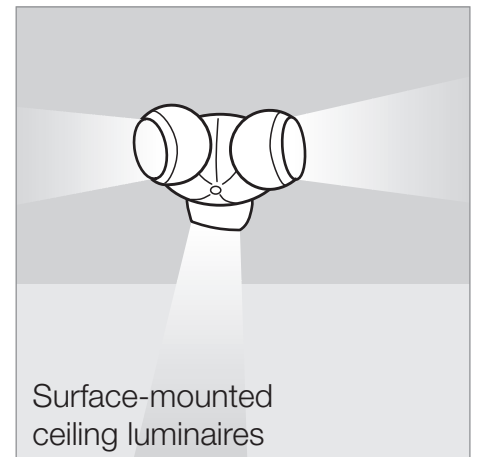
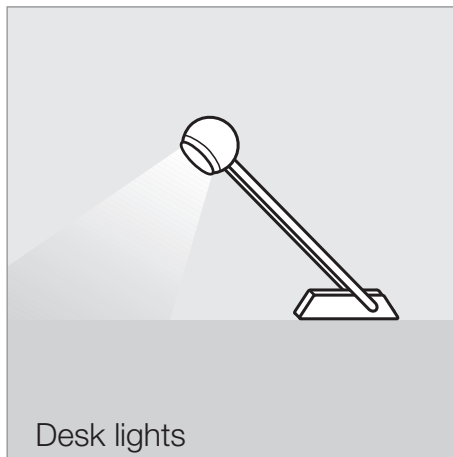
Table 4

3.17 Service life

The failure rate of electronic components obviously depends on their specifications and construction quality but the temperature at which they operate also plays quite a significant role. HALOTRONIC® units are designed so that at the maximum permissible device temperature ($t_c \max.$) a failure rate of fewer than 2 per thousand per 1000 hours of operation can be expected. This corresponds to a life of 50,000 hours at a percentage component failure of less than 10 % (HTM and HTN: 30,000 hours at a percentage component failure of less than 10 %).

By lowering the operating temperature by 10 degrees celcius it is nearly possible to double the lifetime.

4.1 Luminaires for HALOTRONIC®



Areas of application:

- Foyers/reception areas
Passages/corridors
- Sales areas and exhibition rooms
- Individual offices/
conference rooms
- Accent lighting
- Decorative lighting

4.2 Main advantages of using HALOTRONIC®

Comfort:

- Just like the cased HALOTRONIC® units, the circuit boards have much smaller dimensions and much lower weights than conventional units
- Silent dimming; with different dimmers depending on the type (see also on page 12)

Economy:

- Protective operation throughout the entire partial load range
- 2/3 less heat generated by the luminaire
- Ready for installation with no additional fusing required
- Lower power consumption than a conventional transformer

Safety:

- The units offer an electronically reversible cut-out to protect against short circuits, overloads and overtemperature
- All units are ENEC and/or VDE tested
- Suitable without any additional measures for luminaires of protection class II and III (for L models) and for luminaires with ∇ and ∇/∇ symbols or with ∇ and ∇/∇ symbols
- The units comply with European standards for safety, operation and EMC
- Direct current operation for emergency lighting systems to VDE 0108 possible with HT ... L-types (see 3.3)

5. Notes on independent installation and installation in luminaires

5.1 Maximum 12 V cable length

The length of 12 V cables must be less than 2 m to comply with radio interference limit values. This means that luminaires can be installed within a radius of 2 m around the electronic transformer. There is no advantage in terms of radio interference suppression in using shielded cables for the secondary line since both secondary poles carry high frequency, which makes shielding impossible.

Note also that long secondary cable lengths (more than 2 m) and/or non-parallel or twisted wires (large loops) produce a large inductance for the electronic transformer. Because of the associated loss of voltage on the cables, this leads to a low lamp voltage. The lamps may flicker, the short-circuit protection circuit in the transformer may fail to respond or, in extreme cases, the unit may fail altogether.

5.2 Recommended cables

The following cables are recommended for the units designed for independent installation:

	HT 70 L HT 105 L HT 150 L HT 210 L	HTN 75 I	HT 120 LF
Primärleitung¹⁾	H03VV/F 2x0.50 mm ² ; H03VV/F 2x0.75 mm ² ; H05VV/F 2x0.75 mm ² ; NYM 3x1.5 mm ² ;	NYM 3x1.5 mm ² ; H03VV/F 2x0.75 mm ² ; H03VH2/F 2x0.75 mm ² ; H05VV/F 2x0.75 mm ² ;	NYM 3x1.5 mm ² ; H03VH2/F 2x0.75 mm ² ; H05VV/F 2x0.75 mm ² ;
Sekundärleitung¹⁾	H03VV/F 2x0.75 mm ² ; H05VV/F 2x0.75 mm ² ; H05VV/F 2x1.00 mm ² ; H05VV/F 2x1.50 mm ² ;	NYM 3x1.5 mm ² ; H03VV/F 2x0.75 mm ² ; H03VV/F 2x0.75 mm ² ; H05VV/F 2x0.75 mm ²	NYM 3x1.5 mm ² ; H03VH2/F 2x0.75 mm ² ; H03VH2/F 2x0.75 mm ² ; H05VV/F 2x0.75 mm ²
Länge a	20 mm	10 mm	15 mm
Länge b	10 mm	6 mm	7 mm

	HTM 70 HTM 105	HTM 150
Primärleitung¹⁾	NYM 3x1.5 mm ² ; H03VV/F 2x0.75 mm ² ; H03VH2/FH 2x0.75 mm ² ; H05VV/F 2x0.75 mm ² ;	NYM 3x1.5 mm ² ; H05VV/F 3x1.5-3x1.0 mm ² ;
Sekundärleitung¹⁾	NYM 3x1.5 mm ² ; H03VH2/F 2x0.75 mm ² ; H03VV/F 2x0.75 mm ² ; H05VV/F 2x0.75 mm ² ;	NYM 3x1.5 mm ² ; H03VH2/F 2x0.75 mm ² ; H05VV/F 2x1.5-2x0.75 mm ²
Länge a	15 mm	12 mm
Länge b	7 mm	8 mm

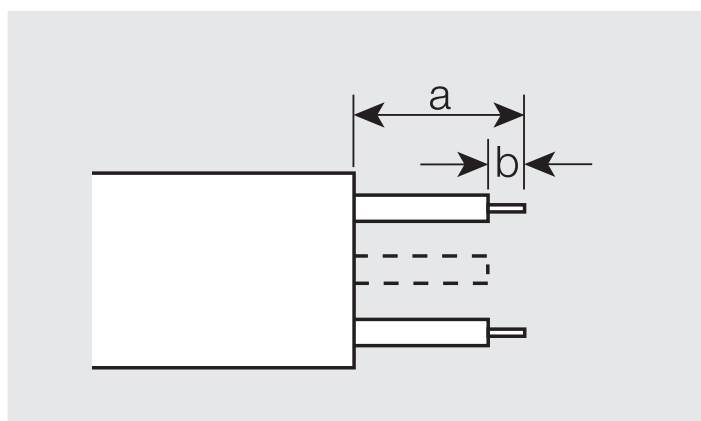


Fig. 10

¹⁾ to DIN 57281

5.3 Cable routing

To ensure good radio interference suppression and maximum safety and reliability, the following rules for cable routing should be observed:

1. Cables between the transformer and the lamp (HF cables) should be kept as short as possible (to reduce electromagnetic interference).
2. Mains and lamp cables should never be routed in parallel. Keep HF cables and mains cables as far away from one another as possible (e.g. 5 to 10 cm). This avoids mutual interference between mains and lamp cables.
3. Lay HF cables away from any metal surfaces (if possible several cm away) to reduce capacitive interference.
4. If two long single HF cables are unavoidable they must be twisted together.
5. Keep mains cables in the luminaire as short as possible to reduce interference.
6. Do not lay mains cables too close to the transformer (this applies in particular to through-wiring).
7. Avoid crossing mains cables and lamp cables; if this is not possible, they should cross at right angles (to reduce HF interference on the mains cable).

Cable penetrations through metal components should never be left unprotected and should be fitted with additional insulation (sleeve, grommet, edge protector, etc.).

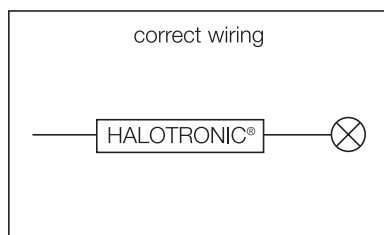
Electronic transformers can be installed in a wide variety of places, including suspended ceilings, furniture, luminaires and tube systems.

The transformers may be mounted on wood since the units comply with the requirements for $\nabla\nabla$ labelling according to VDE 0710 and VDE 0100 Part 559.

If HALOTRONIC® is to be dimmed it should be installed away from resonating surfaces so that any dimming noise is not magnified by vibrations.

5.4 Installation

correct wiring



incorrect wiring

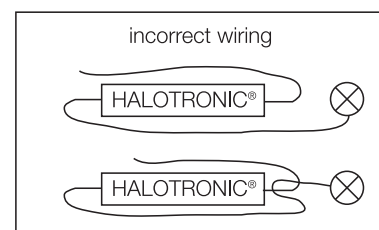


Fig. 11

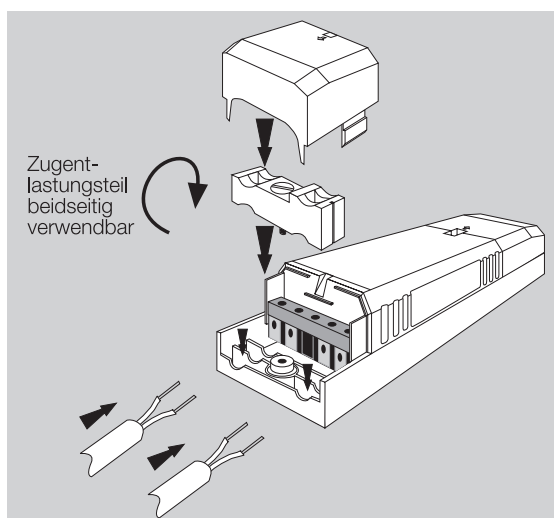
5.4.1 Ease of installation

L models:

- Blanking caps on the primary and secondary sides can be easily levered off with a screwdriver, saving you considerable time and effort.
- Two pairs of terminals on the primary side for mains looping from unit to unit; a maximum current of 16 A may be looped through.
- One and the same screwdriver can be used to lever off the blanking caps, connect the wires and adjust the strain relief.
- Strain relief possible on the primary side for e.g. two NYM 3x1.5 mm² cables, three pairs of terminals on the secondary side for the parallel connection of three luminaires.
- Sufficient cable space in front of the screw terminals.

LF models:

- Extremely low-profile design
- Two pairs of terminals on the primary side for mains looping through
- Strain relief possible on the primary side for two NYM 3x1.5 mm² cables
- Two pairs of terminals on the secondary side for the parallel connection of two luminaires



HT...L

Fig. 12

HTM

- Standard unit with functional, compact design for small spaces
- Cable clamp suitable for different cables and cross sections
- HTM 70/105: One pair of terminals on the primary side and two pairs on secondary sides for connection of two luminaires
- HTM 150: Two pairs of terminals on the primary side for mains looping.

Three pairs of terminals on the secondary side for connection of up to six luminaires.

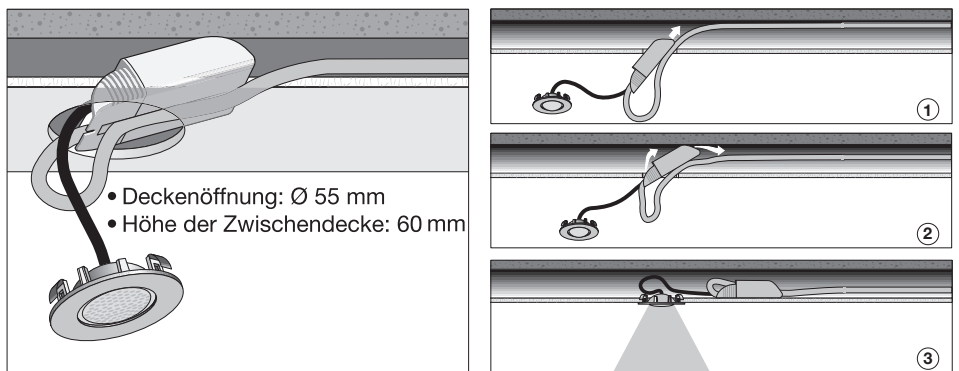


Fig. 13

5.4.2 Space needed to install stand alone transformers

The distance needed between the actual ceiling and the suspended ceiling will vary according to the size of the opening (see Table 5).

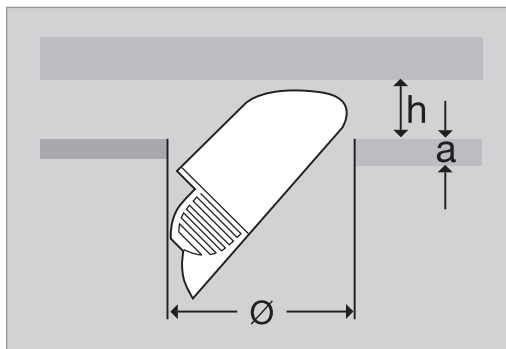


Fig. 14
















Ø/mm	HTN 75 I	HTM 70/105	HTM 150
40	70	–	–
55	40	60	105
68	31	48	75

Ø/mm	HT 70...105 L	HT 150...210 L	HT 120 LF
55	135	–	93
68	101	145	60

Table 5: Minimum depth of the suspended ceiling for installing HALOTRONIC® transformers (for $a \leq 13$ mm).

- 5.5 Heat dissipation** The units generate little heat, but this heat still has to be dissipated. To avoid overheating, make sure that the electronic transformer is not installed too close to a heat source (distance between lamp and transformer: 30 cm).
If the units are to be installed in luminaires, take suitable steps to ensure there is good heat transfer between the HALOTRONIC® unit and the luminaire casing. Temperature t_c at the test point must be measured to ensure that it does not exceed its maximum permissible value.
Low unit temperatures prolong the life of the unit (see also 3.17).
- 5.6 Environmental influences** Electronic transformers are designed for indoor use.
There is no protection against water or humidity (IP 20).
- 5.7 Integration in luminaires** If HALOTRONIC® transformers, particularly the uncased units, are to be installed in luminaires, the luminaire manufacturer is responsible for complying with the necessary clearances and leakage paths and for providing adequate protection against electrical shock, as defined in EN 60598.
Since all HALOTRONIC® models are protection class II devices, radio interference values must be checked if the units are installed in metallic protection class I luminaires. If necessary, external filters must be fitted to bring these values within the permitted range.
- 5.8 Instruments for secondary voltage measurement** An instrument for secondary voltage measurement must allow measurement of the true rms value and have a bandwidth of at least 500 kHz (-3 dB). Any other instrument will give incorrect measurements.
Reference Standard Pack

6. Comparison of stand alone units

	HTM 70/105	HTM 150	HTN 75 I	HT... LF	HT... L
Wattages (range)	070 W (20 - 70 W) 105 W (35 - 105 W)	150 W (50 - 150 W)	75 W (20 - 75 W)	120 W (35 - 120 W)	070 W (20 - 70 W) 105 W (20 - 105 W) 150 W (50 - 150 W) 210 W (50 - 210 W)
Primary voltage	230 - 240 V	230 - 240 V	230 - 240 V	230 - 240 V	230 V
Mains frequency	50/60 Hz	60 Hz	50/60 Hz	50 Hz	0/50 Hz
Dimming	Leading edge and trailing edge	Leading Edge and trailing edge	Trailing edge	Trailing edge	Trailing edge
Design	Compact, functional	Compact, functional	Very small	Long, low-profile	Long
Wiring work	Medium	Medium	High	Medium	Low
Mains looping	No	Yes	No	Yes	Yes
Secondary connections	2	3 (up to 6 cables)	1	2	3
Life*	30.000 h	30.000 h	30.000 h	50.000 h	50.000 h
Approval marks	  	  	  	  	  
Preferred use	Low ceiling height/ small opening	Medium ceiling height/ small openings	Very low ceiling height/ very small openings	Furniture, behind panels	Complex, high-quality installations
Special features	Standard product, excellent price/ performance ratio	Standard product, excellent price/ performance ratio	Special applications (espec. in comb. with OSRAM MINISTAR-lamp)	Extremely low-profile design	High-end family, easy to install

See definition in 3.17

Table 6

7. Standard packs

Reference		Standard Pack
HT	70/230/12 L	10
HT	105/230/12 L	10
HT	150/230/12 L	10
HT	210/230/12 L	10
HT	120/230-240/12 LF	20
HTN	75/230-240/12 I u. S	20
HTM	70/230-240/12	20
HTM	105/230-240/12	20
HTM	150/230-240	10
HT	50/230-240/12 SB	100

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