WERMA
SIGNALTECHNIK

Catalogue 2011/12

General Information

Category "Technical Information"

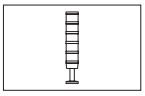
General Information

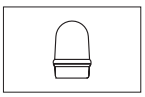
Under the heading **"General Information"** you will find basic information and explanations of our products and catalogue entries. For example, definitions of the pictograms and abbreviations used in the catalogue as well as explanations of the meaning of the optical and audible signals.

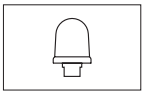
Tech-Talk

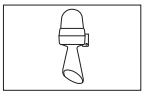
Starting on page 320 you will find the heading **"Tech-Talk"**, compiled by experts for experts, providing interesting background information on selected topics related to signalling technology.

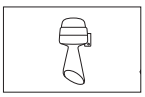
Key to Pictograms "Product Groups"


Product Group "Signal Towers"


Product Group "Optical Signal Devices – Free-standing Beacons"


Product Group "Optical Signal Devices – Installation Beacons"

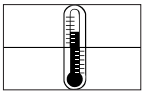

Product Group "Optical-Audible Signal Devices"

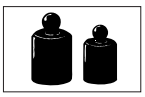

Product Group "Audible Signal Devices"

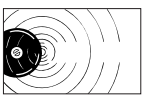
Product Group "Ex Signal Devices"

Key to Pictograms "Product Descriptions"


Protection rating according to EN 60 529. Explanation page 318

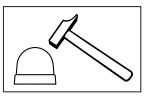

Working temperature in °C, highest and lowest rating


Net weight excluding packaging, in grams, ie. kgs


Volume in decibels (dB (A)) measured at 1m distance


Number of possible tones


Flash energy in watt seconds (Joules)


Impact resistance in Joules

Suitable for triggering via PLC

Key to Pictograms "Marks of conformity and protection types"

All WERMA products bearing the CE mark conform to current EU regulations and are tested for adherence to EMC codes.

This mark confirms that the product is suited to the intended application and conforms to the relevant standards and guidelines. In addition, the technical specifications provided by the manufacturer are certified by the TÜV.

Products with this mark have been tested and registered by UL for the North American market. This certification is also valid for Canada. The WERMA production facility is audited by UL. Products with the addendum "Class 2" may only be used in electric circuits that have been constructed in accordance with UL Class 2.

The aim of EHEDG (European Hygienic Engineering and Design Group) is to prepare and publish guidelines for hygienic engineering in the maufacturing and packaging of foodstuffs. The certification by this consortium confirms compliance with strict design criteria for avoiding weaknesses in construction and for minimising the risk of contamination.

The Frauenhofer-Institut certificate for production engineering and automisation (IPA) is a test label for products which have been qualified according to recognised standards and guidelines as to their objective suitablility for use in clean rooms.

Devices bearing this mark and number are authorised for use in hazardous areas. Ex devices guarantee a high level of resistance to extreme conditions.

Products in compliance with the AS-Interface specifications (EN 50295, IEC 62026-2) and which have been certified by the AS International Association are marked with the AS-Interface certification logo (shadowed logo).

Due to differences between the European and Russian production and testing standards, the majority of goods exported to Russia must be tested by an independent and accredited professional association in order to ensure conformity with Russian standards and requirements. Proof of conformity must be provided in the form of a GOST-R certificate.

German Lloyd sets technical, quality and safety standards for the industrial and maritime sector. In addition to the classification of ships of all types, German Lloyd is also active as a worldwide technical monitoring society.

This approval symbol documents that the product fulfills the minimum technical requirements for use on vehicles.

The VdS guidelines contain the standards which signal devices must fulfil in order to be built into intruder and fire alarm systems.

General Information

General notes on catalogue descriptions

Sound levels and frequencies
The specified sound levels are based on tests carried out in our factory. These levels are typical for the specific products and inevitably subject to variation. Mounting position and/or type can alter specifications.

The rated frequencies of buzzers are also dependent on the tolerances of the individual components and can vary up to 500 Hz from the quoted rating. No frequency rating can be stated for horns as the spectrum is so wide that any stated rating cannot be accurate. The fundamental frequency for AC devices is 100 Hz, for DC devices c. 200 - 500 Hz. This means that they emit a deeper tone than piezo devices which have values typically between 2000 and 3000 Hz.

Current consumption
The current consumption levels quoted are standard values. The ratings are based on the virtual value for AC, i.e. the average value for Dc.

The measured value is normally calculated over a period of 10 seconds. The highest current consumption rating can be considerably higher than the calculated rating.

The starting current of a product can be above the rated current by ten fold.

Assured values
The technical specifications of our products have been rigorously and thoroughly tested. A quality guarantee according to § 463 BGB is however only applicable where expressly stated.
WERMA is only liable for damage arising from the failure of guaranteed properties when the guarantee was expressly intended to protect the customer from this damage.

Measurements, weights, ratings and illustrations are subject to technical amendment.

Product descriptions

The product descriptions found in the price list and on all documents are made up of the following information:

Product type:	**Fixing:**	**Tone type:**	**Voltage:**	**Voltage type:**	**Colour:**
Electronic Buzzer LED Permanent Beacon etc.	BM = Base mounting BWM = Base/Bracket mounting EM = Installation mounting RM = Tube mounting WM = Bracket mounting	32 tones 4 tones etc. alternating cont./pulse continuous pulse	12 V 24 V 115 V 230 V etc.	AC (~) DC (⎓) AC/DC (≂)	BK = black BU = blue CL = clear GN = green GY = grey RD = red YE = yellow WH = white MC = multicolour

Examples:
Electr. Buzzer EM Continuous tone 115 V UC
LED Permanent Beacon EM 24 V DC RD

Technical Drawings, CAD Drawings and Connection Diagrams

A detailed drawing of each product can be found under the **heading "Technical Diagrams" beginning on page 266 onwards**. The technical diagrams are in the numerical order of the first three digits of the article number.

To help customers find the technical diagrams for the desired product even more quickly, we have included a reference on the relevant product page stating the page number for the corresponding diagram located in the "Technical diagrams" section.

You are welcome to request the technical diagrams in **digital form**. The relevant **3D models**, **instruction leaflets** and **connection diagrams** can be obtained from us or downloaded from our homepage at any time.

Simply select the desired product or search for it by article number, then download the file and save it locally for your further use.

Key to optical signals

Colour: Red

Meaning:
extreme danger /
hazardous conditions

Colour: Yellow

Meaning:
beware /
dangerous conditions
imminent

Colour: Green

Meaning:
normal conditions

Colour: White/Clear

Meaning:
no particular
meaning

Colour: Blue

Meaning:
conditions requiring
defined action

Key to audible signals

Multi-Tone

Description
scale in differing frequencies (various high / low frequencies) with regular, cyclical intervals

Meaning:
extreme danger /
immediate action

Two-Tone

Description
scale in differing frequencies (one high, one low frequency) with regular, cyclical intervals

Meaning:
extreme danger /
immediate action

Alternating Tone

Description
continuous tone with graduated decrease and increase of sound frequencies

Meaning:
danger / immediate action

Pulse Tone

Description
regular intervals between on and off cycle

Meaning:
danger / immediate
reaction

Continuous tone

Description
continuous tone in specific frequency

Meaning:
safety

MTTF values

"MTTF" is the abreviation for **Mean Time To Failure** and is also described as the average life cycle or **"$MTTF_d$"** (= the average time until failure leading to a dangerous situation).

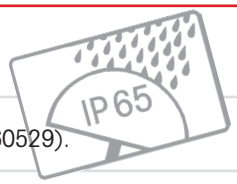
The European Norm **EN ISO 13849-1** has caused a new significance to be attached to "MTTF" values, because they are used to evaluate machine safety within the conformity tests.

The MTTF is a statistical value, which is calculated by **means of testing or experience** of past values. It does not provide a guaranteed life duration or a guaranteed functional period.

MTTF values have been calculated for a variety of **WERMA products**. Please contact us for further details.

General Information

Protection ratings



Protection ratings for signal devices: Protection ratings for housings DIN EN 60529 (DIN VDE 0470 IEC 60529).

First digit:
degree of protection against contact with dangerous parts and the intrusion of foreign particles.

IP 0X no protection

IP 1X protection against contact with the back of the hand.

IP 2X protection against finger contact with live or moving parts in the appliance. The test finger with Ø 12 mm and 80 mm length must not come into contact with dangerous parts. A ball of 12.5 mm diameter should not be able to fully penetrate the housing.

IP 3X test bar Ø 2.5 mm may not penetrate the housing.

IP 4X a wire with Ø 1 mm may not penetrate the housing.

IP 5X complete protection against dust cannot be guaranteed, but dust is not able to accumulate in such a way as to impair the operation of the device.

IP 6X total protection against dust (no penetration).

Second digit:
degree of protection against water.

IP X0 no protection

IP X1 protection against vertically falling water drops.

IP X2 protection against water drops so long as the device is tilted to an angle of 15°.

IP X3 protection against water spraying at any angle up to 60° to the vertical.

IP X4 protection against water spraying at any angle.

IP X5 protection against jets of water directed from any angle at the appliance.

IP X6 protection against heavy seas. A strong jet of water may not harm the appliance.

IP X7 protection against occasional immersion.

IP X8 protection against permanent immersion.

IP X9k protection against water during high pressure / steam cleaning.

Comparison between NEMA and IEC protection ratings – classification

NEMA Protection Type Number	Protection	IEC Protection Classification Designation
1	Falling dirt	IP 10
2	Dripping water and falling dirt	IP 11
3	Wind blown dust, rain and hail;	
	no damage due to external ice formation	IP 54
3 R	Rain and hail; no damage due to external ice formation	IP 14
3 S	Wind blown dust, rain and hail;	
	can be operated even with external ice formation	IP 54
4	Wind blown dust, rain, splashes and a direct jet of water;	
	no damage due to external ice formation	IP 56
4 X	Wind blown dust, rain, splashes and a direct jet of water;	
	no damage due to external ice formation, corrosion protection	
5	Dust, falling dirt, dripping non-corrosive liquids	IP 52
6	Direct jet of water, temporary submersion;	
	no damage due to external ice formation	IP 67
6 P	Direct jet of water, longer periods of submersion;	
	no damage due to external ice formation	IP 67
12 and 12 K	Circulating dust, falling dirt, dripping non-corrosive liquids	IP 52
13	Dust, splashes of water, oil, non-corrosive liquids	IP 54

Cannot be used to convert IEC Classification Designations to NEMA Type Numbers.
Note: This comparison is based on tests specified in IEC Publication 60529.

AS-Interface

AS-Interface, the Actuator Sensor Interface and its distinctive 'yellow cable' is one of the most innovative networking solutions in modern automation technology.

Conceived in 1990 as a cost-efficient, feature-rich alternative to conventional hard-wiring, AS-Interface has now been proven in hundreds of thousands of products and applications spanning the entire automation spectrum.

AS-Interface offers many of the benefits of more powerful and expensive fieldbuses, but at much lower cost and at much simpler application. The complete network is controlled automatically by a 'master' which polls the network sending and receiving data from each connected device in turn. It automatically senses and registers any connected devices, thus neither configuration nor application-specific software for the master is necessary.

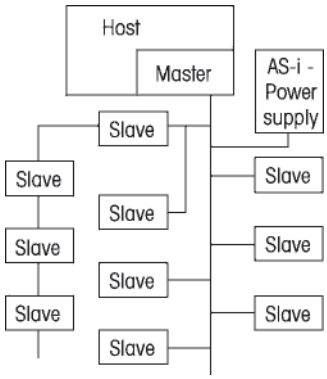
Unique technology

Due to the cable structure, AS-Interface offers a unique mounting technology. Without any cutting or removal of insulation, sharp pins penetrate the cable insulation making the electrical contact as the connection elements are closed. This technology ensures protection up to IP 65.

Cost savings

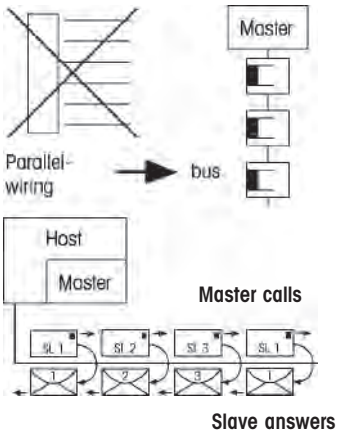
In general, applications from as few as ten sensors and actuators to very large systems can benefit, especially when the whole life cost advantages are taken into account. Distributing the input and output functionality is one starting point for cost savings, enabling point to point wiring systems to be reduced to a single cable, eliminating or reducing cable trees, service cabinets and multiple connectors. The special AS-Interface connection technology replaces labour-intensive wiring. The tree structure permits better optimised system design and improved layouts, bringing easier installation and maintenance. Network configuration is eliminated.

System Survey



- Single master-slave principle
- Up to 62 slaves with one master
- Per slave up to 4 digital inputs + 4 digital outputs
- Max. 248 digital inputs and outputs
- Additional 4 parameter bits/salve
- Also possible: analogue I/O
- Electronic addressing of slaves
- Free structure of the network

How AS-Interface® works



- AS-Interface® – a bus system, which subsitutes parallel wired installation from pic to sensors and actuators
- Data and energy in the same cable
- 1 Master and max. 62 slaves
- Total cycle time < 10 ms – with max. number of 32 slaves
- Master-slave principle: The master calls and the slave answers immediately

Cable power

The yellow cable can carry up to 8 A, which means that no additional wiring is required in typical installations. Several hundred mA may be drawn by a single slave device on the network. Where higher power is needed, or for emergency stop situations, a black secondary DC or AC power cable offers complementary advantages. If round cable is preferred, a wide variety of screw and push-fit termination modules offer this, with no performance compromise.

Products with AS-Interface

WERMA Signaltechnik GmbH & Co. KG has been a member of the AS – Interface® Association since 1996.

WERMA's product range encompasses the LED/Buzzer Combination 450 with acknowledgement function for AS-Interface®. The combination unites a very bright light signal with the powerful sound of a buzzer. By gently pressing the front surface of the product the audible signal can be turned off in a matter of seconds. This acknowledgement signal is fed back to the master via the AS-Interface Bus.

In addition, the new LED Installation Beacon (Multicolour) 239 is available for AS-Interface®. This is suitable for the extended addressing (A/B engineering) of up to 62 modules. This beacon is provided with electricity via the bus.

WERMA's product range also contains products with AS-Interface® for Kombi*SIGN* 50, 70 and 71 as well as customised developments. The entire BUS electronic system is integrated in the element placed at the base of the signal tower. The Kombi*SIGN* AS-Interface® elements offer the customer beneficial features such as an addressing socket and status LEDs. A user-friendly sliding switch inside the module can be used to provide the power supply required for the signal towers from an external 24 V auxiliary voltage or via the integrated bus bypass.

Tech-Talk
By Experts
for Experts

WIN – Wireless Information Network

WIN enables centralised monitoring of a diverse range of machines (e.g. injection moulding, pick and place component assembly or entire automated assembly lines)

Benefit from a complete overview with WIN – The simple way to increase machine productivity and save costs

Do you want a simple Machine Data Collection system (MDC system) without expensive investment and wiring costs?

WERMA has the ideal solution for you:
With WIN, the "Wireless Information Network", from WERMA Signaltechnik you can:

- monitor your machines
- react quickly and safely in the event of malfunctions
- save costs
- improve the productivity and efficiency of your machines

Centralised machine monitoring without additional wiring

WERMA Signaltechnik now provides a simple solution for the remote wireless monitoring of machinery. The "Wireless Information Network", "WIN" for short, is a simple MDC system, enabling you to **centrally monitor and evaluate the performance of up to fifty machines** of varying ages and functions via wireless technology. Even machines which were not previously network-capable can now be integrated into networks.

WIN can be easily installed via "plug & play". This straightforward installation process lets you centrally monitor your machines – whether **temporarily** or **permanently.** No **additional wiring** is needed as your existing WERMA signal towers can be used and the signals are transmitted via wireless technology.

The all inclusive kit: "WIN complete" for Kombi*SIGN* 71

With the all inclusive kit "WIN complete" you can **immediately start monitoring up to three machines.** All you have to do is mount the signal towers from the kit onto your machines. After installing the supplied software on to your PC you can immediately start monitoring the status of your machines.

Each of the three **pre-configured Kombi*SIGN* 71 signal towers** has three LED permanent lights in red, yellow and green, as well as a WIN slave and a base with integrated tube for mounting. "WIN complete" can be **expanded to up to fifty slaves** per network as and when required.

The kit also contains a **WIN master**, a USB cable and PC software. The master, which is equipped with a small antenna, is positioned on the wall or next to the PC and **connected via USB cable.**

You will find further technical information together with the order data on page 24.

WERMA SIGNALTECHNIK

More choice with “WIN system” for Kombi*SIGN* 70 and 71

With “WIN system” the user has even more choice: The kit consists of a **WIN master** including the software, a USB cable and **three pre-configured WIN slaves.**

The slaves are fitted to the **existing WERMA signal towers** which need to be monitored. Or you can order your own signal towers from WERMA’s wide range of Kombi*SIGN* products - enabling you to combine audible elements, different light effects, colours and mounting options as required.

The WIN system allows up to four machine states per machine to be monitored and can also be expanded to **up to fifty slaves per network** via subsequent order.

You will find further technical information together with the order data on pages 24 + 43.

Software for monitoring and analysing the machine operating status

With the supplied software, users can wirelessly monitor machinery **on their Pc.** They can search for faults or analyse the operating status, thus raising the efficiency and productivity of their machines.

The software displays the status of the signal towers integrated into the wireless network. Users can therefore specify which machine data they monitor and evaluate.

WIN also enables machine status information to be sent by email. Users can decide who is to be informed and over which period.

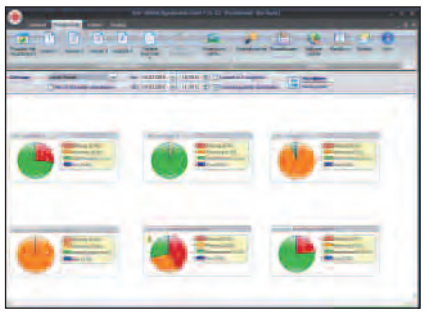
Quick and easy installation

The PC software can be quickly and easily installed and guides the user through the individual steps required to set up the wireless network.

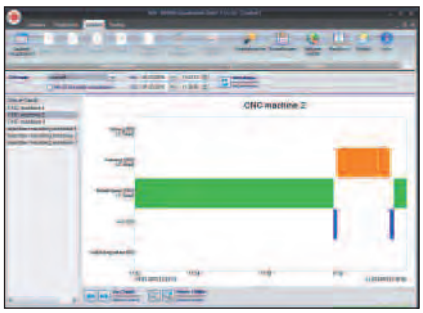
A simple **display interface** enables intuitive operation and monitoring. The status descriptions of the individual signal elements can be defined in the software as required, e.g. tier one “Machine in operation”, tier two “Retool”, tier three “Fault”. A range of different **analysis and monitoring modules** are available (e.g. failure analysis over time, downtime per machine).

Examples:

Module 1: Status indication of the networked signal towers



Module 2: Productivity per machine



Module 3: Failure analysis over time

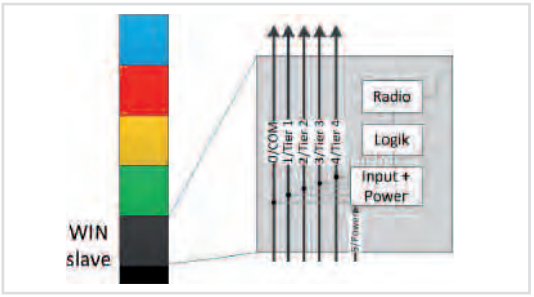
Tech-Talk
By Experts
for Experts

WIN – the technology

Quick installation

The WIN slave is fitted to the signal tower by **"Plug & Play"** as the lower-most element. This will not alter how your signal tower is triggered or how the individual signal elements are assigned.

The WIN slave **is powered** by the signal lines. Here, you should note that no power will be supplied when the signal lines are without power. If such cases occur, we recommend that a 24 V continuous supply be connected up to pin 5.

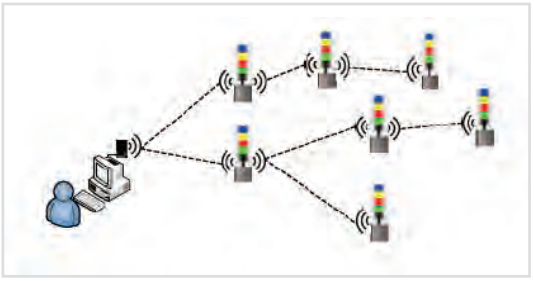


WIN slave block diagram

Intelligent "repeater" system for stable wireless connections

WIN transfers all signals wirelessly. With a clear line of sight, the **wireless signal's range** is up to 300 metres. The indoor range is less depending on the characteristics of the building.

Each slave has also been designed as a **"repeater"** to ensure stable wireless connections in buildings.The signals are then transferred to the master by the other WIN slaves, which regularly scan their environment to determine **the best transmission route** to the WIN master.



The "repeater" function makes WIN a very stable wireless system that is particularly suitable for industrial environments.

Stable radio frequency – without WLAN or Bluetooth interference

WIN uses the **868.0-868.6 MHz** frequency which offers a variety of benefits compared with conventional bands (e.g. WLAN, Bluetooth).

Interference-free radio transmission

Interference-free wireless transmission
The device meets the requirements of current regulations which allow several devices to easily use the same frequency without interfering with each other's transmissions.

Greater network range in buildings
The lower frequency of 868 MHz is better able to penetrate objects than, for instance, WLAN or Bluetooth. This means that WIN achieves a considerably greater range in buildings.

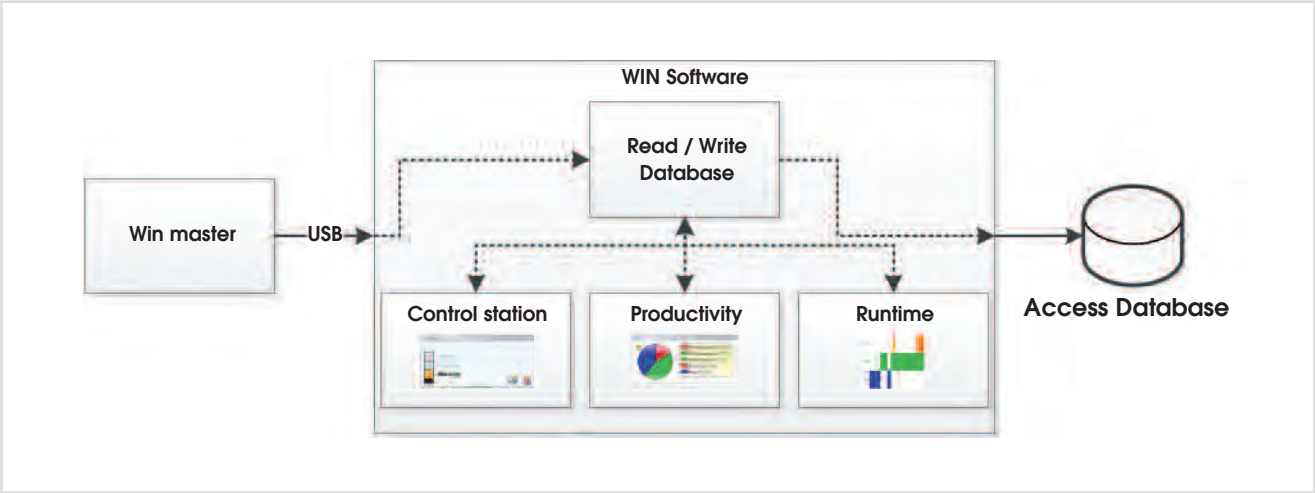
No interference with WLAN/Bluetooth
Due to the fact that WIN works on a different frequency band, it will not interfere with any existing WLAN or Bluetooth systems.

Low radio exposure
The very good frequency properties mean that WIN causes considerably less radio exposure than WLANs do for instance. The reason for this is WIN's lower transmission power (1/10 compared with standard WLAN routers) and frequency properties that are superior to those of WLAN systems.

Database records all status changes

The WIN software logs all data received from the master in an **Access database** and thus records all status changes indicated by the machine's signal tower. This allows the user to then simply process and analyse these status changes with the software's own productivity and runtime module.

Thanks to the **clearly structured** Access database, it is also possible to write your own entirely **individual queries** and **special analysis reports**. Please note, that for safety reasons, you should not write to the database but should permit "read access" only.

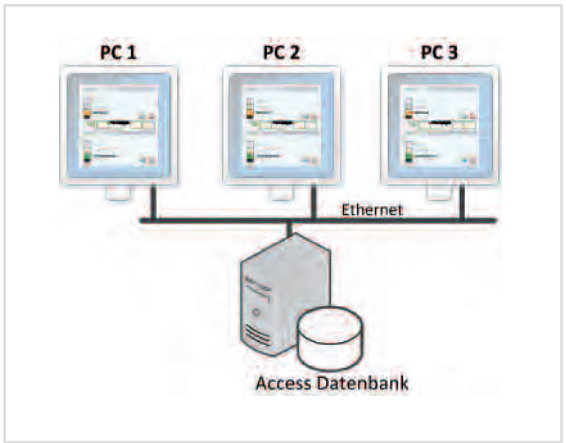


Block diagram of the WIN software with database access

Network licence included with WIN

The database software structure allows multiple access to WIN. This means that the WIN software can be used simultaneously on several PCs within the same company to access the database.

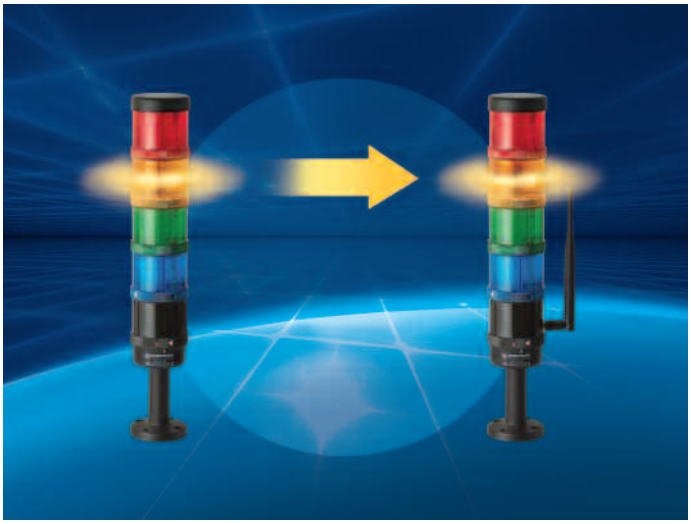
- **Multiple PC access to the WIN system**
  The system can be used simultaneously by the machine operator, team leader and division manager.
- **Network licence included**
  The supplied software comes with a network licence. This can be installed and used at different workstations within a company. No additional licence costs will be incurred.



Multiple access to the WIN system from several workstations

Tech-Talk
By Experts
for Experts

Kombi*SIGN* reflect



Keep an eye on your machines with Kombi*SIGN* ref ect

Do you want

- to monitor machines that are out of view?
- to improve the productivity and efficiency of your machines?
- to react quickly and safely in the event of malfunctions?
- to save costs?

Then WERMA has the solution for you!

Signal tower “ref ection”

WERMA Signaltechnik provides a simple solution for the remote wireless monitoring of machinery. The new **Kombi*SIGN* reflect** kit can be integrated into existing WERMA signal towers which are already installed on your machines.

Kombi*SIGN* reflect **“reflects” the status** of the machine to a signal tower within your line of sight. This enables you to **wirelessly monitor** machines situated at a greater distance and respond quickly to malfunctions. With Kombi*SIGN* reflect, even machines which were not previously network-capable can now be remotely monitored.

Kombi*SIGN* reflect is available for the WERMA Kombi*SIGN* 70 and 71 signal tower ranges. The kit consists of two elements that transmit and receive the data via wireless signal **(slave and master).**

Kombi*SIGN* reflect consists of a slave and a master

Kombi*SIGN* ref ect: Simple “plug & play” integration

The two Kombi*SIGN* reflect elements are **synchronised and ready for immediate operation**. The signal towers located on the machines can simply be fitted with the Kombi*SIGN* reflect slave. A second identical signal tower, which you have previously selected from WERMA’s Kombi*SIGN* product range, is fitted with the Kombi*SIGN* reflect master and placed within view.

The status of the first tower is then immediately transmitted to the second tower, where it is **reflected one-to-one.**

The system uses the **868 MHz frequency band** and has a **transmission range of** up to **300 m** (unobstructed line of sight). The indoor range may be less depending on the characteristics of the building.

You will find further technical information together with the order data on page 44 (Kombi*SIGN* 70) and page 23 (Kombi*SIGN* 71).

Simply fit the Kombi*SIGN* reflect slave to the signal tower on the machine

WERMA SIGNALTECHNIK

LED Element „ultrabright“

Good visibility, even in direct sunlight, is a basic precondition for the reliable deployment of signal devices in outdoor areas. This is a standard feature of the signal towers and beacons from WERMA Signaltechnik. There are however applications which place even more extreme demands on the visibility of optical signalling.

Up to 20 times brighter

Thanks to its sophisticated triggering, the innovative LED element "ultrabright" is up to 20 times brighter than conventional LED beacons – making it almost certainly the **brightest permanent light** that the world of signalling technology currently has to offer.

Furthermore, the **intelligent electronics** ensure that the LEDs operate at maximum brightness, depending on the ambient and operating temperatures. The "ultrabright" LED element is therefore always working at its optimum, and the energy-saving LED technology ensures that power consumption is kept to a minimum.

Brighter than sunlight

For example, the signalling of **mobile cranes movements** on large construction sites must be clearly visible over large distances, even when the signal beacon is exposed to direct sunlight.

The new, "ultrabright" LED signal tower element for the WERMA signal towers Kombi*SIGN* 70 and 71, effortlessly meets these requirements. Its **bundled light** is brighter than the incidental sunlight, making it clearly visible.

“Ultrabright“ masters the ref ection of sunlight in snowy conditions

Skiers on the piste enjoy the sunlight. However, at the lift **turnstiles** sunlight reflected from the snow can be debilitating. Even in these extreme conditions, the Kombi*SIGN* "ultrabright" element wins out against the blinding sunlight, **providing a clear and unambiguous signal:** "Please enter now!"

In short: Wherever the sun or other lighting factors impede visual perception, the WERMA signal towers Kombi*SIGN* 70 and 71 triumph with their new, "ultrabright" LED element.

You will find further technical information together with the order data on page 47 (Kombi*SIGN* 70) and page 28 (Kombi*SIGN* 71).

Tech-Talk
By Experts
for Experts

EVS – Enhanced Visibility System

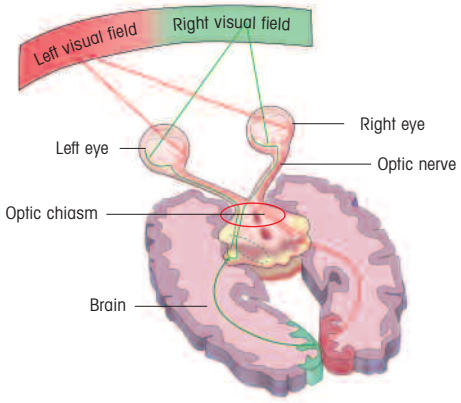
A groundbreaking innovation in LED technology opens up a completely new dimension in optical signalling. Enhanced Visibility System, or the electronic improvement of visibility, EVS for short, is the name WERMA has given to this latest development which promises to bring about a revolution in signal technology.

EVS – attention-grabbing neurobiological light effect

The flickering of neon lamps and comparable lighting effects are highly effective at attracting our attention. The neurobiological basis of this phenomenon is explained by a university scientist as follows: Light signals are processed in the human brain, not directly in the eye. In order to be consciously registered there, incoming stimuli first have to pass through a form of filter.

This filter has a "protective" function. During sleep it reduces disturbing stimuli to a minimum and assists in "overlooking" regular or continuous signals.

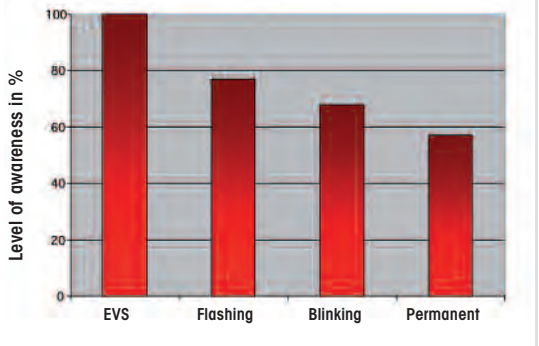
Irregular light impulses can circumvent the brain's filter function. Random light signals fail to generate an acclimatisation effect and the brain is unable to escape the stimulus, even when the flickering continues for an extended period.



The way in which the brain processes visual stimuli formed the basis for the development of the new EVS technology

EVS – flickering light without acclimatisation

Laboratory Test Results
Level of awareness generated by different light effects



On the basis of this understanding, WERMA's R+D department set out to find a flickering light with a high degree of effectivity in attracting attention. In a multi-stage laboratory experiment test candidates were asked to judge a series of different light signals and determine the most eye-catching light.

The result of the study was a stochastic flickering light with optimal attention-grabbing characteristics: EVS – Enhanced Visibility System! The light effect of this system is completely new and distinguishes it from all previous systems.

WERMA SIGNALTECHNIK

EVS signal devices communicate highly urgent situations

As a result of the extremely powerful signal effect, the EVS light is especially suited to signalling acute or highly important conditions. The EVS element can also be deployed in hazardous situations or in areas where immediate action is required.

Integrated into Kombi*SIGN* Signal Towers, the new EVS LED Element generates a highly attention-grabbing signal (see page 48 and 29).

This innovative technology is also used in the 853, 280 and 829 series (page 137 onwards) and in the optical-audible combination 444 (page 191).

EVS – unique light effect using LED technology

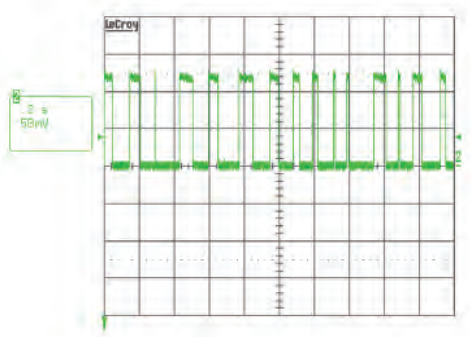
For the EVS system WERMA employs light emitting diodes. A microprocessor generates random light signals.

This gives the light a very "agitated" character which proves highly effective in drawing the attention of those in its vicinity – even when seen out of the corner of the eye.

Up to now LED signal devices have confined themselves to imitating the light effects of light bulbs or xenon flashes, EVS however utilises the strengths of light emitting diodes. LEDs are capable of generating the required high flickering frequency with ease - frequencies which xenon flashes are for example incapable of generating.

There are a series of additional, classical advantages to LEDs – their resistance to vibration and shocks, their long life duration as well as their low energy consumption.

Typical 2 second section of an EVS LED element's illumination sequence



Tech-Talk
By Experts
for Experts

Light in Signalling technology

Optical Signals in everyday life

The field of signalling technology offers us not only the possibility of audible signals, but also that of optical signals. These are to be found everywhere in everyday life; at traffic lights, in alarm systems or where obstructions arise. Countless uses can also be found in the industrial sector, above all in the signalisation of a machine operating status.

The generation of light – a summary of the possibilities

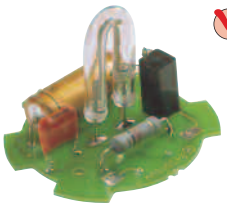
Light can be generated in various ways. Signalling technology mostly uses bulbs, halogen bulbs, electric discharge tubes and LEDs.

Bulbs

A tungsten filament is heated up to a high temperature, so radiating energy over a wide wavelength. This is perceived as light similar to sunlight. The tungsten filament evaporates with time. When the tungsten content falls below a certain level, the maximum life duration of the bulb is reached. As tungsten oxidises quickly and is destroyed when it comes into contact with air, the filament must be kept in a non-oxidising atmosphere such as vacuum. This leads us to the familiar light bulb with its sealed glass body.

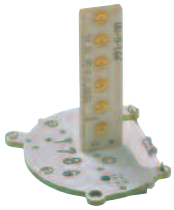
Halogen bulbs

These are bulbs wherein the tungsten filament is enclosed by a small amount of halogen. The resulting chemical reaction has the effect of lengthening the life of the tungsten and stabilising the light output throughout the entire life duration of the bulb.



Electric discharge tubes

Xenon flash tubes are widely used in signalling technology. They consist of a glass tube filled with the inert gas xenon. A sufficiently high voltage leads to a discharge of energy with a spark gap and a flash of high intensity.



LED

Light emitting diodes are constructed using certain semiconductors. Foreign atoms are built into the semiconductor with the purpose of optimising the conductibility. Half of the semiconductor (n-region) is doped with foreign atoms that contain one bonding electron more than the semiconductor atom. This surplus atom can move freely and increases conductibility. The other half (p-region) is doped with foreign atoms containing one electron less than the semiconductor. When the LED is switched on, these faults ("holes") fill up with free electrons (recombination). Energy in the form of radiant photons is hereby released. The energy and therefore the colour of the light emitted is determined by the material the semiconductor is made of; e.g. GaAsP (Gallium Arsenic Phosphide) results in red light.

LED – Beacons with many advantages

LEDs offer many advantages when compared with conventional light bulbs:

- Minute dimensions
- Low current consumption
- Low heat generation
- Extremely high life duration of up to 50,000 hours
- All major colours can be realised
- Vibration and shock resistance
- Immediate illumination

Fundamental units of light magnitude

The fields of lighting and signalling technology differentiate between fundamental units to define light itself. The most important of these are the units Lumen, Candela and Lux.

Lumen (unit lm)

Light current is measured in Lumen; this is the unit for the entire visible light output of a light-emitting source. The light current is defined by the following formula known as the brightness characteristic:

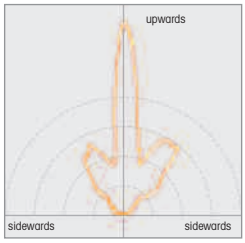
Light current ϕ [in *lm*] = radiation capacity x brightness characteristic V(λ)

The brightness impression upon the human eye is based on a sensitivity curve V(λ) which reproduces the sensation felt by the eye in relation to the wavelength. The maximum point on this curve is at about 555 nm; we see best at this wavelength; V(555 nm) = 1.

Candela (unit cd)

In signalling technology only the part of the light current that is emitted in a certain direction is of importance. This light intensity is measured in Candela. It is defined by the light current of a lamp and the steradian measure $\frac{1}{4\pi\ sr}$.

$$\text{Light intensity [in } cd\text{]} = \frac{\text{Light current } \phi}{\text{Steradian measure } \Omega}$$



A complete sphere has a dihedral angle of $\Omega = 4\ \pi$ sr. sr stands for the steradian and is the unit for the dihedral angle.

Example: a household candle emitting a light intensity of 12,566 Lumen has a light intensity in relation to the steridian measure $\frac{12{,}566\ lm}{4\pi\ sr} \approx 1cd$.
This explains the name: candela is the Latin word for candle.

Lux (unit lx)

Illumination density is an important unit in lighting installations. It is the measure of the brightness with which an area is illuminated. Whereas light intensity (in cd) is a property of a light source, illumination density is calculated in regard to the area to be illuminated.
Where the light current emitted is constant, the following formula is applicable:

$$\text{Light density E [in lux]} = \frac{\text{Light current } \phi}{\text{Surface A}}$$

Tech-Talk
By Experts
for Experts

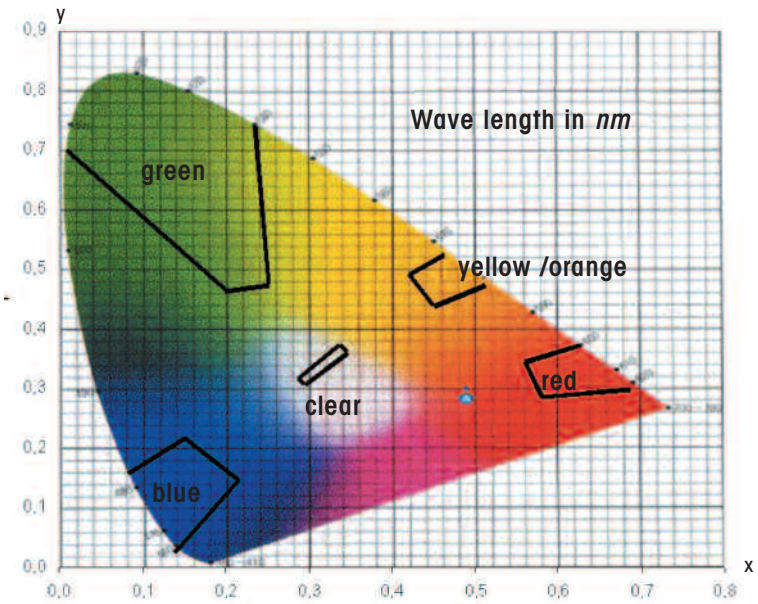
Light in Signalling technology

Types of optical signal devices

We differentiate between permanent, blinking and flashing beacons as well as beacons with rotating light. The appropriate signal type must be chosen to meet the needs of the specific application, whether as a warning, an informative signal or a simple piece of information.

Signalling technology relies mainly on the colours green, red, yellow, blue and clear.

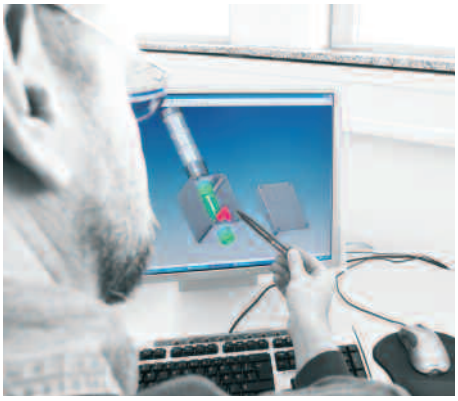
The following diagram shows the position of these colours in the spectrum:



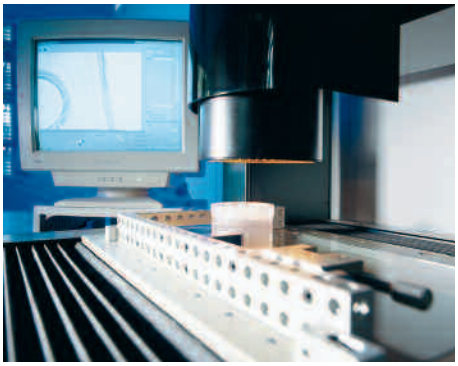
Experience and Know-How – the right combination

WERMA can look back on many years of experience and in-depth knowledge in the field of optical signals. Our technicians have been researching the fundamental principles of light effusion for many years, and the fruits of their work flow into the conception and development of all new products.

Our guiding principle has always been to implement and realise the newest trends in technology. To achieve this goal we employ a large and competent team of R + D engineers and invest in the most modern testing facilities.

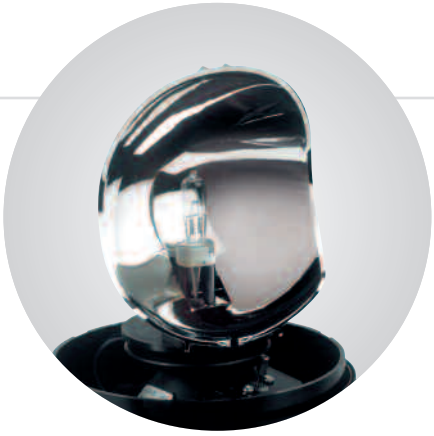


It is WERMA's declared goal to market only truly innovative products; with this in mind, we invest about 11% of overall expenditure in the development of new products, a strategy which will enable WERMA to carry on setting the standards in the field of optical signalling.



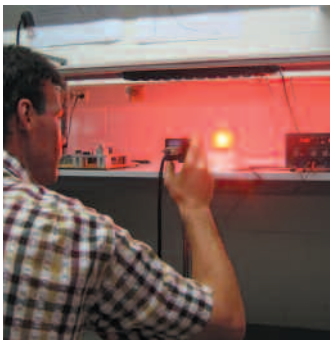
WERMA SIGNALTECHNIK

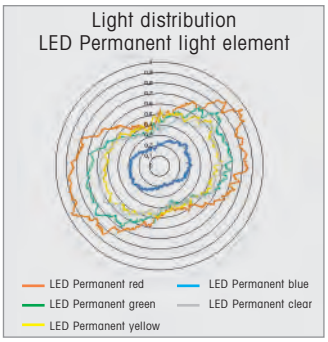
Research and development as the basis for innovation



The different types of optical signal devices call for an individually suited transparent housing, known as a lens.

The lens of a flashing beacon has, for example, an especially designed ribbing. The light is dispersed in such a way as if the whole lens is flashing. The lens of a rotating mirror beacon is by contrast a consistent thickness. The rotating light signal is not scattered here, but bundled to a point. The precise setting of the rotating mirror is of great importance, as the aim is to attain the greatest possible bundling of light.





WERMA is able to make exact calculations regarding the positioning of the path of rays. The optical laboratory can measure all relevant units of light. Even the brightness curve of a flash can be analysed in nanoseconds.

Reliable LED technology

WERMA is a market leader in the use of LED technology parallel to conventional bulbs and halogen bulbs. The advantages are obvious: high life duration, low heat emission, and low current consumption. Even flashing light can be produced using LEDs.

WERMA uses different types of LEDs in its optical signal devices: Chip-on-Board (COB), SMD, and wired LEDs (e.g. Super-Flux).

- With the **COB method**, single LED chips are bonded onto a gold-plated printed circuit board.
- With **SMD LEDs** the chip itself is already encased in a housing and is set onto the printed circuit board with the other components on WERMA's own assembly line.
- **Super-Flux** models are characterised by their extreme light intensity and are used whenever a signal must be particularly bright.

Tech-Talk
By Experts
for Experts

Acoustics in Signalling technology

Audible signals are everywhere!

Audible signals warn, protect and guide us in the modern industrial world. They function where caution, prudence and clarity are imperative, indicate emergencies and demand direct action. They are globally understood, irrespective of language, written or spoken.

Audible signals are deployed where an optical signal is insufficient or inappropriate. A wide range of products belong to this essential group of audible signal devices: The car horn, indispensable for driving in traffic, the buzzer of an egg timer, the school bell signalling break times and the siren on emergency vehicles.

Audible devices also enjoy a wide range of applications in industrial environments where they are deployed to indicate malfunctions or to provide a warning in dangerous situations. The basic signal is provided by one or more tones or a sequence of tones, and is to raise awareness and alert to a specific danger.

Types of audible signals

WERMA provides a wide range of audible signal devices for the most diverse fields of use:

- Sirens and multi-tone sirens
- Buzzers and installation buzzers
- Signal horns
- Three-tone gongs
- Alarm bells

Double safety with optical-audible signals

Under certain conditions, operational sites with a high or changing noise level require a coloured, optical stimulus in addition to the audible signal.

The combination of optical and audible signals leads to greater effectivity as both the eyes and ears are addressed by the sensory stimuli. The combination of an optical and an audible signal rules out the possibility of mistakes or the audible signal being overheard.

WERMA SIGNALTECHNIK

Types of sound generation used in signal technology

Electromechanical sound generation

Electromechanical signal horns from WERMA work according to the oscillating armature principle. This can also be described as a special form of Wagner's interrupter, whereby an electromagnetic oscillation generator produces mechanical oscillations.

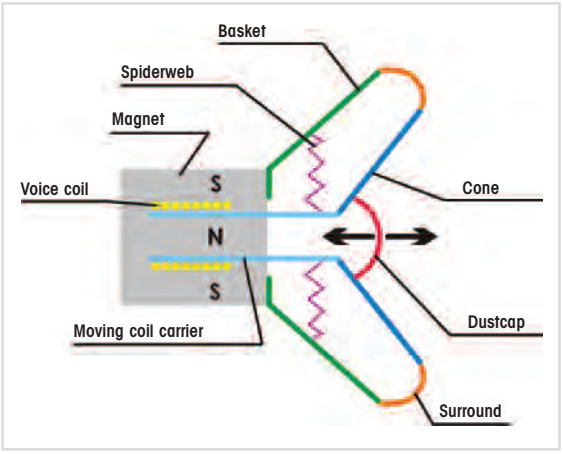
The oscillation generator is composed of a solid iron core with a field coil and a moving armature that is held at rest by a plate spring (membrane). When an electric current passes through the field coil, the armature is pulled i.e. pushed from its resting position. If the amperage or the direction of the current changes continually, the armature oscillates. This is achieved by means of an alternating current or an appropriately prepared direct current. The mechanical adjustment is such that the armature strikes the iron core, leading to a considerable amplification of the principle audible vibrations (structure-borne noise).

As opposed to the classical Wagner's interrupter where the oscillating element simultaneously controls the current flow (interrupter), producing considerable radio interference voltages, the oscillating armature operating with an alternating current does not produce any interference voltages. When operating with a constant current the suppressors can be integrated into the required driving circuits.

As a result of this operating principle such systems are resistant to extreme temperatures and humidity. The life duration is solely determined by the mechanical wear and tear of the parts.

Loudspeakers (electro-dynamic sound generation)

A loudspeaker converts an alternating electric current into sound waves. This occurs by means of the interaction between the electric current and a permanent magnet. The coil is positioned within the magnetic field of the permanent magnet. When an electric current is applied to the coil, the Lorentz force generated leads to a deflection of the coil, causing the membrane to vibrate.



As a result of the centering spider this proceeds in an up and down motion. It centres the coil and, together with the bead, ensures that it returns to the resting position.

With the use of the appropriate size of membrane and material, as well as different drives (coils and permanent magnets), loudspeakers can be optimised for a variety of different frequency ranges.

Tech-Talk
By Experts
for Experts

Acoustics in Signalling technology

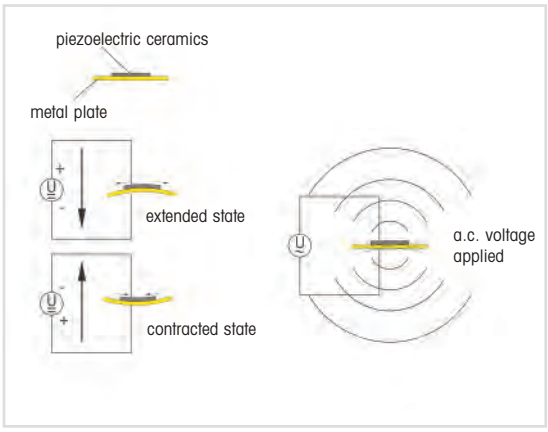
Acoustic capsule (electromagnetic sound generation)

The acoustic capsule belongs to the group of electromagnetic sound generators. This principle was previously used for telephone earpieces. Within the capsule a permanent magnet serves to pre-magnetise the armature which is connected to the membrane. This is made to oscillate and these oscillations are then converted into audible tones. The acoustic capsule is characterized by a relatively simple construction and a compact form and displays a high degree of effectivity.

Piezo disc

Piezoelectricity (also known as the piezoelectric effect, or for short: piezo effect) refers to the interaction of mechanical pressure (Greek piezein = to press) and electrical currents in solid bodies. It describes the phenomenon whereby the deformation of certain materials leads to the generation of an electric charge at the surface (direct piezoelectric effect).

In a reverse process these materials (predominately crystals) deform when a voltage is applied. The deflection is relatively small so they need to be transmitted to a membrane, from where the oscillations excite air molecules which are then perceived as sound.



Audibility factor of audible signals devices

One of the most important properties of audible signals is their sound output and therefore their audibility factor. The signal must be able to be heard without disturbing those around it.

The audibility of an audible signal is dependent on a number of different factors:

- the sound output of the signal (in dB)
- the tone frequency (in Hz)
- the distance between signal device and recipient
- the noise level of the surrounding area
- other influences (for example air humidity, wind direction)

WERMA SIGNALTECHNIK

Principle acoustic parameters

Sound output level

The sound output level L_p refers to the logarithmic relationship of the square of the sound output of an acoustic event to the square of the reference value p_0 = 20 µP. The result is given in decibels (abbreviation dB).

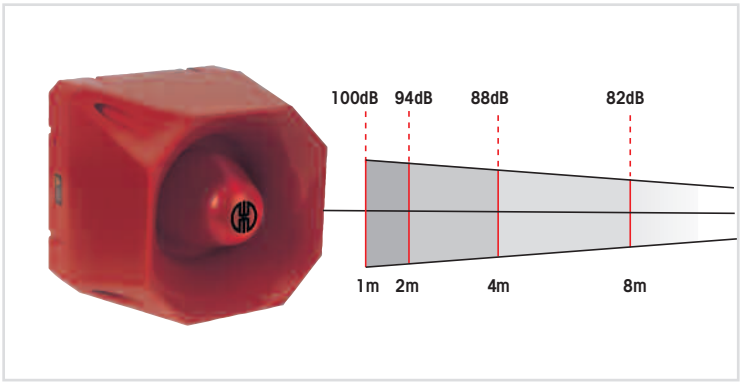
$$L_p = 10 \log_{10}\left(\frac{p_1^2}{p_0^2}\right) \text{dB} = 20 \log_{10}\left(\frac{p_1}{p_0}\right) \text{dB}$$

When indicating an absolute level (with reference to the standardized reference level p_0 the abbreviation "SPL" (sound pressure level) is added.

With intermediate to high levels and frequencies a sound output difference of 10 dB is heard as approximately twice as loud. Differences of 3 dB are clearly audible. The perceived sound level is not just dependent on the sound output level, but also on the spectrum of the sound signal and its temporal progression. Single tones are perceived as being considerably louder than a broadband audible signal with the same sound output level. Audible signals with sharply changing levels are also perceived as being significantly louder than uniform audible signals with the same average level.

Weighting curves (A, B and C according to DIN EN 61672-1, formerly IEC/DIN 651) are the curves from weighting filters that are applied to the sound output signal. They are designed to reproduce a similar frequency response as that of the human ear for a specific sound level. However they are only able to achieve a rough approximation, the values obtained for the weighted sound output measurements do not exactly match those of the human ear.

Weighting levels are indicated by the corresponding letter of the frequency weighting, e.g. a C weighting sound output level is given in dB (C). In the field of technical acoustics the A weighting level is predominately employed. For this reason WERMA specifies levels in dB (A).



The sound output level is always dependent on the distance from the source of the sound. WERMA specifications are always based on a measuring distance of 1 m, unless otherwise stated.

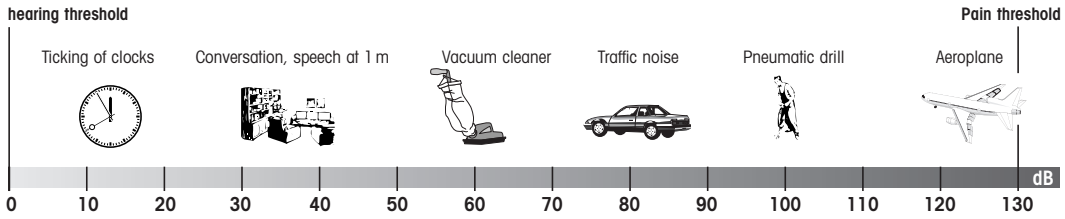
In the case of point sound sources (generally applies for all sources radiating equally in all directions), the sound output level decreases by **6 dB with each doubling of the distance from the source**.

Acoustics in Signalling technology

Table of working range

Sound pressure level dB (A)	Distance in m												
	1	2	3	5	10	20	30	50	100	200	300	500	1000
	120	114	110	106	100	94	90	86	80	74	70	66	60
	118	112	108	104	98	92	88	84	78	72	68	64	58
	116	110	106	102	96	90	86	82	76	70	66	62	56
	114	108	104	100	94	88	84	80	74	68	64	60	54
	112	106	102	98	92	86	82	78	72	66	62	58	52
	110	104	100	96	90	84	80	76	70	64	60	56	50
	108	102	98	94	88	82	78	74	68	62	58	54	48
	106	100	96	92	86	80	76	72	66	60	56	52	46
	104	98	94	90	84	78	74	70	64	58	54	50	44
	102	96	92	88	82	76	72	68	62	56	52	48	42
	100	94	90	86	80	74	70	66	60	54	50	46	40
	98	92	88	84	78	72	68	64	58	52	48	44	38
	96	90	86	82	76	70	66	62	56	50	46	42	
	94	88	84	80	74	68	64	60	54	48	44	40	
	92	86	82	78	72	66	62	58	52	46	42	38	
	90	84	80	76	70	64	60	56	50	44	40		
	85	79	75	71	65	59	55	51	45	39			
	80	74	70	66	60	54	50	46	40				
	75	69	65	61	55	49	45	41					
	70	64	60	56	50	44	40	36					
	65	59	55	51	45	39	35						

Examples of noise in everyday life



Tone frequency

Sound is a series of fluctuations in the air pressure at different amplitudes occurring at a specific rate per unit of time. This rate is termed frequency and is measured in the unit 1/s = 1Hz (Hertz). It is named after the German physicist Heinrich Rudolf Hertz. A tone is generated by an oscillation at a certain frequency. The musical tone A for example, has a frequency of 440 Hz. Noise is the term used to describe a number of overlapping tones.

The human ear is only capable of hearing tones within a certain frequency range. In the case of children this range is between 20 and 20,000 Hz. This sensitivity declines with increasing age: by the age of 50 the limit is approximately 12,000 Hz, and with advanced age this is often as low as 5,000 Hz.

The human ear hears tones of different frequencies at different relative strengths. The limit of audibility and the pain threshold are therefore dependent on the respective frequency. For this reason audible signal devices generally operate at a frequency between 500 and 3,000 Hz.

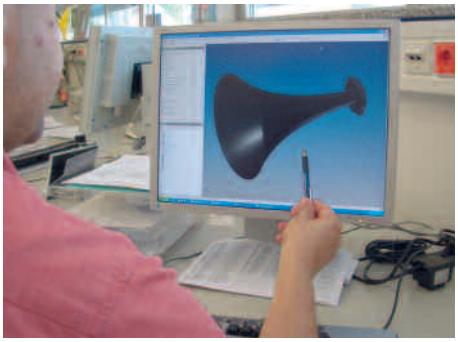
Environmental factors

In addition to the sound output level, the tone frequency and the distance to the signal device, environmental factors are also decisive for the quality of the signal. Wind, humidity or even rain all have an effect on audibility. A very important factor is the ambient noise level.

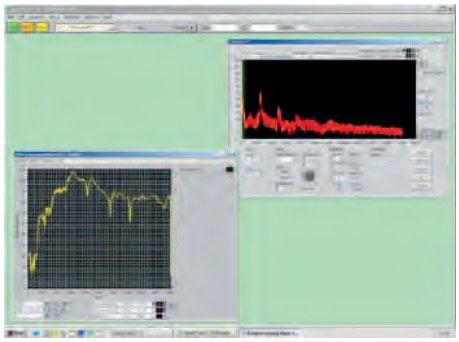
In industrial environments in particular, the ambient noise level produced by machines is often very high. Accordingly, the signal devices must produce a sufficiently high sound output in order to be heard.

WERMA has developed loud signal horns and sirens for this purpose. With fluctuating ambient noise levels, the use of a siren with a self-adjusting sound level is recommended – a patented invention from WERMA.

Research and development at WERMA



For over 50 years WERMA has been developing audible signal devices of the highest quality. Year after year we invest in research and development, enabling us to offer our customers innovative products employing state of the art technology.



Today our development team has a number of acoustic specialists in its ranks, equipped with the latest laboratory and test equipment.

WERMA places great importance on acoustic measuring technology and life duration testing facilities. Our products are only brought onto the market after they have passed the toughest of product tests.

The optimal sound generation and diffusion is achieved by means of extensive calculations, simulations and subsequent tests. For example, the horn dimensions of an audible signal device are precisely tailored to the required frequency.

Product number index

Our Products

If you are searching for a specific product, then our overview pages at the beginning of each product section provide additional support. All product variants for the specific product group are arranged according to their features (for example light effect or sound output).

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Installation Beacons

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Free-standing Beacons

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Optical-Audible Signal Devices

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Audible Signal Devices

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Ex Signal Devices

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WERMA
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