

# smartengine for planners

Information about the wtec smartengine system

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# 1 Information about smartengine and wtec

## 1.1 Technology and services

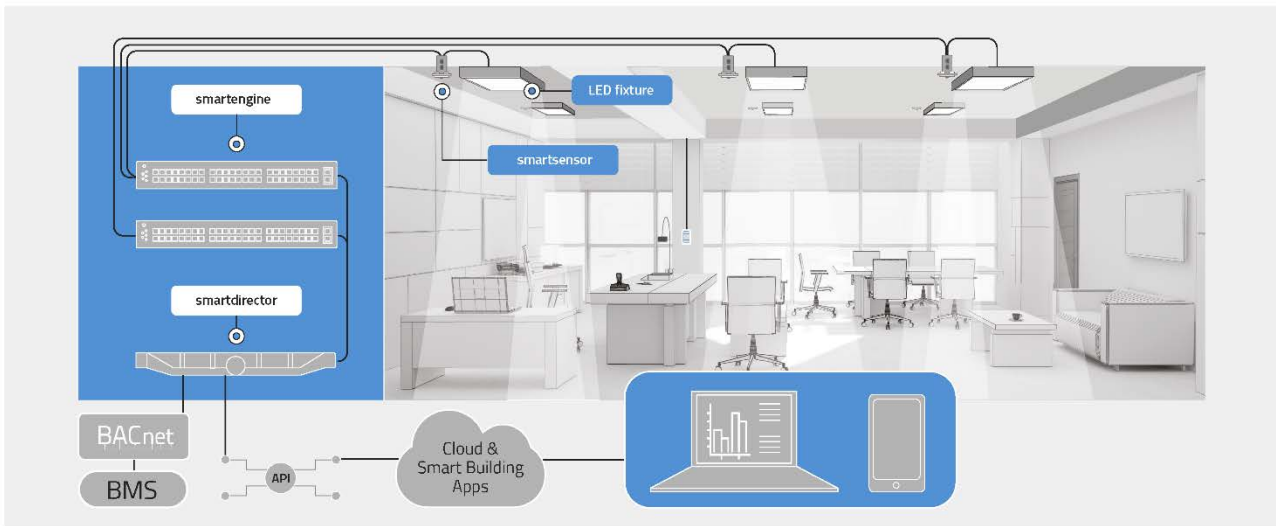
### 1.1.1 Technology

wtec GmbH is a company that operates in the field of Smart Building / IT / Network Powered Lighting. The smartengine technology is an infrastructure for building intelligence and lighting control. Manufacturer-neutral LED lights are supplied with power by using conventional data cables while simultaneously integrating multifunctional sensors into this power infrastructure. The technology replaces and simplifies numerous infrastructures and achieves high savings in operation. The solution also offers numerous applications / use cases for intelligent buildings and has already been successfully installed in over 500 projects and on more than 1.5 million square meters of developed space.

The benefits: The fine-meshed and multifunctional sensors (brightness, temperature, presence, Bluetooth communication via bidirectional beacon, air quality) become the "sensory organs" of real estate and provide historical and real-time information. Via open interfaces (BACnet/IP and open API as software data points) smartengine can exchange data with other applications (GLT integration, software applications) of building services engineering and thus becomes the "central nervous system" in the intelligent building.

### 1.1.2 System architecture / structure

The smartengine technology is based on conventional data cables that connect LED lights and central active components, the so-called "smartengines" and the "smartdirector". The following diagram shows the star-shaped topology of the smartengine system and the integration of the smartengine components. The smartdirector manages up to 40 smartengines and serves as an interface to external components like a BMS. The smartengines are used for the power supply of the LED lights. Equipped with 48 ports, 1-x lights incl. sensor can be connected and powered via a data cable (details see 2.3).



In the appendix there is a technical 1-line diagram for the topology shown above with further application possibilities (appendix 1). A topology showing the interfaces to the BMS (BACnet/IP) and other applications (open API) can be found under 2.4.5 Interfaces in this document.

### 1.1.3 Service description

wtec is a supplier of hardware and software and also provides services / supports in planning and execution.

The following products (hardware and software) are offered by wtec:

Product	Hardware / Software	Short description
smartengine	Hardware	Supply and control of LED lights (manufacturer independent).
smartdirector	Hardware	Logical management of up to 40 smartengines / 2000 sensors. API and BACnet/IP interface for integration of other systems.
smartsensor	Hardware	Multifunctional sensor.
Sonstige	Hardware	smartgateways, smartinterfaces for the integration of lights, relays for the integration of further components.
smartmanager	Software	Control and monitoring of the system. Evaluation of real-time data.
App	Software	Visual display of consumption data, light control and more

The data sheets for the individual components are given in Appendix 2.

Components from other suppliers, such as push buttons, can be integrated into the system.

The company wtec delivers a complete solution, which includes planning, installation and commissioning up to maintenance and service of the smartengine system. Due to many years of experience, there is an extensive expertise in the integration into existing planning and construction processes. Depending on your requirements, wtec can also provide optional services.

The company wtec offers the following services:

Services	Planning phase according to HOAI (Germany)	Standard service wtec	optional
Basic and needs assessment	Starting at LP 1		yes
Planning of the smartengine system	Starting at LP 1, At the latest LP 3	yes	
Lighting planning and/or optimization	Starting at LP3		yes
Route planning	Starting at LP3		yes (via Partner)
Support for the purchase of smartengine-compatible luminaires	Starting at LP3	yes	
Installation	Starting at LP8		yes (via Partner)
Commissioning	Starting at LP8	yes	
Maintenance	Starting at LP9	yes	
Service	Starting at LP9	yes	

## 1.2 References

The smartengine technology has been on the market since 2012 and has been used in numerous projects worldwide since then. The core markets include the USA, India and the DACH region (Germany, Austria, Switzerland). The size of the installations ranges from small projects with a few 100 square meters to entire campus installations with up to 100,000 square meters. Currently, more than 1.5 million square meters in over 15 countries worldwide are in operation with the smartengine technology. The technology has been continuously developed and improved. This applies to both the software and the hardware. The smartengines for example are in the fourth

generation (smartengine 3GS) and the sensors are in the third generation (smartsensor 3G). The longevity of the products has been proven in the numerous references.

The types of use range from office buildings to educational institutions, hotels, data centers, production plants and retail buildings.

Among others, we have successfully realized the following projects:

Customer/Project	m <sup>2</sup>	Area of application	Location	Country
DAX 30 Company, Innovation Center	10.000	Office / Administration	Darmstadt	Germany
Hessian Ministry	14.000	Office / Administration	Wiesbaden	Germany
Service Center Bank	8.000	Office / Administration	Bad Homburg und weitere	Germany
International consulting company	8.000	Office / Administration	Kronberg	Germany
accadis University	1.000	School / educational institution	Bad Homburg	Germany
REWE stores (Kaffenberg)	1.600	Retail	Bad Vilbel	Germany
Technology Company	2.500	Data Center	Frankfurt	Germany
CEWE Photoprint	2.000	Production	Eschbach	Germany
Hotel	800	Hotel	Frankfurt	Germany
AMS Vienna	3.300	Office/administration	Wien	Austria
Technology Company	120.000	Office/administration	diverse	India
German major bank	110.000	Office/administration	Eschborn und weitere	Germany and India
Gymshark	4.200	Office/administration	Solihull	England
Technology company	100.000	Office/administration	Bangalore	India

Further references are available on request. Visiting some of the reference projects is possible on request.

## 2 Technical information on smartengine

Below is technical information about main components of the smartengine solution:

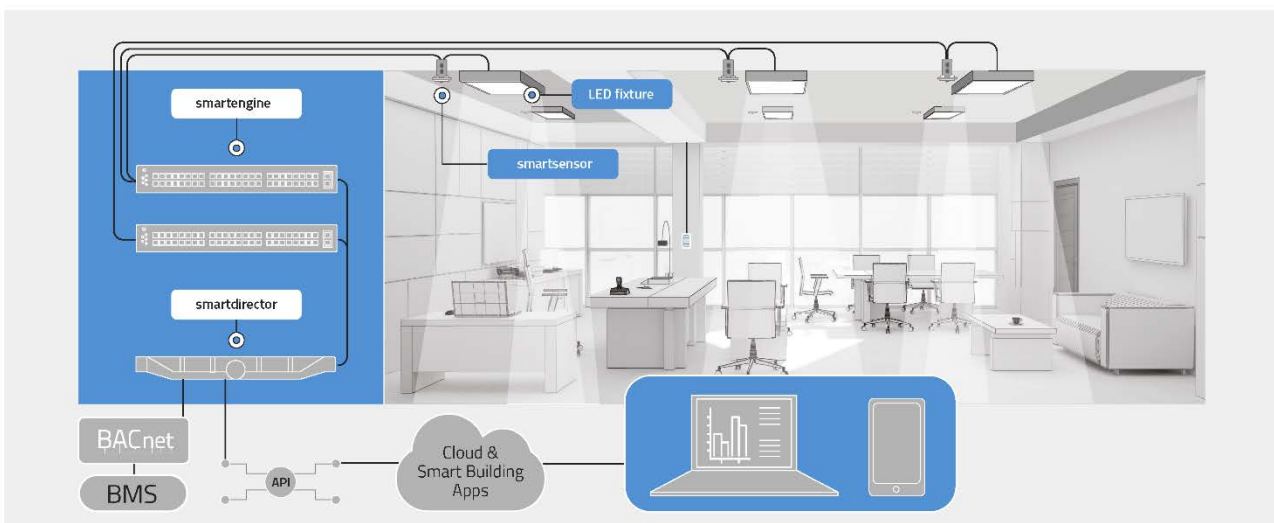
- the smartengine components of wtec
- the required data cables (standard data cables)
- the LED lights used (manufacturer-neutral LED lights with smartengine compatibility)

The technical information on the smartengine components can also be found in the Functional Specifications in the Appendix (Appendix 3).

### 2.1 smartengine components

#### 2.1.1 System architecture

The following schematic shows the star-shaped topology of the smartengine system and the integration of the smartengine components. The smartdirector manages up to 40 smartengines and serves as an interface to external components like a BMS. The smartengines are used for power supply and regulation of the lights. They are usually located in the decentralized IT rooms, the smartdirector in a central or decentralized IT room. The sensors are located in the suspended ceiling or the LED lights. The cabling via standard data cables is star-shaped, whereby sequencing several sensors/luminaires is possible.



## 2.1.2 Quantity of smartengines / Calculator

The following approximate values can be used to determine the number of components required:

- 1 smartengine per 250 – 350 m<sup>2</sup> space
- 1 sensor per fixture
- 1 smartdirector per 40 smartengines

A slightly more precise approximation of the required components and space in the rack can be made using the calculator (Appendix 4).

## 2.1.3 Server Rack

Fundamentally, the cabling is low voltage IT infrastructure cabling. Accordingly, additional IT components such as patch panels and switches are required. It is recommended to place these components in a conventional IT rack in the server rooms. In addition, it is recommended to position the IT rooms or racks in which the smartengine components are installed decentral in the building (for example, per rental area).

### **Cost advantage:**

**Due to the decentralized position, the cable masses are reduced**

In order that all our components (smartdirector, smartengine) including connectors can be optimally installed, we need a rack with the following requirements:

19 inch rack, 600x800 (W/D)

The following assumptions can be used as a guideline to determine the number of smartengines and the space required in the rack:

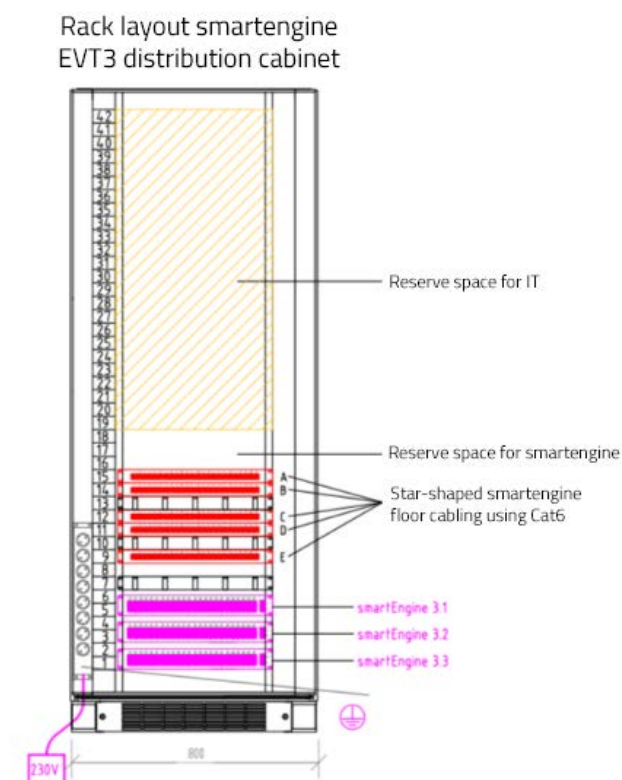


- 1 smartengine per 250-350 m<sup>2</sup> (depending on use / required illuminance)
  - 1 smartengine has 48 Ports à 34 Watt; this corresponds to a power density of 4.7-6.5 W/m<sup>2</sup>
  - 1 smartengine has 1.5 height units
- 1 patch panel per smartengine, i.e. per 250-350 m<sup>2</sup>
  - Assumption: Using a 48 port patch panel with 2 height units
- 1 smartdirector per 10,000 bis 14,000 m<sup>2</sup>
  - 1 smartdirector can cluster up to 40 smartengines
  - 1 smartdirector has 1 height unit

This results in a space requirement of 100-140 height units for an area of around 10,000 m<sup>2</sup>. With an average floor area of around 2,000 m<sup>2</sup>, this would correspond to 20 to 30 height units per floor or 4 to 6 height units per rental area (400 m<sup>2</sup>).

The required space can be accommodated in an overhead (ceiling mounted)/mini-rack or the standard IT rack, so that no additional space is required.

#### Example rack assembly with SE components:



## 2.1.4 Waste heat

The performance data of the smartengine can also be taken from the attached product data sheet

By using the smartengine technology, the drivers/ballasts in the lights are no longer required (see chapter "Lights"). These reach a temperature of 70°C and more during operation. As a result, heat is introduced over the entire surface, which must be dissipated by cooling power.

By omitting the drivers/ballasts on the luminaire, additional heat loads in the room are greatly reduced. The smartengine technology eliminates these numerous decentralized heat sources and reduces them to the smartengines and smartdirectors, which have a higher efficiency and are centrally located in a server room usually equipped with cooling power. The smartengine can be operated in a temperature range from 0 to 50°C ambient temperature.

Comparison:

Input area			
Area	10.000 m <sup>2</sup>		
Number of lights	2.500 pieces	(2 lights per 8 m <sup>2</sup> )	
Output per luminaire (cut)	17 watts	(34 W/8 m <sup>2</sup> = 4.25 W/m <sup>2</sup> )	
conventional system		smartengine	
Number of drivers/ballasts	2.500 Stück	Anzahl an smartengines	28-40
Power loss per device	approx. 4 W <sup>1</sup>	Waste heat per smartengine	220 W
Waste heat	10.000 W	Waste heat	6.160 – 8.800 W
Reduction of waste heat through smartengine			
10,000 W versus 6,160 - 8,800 W => reduction by 1,200 W to 3,840 W			Reduction: 14% - 38%

<sup>1</sup> Average value, exact value to be taken from the data sheet of the respective luminaire (waste heat of the driver/ballast)

The calculation example shows that the smartengine technology produces about 14% to 38% less waste heat than conventional systems. A further advantage is that this waste heat is generated centrally and can be removed easily.

#### Advantage:

Due to the high efficiency of the smart engines and the omission of decentralized drivers/ballasts, less waste heat is generated and the resulting waste heat can be bundled and dissipated.

## 2.2 Cabling

The cabling is done with conventional Cat5e or higher quality data cables. These are laid from the smartengines in a star shape to the end users. The cabling is a conventional IT network infrastructure.

### 2.2.1 Standard

The smartengine technology falls within the scope of the standard for data cabling and in protection class 3 SELV.

The cabling of the infrastructure is carried out in accordance with the standard DIN EN 50173-6. This specifies the application-neutral communication cable systems.

The smartengine system also falls under protection class 3 SELV. Therefore, no DIN VDE 0100 approval is necessary. In addition, the prescribed maintenance for electrical installations is not required.

#### Cost advantage:

**No mandatory inspection and electrical maintenance for the smartengine system, savings during operation by eliminating maintenance**

### 2.2.2 Route

The data cables are laid over routes or collector holders. The width of the required cable paths decreases strongly with increasing branching of the cabling. To give an idea of the required cable paths, the following approximations can be used:

In case of full occupancy (48 ports), 48 data cables (outer diameter from 5.7 mm to 7.3 mm) are coming out of each smartengine, i.e. a maximum thickness of a cable bundle consisting of 24 cables

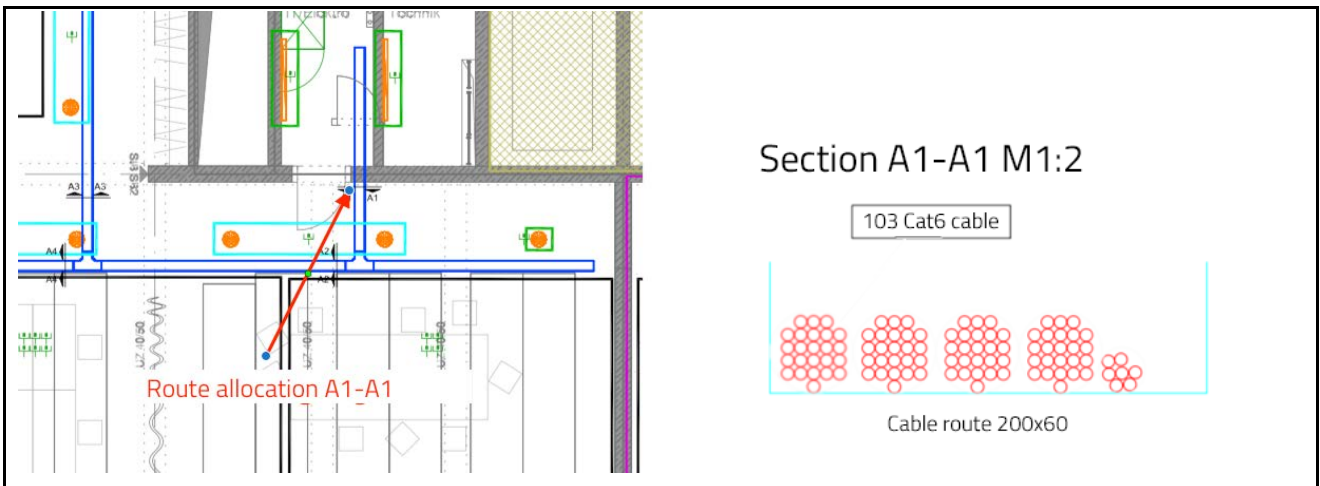
of 250 mm (100%). By fanning out the cables to the different areas, experience shows that the thickness of the cable bundle decreases as follows:

- IT room (location of the smartengines): 100%
- Core: 70-100%
- Corridor: 35-70%
- office area: 1-35%

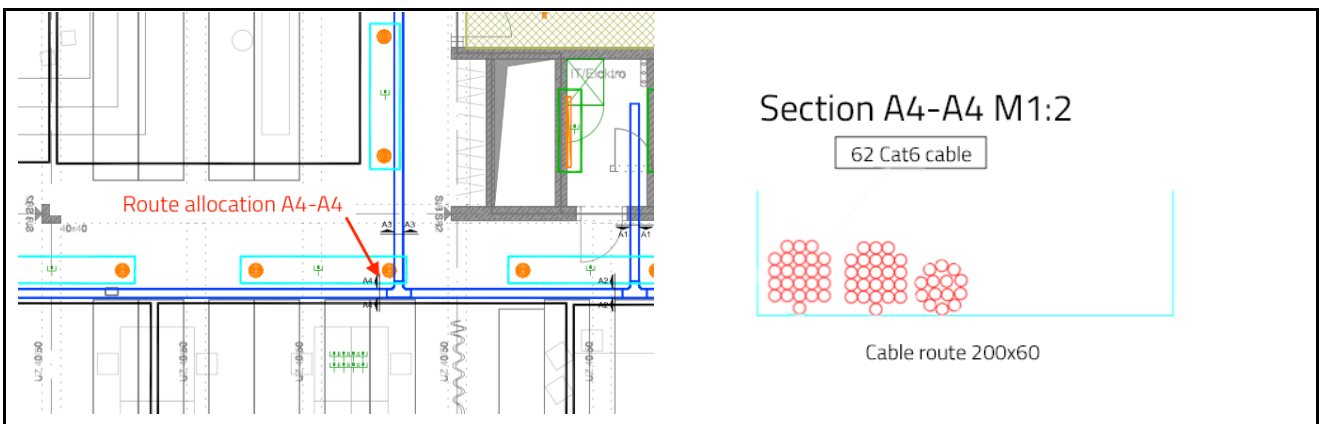
The width of the cable paths / bundles also depends on how many IT rooms are available as locations for the smartengines (per rental area) and where they are positioned. As an example, the following occupancies can be assumed:

1<sup>st</sup> example:

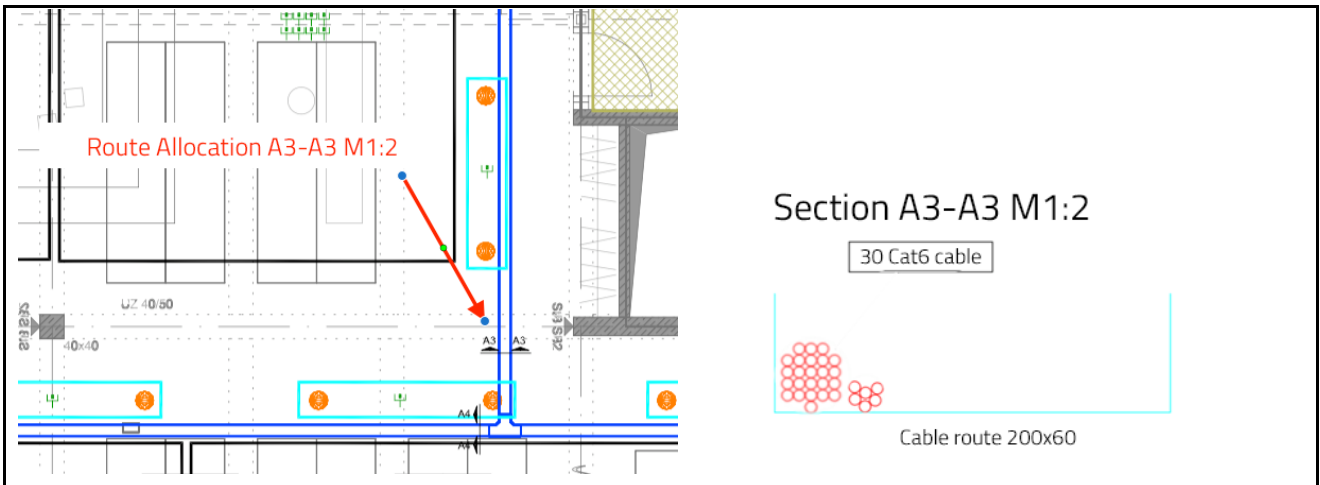
Core:



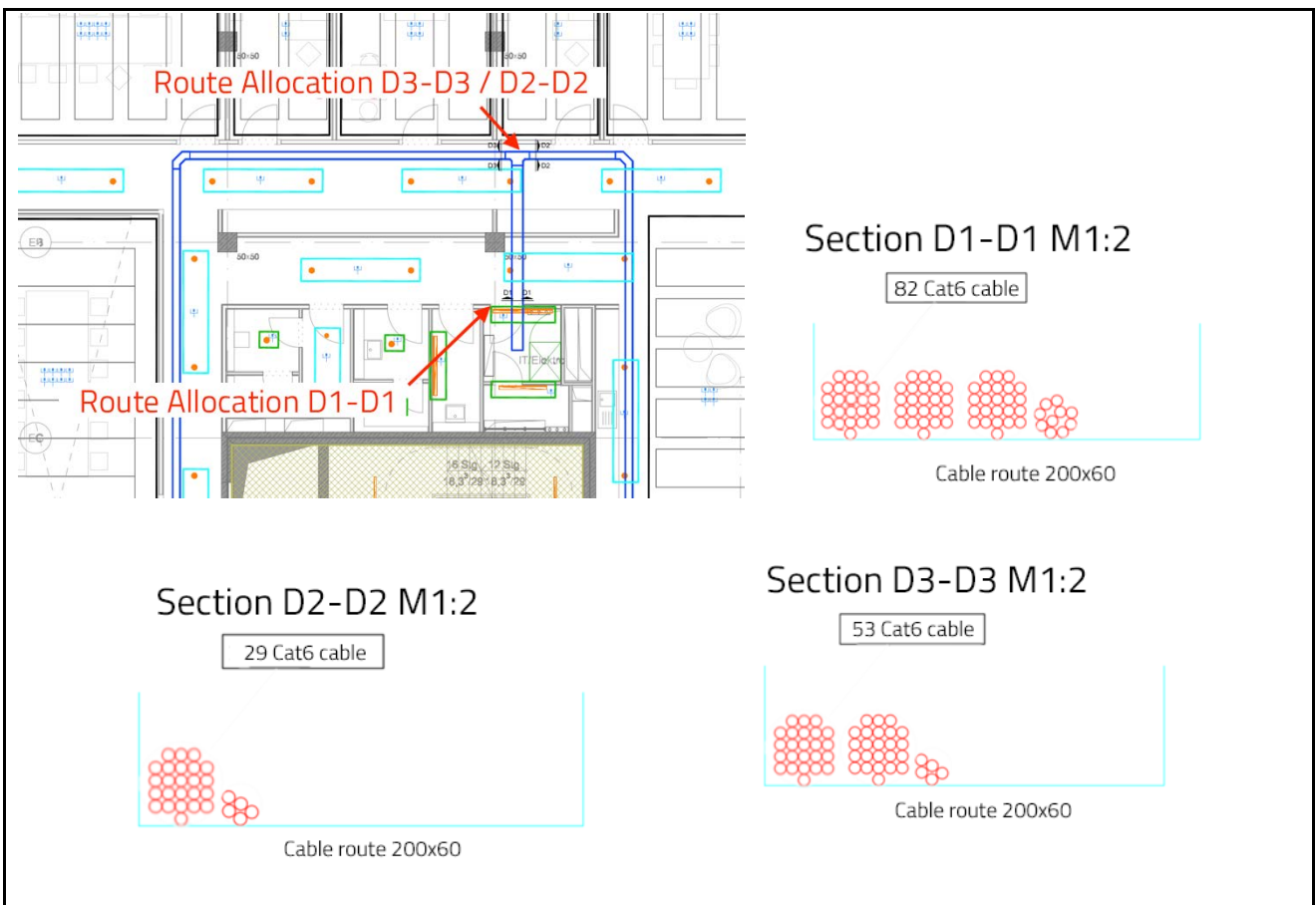
Corridor:



Office area:



2<sup>nd</sup> example:



The type of installation (route or collective holder) can be adapted according to requirements.

### 2.2.3 Fire loads

Depending on the data cable used, different fire loads occur. The following table shows an example of the fire loads of frequently used cables:

Manufacturer	Cable description	Fire load in MJ / km
Commscope	Systimax 3071	431
Dätwyler	CU 7080 4P / 2x4P F8	1140
Leoni Kerpen	MegaLine® E2-30 U/U	650

Note: In most cases smartengine installations are done with the cables by Commscope and Excel. Depending on planning requirements (price, fire load, cable properties) an optimal cable can be used.

## 2.3 Fixtures

Almost all fixtures can be produced smartengine-compatible. The compatibility is independent of

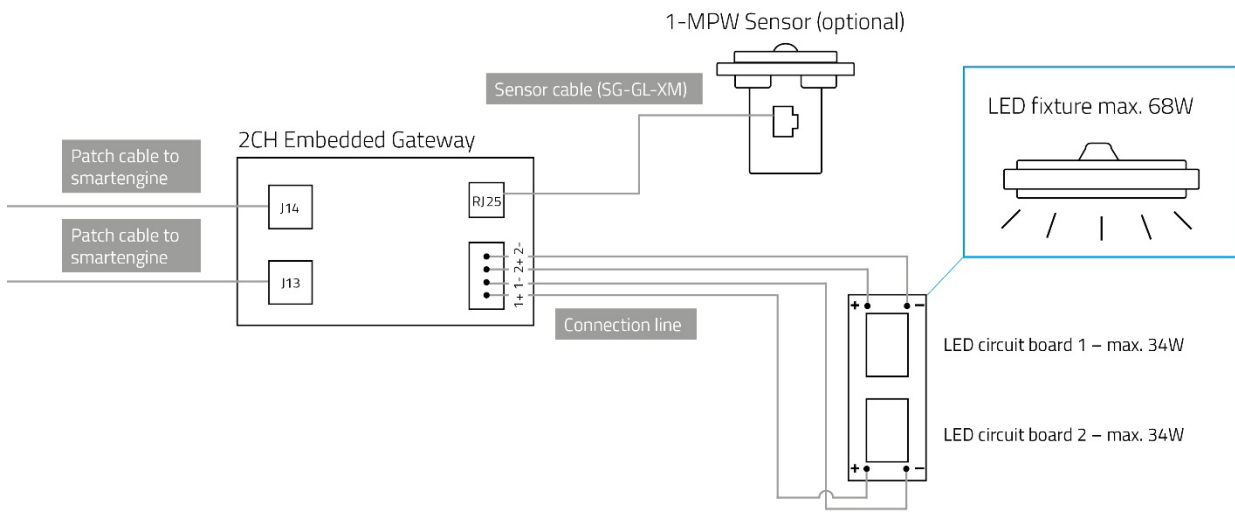
- Lighting manufacturer
- Luminaire type (floor lamp, pendant lamp, downlight, decorative lamp, etc.)

In principle, a power of 34 watts can be supplied per port (data cable). Ideally, the lights should meet the following technical requirements:

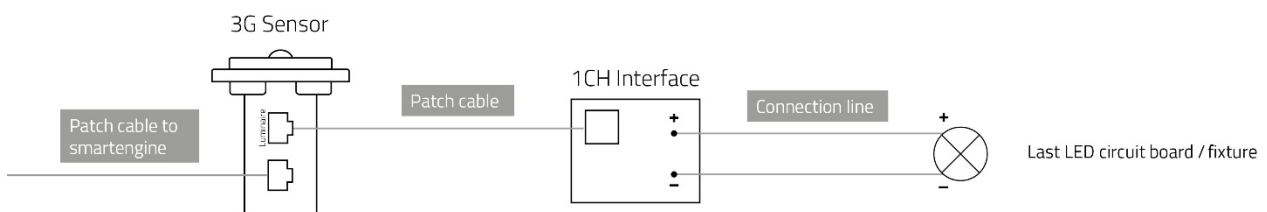
- Voltage = 18-48Vdc (direct voltage)
- Current = 100-700mA
- Max. 34W System power
- Optional: Consider installation space for smartsensor or smartgateway (RJ-45 connection)
- The LED PCBs do not require any additional components such as a PWM.
- Constant current supply

The use of smartengine eliminates the need for drivers / ballasts in the luminaires. Based on the above mentioned parameters 1-x lights can be connected per port and connected in series:

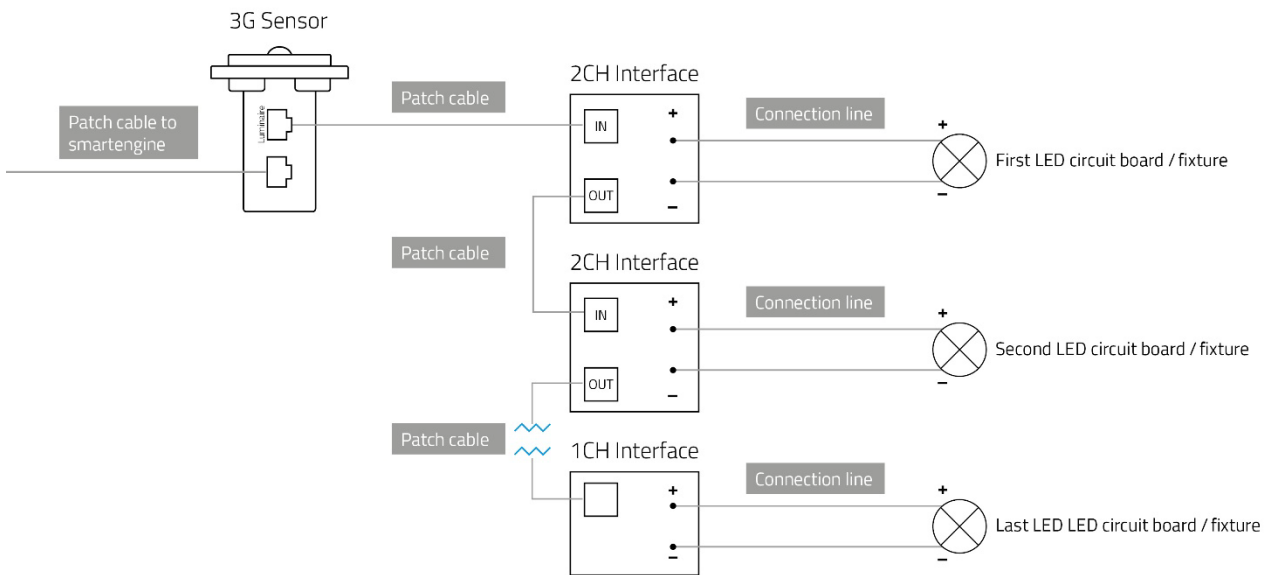
## Connection via 2CH Embedded Gateway



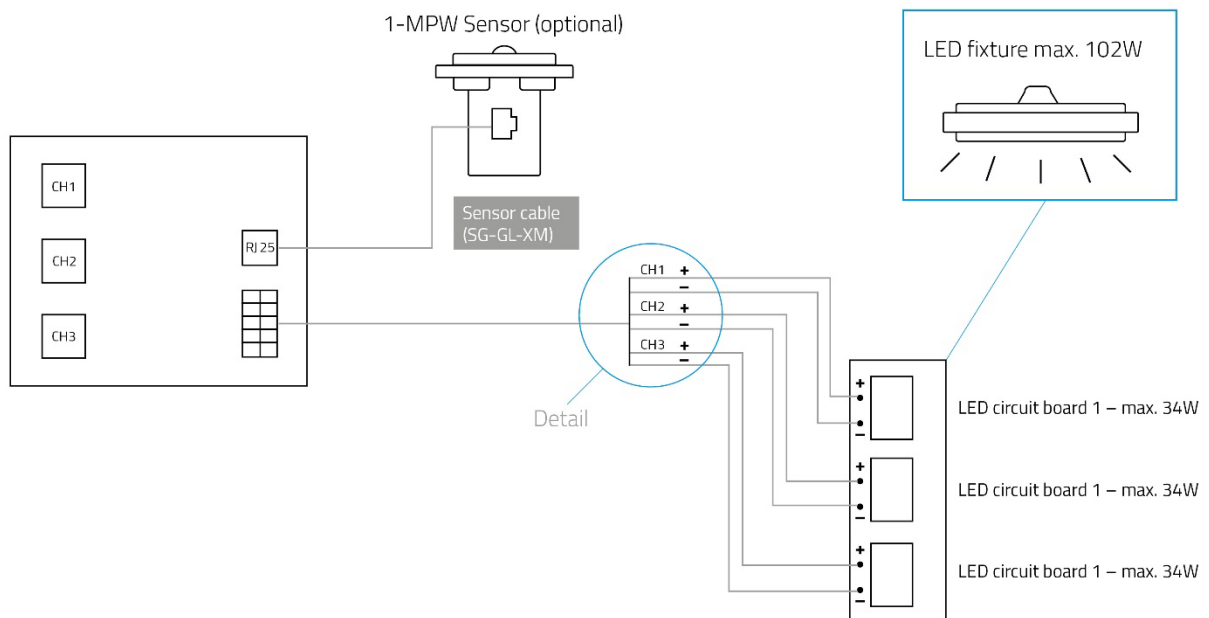
## Connection via 3G Sensor (single fixture)



## Connection via 3G Sensor (fixture group)



## Connection via LED Gateway





**Cost advantage:**

**No mandatory inspection and electrical maintenance for the smartengine system, savings during operation by eliminating maintenance**

Appendix 5 contains the Luminaire Guide for a more detailed description of the requirements.

The process concerning the luminaires is as follows:

- the light planner creates the lighting design,
- If required, wtec can optimize the light planning with regard to the use of smartengine,
- the builder-owner selects luminaires,
- after selection of the lights by the building owners, a sample light is produced and tested by wtec
- after successful test the luminaire is certified as "smartengine-compatible"
- the lights are produced for the project by the manufacturer smartengine-compatible and ready to plug in (RJ45) and, if necessary, with a sensor and delivered directly smartengine-compatible to the construction site

The following exemplary lighting manufacturers have already produced smartengine-compatible lights:

The mentioned light manufacturers have partly integrated the wtec sensors in their lights (linear lights, etc.). For suspended ceilings the sensors are installed in the ceiling.

Appendix 6 shows the current status of various lights which are smartengine-compatible. If new luminaires are certified, they are continuously added to the list. Please contact us for a current list.

It is possible to combine the emergency lighting with the smartengine system. For this, a coordination with the TÜV and fire protection officer is necessary.

### **Cost advantage:**

**The integration of the sensors saves installation time on site**

## **2.4 Planning**

### **2.4.1 Necessary documents**

wtec has many years of project experience in terms of project management and cooperation with the participating planners, architects, building owners, lighting manufacturers, etc. Usually, a personal meeting or a kick-off call takes place at the start of the project to clarify the basics. The documents required for further processing can be found in the attached checklist (Annex 7). The most important documents are:

- Floor plan
- Lighting design (or at least -concept)
- Cross section
- Ceiling mirror

### **2.4.2 Time / Procedure**

The smartengine technology can also be integrated at a late stage of the planning and construction phase. However, it is advisable to integrate it at an early stage in the planning process. wtec supports the lighting design (optimization); the use of smartengine can save time in the construction process due to the quick installation and commissioning.

### 2.4.3 Tender

Since smartengine replaces certain components, it is recommended to remove these from the tender:

- 230 Volt cabling and corresponding terminal points / sub-distribution
- Bus (KNX or similar)
- DALI drivers/ballasts in the LED lights
- presence detector

Ideally, the entire lighting system including cables, controls, etc. is tendered separately. The tender texts for the smartengine components can be requested from wtec if required.

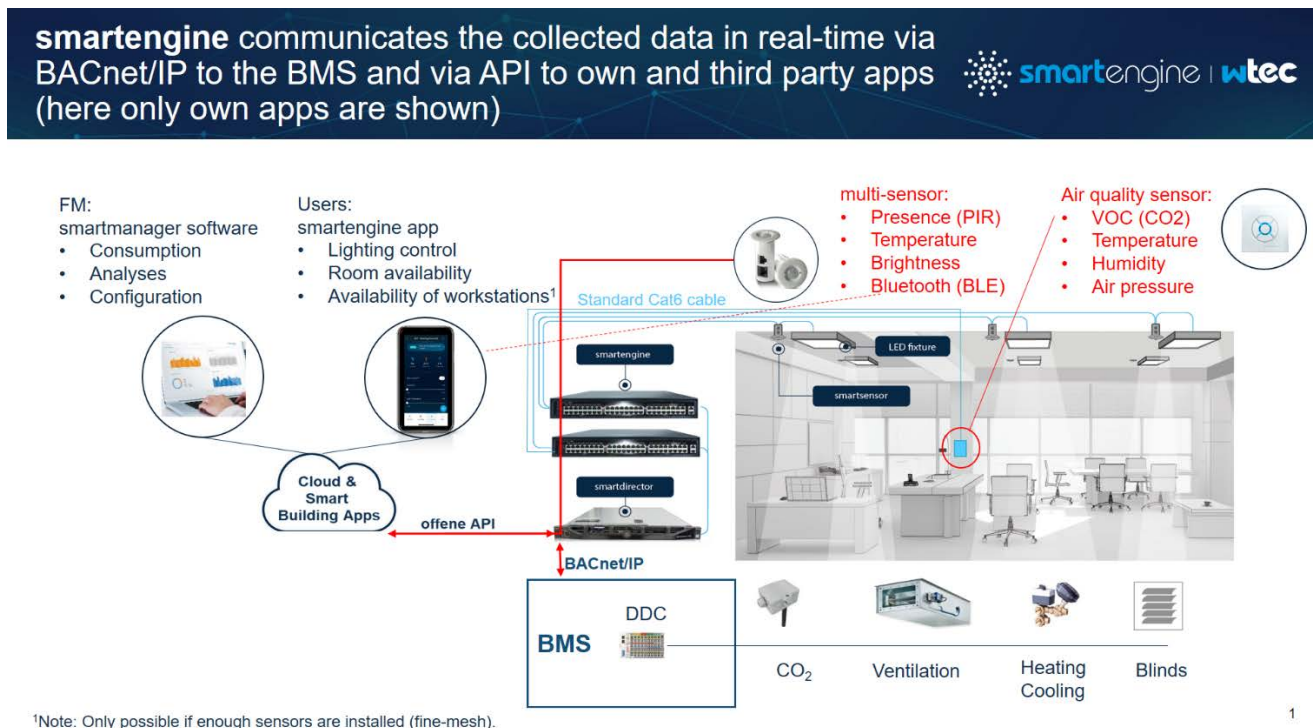
### 2.4.4 Replacing BMS components / data points

The following elements are eliminated through the use of smartengine technology:

- Temperature sensor / room thermostat
  - Replaced by smartsensor from wtec
  - Data point on GLT/DDC: digital data point instead of analog data point
- Motion detector/KNX
  - Replaced by smartsensor from wtec
  - Data point on GLT/DDC: digital data point instead of analog data point
- KNX/Dali Gateway
- Line / area coupler
- Integration possibilities in general:
  - BACnet/IP and open API
  - various GLTs from different manufacturers

## 2.4.5 Interfaces

Via the open API as well as the BACnet/IP interface the data from the smartdirector can be integrated into various external systems.



## 2.5 Other

### 2.5.1 Investment costs

For the smartengine system there are investment costs for the installation of data cables, for smartengine components as well as the corresponding working hours.

Due to the smartengine system, some services/hardware are no longer required, as they are replaced or rendered obsolete by the smartengine system. These are:

- 230V cabling including fuse protection (NYM cables) to the luminaires
- Smaller sub-distribution
- Bus Cabling
- Control elements in the sub-distributions (e.g. staircase time switch)
- Drivers in the luminaires
- External temperature sensors
- Conventional switches
- brightness sensors

- Actuators
- line coupler
- Electrical approval

When integrating the data points, it should be noted that the data from wtec are digital data points and therefore the costs per data point are significantly lower when integrated on the BMS/DDC than with conventional analog data points:

- Average cost for an analog data point: 300 €
- Average cost for a digital data point: 70 € (set of data points)

## 3 Appendix List

Appendix 1: [Topology/ one line diagram](#):

Appendix 2: Datenblätter der Komponenten (smartdirector, smartengine, smartsensor):

- [smartdirector instruction manual](#)
- [smartdirector specifications](#)
- [smartengine instruction manual](#)
- [smartengine specifications](#)
- [smartsensor SSEN-1-W-GNEW1500](#)

(Further data sheets can be found at [wtec.io/downloads](https://wtec.io/downloads))

Appendix 3: [Funktionale Leistungsbeschreibung](#)

Appendix 4: [Calculator smartengines](#)

Appendix 5: Luminaire Guide:

- [smartengine ready luminaire design guide](#)
- [Funktionale Leistungsbeschreibung](#)
- [smartengine ready luminaire questionnaire examples](#)

Appendix 6: [Compatible fixture list](#)

Appendix 7: [Checklist](#)

## 4 Disclaimer

This information brochure has been prepared with the utmost care. Nevertheless, no claims or liabilities can be derived from it. Deviations and errors are reserved.

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