Introduction:

System Integration requires detailed planning. All components should be selected properly to get a long-time running system.
Definition System Integration

Perfect fit of each module

- Power supply
- Cabinet
- Lightning protection
- Sensors
- Communication device
- Data logger
Station structure
Definition System Integration

- Transmitter space
- Power supply: z.B. PCU 12, Solar / 230V Anschluss
- Additional components

- Data logger
- Modem
- Sensor space
- Lightning modules

- z.B. PCU 12
- Solar / 230V Anschluss

- Additional components
- Sensor space
- Data logger
- Modem

- Transmitter space
- Power supply
Definition System Integration

- Modem
- Housing
- Data logger
- Overvoltage Protection
- Sensor
- Power Unit PCU 12
- Battery
System components

Power supply - datalogger, communication devices, sensors
System components

**Housing**
- Plastic
- (Stainless) steel
- Different sizes
- Different IP ratings
- Different mounting possibilities
- Buoys

**Transmission unit**
- GSM/GPRS modem
- Landline modem
- Radio modem
- Satellite modem
- Different antennas

**Data logger**
- DuoSens
- LogoSens 2
- ...

**Sensors**
- Bubbler
- Shaft Encoder
- Radar
- Pressure
- Hydrolab
- SLD
- Meteorological
- ...

**Power Supply**
- Mains
- Solar
- Battery
- Fuel cell

**Interfaces**
- Data base
- IP communication
- SCADA systems
- Analogue outputs
- Displays
- ...

**Data logger**
- DuoSens
- LogoSens 2
- ...

**Transmission unit**
- GSM/GPRS modem
- Landline modem
- Radio modem
- Satellite modem
- Different antennas
### System components

<table>
<thead>
<tr>
<th>Beispiele</th>
<th>PCU oder PR1205</th>
<th>Logosens</th>
<th>Duosens</th>
<th>CBS</th>
<th>Modem</th>
<th>Midi</th>
<th>HDR</th>
<th>FAD Dose</th>
<th>Akku 6,5Ah</th>
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<tbody>
<tr>
<td>KS 1434</td>
<td>300<em>400</em>200</td>
<td>x</td>
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<tr>
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<tr>
<td>KS 1468</td>
<td>600<em>800</em>300</td>
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<tr>
<td>Edelstahl</td>
<td>600<em>380</em>210 AE 1008</td>
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<td>x</td>
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<tr>
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<td>x</td>
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<tr>
<td>Edelstahl</td>
<td>760*600 AE 1076</td>
<td>x</td>
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<td>x</td>
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<tr>
<td>AE 1057</td>
<td>Blechschrank 700<em>500</em>300</td>
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<td>x</td>
<td>x</td>
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<td>AE 1080</td>
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<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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</tr>
</tbody>
</table>

**Skizzenvorlage für Schaltschrank**

**Klemmen oder Blitzschutzmodule für Gebereingänge sind bei dieser Auswahl nicht berücksichtigt!!**

Maßangaben:
- Dehn BS=15mm
- Klemme = 5mm Stopper = 5mm SPI Adapter= 50mm Steckdose = 60mm
- Schienenlänge TS-35 bei KS1446 = 170mm
- Schienenlänge TS-35 bei KS1466 = 300mm

**Link zum Projektordner**
**System:** Logosens, OTT-PLS, Wavecom Modem

<table>
<thead>
<tr>
<th>Power consumption Logosens 2, Sensor and transmission.</th>
<th>Logosens 2</th>
<th>Logosens 2 with Impulse input</th>
<th>Solar Regulator</th>
<th>OTT PLS</th>
<th>OTT CBS</th>
<th>OTT RLS</th>
<th>OTT SE200</th>
<th>Kalesto v</th>
<th>Wavecom Modem</th>
<th>Sat Transmitter Thrane &amp; Thrane TT 3026</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment enable</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<tr>
<td>Power consumption sleep [mAh/day]</td>
<td>16,80</td>
<td>120,00</td>
<td>48,00</td>
<td>10,80</td>
<td>1,20</td>
<td>1,20</td>
<td>0,12</td>
<td></td>
<td>1</td>
<td>0</td>
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<tr>
<td>Power consumption measurements per day [mAh/day]</td>
<td>1,33</td>
<td>1,33</td>
<td>0,11</td>
<td>100,00</td>
<td>6,40</td>
<td>0,27</td>
<td>2933,33</td>
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<tr>
<td>Power consumption for each measurement [mA]</td>
<td>50,00</td>
<td>50,00</td>
<td>4,00</td>
<td>12,00</td>
<td>10,00</td>
<td>550,00</td>
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<tr>
<td>Measurements time [s]</td>
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<td>1</td>
<td>1</td>
<td>50</td>
<td>20</td>
<td>1</td>
<td>20</td>
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<tr>
<td>Measurements Intervals per day</td>
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<td>96</td>
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<tr>
<td>Total power consumption communication per day [mAh/day]</td>
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<td>7,50</td>
<td></td>
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<td></td>
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<td>24,00</td>
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<tr>
<td>Power consumption for each connection</td>
<td>0,25</td>
<td>0,25</td>
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<td></td>
<td></td>
<td>1,00</td>
<td>27,78</td>
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<td>30</td>
<td>25</td>
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<td>Transmissions per day</td>
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<td></td>
<td></td>
<td>2</td>
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<tr>
<td>Total power consumption [mAh/day]</td>
<td>25,63</td>
<td>0,00</td>
<td>48,00</td>
<td>10,91</td>
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<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>24,00</td>
<td>0,00</td>
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</table>

**Lifetime only powered by battery**

- **Lifetime:** 100Ah Battery
- **Usable capacity:** 60%
- **Lifetime:** 553 days
**Power consumption**

**System:** Duosens with analog input, OTT-PLS, OTT-RLS, Wavecom Modem (GPRS)

<table>
<thead>
<tr>
<th>Power consumption Logosens 2 / DuoSens, Sensor and transmission.</th>
<th>DuoSens with analog or serial input card</th>
<th>DuoSens</th>
<th>Solar Regulator</th>
<th>OTT PLS</th>
<th>OTT CBS</th>
<th>OTT RLS</th>
<th>OTT SE200</th>
<th>Kalesto v</th>
<th>Wavecom Modem</th>
<th>Sat Transmitter Thrane &amp; Thrane TT 3026</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption measurements per day [mAh/day]</td>
<td>1,68</td>
<td>0,72</td>
<td>48,00</td>
<td>10,80</td>
<td>1,20</td>
<td>1,20</td>
<td>0,12</td>
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<tr>
<td>Power consumption measurements [mAh/day]</td>
<td>1,33</td>
<td>0,53</td>
<td>0,11</td>
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<td>0,00</td>
<td>0,00</td>
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<tr>
<td>Power consumption sleep [mAh/day]</td>
<td>50,00</td>
<td>20,00</td>
<td>4,00</td>
<td>12,00</td>
<td>10,00</td>
<td>550,00</td>
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<tr>
<td>Measurements time [s]</td>
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<td>1</td>
<td>1</td>
<td>50</td>
<td>20</td>
<td>1</td>
<td>20</td>
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<td>Measurements Intervals per day</td>
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<td>96</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td></td>
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<tr>
<td>Total power consumption communication per day [mAh/day]</td>
<td>1,20</td>
<td>1,20</td>
<td>1420,80</td>
<td>666,67</td>
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<tr>
<td>Power consumption for each connection [mA]</td>
<td>0,10</td>
<td>0,10</td>
<td>19,20</td>
<td>27,78</td>
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<tr>
<td>Transmission time [s]</td>
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<td>12</td>
<td>12</td>
<td>25</td>
<td></td>
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<tr>
<td>Transmissions per day</td>
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<td>2</td>
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<tr>
<td>Total power consumption [mAh/day]</td>
<td>4,21</td>
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<td>0,00</td>
<td>10,91</td>
<td>100,00</td>
<td>0,00</td>
<td>0,00</td>
<td>1420,80</td>
<td>1536</td>
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</tbody>
</table>
Power Supply

System: Main power and buffer battery

- Power Control Unit (12V/230V)
  - Solar controller & net converter
- Buffer battery
- PCU12 needs always an accumulator
- Cross-section cable!
System: Solar power

- Solar controller
- Buffer battery outside the cabinet
OTT PCU12:

Technical specifications:

Mains voltage 90 to 250V, 40 to 60 Hz
Power input (mains) < 30VA
Output voltage 10.5 to 14 V
Output current with battery max. 20A

Power consumption PCU12
Mains operation < 20 mA
Solar operation < 2 mA
Battery operation < 0.5 mA !!!

Solar panel
open-circuit voltage < 23 V
nominal voltage 12 V
short-circuit current < 12 A

Battery capacity max. 200 Ah
End-of-charging voltage approx. 15.5 V at ≤ –20 °C
approx. 14.2 V at +20 °C
approx. 13.3 V at ≥ +50°C
OTT PCU12:

Technical specifications:

Deep charging thresholds (separated load connections) 10.5 V and 7.5 V
Connecting the load connections 11.5 V

Operating status display LED, visible from outside

Protection in the event of polarity current automatically limited at the reversal, overload, short-circuit battery and solar panel input

Earth group earth at the solderless terminal strip, connected to the protective earth conductor

Overvoltage protection in accordance with IEC 100-4-5
Protection IP 54 (without IEC connector)
Ambient temperature range –40 °C to +85 °C
OTT PCU12:

Particulars:

• Very low power consumption
• Intelligent overvoltage concept

• LED operating status
  continuously on power supply by mains
  continuously off exhaustive discharge protection on
  blinks continuously short circuit or output overload
  flashes 1 x only output 1 active
  flashes 2 x output 1 and 2 active
  flashes 3 x battery charging by solar panel
PCU12:

Technical specifications:

- Overload and low voltage battery protection
- Temperature-controlled charging
- Self-timed overload protection, no fuse !!!

Solar panel
- Open-circuit voltage: $< 23\, \text{V}$
- Nominal voltage: $12\, \text{V}$
- Short-circuit current: $< 12\, \text{A}$
OTT Solar 1205:

Technical specifications:

- Power consumption: 3 mA
- Solar panel:
  - Open-circuit voltage: < 47 V
  - Nominal voltage: 12 V
  - Output voltage swing: 11 to 14 V
  - Short-circuit current: < 5 A
- Deep discharge protection (LVD): 11V ... 11.5V
- Reconnection voltage (LVR): 12.5V
- Ambient temperature range: -25°C ... +50 °C
- Protection IP 32
OTT Solar 1205:  

**Electronic protection functions**

- Overcharge protection
- Deep discharge protection
- Reverse polarity protection of load, module and battery
- Automatic electronic fuse
- Short circuit protection of load and module
- Overvoltage protection at module input
- Open circuit protection without battery
- Reverse current protection at night
- Overtemperature and overload protection
- Battery overvoltage shutdown
Batteries rechargeable
### Batteries rechargeable

<table>
<thead>
<tr>
<th></th>
<th>Nickel-cadmium</th>
<th>Nickel-metal hydride</th>
<th>Lead-acid sealed</th>
<th>Lithium-ion cobalt</th>
<th>Lithium-ion manganese</th>
<th>Lithium-ion phosphate</th>
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</thead>
<tbody>
<tr>
<td><strong>Gravimetric Energy Density (Wh/kg)</strong></td>
<td>45-80</td>
<td>60-120</td>
<td>30-50</td>
<td>150 - 190</td>
<td>100 - 135</td>
<td>90 - 120</td>
</tr>
<tr>
<td><strong>Internal Resistance in mΩ</strong></td>
<td>100 to 200¹ 6V pack</td>
<td>200 to 300¹ 6V pack</td>
<td>&lt;100¹ 12V pack</td>
<td>150 - 300¹ pack 100 - 130 per cell</td>
<td>25 – 75² per cell</td>
<td>25 – 50² per cell</td>
</tr>
<tr>
<td><strong>Cycle Life</strong> (to 80% of initial capacity)</td>
<td>1500²</td>
<td>300 to 500³</td>
<td>200 to 300³</td>
<td>300 - 500³</td>
<td>Better than 300 – 500⁴</td>
<td>&gt;1000 lab conditions</td>
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<tr>
<td><strong>Fast Charge Time</strong></td>
<td>1h typical</td>
<td>2 to 4h</td>
<td>8 to 16h</td>
<td>1.5 - 3h</td>
<td>1h or less</td>
<td>1h or less</td>
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<tr>
<td><strong>Overcharge Tolerance</strong></td>
<td>moderate</td>
<td>low</td>
<td>high</td>
<td></td>
<td>Low. Cannot tolerate trickle charge.</td>
<td></td>
</tr>
<tr>
<td><strong>Self-discharge / Month (room temperature)</strong></td>
<td>20%⁵</td>
<td>30%⁵</td>
<td>5%</td>
<td></td>
<td>&lt;10%⁵</td>
<td></td>
</tr>
<tr>
<td><strong>Cell Voltage</strong></td>
<td>Nominal Average</td>
<td>1.25V²</td>
<td>1.25V²</td>
<td>2V</td>
<td>3.6V 3.7V³</td>
<td>Nominal 3.6V Average 3.8V³</td>
</tr>
<tr>
<td><strong>Load Current</strong></td>
<td>peak average</td>
<td>20C 0.5C or lower</td>
<td>5C 0.2C</td>
<td>&lt;3C 1C or lower</td>
<td>&gt;30C 10C or lower</td>
<td>&gt;30C 10C or lower</td>
</tr>
<tr>
<td><strong>Operating Temperature (discharge only)</strong></td>
<td>-40 to 60°C</td>
<td>-20 to 60°C</td>
<td>-20 to 60°C</td>
<td>-20 to 60°C</td>
<td></td>
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</tr>
<tr>
<td><strong>Maintenance Requirement</strong></td>
<td>30 to 60 days</td>
<td>60 to 90 days</td>
<td>3 to 6 months¹¹</td>
<td>not required</td>
<td></td>
<td></td>
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<tr>
<td><strong>Safety</strong></td>
<td>Thermally stable, fuse recommended</td>
<td>Thermally stable, fuse recommended</td>
<td>Thermally stable</td>
<td>Protection circuit mandatory; stable to 150°C</td>
<td>Protection circuit recommended; stable to 250°C</td>
<td>Protection circuit recommended; stable to 250°C</td>
</tr>
<tr>
<td><strong>Toxicity</strong></td>
<td>Highly toxic, harmful to environment</td>
<td>Relatively low toxicity, should be recycled</td>
<td>Toxic lead and acids, harmful to environment</td>
<td>Low toxicity, can be disposed in small quantities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sealed lead accumulators:

Discharge characteristics

The diagram shows the voltage curve of a cell dependent on the discharge time.

20° C was selected as reference temperature and discharge currents of 1 x I20 to 40 x I20 as parameters.

The dashed boundary curve indicates the relevant final discharge voltages.

Deep discharging starts beyond this region.

The curves indicate that there is no advantage to be gained by discharging below this line.
Effect of temperature on battery capacity

The available capacity of a battery varies with temperature and also load current.

All nominal capacities are based on a battery temperature of 20° C and a 20 hour discharge load.
Charging

Sealed lead batteries require regulated battery chargers which limit the charging voltage according to the WU or IU charging characteristic for initial charging and trickle charging.

The optimum charging voltage as a function of the continuous ambient temperature (battery temperature) is indicated in the diagram.

If wide variations of temperature are expected it is recommended to operate with a temperature dependent voltage regulation as standard rather than to use a fixed charging voltage.
Storage

Batteries should be stored in a fully charged condition in a dry room. Excess humidity can lead to surface conduction between terminals and as a result, self discharge will increase and sulphation may occur. The diagram illustrates the relationship between the storage time and self-discharge at certain storage temperatures. Batteries stored at 20°C should not be left for longer than 16 months before recharging.
Solar Panel, a good power source, if the system is designed for it.
Solar Radiation:

The map below shows the yearly average of the approximate daily sunshine in KiloWattHours per square meter of flat panel surface area facing the equator and tilted at an angle equal to your latitude.
4 different types of solar panels.

**Monocystalline** - these are made from cells created by cutting thin slices from single crystal silicon block and are higher in efficiency, but also higher in cost per watt. They are easy to spot because they have a smooth even colour, usually black.

**Polycrystalline** – these are made from cells created by cutting thin slices from polycrystal silicon block and are slightly lower in efficiency, but also lower in cost per watt. Polycrystal silicon is the “chicken nugget” of silicon, made by combining many individual crystals. They are easy to spot because they have an uneven colour, usually blue.

**Multicrystalline** – a different term for polycrystalline.

**Thin film** – these are made by depositing a thin layer of very finely powdered silicon (amorphous silicon) or other photovoltaic material, on a substrate. These are much lower in efficiency that crystalline cells, and somewhat cheaper per watt. They are a good choice for large ground mounted utility scale solar arrays where real estate is plentiful. Their low efficiency makes them undesirable for commercial and residential applications because they consume a large amount of roof space compared to mono or poly panels.
Which solar panel should be used for the system?

Main questions to get the answer:

At which location will be the system installed? (Solar Radiation)

Which power consumption is calculated for the system? (Ah/day)

How many days the system should work without sun shine? (Days, weeks)
Technical data: 50 W solar panel

**SL050-12**

- Rated max. Power (P max.): 50W
- Current at Pmax. (Imp): 2.9A
- Voltage at Pmax. (Vmp): 17.2V
- Short - Circuit Current (Isc): 3.20A
- Open - Circuit Voltage (Voc): 21.6V
- Nominal Operating Cell Temp. (Tnoct): 50°C
- Maximum System Voltage: 715V
- Maximum Series fuse Rating: 5.0A

Am = 1.5  E = 1000W/m²  T = 25°C
Characteristic equation

From the equivalent circuit it is evident that the current produced by the solar cell is equal to that produced by the current source, minus that which flows through the diode, minus that which flows through the shunt resistor.

\[ I = IL - ID - ISH \]

where

- \( I \) = output current (amperes)
- \( IL \) = photogenerated current (amperes)
- \( ID \) = diode current (amperes)
- \( ISH \) = shunt current (amperes)

The current through these elements is governed by the voltage across them:

\[ V_{j} = V + IRS \]

where

- \( V_{j} \) = voltage across both diode and resistor \( RSH \) (volts)
- \( V \) = voltage across the output terminals (volts)
- \( I \) = output current (amperes)
- \( RS \) = series resistance (Ω)
Solar panel orientation and angle

Again, this is dependent upon where you are in the world and also greatly varies with the season.

The general guidelines are:
Solar panels should face South in the Northern Hemisphere and North in the Southern Hemisphere.

A solar panel's angle should be set to the equivalent of your latitude plus 15 degrees during winter, or minus 15 degrees in summer.

e.g.

For a data logger we need always a good average power from the solar panel over the whole year.

A good angle for the solar panel in Germany:

60° - 70°
Solar panel orientation and angle

Influence latitude, solar power

\[ E = E_0 \cos(\beta) \]

Solar panel orientation and angle

Influence latitude, solar power
Solar panel influence

Radiation:
- Shadowing
- Snow

Installation
- Wind

sun

Solar module
Solar Panel lightning protection

Lightning modules:
Dehn lightning modules are used to protect the system

Lightning rod:
Lightning rods are also a good to protect the system

<table>
<thead>
<tr>
<th>Protection class</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection angle</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Size of lightning rod (m)</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
</tr>
</tbody>
</table>

Diagram:
- Lightning rod
- Protection angle
- Grounding

Legend:
- Protection class I, II, III, IV

Graph:
- X-axis: Size of lightning rod (m)
- Y-axis: Protection class
- Angle range: 10 to 80 degrees
Lightning protection

Lightning protection will protect the system and is necessary to get all time actual values from the system.

Lightning density south Germany 1992-1994
Lightning protection

Description
Lightning protection systems are used to lessen damage to structures by lightning strikes. Lightning protection systems mitigate the fire hazard which lightning poses to structures.
A lightning protection system provides a low-impedance path for the lightning current to lessen the heating effect of current flowing through flammable structural materials. Porous, water-saturated materials may literally explode if their water content is flashed to steam by heat produced from lightning current.

Grounding electrodes
Proper grounding of a lightning protection system is critical for the protection of a structure. Failure to provide sufficient grounding could result in the damage or loss of property.
The most common methods for grounding a lightning protection system include ground rods, ground plates, Ufer grounds or a ground ring (counterpoise). In poor grounding conditions such as rocky soil or shallow topsoil, additional grounding measures should be taken to ensure adequate grounding for the system.
Electrical specifications of Earth Lightning

Cloud-to-earth lightning has the greatest damage potential. This type of lightning is divided into positive and negative lightning, depending on the polarity of the cloud charge.
Positive cloud-to-earth lightning is the most critical, due to the duration of the lightning current pulse. With a maximum current of several 10 kA, it may last longer than 2 ms. The electrical charge is typically higher than 50 As.
Negative cloud-to-earth lightning starts with a lightning current pulse whose maximum amplitude amounts also to several 10 kA, but lasts merely 1/10 of the time of a positive one. Its peculiarity lies in the subsequent smaller multiple discharges, which may result in a total duration of the lightning of over one second and a total electrical discharge of over 100 As.

Positive or negative lightning current pulse of several 10 kA and less than 2 ms duration (TS).

Lightning current of positive or negative polarity, first stroke – wave form 10/350 μs
Lightning protection modules DEHN Signal

Max. continuous operating d.c. voltage
33 V

Nominal current for 45°C
0.75 A

D1 Total lightning impulse current (10/350 µs)
9 kA

Series impedance per line
1.8

Shock test
EN 60068-2-27 (Ea Test)

Examination of vibration performance (sinusoidal)
EN 60068-2-6 (Fc Test)

Test for vibration performance (coincidental)
EN 60068-2-64 (Fh Test)
Lightning protection modules DEHN Main

High discharge capacity due to powerful zinc-oxide-varistor/spark-gap combination
Base part with plug-in protection modules

max. continuous voltage: 255 V ac/dc
Nominal discharge current: 5 kA
Voltage protection level L/N: < 1.25 kV
Backup fuse: 25 A ; gL/gG or B 25 A
Energy coordinated according to IEC 62305-4 with SPDs Type 2 and combined arresters Type 1 of the Red/Line family
Operating state/fault indication
Lightning protection

Nominal Voltage $U_n$ will increase with surge current
Lightning protection module OTT

18 channel lightning protection module (90V Gas Tube Surge Arrester)
Lightning Rod

Lightning rod can also protect the system

![Diagram showing protection class and angle vs. size of lightning rod.]

- Protection class
- Protection angle
- Lightning rod
- Grounding
Lightning protection

Grounding

The Lightning protection needs a low earth resistance.

Protection class I:
Current amplitude: 200kA
Rate of current rise: 200kA/µs
Aperture width: 5m x 5m
Typical distance between grounding point: 10m
Grounding

There are different methods of grounding possible:

- Metal frame of building
- Concrete encased electrode
- Ground ring rod and pipe electrodes
- Plate electrodes

For a good working lightning protection the ground resistance should be lower than 10 Ohm !!!

Material for ground rods and connections:
- Galvanized steel (zinc coated steel)
- Copper clad steel
- Stainless steel
- Copper
Shield concept:

Additional to the lightning concept shielding will also defense overvoltage influence. Shielding is possible for each connection between the components, cabinet and ground.
Galvanic isolated systems:

Definition:
Systems that are only battery powered and without direct connection to ground or water.

Thalimedes:
no connection between electronic and ground (earth) or water

Orpheus Mini:
isolated electronic from metal housing
## Lightning protection

OTT Data Logger and Sensor implemented lightning/ over voltage protection

<table>
<thead>
<tr>
<th></th>
<th>Surge protection with Gas Tube Surge Arrester</th>
<th>Surge protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>LogoSens</td>
<td>no</td>
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<tr>
<td>DuoSens</td>
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<tr>
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<tr>
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<td>2kV</td>
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<tr>
<td>OTT PLUVIO2</td>
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<tr>
<td>OTT KALESTO</td>
<td>yes</td>
<td>4kV</td>
</tr>
<tr>
<td>OTT HDR</td>
<td>yes</td>
<td>4kV</td>
</tr>
</tbody>
</table>
Cabinet material

Plastic cabinet
- Low price
- Not possible accumulator > 26Ah

Metal cabinet
- No or low electromagnetic influence
- More condensation
Placement, System Components

Principle of unprotected and protected zone

Protected zone:
All power and signal protected (lightning modules).

Unprotected zone:
All incoming signal (power and signals)
A good documentation makes it easy to expand or to repair the system.

OTT has a special software to draw the documentation.
OTT documentation makes it easy to expand or to repair the system.
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OTT documentation makes it easy to expand or to repair the system..
Sensor connection

Sensor should be connected like the manual drawings.

- Power connection

- Wire cross section !!!

- Power/ Sensor should be connected to lightning modules

- Power/ Sensor should be connected in the unprotected zone.
Check:

- Power polarity
- Solar power
- Mains power
- Battery power
- Power up the data logger
- First program the configuration file
- Connect all sensor to the data logger inputs.