InHand Wireless Overhead-lines System

Overhead Line Sensor

Smart power distribution is an important sector of smart grid. One great challenge faces the operation team of distribution networks is how to quickly and accurately locate the faulty section when power line faults, especially low-current ground faults occur. Existing distribution automation, feeder automation, and fault indicating technologies have the problems of high investment, requiring power off for deployment, low accuracy, etc. InHand Wireless Overhead-lines System, the smart distribution lines monitoring system launched by InHand Networks, can accurately identify the type of power line faults and quickly locate the faulty section based on innovative technologies of high-precision measurement and high-speed wave-recording of line currents, thus significantly shorten response and processing time of power line faults, improve power supply reliability.

The Overhead Line Sensor is the acquisition unit and core sensing unit of the system, applicable to 10kV overhead distribution lines. With innovative low current energy harvesting and wireless communication technologies, the Overhead Line Sensor can submit monitoring data in real time to keep the power utility operational staff updated of the operation status of power lines. With big-data based comprehensive analysis of distribution lines status, the system can generate line status analysis, including line faults, line loads, energy quality, etc., and provide solid data support for the structural optimization of distribution network.
Features and Advantages

- Innovative low current (1A) energy harvesting, maintaining stable connection and operation
- Advanced electronic current transformer, precision of line current measurement reaching ±0.5%
- Electric-field sensor of optimized design, unaffected by multi-circuit lines on one pole, accurately identify voltage fall and power outage
- Intelligent trigger of high-rate (12.8kHz, 256 points per wave cycle) wave-recording of line current and line-to-ground electric field, capture the transient waveforms of low-current ground faults
- High precision (<20μs) wireless time synchronization based sync collection of 3 phase current and line-to-ground electric field waveforms
- Low-consumption two-way wireless communication, support remote upgrade and maintenance
- Live installation and removal, IP67 protection rating

- Accurately Identify Line Status, Support Line Current Wave-recording
  With innovative precision current measurement and line-to-ground electric field detection technologies, the measurement precision with line current between 0~630A reaches ±0.5%, can detect a ±0.5% change of amplitude of the line-to-ground electric field, thus can accurately identify the power line status. It further supports wave-recording of line current during faults or batch summon of operation data, for the accumulation of operational experiences and continuous improvement.

- Smart Detection of Line Faults, No More Mal-operation or Failure-to-operate
  Based on accurate identification of line status, the product can detect interphase short circuit, single phase grounding, etc. accurately. With powerful signal processing and micro-computing capabilities, it can auto decide the activation value of fault current alarming, effectively prevent mal-operation or failure-to-operate caused by load fluctuation, reclosing magnetizing inrush, etc.. It supports anti-time limit action, can maximumly cooperate with the substation protection action, avoiding transient disturbances and ensuring correct operation.

- Provide Abundant Operation Information
  Provides operational information to main station system, including line current, line-to-ground electric field, fault status, live or not, etc.; also provides auxiliary information like cellular signal strength, battery voltage, etc., to help operational staff to learn the overall operation status of the lines.

- Diversified Line Status Indications
  Super bright LED provides 360° visible status indication, indicates current line status with different combinations of flashing rates. Can auto reset when the fault is removed and power supply recovers; also supports timed reset, and wireless remote set and reset.

- Always Online, Keep Track of Line Status
  Hybrid of short and long range wireless networking, support various complicated line topologies; proactive regular (configurable, default is every 5 minutes) reporting of line status, supporting bi-directional communication confirming and resending function to ensure reliable data transmission. Keep track of real-time line status, putting an end to the “wake up once a day or never wake up” mode of traditional fault indicators, while effectively saving less wireless communication costs.

- Innovative Low-current Energy Harvesting Technology, Get Rid of Batteries
  Though embedded with a large capacity, long-service argon lithium battery, by applying new material and innovative power supply technology, the sensor can continuously harvest energy from the line when line current is between 0~630A. A line current of 1A can meet the minimum requirement for operation, saving the use of batteries and thus effectively extended the product service life.

- Maintenance Free, Wireless Remote Upgrade
  Work autonomously once hanged on line, completely maintenance free. May remote configure parameters, update fault criteria or upgrade the software wirelessly when needed, convenient and flexible, improving operation efficiency.

- Live Installation and Removal, Safe and Convenient
  Use insulated hot stick to live install or remove the device which is safe and convenient.

- High Protection Rating, Rugged for Challenging Environments
  The sensor is ruggedized to ensure long hours of stable operation even under harsh conditions, e.g. storms and typhoons of force 8, featuring high EMC level, extreme wide tolerance of input voltages and operating temperatures, IP67 protection rating, and treated structural parts that are corrosion and rust proof and salt spray spray corrosion proof.
## IWO-C Hardware Specifications

### IWO-C-CL (Basic Version)
- **Applicable Power System**
  - **Rated Frequency**: 50Hz & 60Hz
  - **Rated Voltage**: 10-35kV
- **Working Current**: 0~630A
- **Applicable Wire Diameter**: 9~26.8mm (36~240mm²)
- **Neutral Earthing Mode**: All earthing modes
- **Measurement Range and Precision**
  - **Line Current**: Measurement range: 0~630A, Measurement precision: 0~100A, ±0.5A; 100~630A, ±0.5%
  - **Line-to-ground Electric Field**: 0~4095, ±1%
- **Amount of Energy Harvesting**: 0~100%, ±0.5%
- **Battery Voltage**: 0~3.6V, ±2%
- **Fault Detection**
  - **Identifiable Fault Types**: Interphase short circuit, single-phase grounding; momentary faults and persistent faults
- **Line Status Indication**
  - **Types of Indication**: Super bright LED, Continuous Flashing Duration after Power Outage
  - **Visible Distance**: Daytime: 200m
- **Fault Reset Methods**
  - **Auto-reset when power supply recovers**, **Timed Reset Period**: Between 0 ~ 48h, default is 24h
- **Short-range Wireless Communication**
  - **Communication Distance**: ≤100m
  - **RX Sensitivity**: ≤90dBm
- **Directionality**: All directions

### IWO-C-CA (High-performance Version)
- **Power Supply**
  - **Energy Harvesting**: IWO-C-CL (Basic Version): line current > 3A, IWO-C-CA (High-performance Version): line current > 1A
- **Battery**: 3.6V, 8.5Ah
- **Mechanical Specs**
  - **Dimensions**: 120x129x173mm (W x H x D)
- **Weight**: IWO-C-CL (Basic Version): < 1.0kg, IWO-C-CA (High-performance Version): < 1.5kg
- **Protection Rating**: IP67, Vibration: level 1, Slanted falling: 1m
- **Tensile Strength of Line-clamp Structure**: Vertical: 50N no shifting, Horizontal (along the line): 50N no shifting
- **Endurance to Installation & Removal**: No damage for >50 times
- **Operating Environment**
  - **Working Temperatures**: -40 ~ +70 °C
  - **Storage Temperatures**: -40 ~ +70 °C
- **Ambient Relative Humidity**: 5% ~ 95% (non-condensing)
- **Safety and EMC**
  - **Tolerance to Impact of Short Circuit Current**: 25kA/2S
  - **Adjacent Interference Test**: 100mm
  - **Damped Oscillatory Electric Field Immunity**: Level 5
  - **Rapid Transient Pulse Train Immunity**: Level 4
  - **Fire Danger Rating**: Level 5
  - **ESD Immunity**: Level 4
  - **RF Field Radiation Immunity**: Level 4
  - **Surge Immunity**: Level 4
  - **Power Frequency Magnetic Field Immunity**: Level 5
- **Service Life**
  - **MTBF**: 27.3 years (whole system, incl. sensors and concentrator)

### Dimensions (mm)

![Dimensions Diagram]
## Ordering Guide

**Model code:** IWO-C-<C/U/M/S><5/6><A/L>

<table>
<thead>
<tr>
<th>Overhead Line Sensor Model</th>
<th>Model code</th>
<th>Short-range Frequency</th>
<th>Line Frequency</th>
<th>Version</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>IWO-C-&lt;C/U/M/S&gt;&lt;5/6&gt;&lt;A/L&gt;</td>
<td>C: 470-510MHz</td>
<td>China, Thailand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U: 915-928MHz</td>
<td>North America, New Zealand</td>
<td>5: 50Hz</td>
<td>A: AI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M: 866MHz</td>
<td>Middle East</td>
<td>6: 60Hz</td>
<td>L: LT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S: 919-923MHz</td>
<td>Malaysia</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example: IWO-C-U6A: overhead line sensor, short-range communication frequency is 470-510MHz, applicable to 60Hz 10KV power lines of North America and New Zealand.

When the Concentrator needs to support 3 groups of line sensors:

- Phase-A: IWO-C1/C4/C7-<C/U/M/S><5/6><A/L>
- Phase-B: IWO-C2/C5/C8-<C/U/M/S><5/6><A/L>
- Phase-C: IWO-C3/C6/C9-<C/U/M/S><5/6><A/L>