

## Metrysense5000

### Smart grid medium voltage sensor



- Reliable online detection of all types of faults
- Reduces the average interruption duration (SAIDI)
- Reducing number of faults by identifying weak spots (SAIFI)
- Powerful cyber security capabilities
- Unique proprietary algorithms to detect high impedance faults with high accuracy
- Power harvesting for line currents as low as 1.5A
- Radio communication for rural areas with no cellular coverage
- Operates with earthing systems including solid-grounded, floating neutral, SWER and Petersen coil
- Connection to existing DMS systems
- Provides online grid visibility of currents, power flow etc.
- Reduces wildfire risk, increases safety
- Fast and easy installation

#### DESCRIPTION

MS5000 is an online wireless system for medium voltage overhead lines which complements distribution management systems and provides online information about faults and grid operations. The MS5000 is designed to operate in power grids with solid grounding and any other type of earthing including Petersen coil compensation.

By identifying weak spots and carrying out pre-emptive maintenance, the grid's reliability can be further improved.

The installation can be easily done with grip all hot stick or insulated gloves.

The system is modular: Once sensors are deployed in a radio network, they automatically create a secured mesh network among themselves. When required, additional routers and sensors automatically and effortlessly connect to the network. The sensors report abnormal events such as surges, current/voltage drops and can be accessed at any time by the MetryView software.

The measurements of different sensors are synchronized with high precision by the radio and marked with timestamps.

The system sensors constantly measure current and electrical field and calculate the voltage and various power quality parameters. The data is transmitted

periodically (e.g. every 15 minutes) to the server.

#### APPLICATIONS

- FLISR (Fault location, isolation, and service restoration)
- Grid analytics
- Power quality and flow monitoring

The MS5000 is available in two versions:

- MS5000-SU: Sensor unit (can be connected to other MS5000 sensors units or/and MS3010 gateway)
- MS5000-GS: Sensor unit with integrated cellular gateway

Typically, a set includes 2 x MS5000-SU and 1 x MS5000-GS to cover three phases. The network size starts with three sensors and can include up to hundreds of sensors.

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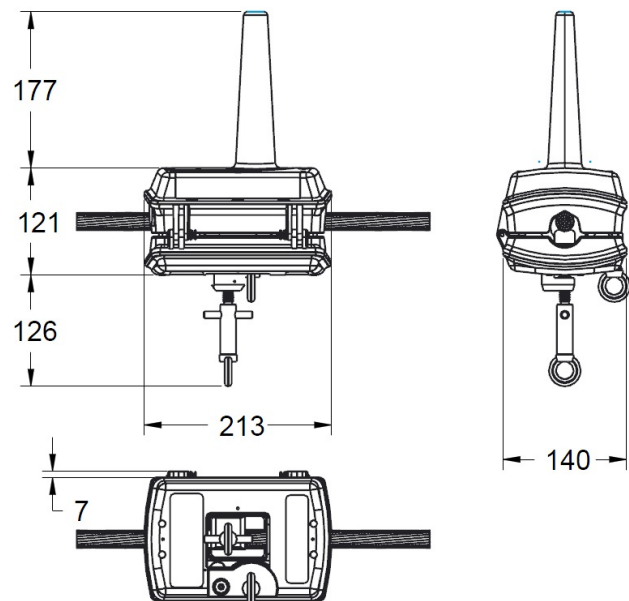
#### FEATURES

- **Extremely low power:**
  - Inductively powered from currents as low as 1.5A in low power mode
  - Backup batteries last for up to 3 years in low power mode
- **Maintenance-free operation for more than 10 years**
- **Robust design:**
  - Aluminum combined with glass filled polymeric material
  - IP67 rating
  - Operating temperature range of - 40 °C to 70 °C
- **Supports voltage from 4 kV up to 140kV**
- **Provides online grid visibility**
  - Currents and Voltages
  - Power flow (real and reactive)
  - Power quality
    - Power factor
    - Phase angle
    - Zero sequence data
    - Harmonics (measured up to 30th harmonic, presented: up to 5th)
    - Transient events
  - Arc waveforms
- **Supports IPv6 mesh Radio (6LoWPAN), and combined cellular & mesh**
- **Communication range between sensors: up to 10km, can be increased to tens of km with high gain antennas.**
- **Supports cellular 2G/3G/4G**
- **Scalable and flexible Radio Network**
- **Connects to the utility's communication infrastructure**

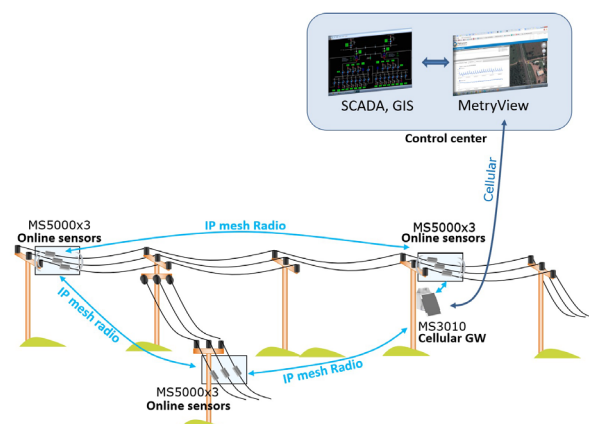
#### OPTIONAL OPERATION WITHOUT CELLULAR COVERAGE

A mesh radio network can be used to extend the communication range to tens of km, and thus reach remote sensors which are not covered by cellular networks and located far away from the nearest access point of the utilities' communication infrastructure. One gateway can access a single sensor, a small group of sensors (e.g. 3 - one for each phase), or up to hundreds of sensors over a range of tens of km when there is a requirement to reach sensor in remote rural areas. The gateway can connect with the server via cellular communication or alternatively by interfacing directly with the substation's communication infrastructure.

#### PHYSICAL DIMENSIONS IN MM



#### EXAMPLE OF MESH RADIO NETWORK



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### TECHNICAL DATA

#### INSTALLATION OPTIONS AND POWER LINE PARAMETERS

<b>Installation options</b>	Grip-all hot-stick Insulated gloves
<b>Conductor diameter</b>	6 - 32 mm
<b>Line voltage</b>	140kV (phase to phase)
<b>Grounding options</b>	Solid Grounding, Floating grounding, compensated grounding, SWER
<b>Conductor external material</b>	Aluminum (Default), Copper (C) or Insulated (I)
<b>Conductor temperature</b>	100 °C Max
<b>Short current</b>	20kA (2sec) Max

#### CONTROL INTERFACES

<b>Led indication</b>	Indicates communication and fault local status
<b>Push button</b>	Controls power and triggers led indication
<b>USB interface</b>	Control interface for configuration

#### POWER OPTIONS

<b>Power Feeding</b>	1.5A for sensor (SU) in low power mode 3A for sensor (SU) with full functionality 5A for cellular sensor (GS) with full functionality
<b>Typical Battery Life</b>	10-20 years
<b>Typical Backup time</b>	3 years in low power mode (for MS5000-SU)

#### FAULT DETECTION

<b>Events detected</b>	Surge current (transient or permanent fault) Phase to GND fault including high impedance
<b>Remote configuration</b>	Threshold levels for fault detection Multiple optional parameters

<b>Inrush current blocking time after reenergizing</b>	3 sec (configurable)
<b>Adjacent conductors</b>	Indifferent to surge according to IEEE 495 4.4.8

#### PHYSICAL AND ENVIRONMENTAL

<b>Chassis body dimensions</b>	12.1 x 14.0 x 21.3 cm (4.76 x 44.9 x 8.39 inch)
<b>Antenna length</b>	17.7 cm (6.97 inch) - See figure above
<b>Mounting-screw length</b>	12.6 cm (4.96 inch) - See figure above
<b>Weight</b>	3.55 kg

<b>Casing</b>	Upper and lower covers: Aluminum, Body: Glass filled polymeric material Mounting Screw: Stainless Steel IP67
<b>Temperature range</b>	-40°C to +70°C

#### MEASUREMENTS

<b>Load Current</b>	Up to 600A nominal
<b>Precision</b>	0.5% Typical at 100A 600A 0.5A Typical at 20A 100A 0.25A Typical at 0A 20A 0.1A resolution at 0A 100A

#### Periodic Measurements

Current and Voltage  
Power factor  
Phase angle  
Harmonics measured up to 30'th  
(Presented: up to 5'th)

**Measurement interval** Each 15 minutes typical (programmable)

**Waveform Sampling** 4.096ksps default, 8.192ksps Max, Current and Voltage

#### Waveform trigger events

Phase to phase faults  
Phase to ground faults  
Current changes  
Voltage changes

#### Alarms

Power Down  
Heavy load current  
Overload current  
LED Blinking  
Low power mode  
Wait for reset mode  
Low backup battery  
Low Secondary Battery  
Charging from backup

**Phase synchronization** 30µs Typical

**Sampling Buffer** 8 seconds

#### CELLULAR COMMUNICATION

##### 4G option "E" (EMEA/Korea/Thailand)

LTE-TDD B38/B40/B41  
LTE-FDD B1/B3/B5/B7/B8/B20  
UMTS/HSPA+ B1/B5/B8 (2100, 850, 900)  
GSM/GPRS/EDGE B3/B8 (1800, 900)

##### 4G option "G" (Global)

LTE-TDD B34/B38/B39/B40/B41  
LTE-FDD B1/B2/B3/B4/B5/B7/B8/B12/B13/  
B18/B19/B20/B25/B26/B28/B66  
UMTS/HSPA + B1/B2/B4/B5/B6/B8/B19  
GSM/GPRS/EDGE 850/900/1800/1900 MHz

#### Cyber Hardening

End-to-end TLS/SSL, certificates enrollment, encrypted local radio communication between sensors, private APN and RADIUS, encrypted firmware upload, three levels of local access permissions

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### IPV6 MESH RADIO COMMUNICATIONS

<b>Protocols</b>	6LoWPAN, RPL Routing
<b>Modulation Type</b>	GFSK, Frequency hopping

### 433 MHz RADIO OPTION

<b>Frequency</b>	433 MHz
<b>Range<sup>(1)</sup></b>	2 km
<b>Carrier Power</b>	10 dBm (10mW) Max

### 915 MHz RADIO OPTION

<b>Frequency</b>	921 - 928 MHz
<b>Range<sup>(1)</sup></b>	10km (tens of km with high gain antenna)
<b>Carrier Power</b>	30dBm (1W) Max

### Notes:

- (1) Range is estimated for high installation and direct line of sight. The radio range specification is for communication between MS5000 SU sensors.
- Range of MS5000 SU to a MS3010 gateway/router can be increased to tens of km using MS3010 with high gain antennas. Cellular sensor MS5000 GS includes a smaller internal antenna and supports a radio range of at least 50m to nearby MS5000 SU sensors.

## ORDERING INFO

### Product part number format: MS5000

MS5000 - XX-XXX-X-X

#### Unit Type

<b>SU</b>	Sensor unit
<b>GS</b>	Sensor integrated with a cellular gateway

#### Radio Frequency option

<b>433</b>	433 MHz (EMEA, Asia, China)
<b>915</b>	915 MHz (Americas, Australia)

#### Cellular modem (only for GS)

<b>E</b>	2G/3G/4G (Europe, Middle East, Africa, Korea, Thailand)
<b>G</b>	2G/3G/4G (Global) See details in the specifications

#### Wire material option

(The default is Aluminum)  
**C** - Copper wire  
**I** - Insulated wire

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### Metrysense5000\_DS\_en\_V1

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