



## **SM100**

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**On-Line Switchgear  
Condition Monitoring**

# On-Line Switchgear Condition Monitoring

## Introduction

Weis is a specialist company with over 20 years of experience in the commissioning, testing & maintenance of switchgear and power network fault monitoring within the Power Utility Industry.

Based on its pioneering of analogue timing techniques developed over more recent years, Weis has applied its expertise to develop a low cost permanently installed switchgear condition monitoring system.

The On-Line Switchgear Condition Monitoring System (SM-100) is an essential substation preventative maintenance tool and aid for power utilities with ever increasing demands for more reliable low cost energy.

Possible on-line test results which can be computed per phase for each breaker operation include:

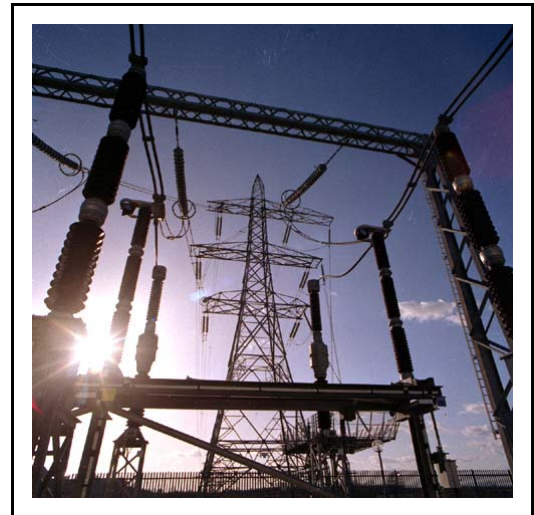
### Feature Extraction

- Peak Coil Current
- Coil Current Pulse Length
- Mechanism Time
- Arc Duration Time
- Pre Latch Period
- Latch Transition
- Trip Latch Release

Coil Current Fingerprint Comparison / Grey Zone Checking  
Accumulated Contact Wear (I<sup>DT</sup>)  
Accumulated Contact Operation Count  
Estimated Main Contact Operated Time  
Mechanism Motion  
Battery Voltage

The SM100 can optionally perform trend recording for:

Gas / Pressure Leakage  
Heater Failure  
Low Pressure  
RMS Current per Phase  
RMS Voltage per Phase  
Battery Voltage



In addition the SM100 can optionally perform a Off-Line timing test on the main contacts.

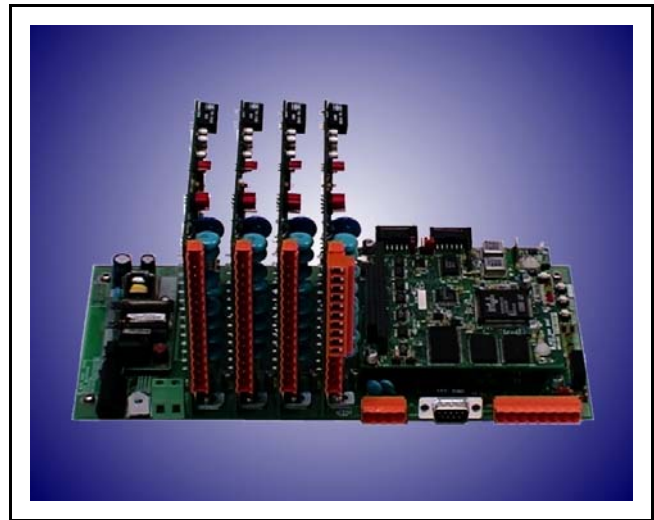
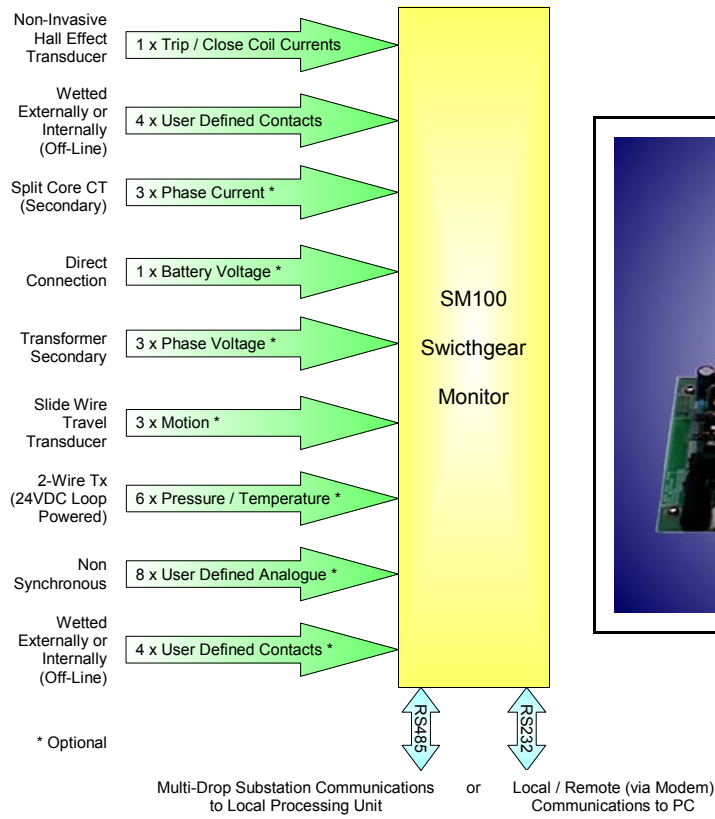
This system is the first step towards 'on-time maintenance' that should be supported with Off-Line dynamic micro-ohm testing / timing, to gain more in-depth knowledge and experience.

## Features

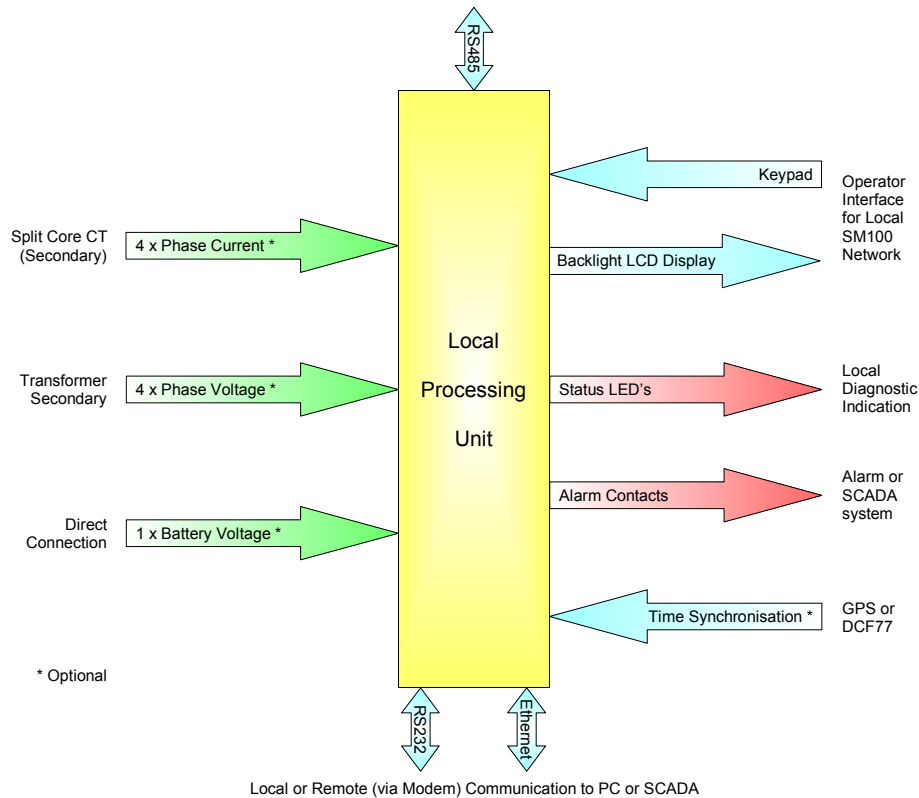
- ◆ Mount within Breaker Drive Unit, external enclosure or indoor
- ◆ Non-Invasive Installation
- ◆ Simple-to-Service Design
- ◆ Capture signature of each breaker operation with option for time tagging to within 1 Sec.
- ◆ Local or Remote Indication of Switchgear Condition
- ◆ Off-Line Timing of Main Contacts – Optional
- ◆ Trend Recording – Optional
- ◆ Power Quality Measurements – Optional
- ◆ Central Database Management Software for Analysis and Performance Monitoring of Switchgear Network



## Connections

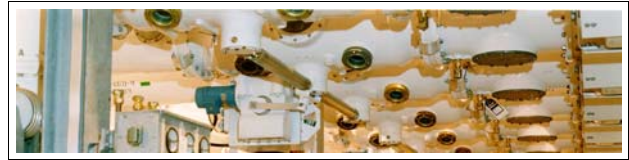


Multi-Drop Substation Communications from SM100 Units (100 max.)



# On-Line Switchgear Condition Monitoring

## Data Management



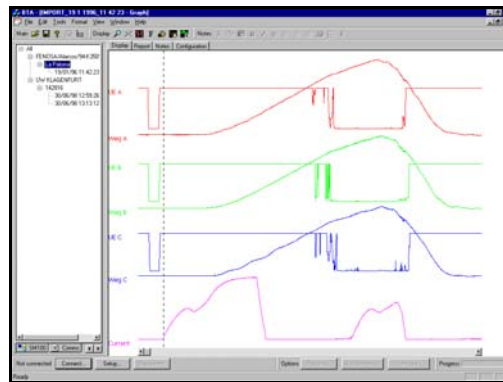
Switchgear Management System software is an essential Windows database program for the gathering of information on the network for switchgear performance monitoring and maintenance scheduling.

### **Possible Features:-**

- ◆ Automatic analysis / classification of breaker operation records
- ◆ Checks protection operation timing
- ◆ Simple network overview
- ◆ Exports measurement to 'Voltage Dips' and 'Breaker Performance' databases
- ◆ Graphical display of captured waveforms
- ◆ Graphical display of trend recording data

The Switchgear Management System runs on a standard IBM compatible PC and would normally be set to auto-poll and / or autocal modes for data gathering.

A graphing function which allows the user to view breaker operation signatures and trend recording data.



This system is the first step towards 'on-time maintenance' that should be supported with Off-Line dynamic micro-ohm testing / timing, to gain more in-depth knowledge and experience. With this in mind, raw sample data is stored for future reference to allow recalculation based on alternative parameters.

The system also includes a configuration program that allow local or remote modification of SM100 units direct or via a Local Processing Unit.

Dependant upon measured signals at the SM100 units, the following resultant information can be gathered :-

**Switchgear Performance**

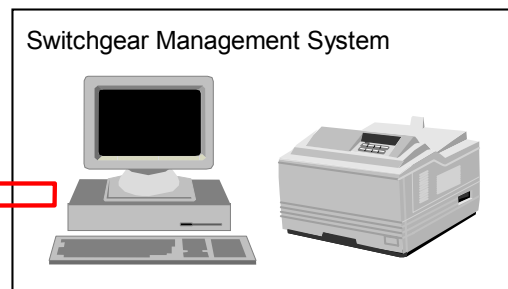
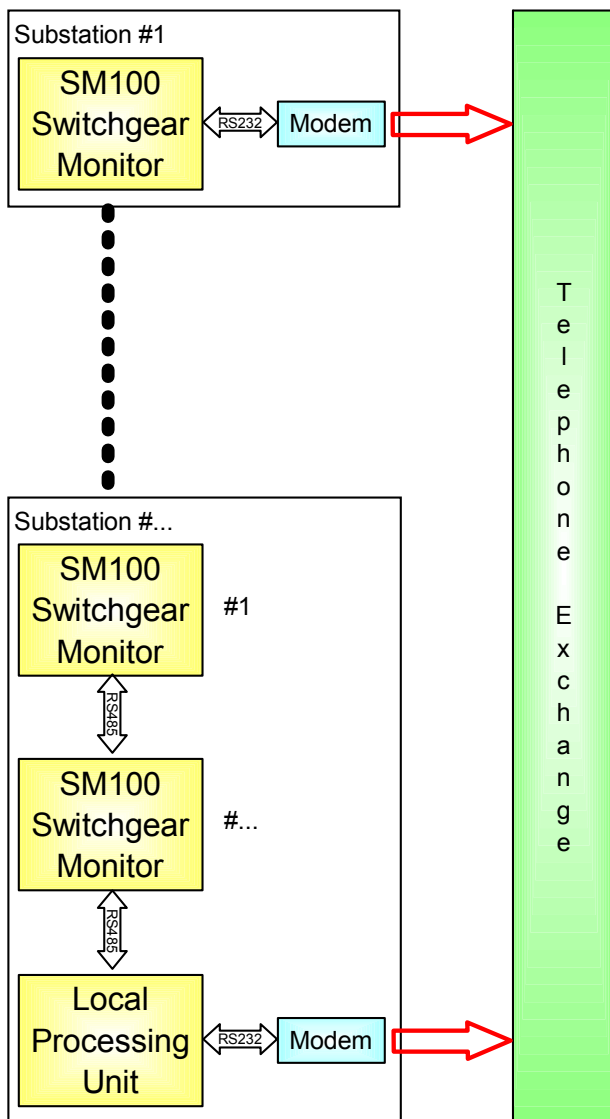
**Contact Condition**

**Voltage Dips**

**Power Quality / Trend**

Digital Signal Processing techniques are used to compare coil current pulses and travel curves (optional) with reference waveforms.

## Typical System



# On-Line Switchgear Condition Monitoring

## Specifications – SM100

### INPUTS

<b>Analogue:</b>	1 x Trip and close coil current inputs. 1 x Battery voltage 300V DC maximum – Optional 3 x Phase current (via secondary level split core CT) - Optional 3 x Phase voltage (VT secondary level) - Optional 3 x Resistive (linear or rotary) travel transducer inputs – Optional 6 x Pressure / Temperature (via 2-wire 24V DC loop powered transmitter) – Optional 8 x User configurable non-synchronous inputs – Optional
<b>Analogue Accuracy:</b>	<0.25% F.S.
<b>Digital:</b>	4 x User configurable 24 to 250V DC externally wetted or 24V DC internally wetted (off-line) inputs for contact timing. 4 x User configurable 24 to 250V DC externally wetted or 24V DC internally wetted (off-line) inputs for contact timing – Optional
<b>Digital Resolution:</b>	100µSec.

### OUTPUTS

<b>Alarm Output:</b>	2 x relay contacts for SM100 watchdog and circuit breaker condition (definable).
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### COMMUNICATIONS

<b>Communication:</b>	RS232 for local / remote (via modem) communication to PC or RS485 (multi-drop) substation communications to Local Processing Unit.
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### RECORDING

<b>Resolution:</b>	12 bit A/D (1:4096)
<b>Sampling Rate:</b>	10, 5, 2, 1 kHz (user selectable).
<b>Real Time Clock:</b>	Free running crystal clock with option to time synchronise via autopoll from PC to within 1 second or via LPU to within 1mS between substations for time stamping of records.
<b>Storage:</b>	2 records minimum (actual depends on selected sample rate).
<b>Start trigger:</b>	Digital input, coil current, over phase current or under phase voltage.

### OPERATING VOLTAGES

<b>Prime Power:</b>	24 / 48 / 110 / 220V DC.
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### ENVIRONMENTAL

<b>Operating Temperature:</b>	-30°C to 60°C (-22°F to 140°F)
<b>Humidity:</b>	0 to 97% RH non-condensing.
<b>Isolation:</b>	2.5kV rms for 1 minute (channel to channel, channel to earth)
<b>Surge Withstand Transient:</b>	To IEC 801-5. 1.2/50µS. Common Mode: Severity level class 4. Series Mode: Severity level class 3.
<b>Fast Transient Burst:</b>	To IEC 801-4 level 3.
<b>RFI Immunity:</b>	To IEC801-3 level 3. 10V/m 26-1000MHz.
<b>Emissions:</b>	To EN50081-1: 1992.

### MECHANICAL DETAILS

<b>Mounting:</b>	Within breaker drive unit, external or indoor enclosure.
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## Specifications – LPU

### INPUTS

**Analogue:** 1 x Battery voltage 300V DC maximum – Optional  
4 x phase current (via secondary level split core CT) - Optional  
4 x phase voltage (VT secondary level) - Optional

### OUTPUTS

**Alarm Output:** 4 x relay contacts (SM100 failure, LPU failure, set contact wear limit reached and data logging parameter outside limites).

### COMMUNICATIONS

**Communication:** RS232 for local / remote (via modem) communication to PC and RS485 (multi-drop) substation communications to SM100 Units (100 max.).

### USER INTERFACE

**Input:** Keypad.  
**Output:** Backlight alpha-numeric LCD display.  
Diagnostic LED's.  
**Configuration:** Configuration of all connected SM100 units and Processing Unit.  
**Indication:** Status of any monitored breaker on LCD display.

### RECORDING

**Resolution:** 12 bit A/D (1:4096)  
**Sampling Rate:** 10 kHz.  
**Trend Recording:** 1 minute min, max & avg on all analogue channel.  
**Storage:** Hard disk drive for mass data from connected SM100 units.  
**Real Time Clock:** Free running crystal clock with option to time synchronise via autopoll from PC to allow time stamping of records / trend data to within 1 second between substations.  
**GPS or RCC:** Optional. GPS accuracy <1mS, DCF77 <10mS.

### OPERATING VOLTAGES

**Prime Power:** 88 to 370V DC, 85 to 264V AC.

### ENVIRONMENTAL

**Operating Temperature:** -10°C to 55°C (14°F to 131°F)  
**Humidity:** 0 to 97% RH non-condensing.  
**Isolation:** 2.5kV rms for 1 minute (channel to channel or channel to earth)  
**Surge Withstand Transient:** To IEC 801-5. 1.2/50µS.  
Common Mode: Severity level class 4.  
Series Mode: Severity level class 3.  
**Fast Transient Burst:** To IEC 801-4 level 3.  
**RFI Immunity:** To IEC801-3 level 3. 10V/m 26-1000MHz.  
**Emissions:** To EN50081-1: 1992.

### MECHANICAL DETAILS

**Mounting:** Surface or 19" wide rack.



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