SURETECH

Outdoor Live Line Sensor

USER INSTALLATION MANUAL

http://www.suretech.co.za

SURE Engineering cc
PO Box 63, Steenberg, Cape Town South Africa 7947

Updated: 24 April 2007

Contents

1. GENERAL DESCRIPTION

1.1. Typical Applications

- ✓ Safety interlocks in HV substations
- ✓ HV substation voltage alarms (upper & lower)
- ✓ Mobile substations
- ✓ Railway maintenance monitoring
- ✓ Vehicles and crane safety systems
- ✓ HV line re-closer voltage control
- ✓ HV substation voltage meter indication
- ✓ HV substation voltage measurements
- ✓ HV pylon monitoring of voltage on each of six phases
- ✓ Measure the voltage on the rotor of an HV motor or generator as it turns
- ✓ Monitor and measure induced voltages on power circuits.

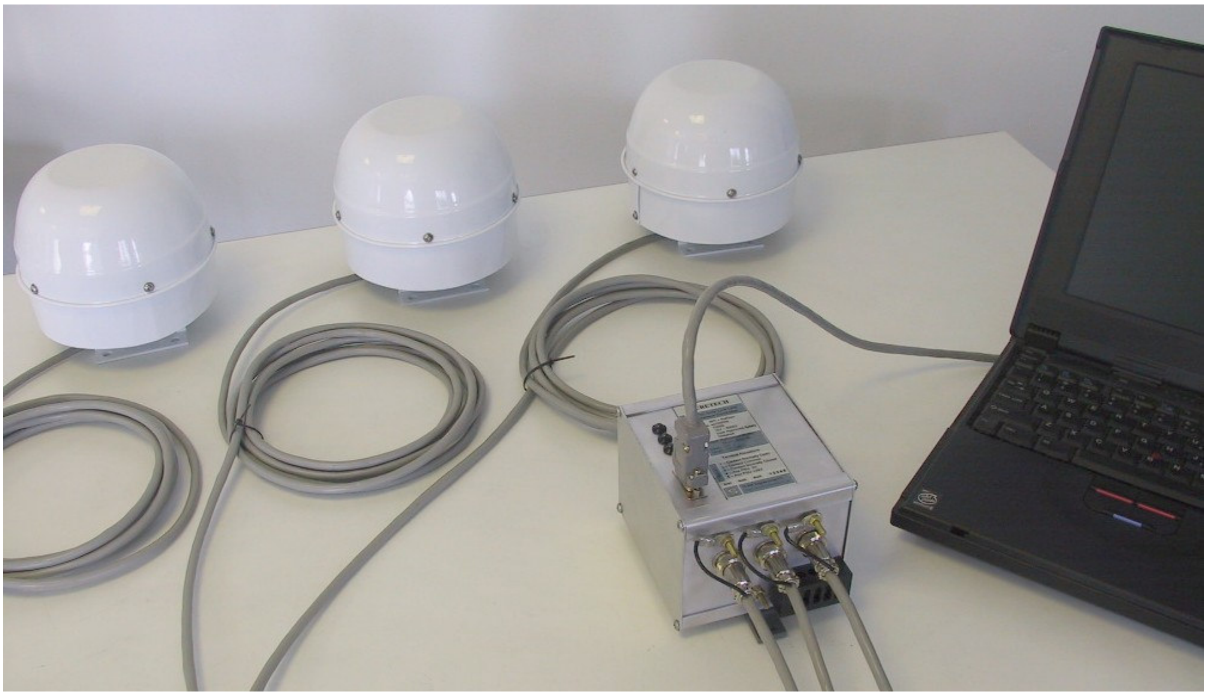
1.2. General Features

- ✓ Capacitively coupled to HV source through air or insulation
- ✓ Ultra linear measurement circuits
- ✓ For use on 50Hz and 60Hz systems
- ✓ Filters control external emissions
- ✓ Static discharge filter
- ✓ Hemispherical enclosure has resin potted sensing components for long life, and stability
- ✓ Dimensions: SENSOR: 165mm diameter x 160mm height SLP: 115mm x 140mm x 100mm
- ✓ Integral cable connections between sensors and control enclosure
- ✓ Transient suppression on input and outputs
- ✓ Wide selection of input and output options including relay, opto-isolated, analogue and RS232
- ✓ Wide selection of auxiliary power supply options
- ✓ Galvanic isolation from HV source
- ✓ Engineering backup to provide you support for design, applications information, installation & calibration, maintenance
- ✓ Patent pending

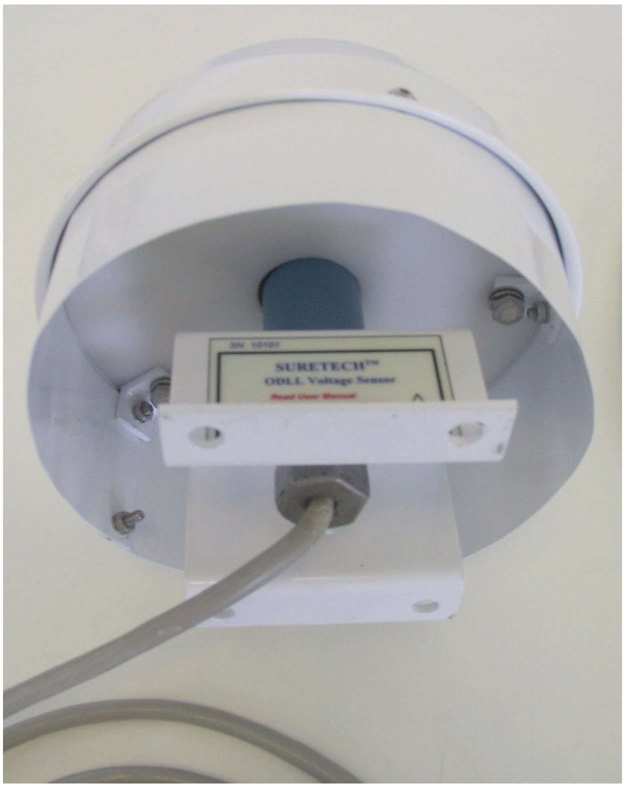
2. EQUIPMENT IDENTIFICATION

2.1. ODLLS Sensor System

Shown below are three sensors, a 3phase controller, 5m interconnect cables, and a Laptop PC to configure and act as a controller / logger. This issue of this ODLLS User Manual does not show the LCD panel in the photo, but the layout diagram does show the LCD front panel.



2.2. ODLLS Sensor

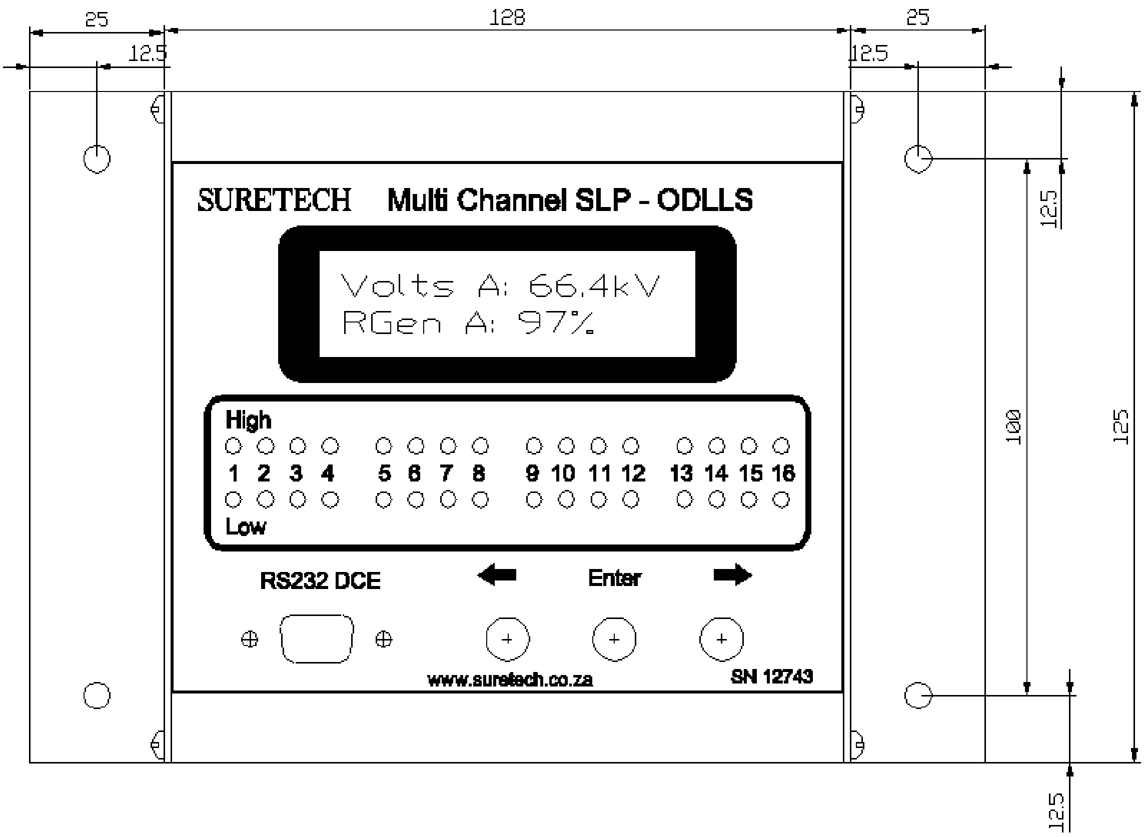


LEFT: the picture shows the mounting foot of the sensor with the cables exiting the foot to the side. This facilitates mounting the sensor without the need to drill holes in the deck for cabling. It can also be seen that the foot is electrically insulated from the bowl by means of a white plastic disk and blue pipe. Inside the head there is a sensor and Reference Generator, which are resin potted but physically separated from each other. The skirt is attached to the head and provides environmental and rain protection. The cable end of the sensor is made off to a 7-way female circular connector.

Later versions of the ODLLS sensor do not have a skirt under below the bowl, which facilitates cleaning.

Through the centre of the insulated (PVC) post for electrical insulation is a steel pipe that physically supports the sensor to give it it's strength. The mounting foot can be seen at the bottom of the picture, with the cable from the sensor being fed through the center PVC post. The Reference Generator, inside the sensor, does not physically touch the bowl, but is close enough to the bowl to inject an electric field into the bowl, and then into the sensor, which is mounted inside the bowl.

2.3. ODLLS Controller:



The aluminium sensor control enclosure has 3 LEDs indicating Power, Test and Alarm. The D-type 9 pin female connector is the RS232 interface to a computer. The label on the front indicates system description as well as designators for various indicators and connection points on the enclosure. If ordered, on the back of the enclosure is a DIN-rail clip for mounting in fixed applications. Bottom right of the enclosure is a 5-way terminal connector for connection of auxiliary power and provides the user with relay outputs (NC, NO, and Common). The 3 circular male connectors are 7-way connectors, and are splash proof. Also on the bottom of the enclosure are brass studs, which provide further earthing points for the sensors. Three phase and single phase controllers are shown below.

2.3.1. Sensor Control Enclosure terminal connections

3 Way terminal connector block LEFT

Terminal No:	Description
1	Contact Normally Closed
2	Contact Common
3	Contact Normally Open

3 Way terminal connector block RIGHT

Terminal No:	Description
1	Earth
2	24Volt Aux 0V
3	24Volt Aux +24V

7 Way circular connector (Sensor A, B & C)

Pin No:	Description
1	+12V (or +15V Apr2007 on)
2	-9V (or -15V Apr2007 on)
3	0V
4	AC signal
5	BRAID (Must be earthed)
6	(Temperature if fitted)
7	+30V switched to RefGen (or +15V Apr2007 on)

3. GENERAL OPERATION

3.1. General mounting

NOTE:

- **THE OUTER BOWL MUST NOT BE CONNECTED TO EARTH**
- **THE FOOT OF THE SENSOR MUST BE CONNECTED TO EARTH**

- The mounting foot is designed to facilitate mounting onto a deck, by feeding the cable through a hole in the deck OR by feeding the cable through the side of the foot.
- Depending on the physical arrangement (distance of sensor from earth, and distance of the sensor from HV source, and special arrangement of the electric field shields) this will determine the electric field strength at the sensor and hence its sensitivity
- Sensor cables should be physically strapped (cable ties) to earth and not allowed to float around
- The most important point about the Live Line Sensor is that any movement or change in the close surroundings will change the field strength reading. The user should take care with the stabilisation of the environment around the sensor to get the best results
- To improve and stabilise the coupling to the HV source in fixed applications, side panel screens could be deployed as shown in the diagram below.
- The Outdoor Live Line Sensor should be mounted vertically, so that rain and dust screening is optimised.
- Earthed metal parts adjacent to the sensor will affect the electric field at the sensor, so they should not be higher than the foot of the sensor; unless they are specifically designed to shape the electric field (contact the factory)

3.2. Accuracy

Voltage accuracy can be calibrated to better than one percent. For the most stringent applications, environmental conditions such as dust, humidity, temperature and air-movement needs to be controlled.

- Phase accuracy can be better than one degree when closely coupled to the HV source
- Wind: if the physical configuration changes due to wind moving HV lines, electric field shields, or mounting arrangement, then the electric field will change, thereby degrading accuracy.
- Rain: The Outdoor Live Line Sensor has a powder coated stainless steel bowl to protect the instrument against rain and sun. The bowl acts as an equi-potential voltage, which is essentially not affected by the rain, as long as the water droplets do not form a continuous connection from the skirt of the bowl to earth below.
- If dirt and moisture gets onto the sensor's insulator under the skirt in a condensed form then the electric field can become affected and hence the accuracy of the instrument will be degraded. By careful analysis of readings from the Reference Generator, this degradation can be monitored by a connected computer.

3.3. Earthing

3.3.1. Sensor earthing

- Each sensor should be mounted to the deck, both mechanically and electrically
- The earth connection to the sensor's foot must be bonded to the earth-point of the sub-station / vehicles earth (which must be the same earth as the ODLLS controller)
- Failure to ensure this effective bonding could lead to high differences in potential between the sensor earth under fault conditions (or even network switching conditions) and the control box earth, leading to an UNSAFE AND DANGEROUS installation, and could damage the ODLLS system

3.3.2. *Control Enclosure earthing*

- The earth connection to the sensor's foot must be bonded to the earth-point of the sub-station / vehicles earth (which must be the same earth as the ODLLS controller)
- A brass stud is provided on the readout enclosure whereby the user can and should earth the sensor system
- All cables are shielded and these shields are connected together internally to the instrument, and to the brass stud.

3.4. *Voltage Range and mounting distance*

- Sensor is capable of measuring voltages from hundreds of volts to 400kVac or higher (user to specify) Distance of operation increases as the voltage increases. In order to obtain the best results, the dielectric path needs to be stabilised
- The SURETECH Live Line Sensor can be (factory) calibrated to operate over a wide range of distances. The trade-offs are given here:
- At 250mm on 66kV, the sensor will be closely coupled to the HV source, and the phase accuracy and voltage accuracy will be very good because external fields from the other phases will have much less contribution
- The down side to this close distance is: due to the close coupling, during an impulse surge, there could be a flashover. If a direct flashover to the sensor occurred, the sensor would most likely be damaged. The sensor needs to be protected against a direct flashover by means of a spark gap being provided near to the SURETECH sensor.
- The sensor has been protected to withstand "seeing" a voltage spike of few hundred thousand volts at this spacing, as long as no breakdown occurs through the sensor.
- The user should choose a sensor operating distance that is larger than a nearby spark gap surge arrester.
- The Live Line Sensor can also be (factory) calibrated to be extremely sensitive and operate a very long distances. This leads to an extremely safe operating environment, but the down side is with low coupling, phase accuracy is diminished, and also the system becomes susceptible to stray electric fields from other / nearby sources, even low voltage sources.

3.5. *Cable type*

Screened six-core, grey, multi-strand. Ie. braided screen plus six other cores connects each sensor to the control enclosure. If used outdoors, it is advisable for the cables to be run through conduit channel for protection

3.6. *Cable length*

Maximum 10m. For longer distances we would need to fit line drivers between sensor and transducer – consult the factory.

3.7. *Cautions*

NOTE:

- **THE OUTER BOWL MUST NOT BE CONNECTED TO EARTH**
- **THE FOOT OF THE SENSOR MUST BE CONNECTED TO EARTH**

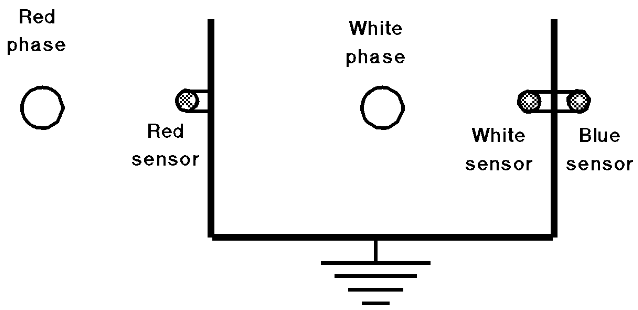
a. Accuracy can be degraded in wind, if structure is not physically stable
b. Accuracy and even operational availability can be impaired if muck and animals are allowed to nest on, or interfere with the sensor environment

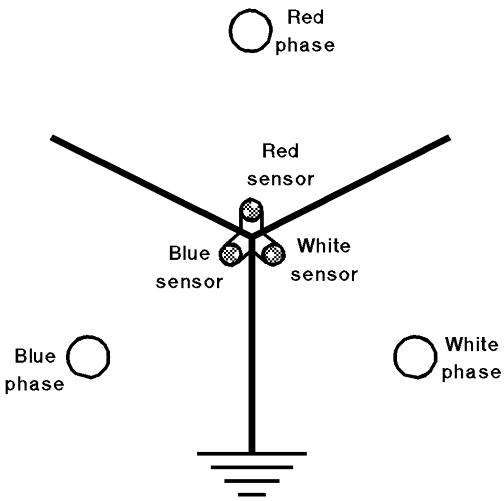
4. OPERATION IN FIXED AND MOBILE APPLICATIONS

4.1. Construction of Electric Field Screens

- To improve the stability and cross coupling across phases, earth screens can be deployed
- Screens can be constructed of any metal or conductor. Ordinary kitchen aluminium foil that is captured between two insulated panels would be good. Very thin brass sheeting could be used, also sandwiched between the two insulated panels that provide the mechanical rigidity and electrical insulation. This technique is good because if properly constructed, the shield will have the desired effect of shaping and stabilising the electric field around the sensor. The insulated plates on the outside will prevent HV impulses from discharging through the thin foil.
- Screens must be properly and securely earth terminated to define and guarrantee the shield is at zero volts at all times. A screw and washer should be used on the aluminium foil. Solder or screw connection could be made to the brass plate.

LAYOUT OF SURETECH CABLE LIVE SENSORS TO OPTIMISE ACCURACY

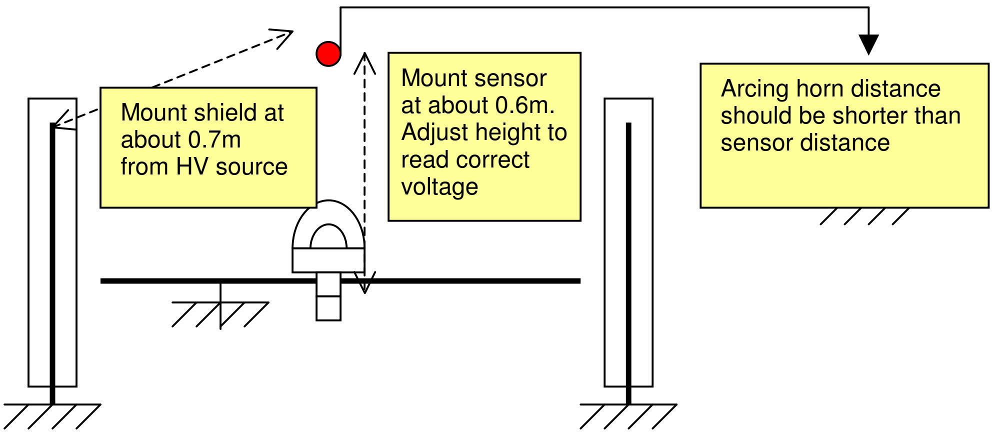




NOTE: THE SURETECH Outdoor Live Line Sensor's mounting height above earth as well as its proximity to the HV source determines the electric coupling.

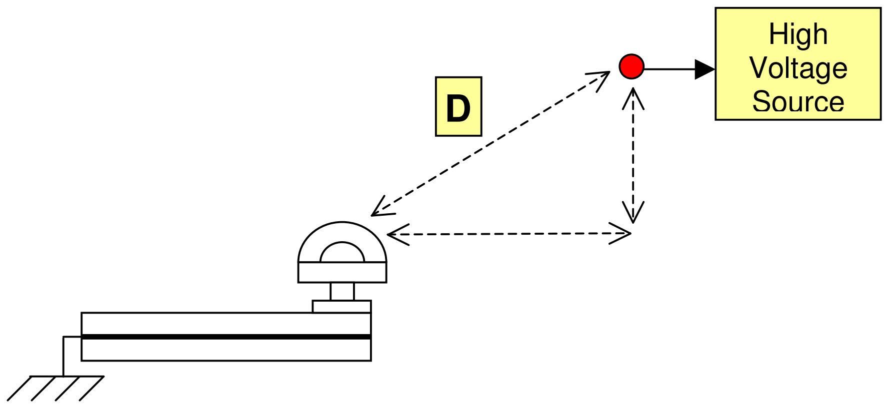
4.2. *Calibration in fixed applications*

- Sensors should be initially mounted at an appropriate distance (for 66kV, about 0.6m) from the HV source. Electric field screens should be placed between the sensors so that the electric field from adjacent phases do not interfere with each other.

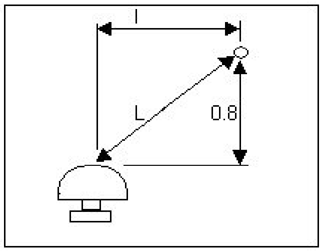


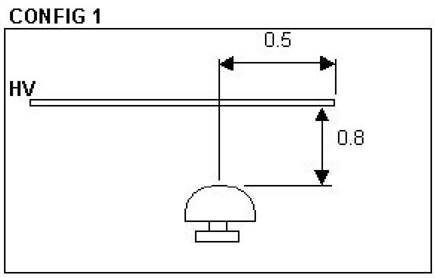
4.3. Calibration in mobile applications

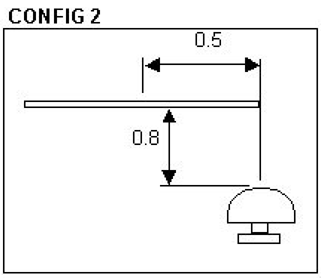
- Calibration of the unit is performed in factory in accordance with the user's specifications of distance **D.** At which the Alarm is triggered
- Trip thresholds can also be altered and set by means of the connected computer
- It is strongly recommended that a PC computer is used to set up and calibrate voltage alarm thresholds, as the user can then see what voltages are "seen" by the sensors

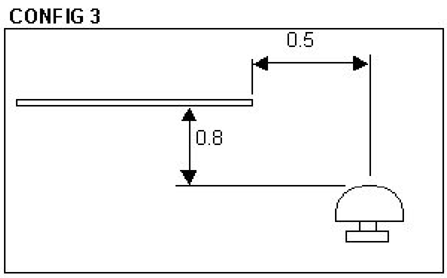


ODLLS Output voltage			
Distance l [m]	Conf1	Conf2	Conf3
0.800	30000	17178	6647
0.943	16307	11452	5129
1.281	6722	4880	2664
1.700	2440	2091	1344
2.154	959	909	722
2.625	473	473	473

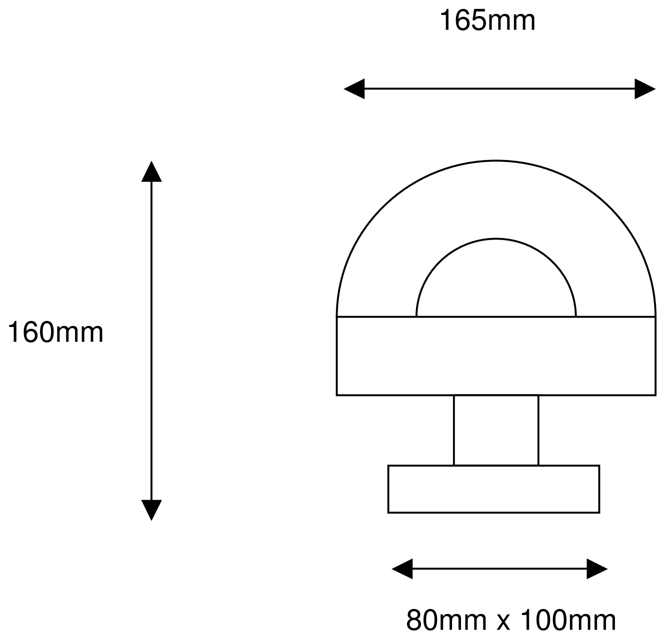


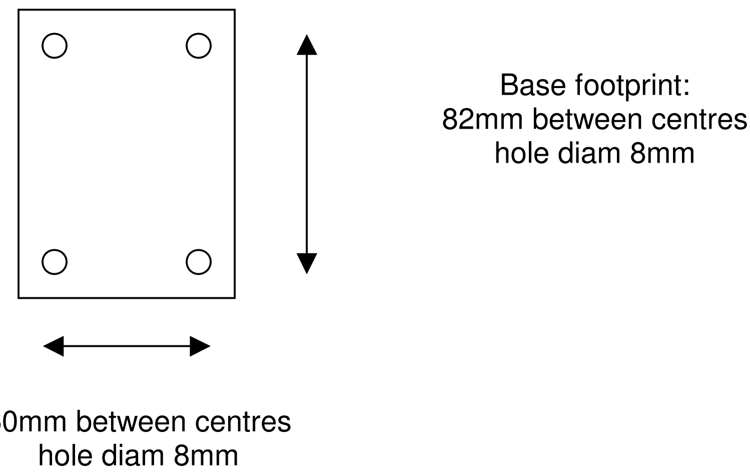






4.4. ODLLS Sensor head dimensions





5. RS232 INTERFACE TO COMPUTER

5.1. Instrument RS232 Output

- The system is equipped with RS232 output for a telemetry interface
- A D-type 9 pin connector is provided on the front of the control enclosure for downloading continuous output from the system
- Only Rx and Tx RS232 signals are implemented on pins 2 and 3, and pin 5 is common
- Baud rate is fixed at 9600Bd, 1 space, 8 bit data, no parity
- ASCII text is output so that a computer configured as a terminal emulator will see this output.
- A Real Time Clock / calendar is provided which takes its time base either from the 50Hz measured (in fixed applications), or from the microprocessor crystal

5.2. Set up Hyperterm on your Windows PC / Notebook computer

- Hyperterm is a standard accessory that comes with MS Windows
- Run this application on your PC and set up the serial interface as specified above
- Once the RS232 cable is connected, the ODLLS output stream should be seen on the display

5.3. User interaction via keyboard

- The way that the user interacts with the ODLLS system via the keyboard is as follows:
- Data is output from ODLLS controller every second.
- A variable is pointed to by selecting it with a single key described in the help menu
- Help menu is invoked with the "?" key, as many times as the user needs it
- NB: the user must see which variable parameter the instrument is pointing to, by keeping an eye on the "Set=x" character
- Then by using the "+" or "-" character, that parameter is increased or decreased

5.4. Examples of RS232 output with "se10003e" firmware

The following dialog boxes shows the RS232 output format that is installed with firmware version "se10003e". Firmware loaded in your system can be observed on the computer display at start-up time when the ODLLS system is powered up. See typical instrument output below:
"se10003e" firmware is orientated to fixed applications where a power line voltage is required to be monitored.

5.4.1. Example output: System help menu

(NO sensors connected)

```
? = show this HELP menu
z = Zero seconds
y = Years
d = Days
h = Hours
m = Minutes
s = Select sensor (0,1,2)
f = set scale Factor of sensor (0,1,2)
g = set scale factor of refGen (0,1,2)
V = reset scale factor Values
t = sensor trip Threshold
r = RefGen trip threshold
+ OR -  increase OR decrease to alter

SF= 06554 06554 06554 06554 06554 06554 00100 00500 00000 00000

2005 001 00:00:22
 Var=0 Set=? VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=01 LEDrg=1 Alarm=1
 Sync=0 CF=0 CC=000
 SnsN= 00004 00004 00004   RG:N= 00004 00004 00004
 SnsS= 00000 00000 00000   RG:S= 00000 00000 00000
```

ODLLS instrument interaction with user:
NOTE WELL: Keyboard CASE (upper or lower case) IS VERY IMPORTANT
Most key instructions are lower case, while "V" is upper case

Instrument output	Description	Select key
Var	Select variable pointer to sensor 0 or 1 or 2	s
Set	Last key input to keyboard selects which variable is to be updated	Last key
VtrThr	Voltage Trip Threshold (trip threshold values are compared to Scaled values, and NOT the Normalised values as seen by the ODLLS controller)	t
VtrCnt	Voltage Trip Counter (voltage has to be below trip threshold for 4 seconds)	None
RGtrThr	Reference Generator Trip Threshold (trip threshold values are compared to Scaled values, and NOT the Normalised values as seen by the ODLLS controller)	r
RGtrCnt	Reference Generator Trip Counter	None
LEDrg	System Healthy LED, system automatically tests itself every minute by switching the Reference Generators on, at the end of the test LEDrg=0 if the test checks out healthy, and LEDrg=1 if not healthy	None
Alarm	If any sensor has a voltage lower than the voltage trip threshold, then Alarm=1 (relay energised), otherwise Alarm=0 (relay de-energised)	None
SF	Scale Factors are the values stored in EE Memory. First three are sensor Scale Factor values remembered Second three are RefGen Scale Factor values remembered Seventh is voltage trip threshold value remembered Eighth is RefGen trip threshold value remembered	?
Sync	User can see whether the ODLLS is synchronised to mains time base (Sync=1), or the internal microprocessor timebase (Sync=0) The system automatically tries to synchronise to mains	None
CF	Check Flag =1 during system checks, =0 otherwise	None
CC	Check Counter, counts the number of 100mSecond time slots for the timing of the system check sequence. During this time, the system test LED will blink	None
2005	Year number defaulted to at startup. can be selected with "y" and set with "+" or "-"	y
001	Day of the year (001 = 1st January) Leap years are NOT implemented. can be selected with "d" and set with "+" or "-"	d
00:	Hours can be selected with "h" and set with "+" or "-"	h
00:	Minutes can be selected with "m" and set with "+" or "-"	m
22	Seconds can be zeroed for accurately setting time	z
SnsN	Sensor Normalised values (for each sensor) This is the raw value the ODLLS controller sees from the sensor, but normalized to 10 000 IE. Sensor saturates when SnsN approaches 10 000 NB: This is a VERY IMPORTANT parameter that the installing technician must watch to set up the distance of ODLLS Sensor from HV line. Once the distance is fixed, then only should the user attempt fine calibration using Scale Factor adjustments	None
SnsS	Sensor Scaled value (for each sensor) User can set to appropriate Scale Factor to calibrate the sensor (accurate to 0.05%)	None
RG:N	RefGen Normalised value (for each sensor) This is the raw value the ODLLS controller sees from the sensor, but normalized to 10 000	None
RG:S	RefGen Scaled value (for each sensor) User can set to appropriate Scale Factor to calibrate the RefGen output	None
V	Reset Scale Factor Values If user mucks up Scale Factors so much, that he wants to get back to factory settings (Watch the upper case V)	V

5.5. *Setting up the ODLLS System*

NOTE:

- It is strongly recommended that a test bench be set up using a variac driving a Neon light transformer. This test bench will prove that the system is operating, and provides means to experiment under safer conditions than in the HV application. Better confidence will also be achieved by the installing technician. Results given in the examples below can also then be verified
- The installing technician must first watch the NORMAILSED VALUES to set up the distance of ODLLS Sensor from HV line, and work with percentage of FSD (10000) shown on display. See examples below.
- Once the distance is fixed, then only should the installing technician attempt fine calibration by setting Scale Factors

5.5.1. *Example output: Under voltage Alarm*

(see phase B & C drop below Threshold)

```
2005 020 11:52:02
 Var=0 Set=z VtrThr=00100 VtrCnt=00 RGtrThr=00500 RGtrCnt=00 LEDrg=1 Alarm=0
 Sync=1 CF=1 CC=025
 SnsN= 01442 01198 01078   RG:N= 01798 01704 01495
 SnsS= 00142 00117 00105   RG:S= 00132 00122 00104

2005 020 11:52:03
 Var=0 Set=z VtrThr=00100 VtrCnt=00 RGtrThr=00500 RGtrCnt=00 LEDrg=1 Alarm=0
 Sync=1 CF=1 CC=035
 SnsN= 01383 01137 01007   RG:N= 00736 00613 00516
 SnsS= 00125 00102 00091   RG:S= 00056 00046 00038

2005 020 11:52:04
Var=0 Set=z VtrThr=00100 VtrCnt=01 RGtrThr=00500 RGtrCnt=00 LEDrg=0 Alarm=0
 Sync=1 CF=0 CC=000
 SnsN= 01090 00894 00794   RG:N= 00333 00272 00227
 SnsS= 00107 00088 00078   RG:S= 00031 00025 00021

2005 020 11:52:05
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=00 LEDrg=0 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 01067 00883 00776   RG:N= 00296 00240 00201
 SnsS= 00106 00088 00077   RG:S= 00029 00023 00020
```

5.5.2. *Example output: Phase A disconnected see Alarm go ON*

```
2005 020 11:54:07
 Var=0 Set=z VtrThr=00100 VtrCnt=00 RGtrThr=00500 RGtrCnt=00 LEDrg=0 Alarm=0
 Sync=1 CF=0 CC=000
 SnsN= 01393 01147 01017   RG:N= 00652 00521 00453
 SnsS= 00139 00114 00101   RG:S= 00064 00051 00044

2005 020 11:54:08
 Var=0 Set=z VtrThr=00100 VtrCnt=00 RGtrThr=00500 RGtrCnt=00 LEDrg=0 Alarm=0
 Sync=0 CF=0 CC=000
 SnsN= 00378 01146 01011   RG:N= 00173 00513 00448
 SnsS= 00023 00114 00101   RG:S= 00010 00051 00045

2005 020 11:54:09
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=00 LEDrg=0 Alarm=1
 Sync=0 CF=0 CC=000
 SnsN= 00032 01147 01012   RG:N= 00010 00512 00444
 SnsS= 00001 00114 00101   RG:S= 00000 00051 00044
```

5.5.3. Example output: Test Reading for Phase A: 6.6kV @ 0.6m

(Sensor Scale Factors NOT calibrated)
NOTE: Sensor Normalised value is 1305 in 10000, ie. 13% of FSD, which leaves the rest of the sensor's dynamic range to cope with increased voltage

```
2005 020 11:46:24
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=01 LEDrg=1 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 01305 00091 00073   RG:N= 00443 00028 00014
 SnsS= 00130 00008 00007   RG:S= 00044 00002 00001

2005 020 11:46:25
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=01 LEDrg=1 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 01309 00090 00073   RG:N= 00440 00028 00014
 SnsS= 00130 00009 00007   RG:S= 00044 00002 00001

2005 020 11:46:26
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=01 LEDrg=1 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 01306 00090 00073   RG:N= 00443 00029 00015
 SnsS= 00130 00009 00007   RG:S= 00044 00003 00001

2005 020 11:46:27
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=01 LEDrg=1 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 01310 00090 00073   RG:N= 00452 00032 00015
 SnsS= 00131 00009 00007   RG:S= 00044 00002 00001
```

5.5.4. Example output: Test Reading for Phase B: 6.6kV @ 0.6m

(Sensor Scale Factors NOT calibrated)
NOTE: Sensor Normalised value is 1567 in 10000, ie. 15.7% of FSD, which leaves the rest of the sensor's dynamic range to cope with increased voltage

```
2005 020 11:43:52
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=01 LEDrg=1 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 00095 01567 00083   RG:N= 00025 00556 00024
 SnsS= 00009 00156 00008   RG:S= 00002 00055 00002

2005 020 11:43:53
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=01 LEDrg=1 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 00095 01567 00083   RG:N= 00024 00553 00024
 SnsS= 00009 00156 00008   RG:S= 00002 00055 00002

2005 020 11:43:54
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=01 LEDrg=1 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 00093 01567 00083   RG:N= 00024 00560 00024
 SnsS= 00009 00156 00008   RG:S= 00002 00056 00002

2005 020 11:43:55
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=01 LEDrg=1 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 00094 01567 00083   RG:N= 00026 00559 00024
 SnsS= 00009 00156 00008   RG:S= 00002 00055 00002
```

5.5.5. Example output: Test Reading for Phase C: 6.6kV @ 0.6m

(Sensor Scale Factors NOT calibrated)
NOTE: Sensor Normalised value is 1250 in 10000, ie. 12.5% of FSD, which leaves the rest of the sensor's dynamic range to cope with increased voltage

```
2005 020 11:40:28
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=00 LEDrg=0 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 00088 00079 01241   RG:N= 00027 00039 00532
 SnsS= 00009 00007 00124   RG:S= 00003 00003 00052

2005 020 11:40:29
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=00 LEDrg=0 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 00087 00079 01242   RG:N= 00026 00039 00531
 SnsS= 00008 00008 00124   RG:S= 00002 00003 00053

2005 020 11:40:30
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=00 LEDrg=0 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 00087 00075 01250   RG:N= 00031 00036 00535
 SnsS= 00008 00007 00125   RG:S= 00002 00003 00053

2005 020 11:40:31
 Var=0 Set=z VtrThr=00100 VtrCnt=04 RGtrThr=00500 RGtrCnt=00 LEDrg=0 Alarm=1
 Sync=1 CF=0 CC=000
 SnsN= 00086 00076 01256   RG:N= 00026 00039 00540
 SnsS= 00008 00007 00126   RG:S= 00002 00003 00054
```

5.5.6. Example output: Self test of the system

(TEST LED is flashing)

```
2005 020 11:52:00
 Var=0 Set=z VtrThr=00100 VtrCnt=00 RGtrThr=00500 RGtrCnt=00 LEDrg=1 Alarm=0
 Sync=1 CF=1 CC=005
 SnsN= 01586 01391 01241   RG:N= 05883 05740 05713
 SnsS= 00161 00139 00129   RG:S= 00664 00624 00656

2005 020 11:52:01
 Var=0 Set=z VtrThr=00100 VtrCnt=00 RGtrThr=00500 RGtrCnt=00 LEDrg=1 Alarm=0
 Sync=1 CF=1 CC=015
 SnsN= 01659 01463 01358   RG:N= 07523 07478 07580
 SnsS= 00166 00146 00133   RG:S= 00757 00750 00730

2005 020 11:52:02
 Var=0 Set=z VtrThr=00100 VtrCnt=00 RGtrThr=00500 RGtrCnt=00 LEDrg=1 Alarm=0
 Sync=1 CF=1 CC=025
 SnsN= 01442 01198 01078   RG:N= 01798 01704 01495
 SnsS= 00142 00117 00105   RG:S= 00132 00122 00104

2005 020 11:52:03
 Var=0 Set=z VtrThr=00100 VtrCnt=00 RGtrThr=00500 RGtrCnt=00 LEDrg=1 Alarm=0
 Sync=1 CF=1 CC=035
 SnsN= 01383 01137 01007   RG:N= 00736 00613 00516
 SnsS= 00125 00102 00091   RG:S= 00056 00046 00038

2005 020 11:52:04
 Var=0 Set=z VtrThr=00100 VtrCnt=01 RGtrThr=00500 RGtrCnt=00 LEDrg=0 Alarm=0
 Sync=1 CF=0 CC=000
 SnsN= 01090 00894 00794   RG:N= 00333 00272 00227
 SnsS= 00107 00088 00078   RG:S= 00031 00025 00021
```

5.6. *Examples of RS232 output with "se10003a" firmware*

The following dialog box shows the RS232 output format that is presently installed with firmware version "se10003a". Firmware loaded in your system can be observed on the computer display at start-up time.

"se10003a" firmware is orientated to mobile applications where the distance of sensors is variable, and the system is used as an early warning alarm

```
2000 001 00:10:01

 Var=1 Set=z VtrThr=00200 VtrCnt=04 RGtrThr=05000 RGtrCnt=01 LEDrg=1 Alarm=1
 Inst 00000 05348 00000 09993  Filt 00003 05305 00000 07693
EE Saved

2000 001 00:10:02

 Var=1 Set=z VtrThr=00200 VtrCnt=04 RGtrThr=05000 RGtrCnt=01 LEDrg=1 Alarm=1
 Inst 00000 05023 00000 01188  Filt 00003 05051 00000 01048

2000 001 00:10:03

 Var=1 Set=z VtrThr=00200 VtrCnt=04 RGtrThr=05000 RGtrCnt=01 LEDrg=1 Alarm=1
 Inst 00000 05003 00000 00734  Filt 00003 05005 00000 00724


? = show HELP menu
z = zero seconds
y = years
d = days
h = hours
m = minutes
s = sensor A,B
f = scale factor
t = voltage trip threshold
r = RG trip threshold
+ OR -  increase OR decrease to alter
SF= 22750 22275 25125 24725 00200 05000 00000 00000

2000 001 00:10:04

 Var=1 Set=? VtrThr=00200 VtrCnt=04 RGtrThr=05000 RGtrCnt=01 LEDrg=1 Alarm=1
 Inst 00000 05003 00000 00688  Filt 00003 05003 00000 00688

2000 001 00:10:05

 Var=1 Set=? VtrThr=00200 VtrCnt=04 RGtrThr=05000 RGtrCnt=01 LEDrg=1 Alarm=1
 Inst 00000 05003 00000 00688  Filt 00003 05003 00000 00688
```

5.7. *Electrically Erasable Memory (EE memory)*

- EE Memory is provided in the ODLLS controller, for the saving of Scale Factors, sensor voltage trip thresholds, and reference generator trip thresholds for each channel
- If a key has been pressed, the ODLLS controller senses this, and when the clock rolls over to the next minute, the trip threshold parameters are saved into EE memory.
- The message "EE Saved" is output
- NB to save parameters in EE Memory, the user **MUST WAIT UNTIL THE NEXT MINUTE HAS PAST**

6. *Auxiliary Power Supply*

PARAMETER	CONDITIONS	MIN	NOM	MAX	UNIT
Aux Power Supply Voltage range		18	24	30	V dc
Aux Power Supply - VA requirement	Normal system operation No alarms No self test		4.5		VA
Aux Power Supply - VA requirement	Normal system operation No alarms Self test energised Occurrence: once per minute Duration: 4 seconds		7.5		VA
Aux Power Supply - VA requirement	Normal system running Alarm relay energised Self test energised Occurrence: once per minute Duration: 4 seconds		8		VA