Operators Manual

Radio Ohmstik

Radio Linked
Micro Ohmmeter

SensorLink®

Model 8-182
Radio Ohmstik Transmitter
Model 8-184 not pictured

Model 8-180
Radio Ohmstik Display Unit

Model 6-182
Radio Ohmstik Kit
and Accessories

OPERATORS MANUAL

Radio Ohmstik

Radio Linked Live-Line Micro Ohmmeter

Available Stock Codes:		
8-182 50HZ	8-182 60HZ	8-182 EURO
8-180	8-180 EURO	8-184 50HZ
8-184 60HZ	8-184 EURO	

Table of Contents

Theory of Operation

The Radio Ohmstik Live-Line Micro Ohmmeter measures the micro-ohm resistance of conductors, connectors, splices and switching devices positioned directly on energized, high voltage lines. The Radio Ohmstik calculates resistance by measuring the AC amperage in the line and the voltage drop due to the resistance of the line segment under test. Using the AC current in the line insures that realistic current distributions through the connection are being measured. The instrument is pressed against the splice or connector in such a manner that the connection under test is between the two electrodes.

The Radio Ohmstik sends its status and measurements to both the Remote Display and the Radio Ohmstik Software on the user's laptop. At the same time, the GPS device sends location data to the Software. When a valid measurement is received, the software writes the data to a comma separated (CSV) file. This allows the user to map the location of the connector as well as its condition.

Safety Information:

The probes on the Radio Ohmstik measure voltage drop and are intended to measure the micro voltage drop from the same phase.

Connecting the probes in a phase to phase, phase to ground, or any application where the voltage potential between the probes is more than 2.5 volts will cause damage to the instrument and create a system fault.

Do not touch or engage the air gap of adjacent phases or ground connections with the probes.

FCC & Industry Canada statements

United States of America and Canada
Contains FCC ID: OUR-XBEEPRO
Contains Model XBee-PRO Radio, IC: 4214A-XBEEPRO

The/XBee-PRO® RF Module has been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Modifications not expressly approved by Digi could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Re-orient or relocate the receiving antenna, Increase the separation between the equipment and receiver, Connect equipment and receiver to outlets on different circuits, or Consult the dealer or an experienced radio/TV technician for help.

Specifications

Model Number & Type	8-182	8-184
Type	Standard	Wide Jaw
Sensor Opening	2.5 in, 6.35 cm	3.86 in, 9.8 cm
Weight	2.3 lbs, 1.05 kg	4.0 lbs, 1.81 kg
Measurements		
Amps	1-1400 A	
Microohms	5-2500 μΩ	
Accuracy		
Amps	±1% ±1 A	
Microhms Absolute	±2% ±2 μΩ	
Microhms Repeatability	±1% ±2 μΩ	
Accuracy is diminished if the current is less than 15 amps 0-35kV and when current is less than 50 A while on 36-500kV		
Range of Operation		
Voltage	Rated 500kV	
Resolution		
Amps 1.9-99 A	0.1 A	
Amps 100-1400 A	1.0 A	
Microhms 0-999 μΩ	1 μΩ	
Frequency	Actual frequency indicated on the unit	
50Hz Calibrated	47 to 53Hz	
60Hz Calibrated	57 to 63Hz	
Radio		
Frequency	ISM 2.4 GHz	
Power	63 mW, 10 mW in Europe & Japan	
Range	150', (46 meters) Line of Sight, 120' (36.5 meters) in Europe & Japan	
Mechanical		
Battery	9 Volt Alkaline, 1 each per unit	
Battery Life	6-8 Hours at 68°F or 20°C, 3-4 Hours at 32°F or 0°C	
Detachable Probes	Fused Probe or Adjustable Probe	
Ambient Temperature	-4 to +140° F, -20 to +60° C	
Display	Graphics LCD	
Software Requirements	Radio Ohmstik Software	
System Requirements	Windows XP, Vista, Windows 7, Windows 8	
Hardware Requirements	Minimum of two USB ports	
EEC Standards	Successfully passed international test standards indicated by CE	

Radio Ohmstik Software

The Radio Ohmstik Software will display information on the Display Unit and will also write the collected data to a comma separated value (CSV) file in software.

The following data is collected: Amps, Micro-Ohms, Date, Time, Comments, Latitude, and Longitude (with the GPS USB plugged into the laptop).

System Requirements

The Radio Ohmstik software installs on all computers running Windows XP, Vista, Windows 7 & 8. The GPS and Radio Ohmstik Software each require a USB port.

Software Installation

1. Place the Radio Ohmstik Software Install CD in your computer's CD Drive
2. The Installation Wizard will automatically load and display on your PC. **If you need to launch the install manually, go to the Start Menu, select RUN and type :\SETUP.EXE, OR - Click on browse, open the drive that your CD is located, and double click on file titled SETUP
3. You must agree to the licensing agreement to proceed with the download
4. A dialog box will appear to let you know when the download is complete
5. Shortcut paths will automatically load during the install

USB Port Permissions

Computers managed by electric utility organizations often limit the programs that can be installed. The USB devices in this kit have install programs that run the first time they are installed. The user may have rights to install programs but may not be aware that the USB ports are locked. If the USB devices are not discovered automatically, their drivers will need to be installed manually. The USB Radio Drivers are loaded on the program CD. The USB GPS Driver came on a CD with the USB GPS device. Please contact your network administrator for permission and instructions to complete the install If the drivers need to be installed manually.

Communicating the Measurement

The user is able to view the measuremet sets on both a Display Unit and on a laptop running Radio Ohmstik software. These communications may be used singly, or at the same time.

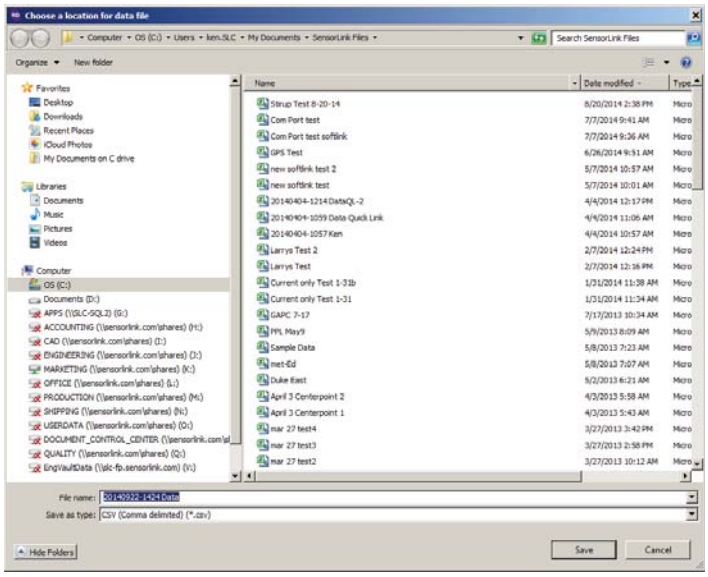
Communicating to the Display Unit: The Display Unit is designed to be attached to a hot stick, or held by hand. The sensor transmits the live readings to the Display Unit via radio. This functionality allows the user to easily see readings were taken. Readings are not saved on the Display unit.

Communicating to the Laptop: With the Radio Ohmstik software loaded, and the radio adapter plugged in, the Sensor will transmit the data and readings to the laptop. The measurement set will automatically be saved as a .csv file for future review.

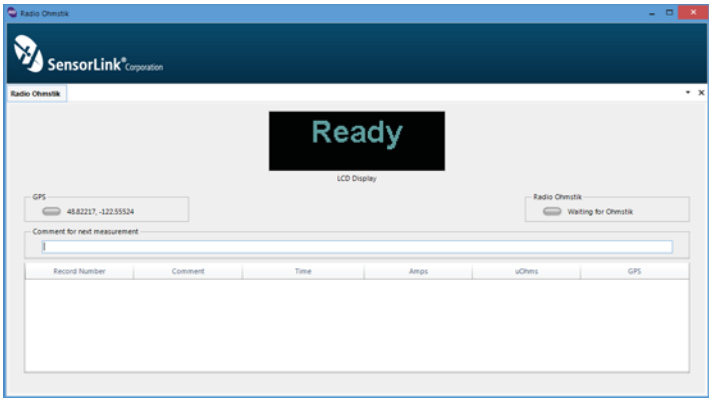
Operating Instructions

Setup Communication with Radio Ohmstik Software

1. Plug the 7-024 USB Radio and the 7-025 USB GPS devices into the laptop's USB ports. It will take several seconds for the computer to discover the devices
2. Open the Radio Ohmstik Software
3. The program starts by asking the user to select a file name and location to write the data. *Note: The default File Name is a date and time code for the date and time the application is opened.*

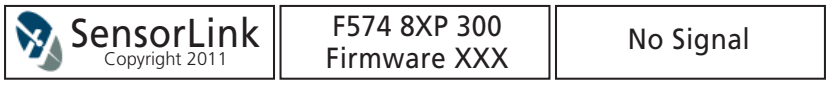


4. Select Save; the Radio Ohmstik Dashboard will load and is ready for measurments



Setup Communication with Display Unit

1. Place the Display Unit on the hot stick with the Velcro strap so the LCD display is visible while taking measurements
2. Press the function button on the Display Unit. The display will run through its boot screens, ending in No Signal



Setup Radio Ohmstik Sensor

1. Attach the Probe to the back of the Radio Ohmstik.
2. Press the function button on the Radio Ohmstik sensor. The Radio Ohmstik transmits to both the Display and the Radio Ohmstik Software
3. They both indicate the Radio Ohmstik is ready to take measurements

Display

Software Dashboard

Taking a Measurement:

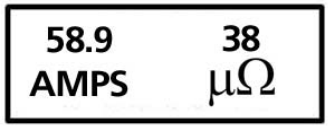
1. Place the Radio Ohmstik on a conductor as depicted in Figure 3.0. It is essential you make contact between the conductor and the voltage sensor, which is the V-shaped plate between the jaws, as well as the voltage probe.
2. Measurement begins as soon as the Ohmstik is in position and is stable

Figure 3.0

3. While the Radio Ohmstik is taking the measurement, the screens will display:
4. The display screens will show the current in the conductor as well as the Micro-

Ohm resistance of whatever is between the two voltage probe

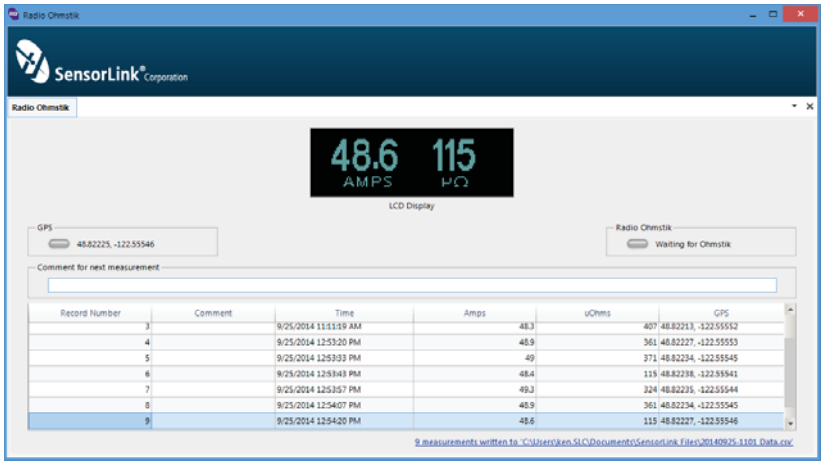
5. Remove the Ohmstik from the conductor. It holds the reading and displays it as follows:
6. Remove the Radio Ohmstik from the conductor or splice



7. The measurements are now written to the Radio Ohmstik software
8. The displays will continue to show readings until the Radio Ohmstik is placed on a new current carrying conductor or until it powers down

Reviewing Measurements in Software

1. The Radio Ohmstik software will display the completed measurement and GPS location on the Dashboard



2. The data will automatically be written to a comma-separated values (CSV) file when the Radio Ohmstik is removed from the conductor
3. A comment may be added before the reading is taken. Any comment written will be a part of the record for the next reading
4. To review the data, open the saved CSV file in any spreadsheet or word processing application
   Note: Opening the CSV file while the dashboard is open, will stop the recording of readings. The number of readings will be recorded on the dashboard but the readings will not be stored.

Power Off the Radio Ohmstik

Press and hold the Function Button on the Display Unit until the LCD goes blank or Press and hold the Function Button on the Radio Ohmstik until the LED goes off. Either of these actions will power off itself and the accompanied device. The Radio Ohmstik will power off by itself if left inactive for 20 minutes.

Troubleshooting and Error Messages:

"No Contact"

The Radio Ohmstik reads current but not μΩs:

This indicates that either one of the two voltage sensors is not making contact. Use the rough edges of the probes to clean the corrosion from the conductor and re-take the measurement. Make certain that both voltage sensors are making contact.

"Poor Contact"

This means either there is Poor Contact between the two voltage contacts:

Provide five seconds to measure, while the Radio Ohmstik is held stationary with both voltage probes securely on the line.

"Reading Ohms"

The following message indicates that the current measurement was completed before the resistance measurement could be completed:

Provide five seconds to measure, while the Radio Ohmstik is held stationary with both voltage probes securely on the line.

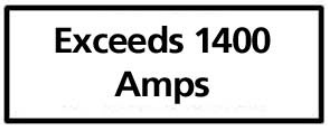
"Unable To Measure"

The Radio Ohmstik uses logic to know when it is on a conductor by looking for a stable load:

Hold the Radio Ohmstik firmly on the line for at least five seconds. The Ohmstik samples the line three times every 100 milliseconds. If it cannot find three consecutive reads that are similar within five seconds it will display "Unable To Measure".

“Exceeds 1400 Amps”

The Radio Ohmstik limits the maximum current to 1400 Amps;



Exceeds Limits indicates that the current limit has exceeded 1400 Amps.

Application: Deterioration Influences

Time is not an "aging factor" for fittings. Deterioration is due to increases in resistance of the connection. The increased resistance is produced, in part, by peaks of load and fault current that can heat the interface, even if only temporarily, or for a few cycles (also in part by oxidation of the interfaces during thermal expansion and cooling, and by corrosion accelerated by moisture and chemicals in very small quantities that get in between the strands). Every splice has at least one "uphill" side for water, etc. to run. The reasons we hear that fewer "dead-ends" fail may be that most of them are pointed "downhill".

All of these influences accelerate the deterioration of fittings that are not installed properly. Cleaning and roughening the conductor was always important in making a "good fitting", and with today's shorter, harder alloy tube fittings, we have found it critically important, even with the new conductor. Proper dispersion of an inhibitor will help keep the interfaces from oxidizing. All major manufacturers have frequently found a missing, or inadequately dispersed, inhibitor when examining failed fittings. Proper die closure is very important, especially with the newer (last 20 years or so) alloy tube "single die" type compression fittings. There is generally less conductor inserted in the fitting than in the older "hex die" type of fitting, so it is less forgiving of installation error. These consequences of installation lead to incremental increases in resistance during the service life of the fitting. Resistance measurements of newly made alloy tube fittings indicate they are more likely to start service at the higher end of the normal range than the lower end.

Lately, what has been learned about fitting reliability indicates that there will be more problems with unexpected failures than in the past. This comes at a time when just the opposite is needed. Fittings need to be replaced on a planned basis, before failure occurs.

Ohmstik Evaluation Method

The Ohmstik Evaluation Method provides definitive and actionable early warnings of a deteriorating fitting. This method directly measures the resistance of the connection with an Ohmstik. The resistance is the electrical condition of the splice. If the resistance is outside the normal range, the connection is deteriorating. A connection with resistance above the normal range is in a failure process, where the time to failure depends on how high the resistance is. The appropriate planned actions for ranges of resistance above normal are shown in Table One. The resistance ratio is calculated by comparing the resistance of the fitting over the resistance of the conductor.

All fittings or splices consist of two different connectors. All connectors consist of three resistors in series; the resistance of the conductor, the connector and the interface between the conductor and the connector (See figure 4.0).

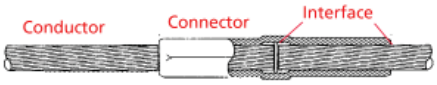


Figure 1.0

The interface is the only resistor of the three that changes over time. The object of the Ohmstik Evaluation Method is to measure as little of the conductor & connector as possible, and all of the section that surrounds the interface.

A good way to make reliability judgments about a connector is to compare the resistance of the connector assembly to the conductor. This ratio allows you to compare measurements on connectors of various sizes.

1. In order to establish the baseline, or denominator, for the ratio of the subsequent measurements, measure the resistance of a portion of the conductor that is equal in length to the interface portion of the connector.

Figure 5.0

2. Measure the interface of one of the connectors.

Figure 5.1

3. Measure the interface of the second connector.

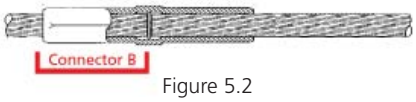


Figure 5.2

The ratio is calculated by making the conductor measurement as the denominator and the Connector measurement as the numerator.

Ratio = Connector / Conductor

The following table shows the suggested action for various ratios based on maintaining the present load rating.

Resistance ratio	Condition of fitting	Action
0.3 to 1.0	Normal Connection Serviceable New connections are expected to be in the 0.3 to 0.8 range	None
1.01 to 1.2	Serviceable; poor Shows deterioration; Overloads & faults may deteriorate the connection	Re-inspect in one year, or after next fault
1.21 to 1.5	Serviceable; poor Serviceable, shows deterioration; Overloads & faults may deteriorate the connection	Fault
1.51 to 2.0	Serviceable; very poor High loads, overloads, or faults may deteriorate the connection	Schedule replacement in less than three months
2.01 to 3.0	Bad; deterioration rate is increasing High loads, overloads, or faults may fail the connection; High tensions from cold weather or wind may initiate failure under normal loading	Schedule replacement very soon
> 3.0	Failing Normal loads, overloads, or faults may fail the connection; High tensions from cold weather or wind are likely to initiate failure under normal loading	Replace as soon as possible

Table 1.0: Actions required based on resistance ratios (^{R}fitting / ^{R}conductor)

Note: This information was developed from field measurements, manufacturer data, lab tests, failure analysis and understanding of deterioration mechanisms. This guideline may be modified as field & test data accumulates.

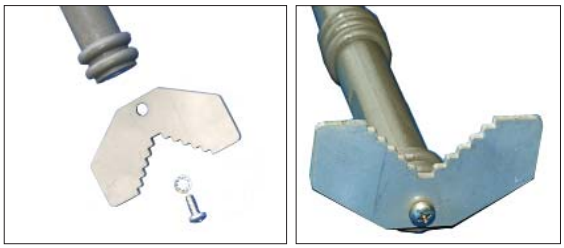
Standard Probes and Accessories

7-081 XT Standard Fused Probe, for 8-182 Transmitter
7-081 Standard Fused Probe, for 8-184 Transmitter

The probe is designed for use in close proximity to adjacent phases or ground structures (see Cautions on page one). In the event of making a phase to phase or phase to ground connection, the Fused Probe will break the connection.

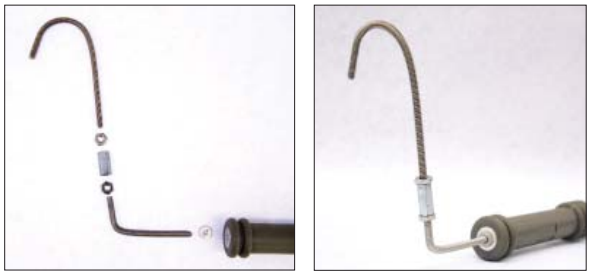
Accessory Kit Includes:

(1) Fused Probe
(1) 7-084 Wire Brush Contactor
(1) 4" Rod, Straight
(1) Philips Head Screw
(4) Lock Washers
(1) Contactor Attachment
(1) Probe Hook
(1) 4" Rod, Bent
(1) Coupling Nut
(6) Hexnuts



Fused Probe Configuration with Contactor Attachment

Fused Probe Configuration with the Straight Rod and Contactor Attachment



Fused Probe Configuration with the Bent Rod and Curved Rod

7-081 ADJ Adjustable Probe Kit

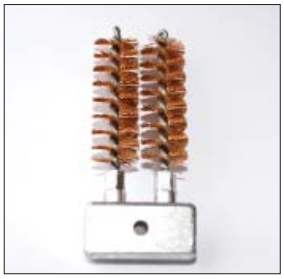
The Adjustable probe is designed for any measurement where the distance to be measured is less than 12 inches. This probe wil adjust from 4 to 13 inches.

Adjustable Probe Kit includes:

(1) Adjustable Probe
(1) Contactor Attachment
(1) 7-084 Wire Brush Contactor
(2) Hex Nuts

Optional and Replacement Accessories

7-084 Wire Brush Contactor



7-050 Universal Adaptor

The Universal Adapter allows the user to adjust the Ohmstik Transmitter at compound angles. This is a useful adapter when working from the ground on complex apparatus.

Battery Replacement

The Radio Ohmstik system is powered by two 9V batteries, one in the Radio Ohmstik and one in the Display. The expected battery life for both units is 6 to 8 hours at 68◦ F or 20◦ C. The expected life declines in colder environments. At 32◦F or 0◦C it is reduced 3 to 4 hours.

Note: It is recommended that fresh batteries be installed prior to operation each day and always replace both batteries.

To replace the battery, remove the four screws on the battery cover at the rear of the unit. Carefully insert a screwdriver blade in the notch and pry the cover out, being careful not to damage the cover seal. Pull the battery out of the compartment and separate the battery from the battery connector. To avoid breaking the battery leads do not pull on the battery only. Install a fresh battery and reinsert the battery in its compartment. Do not pinch the wires between the battery and compartment; put wires in slot above the battery. Reinstall the cover by gently pressing it into place while pulling out on the edges of the compartment, and reinstall the four cover screws. Take care to avoid over tightening the screws. Always reuse the screws provided and do not damage or lose the O-ring seal on each screw.

Cleaning

The Radio Ohmstik can be cleaned by wiping with a small amount of alcohol.

Transporting

There are no special consideration for transporting this device.

Sensorlink Corporation Warranty

SensorLink warrants each instrument it manufactures to be free from defects in materials and workmanship under normal use and service for the period of one year after date of shipment. Within this period, SensorLink agrees to repair or replace, at SensorLink's option, any instrument that fails to perform as specified. This Warranty shall not apply to any instrument that has been:

1 Repaired, worked on, or altered, including removal of the front panel, by persons unauthorized by SensorLink in such a manner as to injure, in SensorLink's sole judgment, the performance, stability, or reliability of the instrument;

2 Subjected to misuse, negligence, or accident; or

3 Connected, installed, adjusted, or used otherwise than in accordance with the instructions furnished by SensorLink.

This Warranty is in lieu of any other warranty, expressed or implied. SensorLink reserves the right to make any changes in the design or construction of its instruments at any time, without incurring any obligation to make any change whatever in units previously delivered.

If a failure occurs, contact the manufacturer for a Return Authorization and instructions for return shipment. This warranty constitutes the full understanding of the manufacturer and buyer, and no terms, conditions, understanding, or agreement purporting to modify or vary the terms hereof shall be binding unless hereafter made in writing and signed by an authorized official of SensorLink Corporation.

Quality Assurance Certification
Radio Ohmstik
Transmitter Models 8-182 and 8-184
Display Unit Model 8-180

SensorLink certifies that its calibration measurements are traceable to the National Institute of Standards and Technology (NIST), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

This document certifies the following Radio Ohmstik was tested at the Sensorlink High Voltage Laboratory, Ferndale, WA, USA to the appropriate standard and comply with the requirements of that standard.

Transmitter; Model Number: _____

Serial Number _____

Display Unit; Model Number: _____

Serial Number _____

I hereby certify that the Radio Ohmstik listed above has passed all tests defined in the Sensorlink Corporation standard. I also certify that I have reviewed the standard and test procedure and that they are sufficient in determining compliance with the standard.

Signed_____

Date_____

Form No: SALE-Manual Template OHMSTIK-008 REV: V03
Date: 02/10/2015
Manual Stock Code No: DOPM-818-200

SensorLink® Corporation

1360 Stonegate Way
Ferndale, WA 98248 USA
phone: 360/595.1000
fax: 360/595.1001
www.sensorlink.com