

Operators Manual
TMS Single Phase
Transformer Meter

Unit and Accessory Part Numbers



Shear head bolts
Model 7-029



USB Radio Adapter
Model 7-027



TMS Sensors
MODEL: 950

Operators Manual

TMS

Single Phase Transformer Meter

Available Stock Codes:			
950-50HZ	950-60HZ		

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Transformer Meter

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SPECIFICATIONS

Model Number	950, (1) TMS Unit
Optional Accessories	7-027, (1) USB Radio Adaptor DREP-950-000, (1) Calibration Verification Report S580-001-003 (1) Steelhead Software 7-029, (2) Replacement Bolts, TMS
Range of Operation	
Voltage	100 - 277 VAC
Current	1 - 700 Amps
Resolution	
Voltage	0.1 V
Current	0.1 AMP
Watts	0.1 kW
KWh	0.1 KWH
Accuracy	
Voltage	0.5% \pm 1 Digit
Current 1A to 3A	0.5% \pm 2 Digits
Current 3A to 700A	0.5% \pm 1 Digits
KWH	1% \pm 1 Digits
Frequency	
50 Hz or 60 Hz	47 to 53 Hz (50 Hz) or 57 to 63 Hz (60 Hz)
Mechanical	
Weight	1.5 lbs, 0.68 kg
Sensor Opening	1 inch, 25 mm
Conductor Range	#2 to 600 kcmil
Maximum Insulation Thickness	Up to 100 mils, 2.5 mm
Operating Temperature	-22 to +140° F, -30 to +60° C
Radio	
Type & Band	ISM 2.4 GHz
Transmit Distance	300 ft, 100 meters
Transmit Power	63 mW, 18 dBm (EU & Japan 10mW, 10dB)
Power	
System	Line Powered
Clock Battery Backup	14 days, 2 each CR2032 Lithium coin cells
Logging Capacity	330 days @ 5 minute intervals
Software Requirement	SensorLink's Steelhead Software
Software System Requirements	Windows XP (SP3), VISTA, Win 7, Win 8, & Win 10
Meter Standards	Applicable Standards of ANSI C12.1, FCC Part 15, & CISPR 22

Safety Information



Read all safety and instruction statements before using the product. Failing to follow the safety guidelines can cause severe injury or death.



TMS units are designed for use on live, secondary overhead lines with 100 to 277 VAC. All procedures appropriate for the line voltage are to be taken, including proper work techniques, equipment, and Personal Protection Equipment.



The TMS unit should be deployed and retrieved only by certified personnel who have been trained for live-line, high voltage work by their organization.



The two TMS units and cable are to be considered at the same potential as the conductor. Putting these within the air gap of adjacent phases or ground could cause a phase to phase or phase to ground fault.



Do not alter the product in any manner.

Theory of Operation

The SensorLink TMS unit gives precise information to quickly identify inefficient Transformer loading or power theft without the requirement of Advance Metering Infrastructure.

The drive-by Transformer Meter is designed to capture the following parameters:

- Accumulated kilowatt hours
- Average Volts
- Average Amps
- Interval Kilowatt hours

Using secure radio protocol, the stored data is downloaded while the meters are still deployed on the Transformer.

The radio in the Transformer Meter communicates to a USB radio transceiver that is connected to the user's laptop. This standards based, non-licensed wireless network solution supports low power consumption, security, and reliability.

The TMS unit quickly installs on the energized, secondary of a pole mounted Transformer. The meters employ a low voltage, insulation piercing connector that securely attaches the sensor to the conductor. This voltage connection supplies the voltage measurement and the power to operate the TMS unit.

Steelhead Software is used for the setup, download, and review of the recorded data. Data may also be saved to a .csv file for review in other software programs.



Clipboard						
Font						
C14	A	B	C	D	E	F
	4051 NW 19 Ave					
	Verified					
	CONFIGURATION					
	Serial Number: 95060-1803612-03					
	Battery Condition: Good					
	TMS Connection Type: Line to Line					
	Outage Occurred: No					
	Accumulated KWH: 820.14					
	Accumulated KWH Start Time: 10/24/17 3:23 PM					
	Date/Time	Voltage	Amps A	Amps B	KWH A	Battery Condition
0	24-Oct-17 15:25:00	-	-	-	-	Good
1	24-Oct-17 15:30:00	248.0	18.1	38.0	0.2	Good
2	24-Oct-17 15:35:00	247.9	18.0	38.0	0.2	Good

Radio Information

FCC and IC Notices

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.

Preventative Maintenance

The TMS units should be visually inspected for cracks or breaks in the housing. Do not use if cracks are present or the unit is damaged.

Cleaning

The TMS units should be cleaned by wiping with a silicone hot stick wipe to remove dirt, sand, and salt that will degrade the housing.

Transporting

Package contains Lithium ion 2032 coin cell batteries. Handle with care. When package is damaged it can cause fire. Special procedures should be followed; inspect the package and arrange repack by qualified persons when required. Contact SensorLink at: +360-595-1000.

Battery

The TMS units are powered by the line; the batteries do not power the TMS units for sampling and logging line data.

Two CR2032 coin cell lithium ion batteries power the clock in the TMS unit during short-term power disruptions and outages. The batteries will provide clock backup for up to 14 days of outage and do not power the unit for data measurement or communication.

Installing the Battery

The batteries need to be installed prior to installing a TMS in the field. The battery compartment is under the clamp assembly on the "Line" sensor.

1. Remove the lid and clamp assembly by removing the three screws



2. Insert the two batteries with the positive (+) side facing the clip that holds them in place



3. Attach the lid and clamp assembly back to the sensor.

Incorrect Battery Installation

The battery status will display "bad battery" in Steelhead when communicating to a unit with an incorrect battery installation. Installing the batteries backwards will result in no battery backup in the instance of an outage and a loss of the clock synchronization and already logged data will be lost. Any new data logged after power is restored will not have correct time and date stamps.

Steelhead for TMS

Steelhead is a data retrieval software for communicating, downloading, viewing, and graphing measurements collected with installed TMS units. For the user to communicate through Steelhead, the TMS unit must be installed on a powered line and the USB Radio must be connected to the computer and within 300 feet, line-of-site, to the units.

Steelhead System Requirements

The computer has to be connected online for installation and activation of the license key. Online access is not necessary for any other use of Steelhead.

OPERATING SYSTEM: Steelhead installs onto computers running Windows 7, 8, and 10. Steelhead requires Service Pack 3 and newer, which will install automatically.

NETWORK INSTALLATION: Steelhead is a single user application and is not supported when installed onto a server.

INSTALLATION AUTHORITY: Installation will require administration rights. Computers managed by electric utility organizations often limit the programs that can be installed. If the user does not have admin rights they will need the assistance of the IT department to download the software.

USB PORT PERMISSIONS: The USB IrDA has an install program that runs the first time it is connected. The user may have rights to install programs but may not be aware that the USB ports are locked on the PC. Please contact the network administrator for permission and instructions to complete the install if drivers are not installing automatically.

License Key

A license key is required to operate Steelhead software. A license key is issued once the user's company email address has been validated by SensorLink. The standard license key is valid for 365 days after the installation on a single computer.

Contact SensorLink to issue new license keys once the original has expired at **licensing@sensorlink.com**.

Steelhead Installation

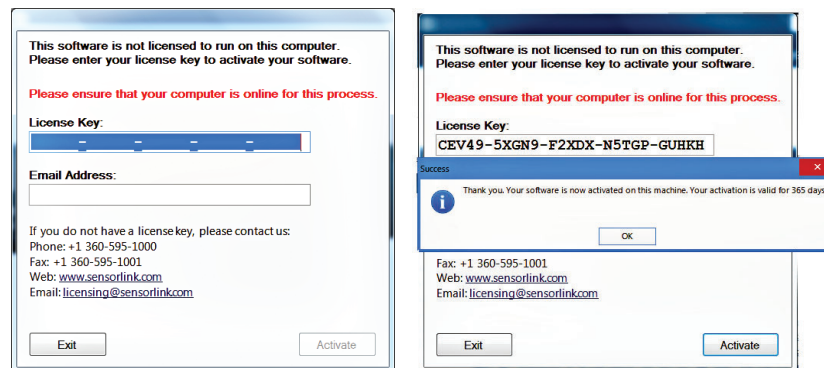
Step 1: Verify the computer has an online connection

Step 2: Steelhead installer is available at www.sensorlink.com/products/tms-meters. Save the file to the desired location. The Steelhead .exe file will automatically begin the download when clicked.

Step 4: Select "I Agree" to the licensing agreement to proceed

Step 5: Enter the license key and validated email address

Step 6: Steelhead can now be opened from the shortcut on your desktop or from the start menu.

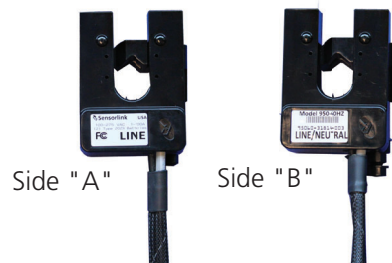


Installation: Line to Neutral

Each sensor is individually labeled: 'LINE' and 'LINE/NEUTRAL'. The unit labeled 'LINE' must be installed on the main line, and the unit labeled 'Line/Neutral' must be installed on the Neutral.

The unit labeled 'LINE' is identified as "A" in Steelhead. The unit labeled 'LINE/NEUTRAL' is identified as "B" in Steelhead.

The TMS units may be installed anywhere between the transformer and the customer's meter.



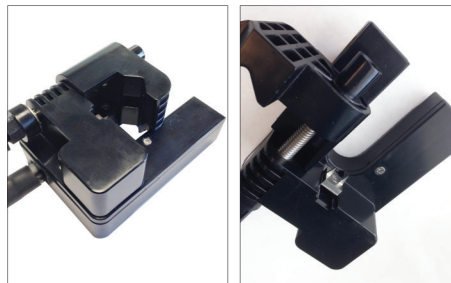
Attaching the TMS Line to Neutral:

Use the following steps to install the TMS Line-to-Neutral on a transformer:

STEP 1 Insert fresh batteries before installing the meter onto the line.

STEP 2 The sensor labelled 'LINE/NEUTRAL' will be installed to the neutral first.

STEP 3 Loosen the clamp bolt so the clamp is open to go on the secondary conductor of the transformer.



STEP 4 Place the sensor of the conductor with the clamp facing up. Center the conductor on the teeth of the piercing connector.

STEP 5 Using a ½ inch socket, ratcheting box wrench, or a power screw gun, tighten the bolt. Tighten the bolt so the sensor remains on the conductor with the clamp facing up.

STEP 6 The shear head nut will break away at 38 in-lbs of torque. This insures the insulation is pierced and the clamp assembly is protected from over tightening.

STEP 7 Repeat steps two through six with the sensor labeled "LINE" on the conductor to be measured.



STEP 8 Three audible beeps should be heard within 15 seconds of the TMS unit being installed. This is confirmation the meter is being powered by the line.

STEP 9 The installation is complete and setup needs to be completed in Steelhead Software.

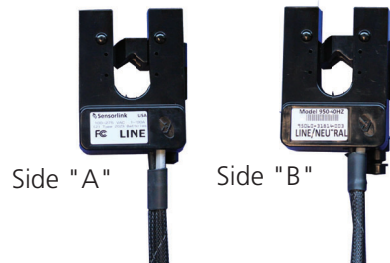


Installation: Line to Line

Each sensor is individually labeled: 'LINE' and 'LINE/NEUTRAL'. When installing on Line-to-Line applications, either sensor can be put on either line.

The unit labeled 'LINE' is identified as "A" in Steelhead. The unit labeled 'LINE/NEUTRAL' is identified as "B" in Steelhead.

The TMS units may be installed anywhere between the transformer and the customer's meter.

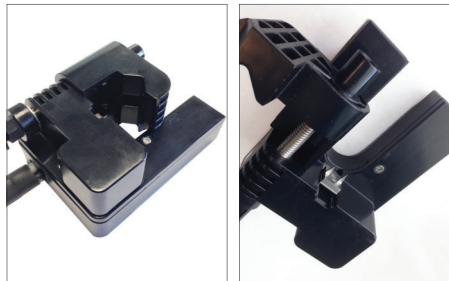


Attaching the TMS Line to Line:

Use the following steps to install the TMS Line-to-Line:

STEP 1 Insert fresh batteries.

STEP 2 Loosen the bolt until the clamp is open enough to fit onto the secondary conductor of the transformer.



STEP 3 Place the first sensor on the conductor with the clamp facing up. Center the conductor on the teeth of the piercing connector.

STEP 4 Using a ½ inch socket, ratcheting box wrench, or a power screw gun, tighten the bolt. Tighten the bolt so the sensor remains on the conductor with the clamp facing up.



STEP 5 The shear head nut will break away at 38 in-lbs of torque. This insures the insulation is pierced and the clamp assembly is protected from over tightening.

STEP 6 Repeat steps two through six on the next conductor with the second unit.



STEP 7 Three audible beeps should be heard within 15 seconds of the TMS unit being installed. This is confirmation the meter is being powered by the line.

STEP 8 The installation is complete and setup needs to be completed in Steelhead Software.

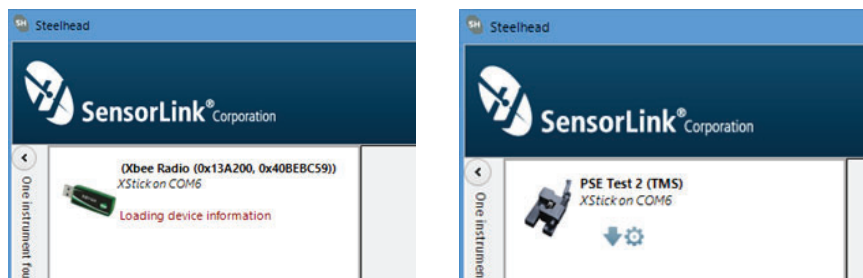


Communicate with USB Radio

Insert the USB radio cable into the Laptop's user port. The USB radio drivers should automatically load the first time it is installed. Open Steelhead from either the desktop or start menu.

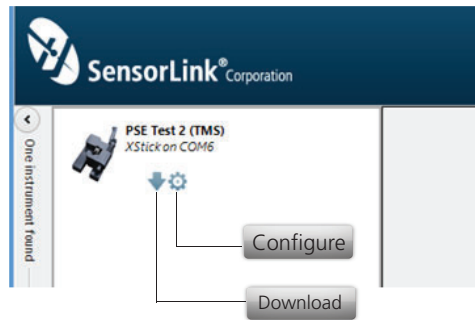
Steelhead will show the communication device and TMS unit once both are within radio distance and are communicating.

With Steelhead running, the description and photo displayed will change from the communication device to the unit when the TMS unit has been discovered:



Configure the TMS

Select the Configure button to setup preferences.

A screenshot of the 'TMS Configuration' dialog box. The title bar says 'TMS Configuration'. Inside, there's a section 'TMS Information' with the following fields: 'Serial Number: 1505015-02' (read-only), 'Name (16 Characters)' with the value 'RevPro #5', 'Description (46 Characters)' with the value '1360 Stonegate Way, June 15-29', and 'TMS Connection Type' with a dropdown menu set to 'Line to Line'. Below these fields is a button labeled 'Update and Delete All' with the text 'Delete Interval Data, Reset Accumulated KWH, and Synchronize Clock:' above it. At the bottom of the dialog are two buttons: 'Delete Interval Data' and 'Cancel'.

Serial Number: The serial number is defined at the time of manufacture and cannot be changed

Name: Identify the TMS Unit with up to 16 characters

Description: Enter a description of up to 46 characters. For example, you may want to note the TMS Unit's service location and the date range for the recordings

TMS Connection Type: Select 'Line to Line' or 'Line to Neutral', per the Transformer style

Update and Delete All: This selection does the following:

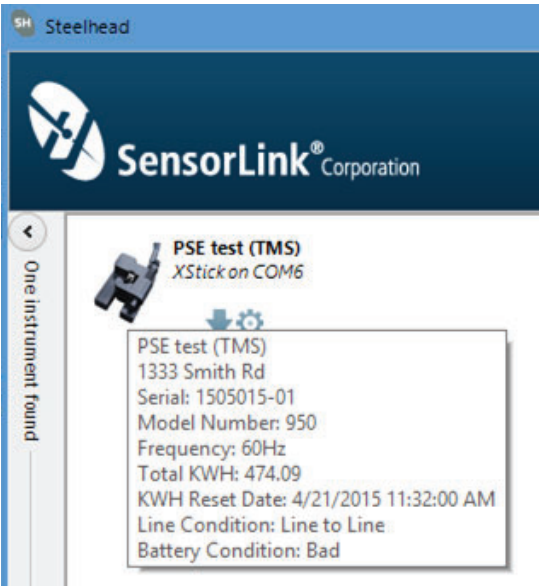
- Deletes all the logged interval data
- Resets the Accumulated KWH readings
- Synchronizes the time clock
- Updates changes made to the name and description of the unit

Synchronizing the time clock has to be done each time fresh batteries are put into the unit.

Delete Interval Data: This selection deletes only the logged interval data

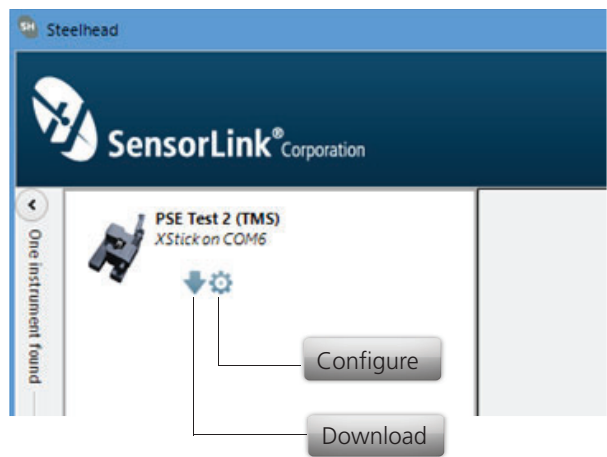
Quick View

Hovering the pointer over the TMS Unit icon will bring up the Quick View. This box will give the user a snapshot of the load data at the point Steelhead connected to the TMS unit.

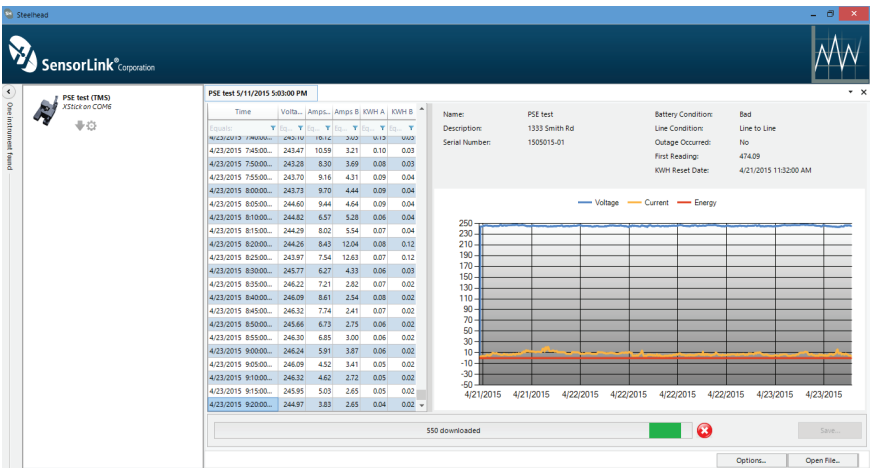


Download Data

Selecting the Download button instructs Steelhead to begin downloading data from the TMS Unit.

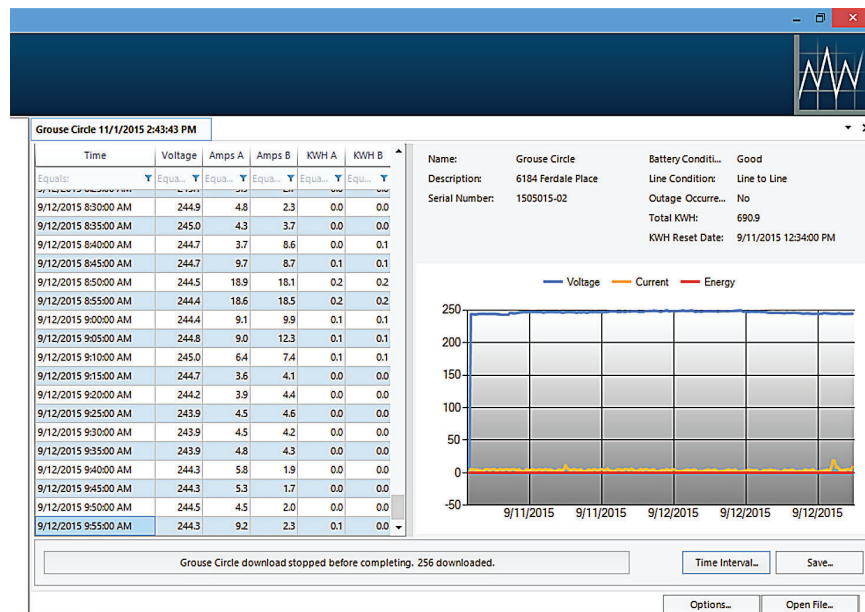


The user is able to view the Recorder's configuration, data, and progress as it is downloading in both a chart view and graph view.



The download can be stopped at any time by clicking the red button.

For best results, communicate to fewer than six units at a time.



Name: This is the 16 Character Name setup in the Configure screen

Description: This is the long description setup in the Configure screen

Serial Number: This is the unit's serial number, assigned by the factory

Battery Condition: The battery can report as GOOD or BAD.

Line Condition: This indicates how the unit was setup in the Configure screen, it can either report being setup as "Line to Line" or "Line to Neutral"

Outage Occurrence: This reports if there was an outage at any time during the Unit's deployment

Total KWH: Total KWH since the last Reset

KWH Reset: This is the start date of the Accumulated KWH

Options: Select this to change the user preferences and to synchronize the clock after installing a new battery

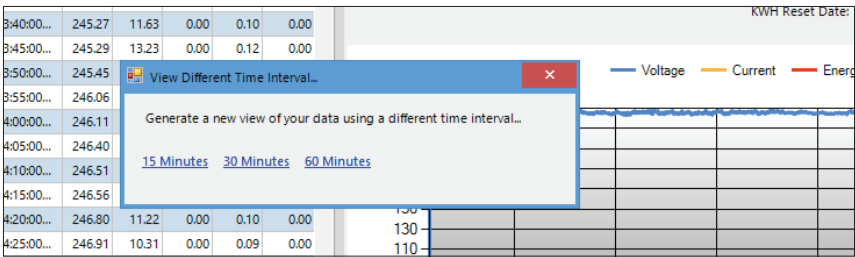
Open File: Select this option to open previously saved data files

Time interval: This option will re-calculate data for log intervals of 15, 30, or 60 minutes. See page 16 for more details.

Save: Select this option to save the file as a .csv file. Each tab of data will save to a unique .csv file.

Time Interval Options

Data from the line is logged every five minutes by the TMS unit. If the customer's meter data is on a different logging time cycle, Steelhead can re-calculate the line data to make direct comparison analysis easier. After the data is downloaded, select the new time interval, either 15, 30, or 60 minutes, and Steelhead will create a new tab with the selected time interval. Save the file for future review and comparison.



Options

Select the Options button on the download screen to change user preferences.



Radio instruments remembered:

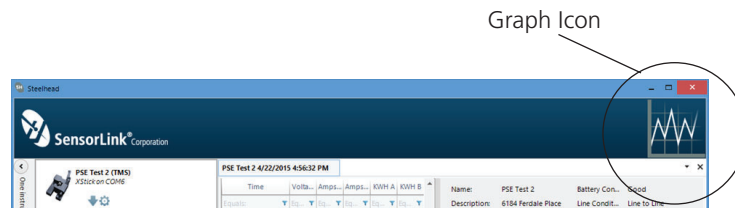
Steelhead Software remembers TMS units in previous download sessions. This memory allows faster recognition in future communications. Select "Reset to Default" for Steelhead to forget the radios.

Chart line thickness:

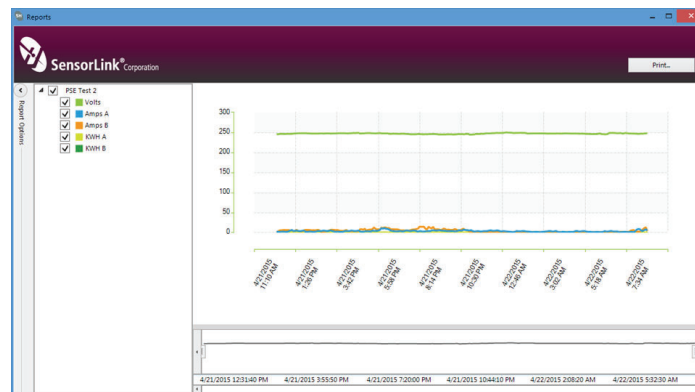
The thickness of the graph lines can be changed by the user. Thickness is numbered 1 - 10, and defaults at three. The software will show a preview to the user as the value is changed. Select "Apply" to update any Chart Line Thickness change.

Graphing

To graph the downloaded data, click the Graph Icon on the download screen.



A second screen will open and display the data in graphical format.



Report Options

Select the units and measurement parameters to graph by clicking in the selection boxes. Only selected measurement parameters will display on the graph. Selecting only one parameter at a time will show more resolution on the graph.

Hide and Show Report Options

Click the left arrow to hide Report Options. Click the right arrow to show the hidden Report options.

Zoom Window

The bottom graph displays the entire time series. To view a section of time, adjust the left and right sliders. The upper graph will display the values between the slides.

Cursor Tool

Placing the cursor over the graph will display the date and time values of the measurements.

Troubleshooting

The TMS unit is not communicating with the laptop

- 1) Verify the TMS unit is installed on a powered line.
- 2) Examine the USB radio connection to the laptop and reconnect if necessary.
- 5) Restart Steelhead by first exiting and then restarting.
- 6) Restart the computer and then re-open Steelhead.
- 7) Reset the TMS radio communications by forgetting the radio configurations in Steelhead by going to the Options menu and "Reset to Default" do forget the radio configurations. Restart Steelhead and connect.
- 8) Verify the USB radio is plugged directly into the laptop and not plugged into a docking station USB port. This will cause the program to hang up or have no communication to the USB.
- 9) Use the same USB port that was unlocked by IT for the USB radio. Using a different port will not work without security permissions from IT.
- 10) If this is a new installation, contact the network administrator for permission and instructions to complete.

Steelhead will not accept the license key

- 1) Verify the computer has online access.
- 2) Verify the email address is the same as what was given for the license key; they must match to validate.
- 3) The license key is valid for five installations on a single computer. Contact SensorLink for additional license keys if the software is needed on multiple laptops.
- 4) License keys are valid for 30 days on demo installs and 365 days for purchased units. Contact SensorLink for additional keys if yours has expired.
- 5) Steelhead verifies the license to the initial hardware ID of the computer at each startup. A new license key will be needed if the machine ID changed due to an update.

Contact your company IT Department if access is denied due to network security policy.

Contact SensorLink for new or additional license keys:

email: licensing@sensorlink.com

phone: +360 595 1000

SensorLink Corporation Warranty

SensorLink Corporation 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 Corporation agrees to repair or replace, at SensorLink Corporation'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 Corporation in such a manner as to injure, in SensorLink Corporation'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 Corporation.

This Warranty is in lieu of any other warranty, expressed or implied. SensorLink Corporation 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 TMS Single Phase Model 950

SensorLink Corporation 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 Model 950 was tested at the SensorLink Corporation High Voltage Laboratory, Ferndale, WA, USA to the appropriate standard and comply with the requirements of that standard.

Serial Number: _____

I hereby certify that the Model 950 TMS Unit 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.

Signature: _____

Date: _____



These products proudly made in the USA.

Form No: SALE-Manual Template TMS SINGLE-016 REV: V03

Date: 11/0219

Manual Stock Code No: M050-001-001

Information contained in this document is subject to change without notice. Product specification may change. Contact your SensorLink representative for the most current product information. © 2015 by SensorLink. All rights reserved.



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