OmniTrak™ Sound Level Meter (SLM)

Model 7591-09

User Manual

P/N 6017972, Revision A
April 2025

NOTICE

Read this manual before using the equipment.

Retain this manual for future use.

Start Seeing the Benefits of Registering Today!

Thank you for your TSI® instrument purchase. Occasionally, TSI® releases information on software updates, product enhancements and new products. By registering your instrument, TSI® will be able to send this important information to you.

http://register.tsi.com

As part of the registration process, you will be asked for your comments on TSI products and services. TSI's customer feedback program gives customers like you a way to tell us how we are doing.

Manual History

Revision	Date
A	April 2025

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Warranty

Part Number 6017972 / Revision A

Address TSI Incorporated / 500 Cardigan Road / Shoreview, MN 55126 / USA

Fax No. 651-490-3824

E-mail Address technical.services@tsi.com

Limitation of Warranty and Liability (effective May 2024)

(For country-specific terms and conditions outside of the USA, please visit www.tsi.com.)

Seller warrants the goods, excluding software, sold hereunder, under normal use and service as described in the operator's manual (version published at the time of sale), to be free from defects in workmanship and material for the longer period of either **12 months**, or **the length of time specified in the operator's manual/warranty statement provided with the goods or made available electronically (version published at the time of sale)**, from the date of shipment to the customer. This warranty period is inclusive of any statutory warranty. **This limited warranty is subject to the following exclusions and exceptions:**

a. Hot-wire or hot-film sensors used with research anemometers, and certain other components when indicated in specifications, are warranted for 90 days from the date of shipment;

b. Pumps are warranted for hours of operation as set forth in product or operator's manuals (versions published at the time of sale);

c. Parts repaired or replaced as a result of repair services are warranted to be free from defects in workmanship and material, under normal use, for 90 days from the date of shipment;

d. Seller does not provide any warranty on finished goods manufactured by others or on any fuses, batteries or other consumable materials. Only the original manufacturer's warranty applies;

e. This warranty does not cover calibration requirements, and Seller warrants only that the goods are properly calibrated at the time of its manufacture. Goods returned for calibration are not covered by this warranty;

f. This warranty is **VOID** if the goods are opened by anyone other than a factory authorized service center with the one exception where requirements set forth in the operator's manual (version published at the time of sale) allow an operator to replace consumables or perform recommended cleaning;

g. This warranty is **VOID** if the goods have been misused, neglected, subjected to accidental or intentional damage, or is not properly installed, maintained, or cleaned according to the requirements of the operator's manual (version published at the time of sale). Unless specifically authorized in a separate writing by Seller, Seller makes no warranty with respect to, and shall have no liability in connection with, goods which are incorporated into other products or equipment, or which are modified by any person other than Seller;

h. New parts or components purchased are warranted to be free from defects in workmanship and material, under normal use, for 90 days from the date of shipment.

The foregoing is **IN LIEU OF** all other warranties and is subject to the LIMITATIONS stated herein. **NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE OR MERCHANTABILITY IS MADE. WITH RESPECT TO SELLER'S BREACH OF THE IMPLIED WARRANTY AGAINST INFRINGEMENT, SAID WARRANTY IS LIMITED TO CLAIMS OF DIRECT INFRINGEMENT AND EXCLUDES CLAIMS OF CONTRIBUTORY OR INDUCED INFRINGEMENTS. BUYER'S EXCLUSIVE REMEDY SHALL BE THE RETURN OF THE PURCHASE PRICE DISCOUNTED FOR REASONABLE WEAR AND TEAR OR AT SELLER'S OPTION REPLACEMENT OF THE GOODS WITH NON-INFRINGING GOODS**.

TO THE EXTENT PERMITTED BY LAW, THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE LIMIT OF SELLER'S LIABILITY FOR ANY AND ALL LOSSES, INJURIES, OR DAMAGES CONCERNING THE GOODS (INCLUDING CLAIMS BASED ON CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) SHALL BE THE RETURN OF GOODS TO SELLER AND THE REFUND OF THE PURCHASE PRICE, OR, AT THE OPTION OF SELLER, THE REPAIR OR REPLACEMENT OF THE GOODS. IN THE CASE OF SOFTWARE, SELLER WILL REPAIR OR REPLACE DEFECTIVE SOFTWARE OR IF UNABLE TO DO SO, WILL REFUND THE PURCHASE PRICE OF THE SOFTWARE. IN NO EVENT SHALL SELLER BE LIABLE FOR LOST PROFITS, BUSINESS INTERRUPTION, OR ANY SPECIAL, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES. SELLER SHALL NOT BE RESPONSIBLE FOR INSTALLATION, DISMANTLING OR REINSTALLATION COSTS OR CHARGES.
No Action, regardless of form, may be brought against Seller more than 12 months after a cause of action has accrued. The goods returned under warranty to Seller's factory shall be at Buyer's risk of loss, and will be returned, if at all, at Seller’s risk of loss.

Buyer and all users are deemed to have accepted this LIMITATION OF WARRANTY AND LIABILITY, which contains the complete and exclusive limited warranty of Seller. This LIMITATION OF WARRANTY AND LIABILITY may not be amended, modified or its terms waived, except by writing signed by an Officer of Seller.

Service Policy

Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call TSI’s Customer Service department at 1-800-680-1220 (USA) or +001 (651) 490-2860 (International).

Trademarks

Warnings, Safety Markings, Best Practices and Compliance.

Safe Operation

WARNING

Repair and battery replacement must be done by authorized service personnel only.

The OmniTrak™ Sound Level Meter (*also referred to as SLM*) will not present a safety risk when you use it as instructed in this User Manual. However, it is possible that the environment where you use the instrument may present a safety risk. For this reason, always follow correct, safe working practices.

WARNING

Always be aware of the risks in the environment where you are working.

- The OmniTrak™ SLM is **NOT** intrinsically safe. **DO NOT** use it in an atmosphere where explosive vapors or dusts might exist.
- Wear approved hearing defenders when taking measurements in noisy environments.
- Wear approved protective PPE suitable for the environment where you are taking measurements.
- Always follow local safety regulations and be aware of risks in the area where you are working.

Handling

CAUTION

The OmniTrak™ SLM is a precision instrument. Always handle it with care. **DO NOT** drop the instrument or subject it to mechanical shock.

Positioning

CAUTION

To satisfy RF exposure requirements, this device and its antenna may be operated near a person's body and the extremities, but must be operated with a separation distance of at least 20 cm from all person's head.

Servicing and Troubleshooting

CAUTION

The OmniTrak™ SLM contains no user serviceable parts. If a fault is suspected, return the instrument to TSI® or a TSI® approved service center.

Battery Care

CAUTION

The OmniTrak™ SLM operates from batteries (or optional mains power). The OmniTrak™ SLM incorporates a battery as a power source that with proper care should give years of operational service (three years is typical).

- **DO NOT** attempt to replace the battery in this instrument.
- **DO NOT** abuse the battery in any way as the battery may rupture or catch fire.
- Use only batteries of the correct type, and **DO NOT** mix battery types in the instrument.
- **DO NOT** use a substitute or non-rechargeable battery in this instrument.
- **DO NOT** short-circuit, incinerate, dismantle or mutilate Lithium-ion batteries.
- **DO NOT** use any battery which shows signs of damage, such as bulging, swelling, a swollen plastic wrap, liquid in the plastic wrap, etc.
- **DO NOT** leave discharged batteries in the OmniTrak™ SLM.
- After use, charge the OmniTrak SLM prior to storage for a prolonged period. It is best not to store the OmniTrak SLM for any period of time in low battery condition. A prolonged period is considered to be two or more months. If the OmniTrak SLM is to be stored for an even longer period, it is best to take the OmniTrak SLM out of storage and recharge every two to three months.
- Remove all batteries from the OmniTrak SLM if you will not use the instrument for a very long time.
- If the OmniTrak SLM has not been used for a prolonged period or was stored in a low battery condition, charge the device before attempting to turn it on. If not using the OmniTrak SLM, it is best to keep it plugged into a power source.
- Always follow local regulations to dispose of used batteries.

Using Near Water

CAUTION

The OmniTrak™ SLM is not waterproof. **DO NOT** immerse the instrument in water or use it in the rain.

Using Near Heat

CAUTION

DO NOT exposure the OmniTrak™ SLM to high temperatures.

Audio Interference

CAUTION

Care should be taken that the operator does not unduly affect the sound field. Ideally the instrument should be mounted on a sturdy tripod with the microphone perpendicular to the source of the sound to be measured and the operator should be as far behind the instrument as possible. If the instrument is to be hand-held, then the arm of the operator should be stretched out as far as possible to minimize reflections from the operator's body.

Operating Staff Precautions

CAUTION

Follow these instructions to safely and securely operate the instrument. Failure to do so can result in injury and/or damage to the instrument.

Owner Responsibilities

CAUTION

The owner of the instrument must make sure that:

- The instrument is operated within its intended use.
- Operators follow all operational recommendations.
- Operators never attempt to service parts of the instrument. All system components are not user-serviceable.
- Operators fully understand and comply with the safety information in this manual, as well as with all applicable safety regulations, and occupational safety regulations.

Disposal

WEEE NOTICE

At the end of the instrument's life please **DO NOT** throw away with the unsorted municipal waste. Please recycle with a registered WEEE handler (e-waste recycler).

Service Information (US)

Should your TSI® equipment need to be returned for repair or for recalibration, please contact the service department at the following number or access the online form via tsi.com/service. For technical issues, please contact Technical Support.

Service Department and Technical Support	1-800-680-1220 (USA) or (651) 490-2860
E-mail	technical.services@tsi.com
Internet	www.tsi.com

Service Information (International)

Contact your local, factory-authorized distributor from whom the product was purchased. You can obtain the name and contact information of your local factory-authorized distributor from TSI® Incorporated by using the e-mail or telephone information listed above.

Disclaimer

DO NOT use the OmniTrak™ SLM until you have thoroughly familiarized yourself with this manual or have been instructed by a TSI® engineer.

At the time of writing, this manual was up to date but due to continual improvements the final operating procedures may differ slightly from those in the manual. If there are any questions, please contact TSI® for clarification.

TSI® makes continual advancements in its products and services. TSI® therefore reserves the right to make changes and improvements to any information contained within this manual.

While every care is taken to ensure that the information in this manual is correct, TSI assumes no responsibility for loss, damage or injury caused by any errors in, or omissions from, the information given.

Compliance

Contains FCC ID: 2A22JTSIBLE

Contains IC ID: 28101-TSIBLE

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

- **This device may not cause interference.**
- **This device must accept any interference, including interference that may cause undesired operation of the device.**

Per FCC 15.21: Changes or modifications not expressly approved by TSI will void the product warranty and may void the user's authority to operate the equipment.

To satisfy RF exposure requirements, this device and its antenna may be operated in a person hand or extremities, but must not be operated with a separation distance of at least 20 cm from all person's torso or head.

Avertissements, marques de sécurité, meilleures pratiques et conformité

Sécurité de fonctionnement

AVERTISSEMENT

La réparation et le remplacement de la batterie doivent être effectués par du personnel de service autorisé uniquement.

Le sonomètre OmniTrak™ ne présente aucun risque pour la sécurité lorsque vous l'utilisez conformément aux instructions de ce manuel d'utilisation. Cependant, il est possible que l'environnement dans lequel vous utilisez l'instrument présente un risque pour la sécurité. Pour cette raison, il faut toujours suivre des pratiques de travail correctes et sécuritaires.

AVERTISSEMENT

Soyez toujours conscient des risques dans l'environnement de travail.

- Le sonomètre OmniTrak™ n'est PAS intrinsèquement sûr. NE PAS l'utiliser dans une atmosphère où des vapeurs ou des poussières explosives pourraient exister.
- Porter des protège-oreilles approuvés lors de la prise de mesures dans des environnements bruyants.
- Portez un EPI de protection approuvé adapté à l'environnement dans lequel vous prenez des mesures.
- Respectez toujours les règles de sécurité locales et soyez conscient des risques dans la région où vous travaillez.

Traitement

ATTENTION

Le sonomètre OmniTrak™ est un instrument de précision. Manipulez-le toujours avec soin. Ne pas laisser tomber l'instrument ou le soumettre à un choc mécanique.

Positionnement

ATTENTION

Pour satisfaire aux exigences d'exposition aux radiofréquences, ce dispositif et son antenne peuvent être utilisés près du corps d'une personne et de ses extrémités, mais doivent être actionnés à une distance d'au moins 20 cm de la tête de toute personne.

Maintenance et dépannage

ATTENTION

Le sonomètre OmniTrak™ ne contient aucune pièce réparable par l'utilisateur. En cas de suspicion de panne, retourner l'instrument à TSI® ou à un centre de service agréé TSI®.

Entretien de la batterie

ATTENTION

Le sonomètre OmniTrak™ fonctionne à partir de batteries (ou d'une alimentation secteur en option). Le sonomètre OmniTrak™ incorpore une batterie comme source d'alimentation qui, avec un soin approprié, devrait offrir des années de service opérationnel (trois ans typiquement).

- **NE PAS** essayer de remplacer la batterie de cet instrument.
- **N'ABUSEZ PAS** de la batterie de quelque façon que ce soit car la batterie pourrait se rompre ou prendre feu.
- Utilisez uniquement des piles du type approprié et **NE MÉLANGEZ PAS** les types de piles dans l'instrument.
- **N'UTILISEZ PAS** de batterie de rechange ou non rechargeable dans cet instrument.
- **NE PAS** court-circuiter, incinérer, démanteler ou mutiler les piles au lithium ionique.
- **N'UTILISEZ PAS** de batterie qui montre des signes de dommages, comme un gonflement, une enveloppe en plastique gonflée, du liquide dans l'enveloppe en plastique, etc.
- **NE LAISSEZ PAS** de piles déchargées dans le sonomètre OmniTrak™.

(suite à la page suivante)

ATTENTION

- Après utilisation, chargez le sonomètre OmniTrak™ avant de le conserver pendant une période prolongée. Il est préférable de ne pas stocker le sonomètre OmniTrak™ pendant une période de temps dans un état de batterie faible. Une période prolongée est considérée comme étant de deux mois ou plus. Si le sonomètre OmniTrak™ doit être stocké pour une période encore plus longue, il est préférable de sortir le sonomètre OmniTrak du stockage et de le recharger tous les deux à trois mois.
- Retirez toutes les batteries du sonomètre OmniTrak si vous n'utiliserez pas l'instrument pendant très longtemps.
- Si le sonomètre OmniTrak n'a pas été utilisé pendant une période prolongée ou a été stocké dans un état de batterie faible, chargez l'appareil avant de tenter de l'allumer. Si vous n'utilisez pas le sonomètre OmniTrak, il est préférable de le maintenir branché sur une source d'alimentation.
- Respectez toujours les réglementations locales pour vous débarrasser des piles usées.

Utilisation près de l'eau

ATTENTION

Le sonomètre OmniTrak™ n'est pas étanche. **NE PAS** immerger l'instrument dans l'eau ou l'utiliser sous la pluie.

Utilisation de la chaleur proche

ATTENTION

NE PAS exposer le sonomètre OmniTrak™ à des températures élevées.

Interférence Audio

ATTENTION

Il convient de veiller à ce que l'opérateur n'affecte pas indûment le champ sonore. Idéalement, l'instrument devrait être monté sur un trépied robuste avec le microphone perpendiculaire à la source du son à mesurer et l'opérateur devrait être aussi loin derrière l'instrument que possible. Si l'instrument doit être tenu à la main, le bras de l'opérateur doit être étiré le plus possible pour minimiser les réflexions du corps de l'opérateur.

Précautions du personnel d'exploitation

ATTENTION

Suivez ces instructions pour utiliser l'instrument en toute sécurité. Sinon, cela peut entraîner des blessures ou d'endommager l'instrument.

Responsabilités du propriétaire

ATTENTION

Le propriétaire de l'instrument doit s'assurer que :

- L'instrument est utilisé conformément à son utilite prédestiné.
- Les opérateurs suivent toutes les recommandations opérationnelles.
- Les opérateurs n'essaient jamais d'entretenir des pièces de l'instrument. Tous les composants du système ne sont pas réparables par l'utilisateur.
- Les opérateurs comprennent parfaitement les informations de sécurité contenues dans ce manuel et s'y conforment, ainsi que toutes les réglementations de sécurité applicables et les réglementations de sécurité au travail.

Élimination

AVIS DEEE

À la fin de la vie de l'instrument, veuillez **NE PAS** jeter avec les déchets municipaux non triés. Veuillez recycler avec un gestionnaire de DEEE enregistré.

Conformité

Contient ID FCC : 2A22JTSIBLE23

Contient ID IC : 28101-TSIBLE23

Cet appareil est conforme à la partie 15 des Règles de la FCC. L'exploitation est soumise aux deux conditions suivantes :

- **Cet appareil ne peut pas provoquer d'interférences nuisibles.**
- **Cet appareil doit accepter toute interférence reçue, y compris les interférences susceptibles de provoquer un fonctionnement indésirable.**

Selon la norme FCC 15.21 : Les modifications non expressément approuvées par la TSI® annulent la garantie du produit et peuvent annuler l'autorisation de l'utilisateur d'utiliser l'équipement.

Pour satisfaire aux exigences d’exposition RF, cet appareil et son antenne peuvent être utilisés à proximité du corps et des extrémités d’une personne, mais doivent être utilisés avec une distance de séparation d’au moins 20 cm de la tête de toute personne.

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About this Manual

Intended Purpose

This document is intended for use by personnel to effectively operate and maintain the OmniTrak™ Sound Level Meter (SLM).

Conventions

This document uses the following conventions:

Convention	Meaning
For more information, see *This section*	A cross-reference to a related or more detailed topic.

Safety Notices

This document uses the following safety notice conventions:

WARNING

Indicates a hazardous situation which, if not avoided, could result in serious injury to personnel or damage to equipment.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury to personnel or damage to equipment.

NOTICE

Indicates an important situation which, if not avoided, may seriously impair operations.

TIP

Indicates additional useful information.

Avis de sécurité

Ce document utilise les conventions suivantes relatives aux avis de sécurité :

AVERTISSEMENT

Indique une situation dangereuse qui, si elle n'est pas évitée, pourrait entraîner des blessures graves au personnel ou des dommages à l'équipement.

ATTENTION

Indique une situation dangereuse qui, si elle n'est pas évitée, pourrait entraîner des blessures mineures ou modérées au personnel ou des dommages à l'équipement.

AVIS

Indique une situation importante qui, si elle n'est pas évitée, peut gravement compromettre les opérations.

POINTE

Indique des informations utiles supplémentaires.

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CHAPTER 1

Product Description

What is Sound Level Monitoring?

Measuring sound levels in the workplace is an important element of hearing conservation and noise reduction programs. Sound level monitoring allows you to record and then analyze sound data over a period of time to determine if noise reduction actions need to be put into place to comply with local regulations.

The benefits of carrying out workplace sound monitoring are:

- **Preserving hearing health:**
  Exposure to high sound levels is a common cause of hearing loss. Sound monitoring helps identify areas with potentially hazardous sound levels, enabling employers to implement control measures that protect employees' hearing.
- **Compliance to local regulations:**
  Monitoring sound levels ensures compliance with local regulations, helping employers avoid legal penalties and ensuring the health and safety of their workforce.
- **Employee well-being:**
  Excessive noise can lead to stress, reduced productivity, and decreased job satisfaction. Monitoring sound levels demonstrates a commitment to employee well-being, fostering a positive workplace culture.
- **Accident prevention:**
  High sound levels or intrusive noise can mask important sounds, increasing the risk of accidents. Effective monitoring allows for early identification of sound-related risks and facilitates preventive actions.
- **Risk identification:**
  Monitoring sound levels helps employers identify areas with excessive noise, enabling interventions and the effective allocation of resources.
- **Effective health and safety decision making:**
  Monitoring sound data assists in making informed decisions regarding engineering controls, Personal Protective Equipment, and noise reduction strategies.
- **Employee engagement:**
  Involving employees in sound-level monitoring cultivates a culture of safety awareness, encouraging active participation in noise control initiatives.

The OmniTrak™ Solution

With TSI®'s OmniTrak™ Sound Level Meter (SLM), you can assess and determine a worker's daily exposure to sound levels quickly and easily. The information recorded can be used to ensure compliance with regulatory bodies or to ensure if hearing conservation programs are needed. The solution consists of:

- A portable touch screen Smart Station which displays sound level data accurately and includes intuitive on-screen navigation allowing you to record studies, manage data, view historical data and display real-time measurements.
- A sound level meter module which can attach to the Smart Station to capture audio signals through a built-in microphone.

You can view sound levels in real-time, view previously recorded data (or studies) and download data directly from the device onto your computer or uploaded data to our TSI Link™ cloud platform to manage and view data remotely.

You also have access to the TSI Link™ Report Creator tool with automated custom templates in Microsoft® Excel® program for simplified data analysis and reporting.

Component	Description
1	Sound Level Meter module
2	Smart Station

Figure 1-1. OmniTrak™ Sound Level Meter Solution

Computer Requirements

You need to meet the following minimum computer requirements if you intend to download data onto your computer:

- Windows® 10 operating system or above
- One (1) available USB-C port or an internet connection

Hardware Components

This table below shows the components that make up the OmniTrak™ Sound Level Meter.

Table 1-1. Hardware Components

Item	Description	Item	Description
	**OmniTrak™ Smart Station** ▪ Quantity: 1		**Sound Level Meter module** ▪ Quantity: 1
	**Acoustic Calibrator** ▪ Quantity: 1		**USB Type C Cable** ▪ Quantity: 1

Connections

Connection ports for both the Smart Station and the Sound Level Meter module are on the underside of each component and are shown in the following sections.

OmniTrak™ Smart Station

The OmniTrak™ Smart Station has one USB-C port on its underside. This is used to connect to your computer to both download data and to charge the battery. Use the provided USB-C cable to make the connection.

Figure 1-2. Smart Station USB-C port

The OmniTrak™ SLM acts as a removable storage device when connected to your computer.

Once connected, your computer will automatically detect that the instrument is connected and within a few seconds will install the necessary drivers.

A **TSI-5** drive provides access to the files on the instrument. You can copy any file to your computer as required. Each study is stored in the **Documents | TSI OmniTrak** folder as a CSV file. This format will automatically open with Microsoft® Excel® or similar spreadsheet applications.

The file names inherit the study names from the Smart Station.

Sound Level Meter Module

The OmniTrak™ Sound Level Meter (SLM) module has connection ports shown in Figure 1-3. The table underneath describes their use.

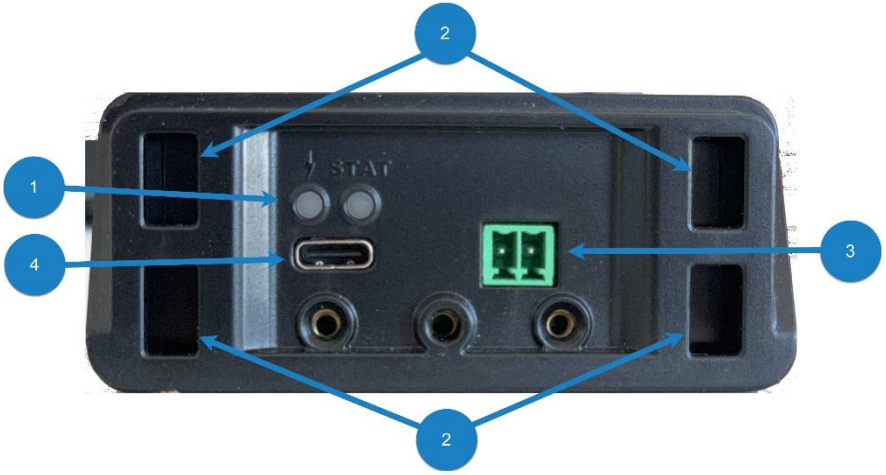

Figure 1-3. SLM Module Connection Ports

Part	Description
1	Battery charging indicators
2	Latch points for physical connection to the Smart Station
3	Port used to connect diagnostics and programming equipment
4	USB-C port used to charge the module

Smart Station Display and Navigation Controls

The OmniTrak™ SLM Smart Station user interface uses touch screen technology. You need to tap the display options to select them. The only physical button is the power on/off button.

Press the power button on the right side of the Smart Station to turn on the device. When the instrument has completed the boot up process, the OmniTrak™ home screen is displayed.

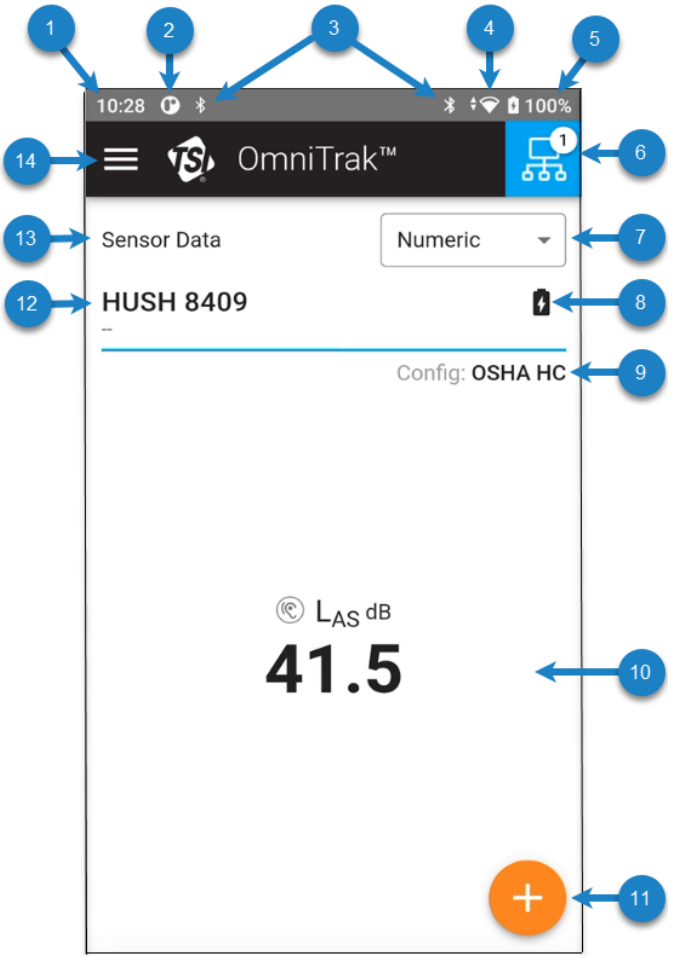

Figure 1-4. Smart Station Home Screen

Item	Type	Description	More information
1	Indicator	Time provided by the network or set by the operator.	*Adjusting the Date and Time*
2	Indicator	A USB-C connection to a computer is present. This is not displayed if the USB-C port is not connected to the USB-C port of your computer.	
3	Indicator	Bluetooth® icon . This is the connection method used between the Smart Station and the SLM module.	
4	Indicator	Wi-Fi® is enabled . This is not displayed if a Wi-Fi® network is not present or disabled. **NOTICE** This is replaced by the standard airplane mode icon if airplane mode is enabled.	*Connecting the Smart Station to a Wi-Fi® network*
5	Indicator	Battery level of the Smart Station, shown graphically and as a percentage.	*Charging the Smart Station*
6	Indicator/ Button	Computer mesh button indicating if a SLM module is paired to the Smart Station and providing access to further functions for those sensors.	*Sensors Window Options*
7	Drop-down	Menu to toggle between displaying data numerically or as a graph.	*Numeric/Graphical Display Drop-Down*
8	Indicator	Battery level indicators for the SLM module paired to the Smart Station.	*Charging the Sound Level Meter Module*
9	Indicator	The configuration set for the current recording.	*How to Create a Study*
10	Indicator	Data display window. All selected measurement parameters for the module paired to the Smart Station are displayed here.	*Viewing and Capturing Data*
11	Button	Study start button . Used to begin recording a study.	*How to Create a Study*
12	Indicator	Name of the sensor paired with the Smart Station.	*Pairing the SLM Module to the Smart Station*
13	Indicator	Title of the current window.	
14	Menu	Navigation drawer icon used to display top-level menu items.	*Navigation Drawer Menu Items*

Navigation Drawer Menu Items

The navigation drawer icon () is used to access the following items:

Table 1-2. Navigation Drawer Menu Items

Item	Description
Sensor Data	Used to display live data being directly sent from the module in the data display window.
Study Manager	Used to access previously recorded study files. You can search for a study by name or display files by ascending or descending study name or age. Three vertical dots ⋮ to the right of each study name provides access to a number of functions you can perform on the study file. *For more information, see Study Manager Window.*
Settings	Allows you to configure your OmniTrak™ SLM setup. *For more information, see Settings Window.*
About	Reveals the following list of instrument parameters: ■ Name ■ Model Number ■ Serial Number ■ Software Version ■ Boot Control Version It will also tell you if a software update is available. To update your software version, see *Updating the Smart* Station Software. You can also choose to view the TSI® Terms and Conditions and software release notes.
Profile	Displays the following profile parameters which you can edit: ■ Name ■ Email address ■ Telephone number ■ Address If you are not logged in to your TSI Link™ account, you will see a prompt to enter your TSI Link™ credentials to access these details. For more information, see ***Error! Reference source not found.***.

Study Manager Window

The Study Manager window is used to access previously recorded study files. These are listed vertically.

The following attributes are displayed:

- The name of the study
- The date and time the study was recorded
- The duration of the study

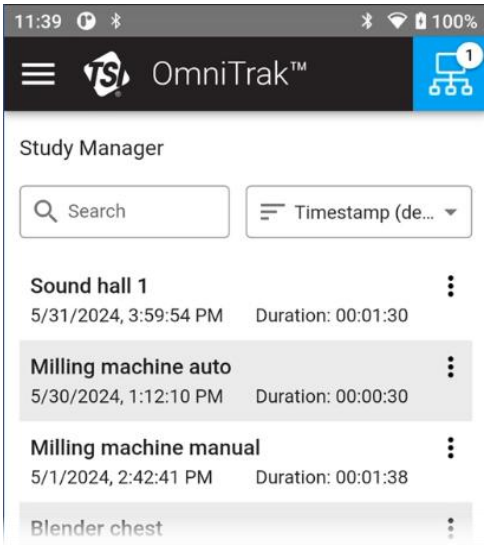

Figure 1-5. Study Manager Window

The ellipsis icon ⋮ to the right of each study name provide access to a number of functions you can perform on the study file. These are:

View	View the study results as a summary, graph or in detail.
Edit	Change the name and/or location of the study and add some study notes if needed.
Upload to TSI Link	Allows you to upload a study to a TSI Link™ account.
Create CSV File	Saves the report as a .csv file to use with the TSI Link™ Report Creator software.
Delete	Removes the study file from the database.

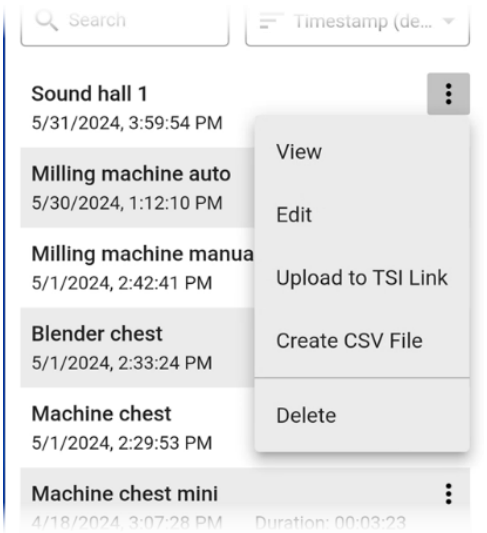

Figure 1-6. Study File Functions

You can search for a study by name, list files by ascending or descending study name or age using the following selections:

Study Name (asc.)	Sorts alphabetically (A-Z)
Study Name (desc.)	Sorts alphabetically (Z-A)
Timestamp (asc.)	Sorts by age (earliest to latest)
Timestamp (desc.)	Sorts by age (latest to earliest)

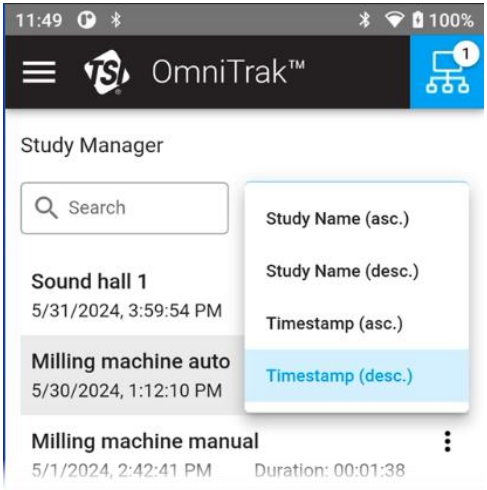

Figure 1-7. Study file search and sort

Settings Window

The Settings window displays buttons used to configure your OmniTrak™ Sound Level Meter setup.

Figure 1-8. Settings Window

You can configure the following parameters:

Table 1-3. Settings Window Configurable Items

Item	Description
Date and time	Set the following: ■ Network provided time, GPS-provided time, or a custom time. ■ Time zone. ■ Time format (12- or 24-hour).
Wi-Fi® connectivity	Do the following: ■ Select an available Wi-Fi® network to connect to. ■ Enter Airplane mode.
Units of measurement	This is not applicable for sound level monitoring as the unit of measurement is decibels only.
Sound level measurement parameters	Configure your sound level parameters either using a pre-configured standard or creating your own customized set.

You can also reset the settings to the factory values by pressing the **FACTORY RESET** button.

Sensors Window Options

The blue computer mesh icon shows if a module is paired with the Smart Station. Touching this reveals the **Sensors** window displaying the module paired with the Smart Station.

NOTICE
■ You can pair only one module at any given time. ■ The computer mesh icon is disabled if a study recording is in progress.

Displayed next to each module name is:

- An indication of the battery level for that module.
- A symbol indicating if the Smart Station is connected to that module.

  Indicates the module is connected.

  Indicates the module is not in range or is powered off.

- The ellipsis icon allows access to the following options:

Module Error Log	Displays a historical list of errors logged for that module.
Information	Displays useful information about:

	▪ The Smart Station (model, serial number, firmware version and battery level). **NOTICE** You can edit the name by touching the pencil icon  . ▪ The module [serial number, user calibration date and time and user calibrated result (pass or fail))].
Calibrate	Used to access the calibration process.
Disconnect	Used to break the connection between the Smart Station and the module.

Numeric/Graphical Display Drop-Down

The **Numeric** / **Graph** drop-down allows you to switch between the default numeric display and a graphical display. When the data is being displayed graphically, you can turn the instrument sideways to enable a landscape view.

In the graphical display mode, you can choose which measurement parameter to display by selecting it from the ellipsis icon.

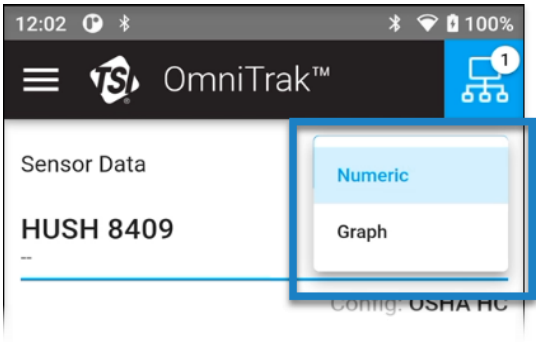

Figure 1-9. Numeric / Graphical Display Toggle

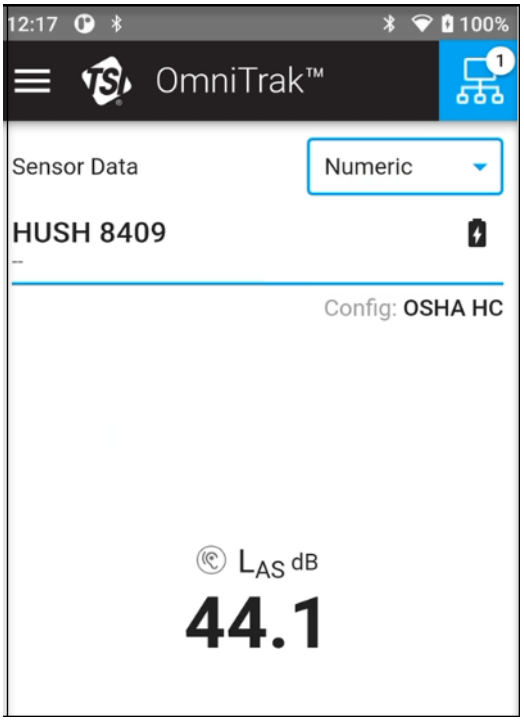

Figure 1-10. Numeric Display

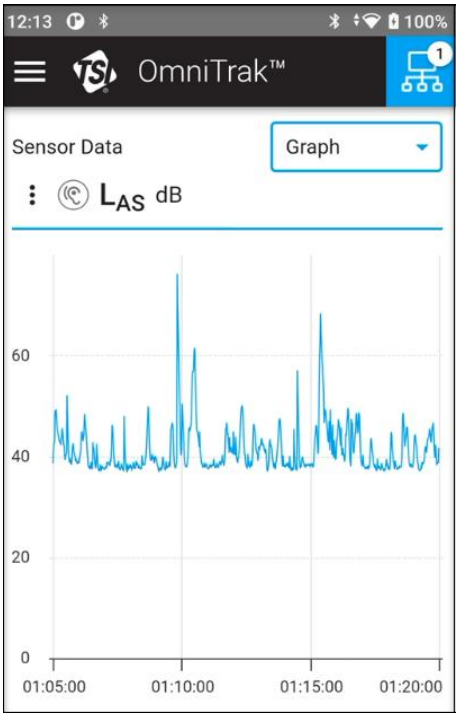

Figure 1-11. Graphical Display

SLM Module Display

On the front of the Sound Level Meter module there is an LED indicator on the bottom left (**1**). This indicates various connection and battery states as described in the table.

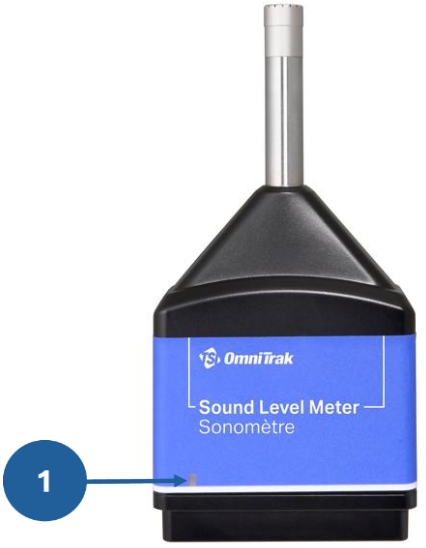

Figure 1-12. SLM Module Display

Table 1-4. SLM Module LED Indicator Meanings

LED status	Meaning
Red flashing	Battery level is at 10% or less.
Yellow flashing	Battery level is at 25% or less.
Green flashing (slow)	Module is connected to a Smart Station and the battery level is at 26% or more.
Blue flashing (fast)	Module is not connected to a Smart Station and can be paired to one.
Green/yellow/red solid in quick succession	Module is being powered down.

CHAPTER 2

Getting Started

This chapter guides you through the steps to take before you begin to record your studies.

Unpacking the Smart Station and Accessories

1. Open the box in which your Smart Station was delivered.
2. Remove the Smart Station unit.
3. Remove the product information sheet, USB-C cable, registration card and service information card.

TIP

Make sure to check you have all the items as indicated in the steps above removed from the box before disposing of the box.

Figure 2-1. Unpacking the Smart Station

Unpacking the Sound Level Meter Module and Accessories

1. Open the box in which your Sound Level Meter (SLM) module was delivered.
2. Remove the SLM module.
3. Remove the inner white cardboard to access the product information sheet, USB-C cable, registration card and service information card.

TIP

Make sure to check you have all the items as indicated in the steps above removed from the box before disposing of the box.

Figure 2-2. Unpacking the SLM Module

Charging the Smart Station

1. Insert one end of the provided USB-C cable into the USB-C port on the underside of the Smart Station.

Figure 2-3. Smart Station USB-C Port Location

2. Insert the other end of the USB-C cable to a suitable USB-C charging port, for example your computer.

NOTICE
An ideal power source is 5 VDC, 2 Amp, 10 Watt. The Smart Station can be charged in either on or off states.

The battery level is indicated on the front screen.

TIP
TSI® recommends changing the Smart Station if the battery level is at 15% or less.

Charging the Sound Level Meter Module

1. Insert one end of the provided USB-C cable into the USB-C port on the underside of the SLM.

Figure 2-4. SLM Module USB-C Port Location

2. Insert the other end of the USB-C cable to a suitable USB-C charging port, for example your computer.

NOTICE
An ideal power source is 5 VDC, 2 Amp, 10 Watt. The SLM can be charged in either on or off states.

The LEDs on the bottom of the SLM adjacent the USB-C port show different charging states.

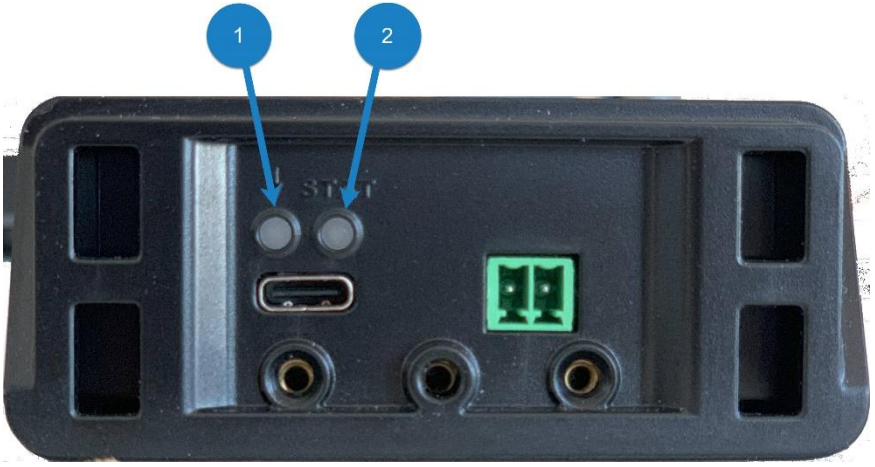

Figure 2-5. SLM Module Charging Indicators

LED	States
1	Green flashing: battery is charging. Green solid: battery is fully charged.
2	Yellow solid: power is connected.

TIP

TSI® recommends charging the SLM if the battery level is at 15% or less. This is indicated by a red flashing LED on the front of the module.

NOTICE

This LED flashes yellow when the battery level is at 25% or less and red when the battery level is at 10% or less.

You can check the battery level for the SLM module from the **Module Information** window.

For more information, see *Sensors Window Options*.

Powering Up the Smart Station

On the right side of the Smart Station, press and hold the button for approximately 2 to 3 seconds.

The TSI® logo on a white background is displayed. This is the boot screen. When the instrument has completed the boot up process, the OmniTrak™ home screen is displayed (see Figure 1-4).

Figure 2-6. Smart Station Power On/Off Button

Powering Down the Smart Station

To power down the smart station:

1. On the right side of the Smart Station, press and hold the button for approximately 2-3 seconds (for its location, see Figure 2-3).

   You are given the option to either power off or restart.

2. Touch **Power off**.

   The Smart Station powers down.

TIP

To go back to the previous screen, press the power button again to go into hibernation mode (blank screen) and press the power button again to exit hibernation mode.

Powering up the Sound Level Meter Module

On the left side of the SLM module, press and hold the button for 2 seconds.

Figure 2-7. SLM Module Connection Indicator

The LED on the front of the Sound Level Meter module flashes blue (approximately twice every second). This indicates that Bluetooth® is on, and the module is ready to be paired with a Smart Station.

NOTICE

All modules are shipped in “Sleep Mode” to protect the battery during shipment and storage. It will not be possible to power on the module using the side button until “Sleep Mode” is disabled. To disable, plug the module into a power source and charge the module for a few minutes (for more information, see *Charging the Sound Level Meter Module*). This process is required only once. Going forward the module can be powered on using the above step.

Powering Down the Sound Level Meter Module

On the left side of the Smart Station, press and hold the button (see Figure 2-6) for approximately 5 seconds.

The LED on the front of the Sound Level Meter module flashes green, yellow and red in quick succession. When no light appears at all, the module is powered down.

Attaching and Detaching the SLM Module to the Smart Station

To attach the SLM module to the Smart Station:

1. Make sure the LED indicator on the SLM module is facing the same side as the Smart Station touch screen.
2. Line up the latch openings on the underside of the SLM module to the latches on the top of the Smart Station.
3. Gently push the two devices together until the latches click into place.

Figure 2-8. Attaching the SLM Module to the Smart Station

NOTICE

You **DO NOT** have to attach the SLM module to the Smart Station to take measurements, however, the two devices have to be within range of each other to communicate. The maximum range is 100 m (328 ft) but this is dependent on many variables (for example, wireless traffic and metal) and cannot be guaranteed.

To detach the SLM module from the Smart Station:

1. Support the Smart Station in one hand and the SLM module in the other.
2. Gently push the two button latch releases on either side of the Smart Station (near the top).

   The SLM detaches from the Smart Station.

Figure 2-9. Smart Station latch releases

Pairing the SLM Module to the Smart Station

NOTICE
The Smart Station can have up to 10 modules connected in total, up to 3 of which can be the SLM module.

To pair an SLM module to the Smart Station:

1. Make sure that both the Smart Station and SLM module are powered up and no more than 2 m (6 ft) apart **for the initial pairing.**
2. In the Smart Station home screen, touch the blue computer mesh button . A list of available sensors to pair with are displayed. If none are displayed, touch **REFRESH**.
3. In the display window, touch the name of the module you want to pair with. When paired, a green check mark and module battery icon appears.

NOTICE
This may take a few seconds to appear.

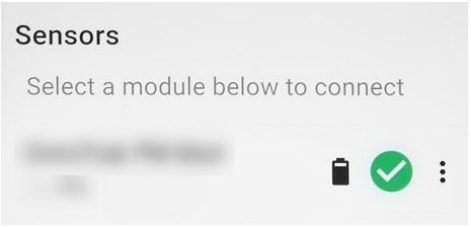

Figure 2-10. Successful module pairing

4. The LED on the front of the SLM module changes from flashing blue to flashing green (once every 5 seconds).

NOTICE
You are asked if you would like to calibrate the module you have just paired to. To do so, touch **CALIBRATE** (for more information see *Calibrate your OmniTrak™ Sound Level Meter*). Otherwise, touch **SKIP**.

5. When finished, touch **DONE**.

TIP
The modules you have paired with the Smart Station is represented in the computer mesh button with the numeric “1”. Touching the icon gives access to the Sensors window displaying a list of sensors you have paired and access to further functions.

NOTICE
▪ It is not possible to connect the same module to two or more Smart Stations at the same time. ▪ If a module goes out of range for at least 15 minutes, it will power itself down to save battery life.

Connecting the Smart Station to a Wi-Fi® Network

To connect the Smart Station to a Wi-Fi® network:

1. Touch the navigation drawer icon to display the top-level menu items.
2. From the drop-down list, touch **Settings**.
3. Touch **WI-FI**. The **Internet Connectivity** window is displayed.

NOTICE
By default, Wi-Fi® is off.

4. Touch the slider icon to enable Wi-Fi®. A list of available Wi-Fi® networks is displayed.
5. Touch the name of the Wi-Fi® network you want to connect to and, if requested, enter any network credentials.
6. Touch **CONNECT**. When connected, the Wi-Fi® connected icon is displayed in the top right corner of the screen.

7. Touch **DONE**.

NOTICE
You can access further Wi-Fi® settings by touching **SEE MORE**.

Adjusting the Date and Time

Setting the appropriate date and time is important in order to record the correct timestamps for your studies. By default, the Smart Station time automatically updates the date and time when the device is connected to Wi-Fi®, but that can be changed to one that suits you (for example, setting a different time zone).

To manually adjust the date and time settings:

1. Touch the navigation drawer icon to display the top-level menu items.
2. From the drop-down list, touch **Settings**.
3. Touch **DATE & TIME**. The **Date & time** window is displayed.
4. Touch **Use network-provided time**.
5. Touch **Off**. You can now manually adjust the date and time.
6. Touch **Set date** to manually adjust the date. Touch **Set time** to manually adjust the time.

NOTICE
▪ By default, the time zone is GMT +00:00. To adjust the time zone to your local time zone, touch **Select time zone**, touch **Region**, then select the time zone you want from the list. ▪ You can also change between a 12- and a 24-hour time format by setting the **Use 24-hour format** slider off for 12-hour and on for 24-hour. To use the local format, turn the **Use locale format** slider to on. This disables the **Use 24-hour format** slider.

Setting the Noise Configuration

The OmniTrak™ Sound Level Meter is capable of measuring, recording and storing a wide range of sound level parameters.

You can choose from a selection of industry standards, or customize your own. The standards available are:

- OSHA HC
- OSHA PEL
- ACGIH
- DOD
- ISO

Each standard uses a different set of sound pressure level parameters. See *Appendix C. Noise Parameter Definitions* for a list of the definitions of these parameters.

To set your noise configuration:

1. On the Smart Station, touch the navigation drawer icon  to display the top-level menu items.
2. From the drop-down list, touch **Settings**.
3. Touch **NOISE CONFIG**. The **Noise Configuration** window is displayed.
4. Do one of the following:
   a. From the **Configuration** drop-down menu, select an industry standard configuration or custom one.
   b. Touch **CREATE CUSTOM SET** to create your own.

To create your own, do the following:

1. In the **Create Custom Set** window, touch inside the **Name** field and type the name of your configuration.
2. In the **Measurement Parameters** section of the window, touch the checkboxes adjacent to the parameters you want to include in your configuration.
3. Touch **SAVE**.

You can also use an existing configuration as a starting point for your own. To do this:

1. From the **Configuration** drop-down menu, select an industry standard configuration or an already defined custom one.
2. Touch **USE AS TEMPLATE**.
3. In the **Create Custom Set** window, touch inside the **Name** field and type the name of your configuration.

4. In the **Measurement Parameters** section of the window, touch the checkboxes adjacent the parameters you want to include in your configuration.
5. Touch **SAVE**.

NOTICE

- If any required parameter values have been omitted, you are asked to add them.
- You can edit any of the custom configurations, but you are not allowed to edit the pre-defined industry standard configurations.
- You can edit or delete any existing customized noise configurations.

  For more information, see *Editing or Deleting Customized Noise Configurations*.

Checking Live Measurements are Present

After you have completed the steps associated with pairing a module to your Smart Station, you should see live data coming from the module displayed in the data display window.

To check this, make sure the Smart Station and SLM module(s) are powered up and go to the **Sensor Data** window (navigation drawer icon ☰ > **Sensor Data**). Check if measurements are being received.

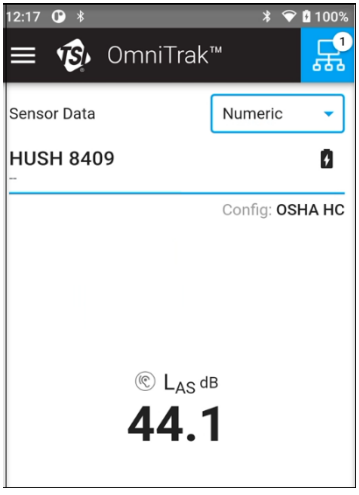

Figure 2-11. Live Measurement (numeric display)

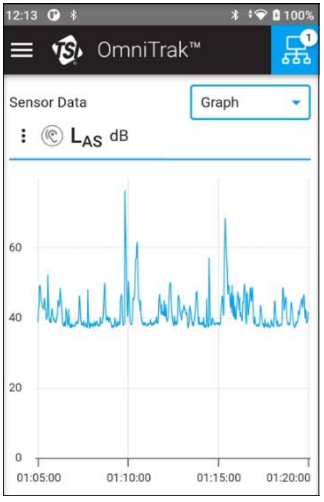

Figure 2-12. Live Measurements (graphical display portrait)

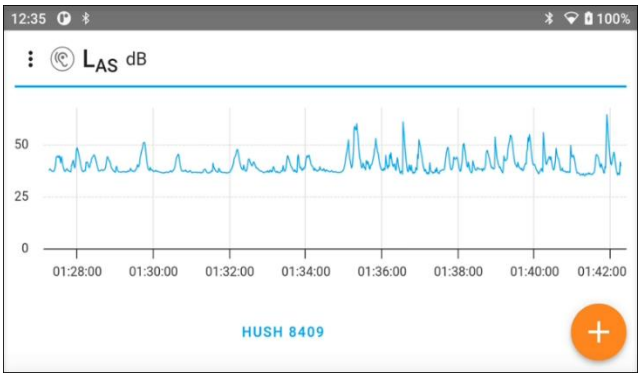

Figure 2-13. Live Measurements (graphical display landscape)

Installing and Enabling the TSI Link™ Report Creator Add-in

The TSI Link™ Report Creator lets you access Microsoft® Excel® templates for your study, including graphs and smart visualizations, and saves time by simplifying data analysis and reporting.

The TSI Link™ Standard Connected subscription supports data transfer via cloud to the OmniTrak™ Smart Station as well as CSV file uploads from different TSI® devices.

After initial purchase, the subscription lasts for 2 years and will auto-renew for one (1) year at the end of the period.

There are four steps needed to access and upload studies to your TSI Link™ account:

1. Create and access a TSI Link™ account.
2. Upload a study file to the account.
3. Install a TSI Link™ Report Creator add-in.
4. Log in to your TSI Link™ account.

To create and access a TSI Link™ account:

1. Create a TSI link™ account.
2. On your OmniTrak™ Smart Station, touch the navigation drawer icon to display the top-level menu items.
3. From the drop-down list, touch **Profile**. You are prompted to enter your credentials.

NOTICE
You will need a Wi-Fi® network connection to log into your account. For more information, see *Connecting the Smart Station to a Wi-Fi® Network*. If you select Profile without a Wi-Fi® network connection, you are prompted to enable one.

4. Enter your credentials to link to your TSI Link™ account. You are now ready to upload files to your TSI Link™ account.

To upload files to your TSI Link™ account:

1. Touch the navigation drawer icon ☰ to display the top-level menu items.
2. From the drop-down list, touch **Study Manager**. A list of previously recorded study files are displayed.
3. Touch the ellipsis menu ⋮ to the right of a study name, and touch **Upload to TSI Link**. You can now install the TSI Link™ Report Creator add-in.

To install the TSI Link™ Report Creator add-in:

1. On your computer, open Microsoft® Excel® spreadsheet program.
2. Select **Insert > Get Add-Ins** (or use the search facility for “Add-In”).
3. Select **STORE** from the **Office Add-ins** window and, in the search field, type TSILINK.

   TSI Link™ Report Creator is displayed in the results list.
4. Select **Add** and select **Continue** in the pop-up window.

   The TSI® Report Creator icon appears on your home ribbon. To use this, you need to be logged on to your account.

To log on to your TSI Link™ account:

1. In Microsoft® Excel® spreadsheet program, select the TSI® Report Creator icon.

   The TSI Link™ task pane is displayed.

2. Select **GET STARTED**.

   You are prompted to enter your account credentials.

3. Enter your credentials and select **LOGIN**.

   The TSI Link™ workbook creator is displayed and you are now ready to create workbooks for recording and analysis.

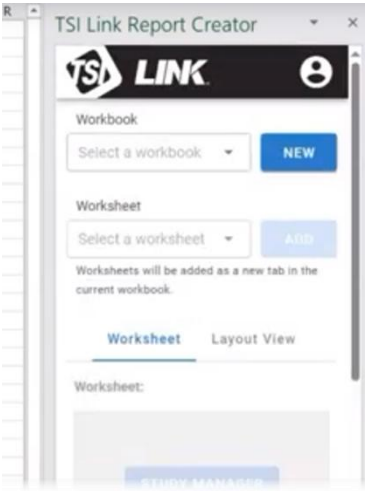

Figure 2-14. TSI Link™ Report Creator

To log out of your TSI Link™ account:

In Microsoft® Excel® program, select the profile icon and select **Logout**.

You are logged out of your TSI Link™ account.

Figure 2-15. TSI Link™ Account Logout

CHAPTER 3

Operations

Onboarding Checks on First Use

When you use the OmniTrak™ Sound Level Meter for the first time, you will need to complete a series of “onboarding” steps to set up parameters for future use. *Chapter 2. Getting Started* describes how to do these.

Check that the following has been set up:

Date and time ✔	See *Adjusting the Date and Time*.
Wi-Fi® connection ✔	See *Connecting the Smart Station to a Wi-Fi® Network*.
Noise configuration ✔	See *Setting the Noise Configuration*.

If you need to perform any of these setup functions, see the relevant sections for instructions.

Positioning the Sound Level Meter

TIP

Care should be taken that you **DO NOT** unduly affect the sound field. If possible, detach the Sound Level Meter (SLM) from the Smart Station and isolate the SLM as close to the sound source as possible. The Smart Station can remain in range of the SLM for up to 100 m (328 ft) but this is dependent on many variables (for example, wireless traffic and metal) and cannot be guaranteed.

Mount the Sound Level Meter on a sturdy surface with the microphone perpendicular to the source of the sound to be measured. You should be as far behind the instrument as possible. If the instrument is to be hand-held, then the instrument should be held out as far as possible to minimize reflections from your body.

Checking Battery Power

Typically, the battery life of the OmniTrak™ Sound Level Meter components are listed in Table 3-1.

Table 3-1. Battery Life of Components

Component	Battery life
Smart Station	Up to 14 hours (with the display brightness at 100%)
Sound Level Meter module	Up to 12 hours

See *Appendix A. Specifications** for more information.

If not connected to power, make sure you have enough battery life in both the Smart Station and Sound Level Meter to complete your study.

NOTICE
For more information about battery care best practices, see *Battery Care*.

The battery level of the Smart Station is indicated in the top-right corner of the main screen.

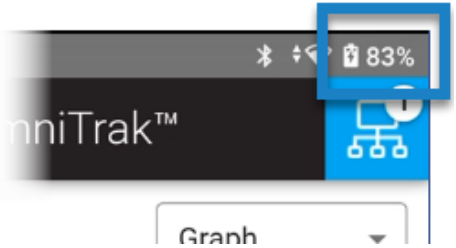

Figure 3-1. Smart Station Battery Status

If the battery level of the Smart Station is below 10% you should charge it. For more information, see *Charging the Smart Station*.

To check the battery level of an SLM:

1. In the Smart Station home screen, touch the blue computer mesh button . A list of sensors within range of the Smart Station is displayed.
2. Touch the ellipsis menu ⋮ to the right of a sensor name, and touch **Information**. The battery levels for the sensor you are paired with is displayed.

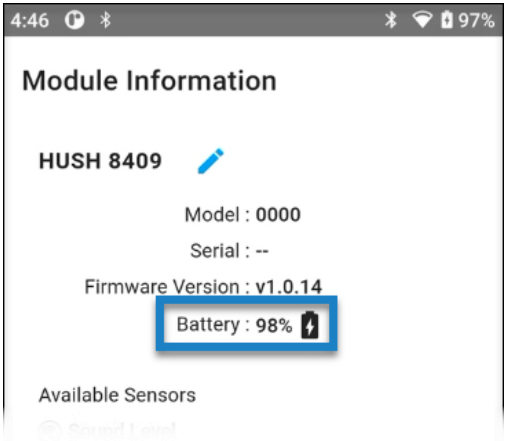

Figure 3-2. SLM Module Battery Status

If the battery level of the SLM Module is below 10%, you should charge it.

For more information, see *Charging the Sound Level Meter Module*.

NOTICE
The LED on the front of the SLM will flash yellow when the battery level is at 25% or less, and flash red when it is at or below 10%.

Viewing and Capturing Data

With the OmniTrak™ Sound Level Meter, you can see levels of sound data being sent from the module to the Smart Station on screen. You can view this either as a numerical value, or as a graphical chart display over a period of time.

You can choose to capture that data over a period of time (referred to as a study) and store the sound data in a file which can be further analyzed. Although the data can always be viewed on the screen, it is only saved when a study is being recorded. The duration of the study is defined by you depending on the nature of your study. For example, if noise levels are constant, the study can be short just to capture the sound levels being generated, or if the sound levels fluctuate over a long period of time, the study may need to run until all possible sound levels have been generated.

Viewing Real-Time Data

You can view live data either numerically or graphically.

To view real-time data:

1. Touch the navigation drawer icon to display the top-level menu items.
2. From the drop-down list, touch **Sensor Data**.

   Live data is displayed in the data display window.

Switching Between Numeric and Graphical Views

1. From the display type drop-down menu, select **Graph** to display the live data graphically.
2. From the display type drop-down menu, select **Numeric** to display the live data numerically.

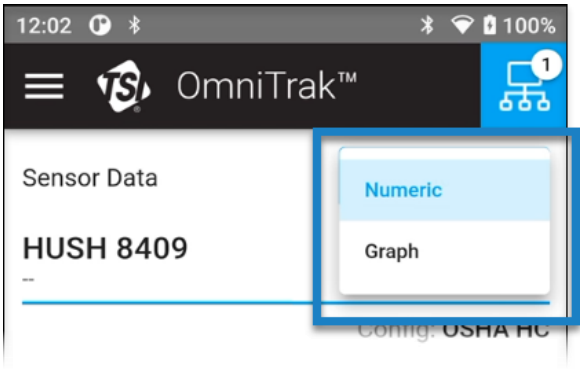

Figure 3-3. Numeric / Graph Toggle Drop-Down

TIP

When viewing data graphically, you can turn the instrument into a landscape position to enable a landscape view (see Figure 2-13).

NOTICE

The data shown graphically is over a period of time starting from when the module was paired and ending when the module is disconnected. The graphical data will only be logged when a study is being recorded.

How to Create a Study

Figure 3-4 shows the process you follow to successfully record a study.

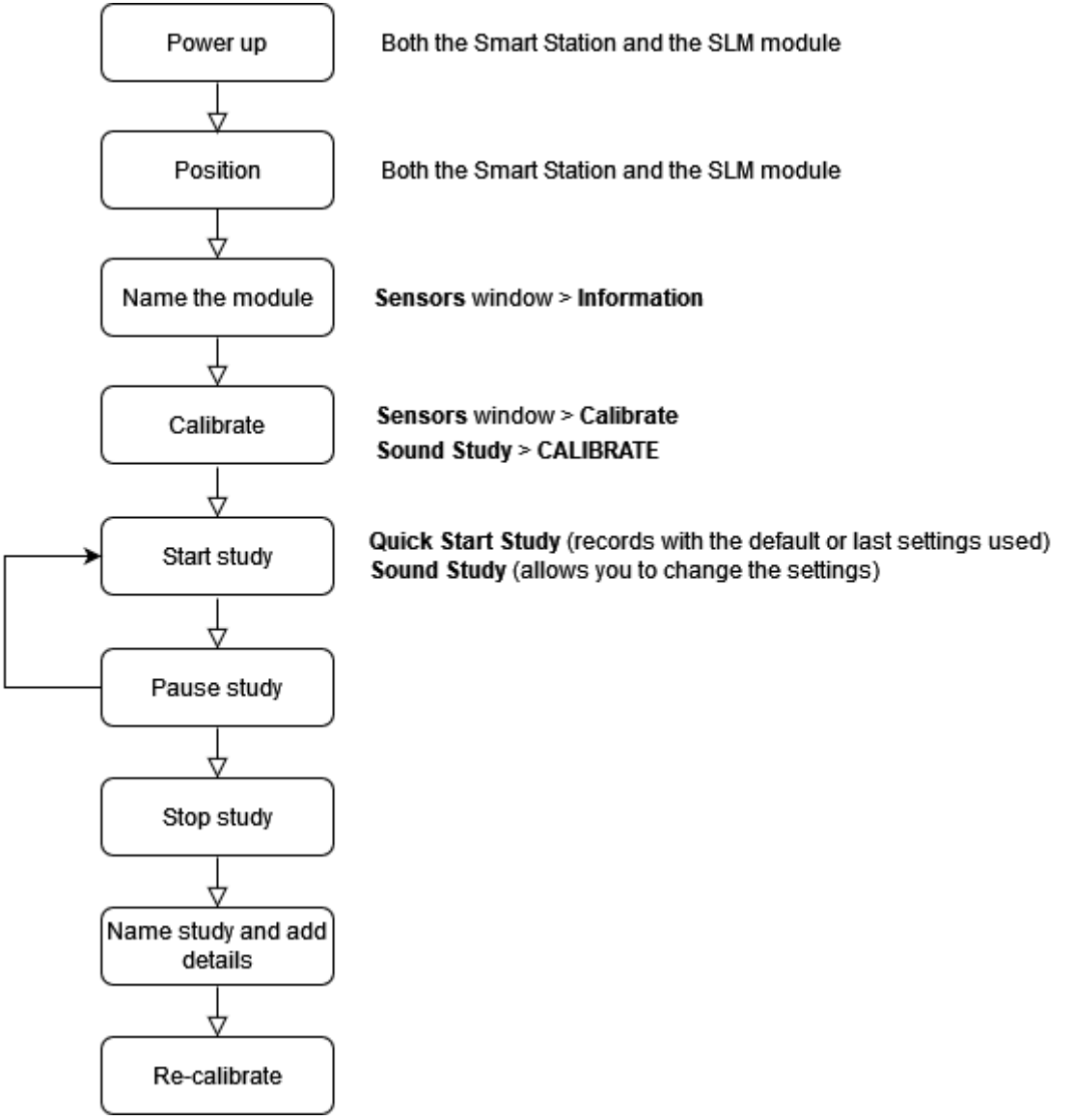

Figure 3-4. Study Creation Process

There are two options to start recording your study:

- **Quick Start Study**
  Starts a recording immediately using the default configuration or the configuration used on the last recording. This study will include all modules (up to 3 SLM modules plus other modules) paired with the Smart Station.
- **Sound Study**
  Allows you to modify the configuration and calibrate before the recording starts. This study will only include Sound Level Meter modules even if other modules are paired with the Smart Station.

Calibrate your OmniTrak™ Sound Level Meter

To make sure you achieve highly accurate measurements, TSI® recommends you calibrate your OmniTrak™ Sound Level Meter before and after you run your study or studies. By doing this, you will minimize any significant drift and achieve accurate measurements over a longer period of use.

NOTICE
The option to calibrate is only enabled once the acoustic calibrator is switched on and fitted to the SLM module microphone.

To Perform an Automatic Calibration:

Button	Description
1	Power on / off
2	Output level

Figure 3-5. Calibrator

1. On the underside of the calibrator (Figure 3-5), press the power button ⏻ to power up the acoustic calibrator.

The acoustic calibrator has either a 94 dB or 114 dB output. Each output is indicated on the underside of the calibrator and the selected output level has a blue flashing LED adjacent to it.

2. Fit the acoustic calibrator firmly over the module microphone.

Figure 3-6. Calibrator Alignment

Figure 3-7. Calibrator Attachment

3. The instrument automatically detects a 1 kHz tone from the calibrator, the blue flashing LED turns solid and a message appears in the Smart Station window to prompt you to perform a calibration.

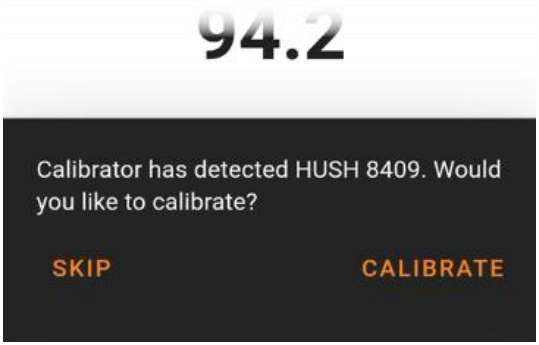

Figure 3-8. Calibration Prompt

4. On the underside of the acoustic calibrator, press the output level button to choose the output level you want (94 dB or 114 dB).

5. In the Smart Station window, touch **CALIBRATE**.
6. In the Calibration window, check the calibration reference level. Make sure it is set to the correct level (**94.0 dB** or **114.0 dB**). Touch the pencil icon to edit it.

NOTICE
The **CALIBRATE** button is grayed out until the correct value is entered.

7. Touch **CALIBRATE**.
8. The calibration process starts. When the calibration process is complete, you are notified when the calibration has passed or failed.

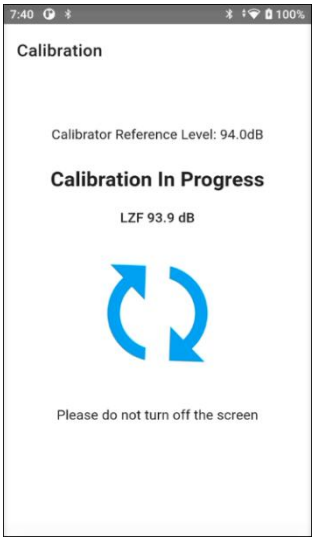

Figure 3-9. Calibration in Progress

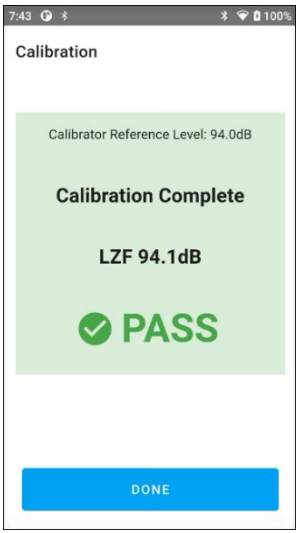

Figure 3-10. Calibration Successful Message

9. Touch **DONE**.
10. Remove and power down the acoustic calibrator.

The calibration process can also be started from other menu routes. If calibration fails, ensure the calibrator is switched on and firmly pressed over the microphone and repeat. If automatic detection of the calibrator fails or if the calibration fails, contact TSI®.

To perform a manual calibration from the Smart Station Sensor Data window:

1. From the **Sensors** window, touch the ellipsis icon .
2. From the drop-down list, touch **Calibrate**.

To perform a manual calibration from the Smart Station Sound Study window:

1. From the **Sensors** window, touch the Study start button .
2. Touch **Sound Study**.
3. Touch **CALIBRATE**.

Recording a Study with the Current Configuration

1. On the Smart Station from the **Sensors** window, touch the Study start button .
2. Touch **Quick Start Study**. The recording starts.
3. To pause your recording touch the pause button.

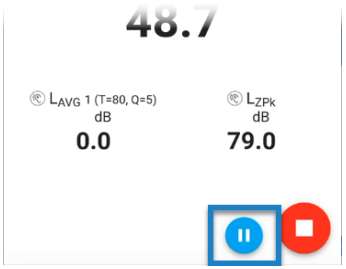

Figure 3-11. Recording Pause Button

4. To enter some notes about the reasons the recording was paused, touch the pencil icon .
5. To stop the recording, touch the stop button. You are prompted to either stop the recording, or go back.

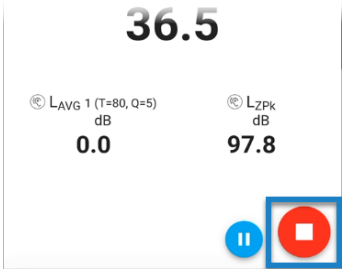

Figure 3-12. Recording Stop Button

6. Touch **STOP**. The **Save Quick Start Study** window is displayed.
7. Enter the study name and optional location and notes details in the displayed fields.
8. Touch **SAVE**. Your study is saved.

Recording a Study with a Different Configuration

1. On the Smart Station, from the **Sensors** window, touch the Study start button .
2. Touch **Sound Study**. The **Sound Setup** window is displayed.
3. Touch **NOISE CONFIGURATION** to change the configuration settings. For more information, see *Setting the Noise Configuration*.
4. To calibrate the instrument, touch **CALIBRATE**. For more information, see *Calibrate your OmniTrak™ Sound Level Meter*.
5. When complete, touch **DONE**.
6. Touch the green **Start Study** button. The recording starts.

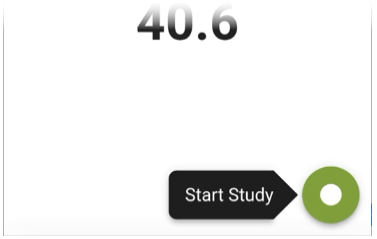

Figure 3-13. Start Study Button

7. To pause your recording, touch the pause button (see Figure 3-11). To enter some notes about the reasons the recording was paused, touch the pencil icon .
8. To stop the recording, touch the stop button (see Figure 3-12). You are prompted to either stop the recording, or go back.
9. Touch **STOP**. The **Save Sound Study** window is displayed.
10. Enter the study name and optional location and notes details in the displayed fields.
11. Touch **SAVE**. Your study is saved.

TIP

When you have finished recording your studies, re-calibrate the instrument to make sure you continue to achieve highly accurate measurements.

For more information, see *Calibrate your OmniTrak™ Sound Level Meter*.

Adding Measurement Parameters to the Sensor Data View on the Smart Station

When a study is running, you can view different measurements within the chosen configuration to view in the data display window.

NOTICE
This applies to studies running in the numeric view only.

1. With a study running, touch the ellipsis icon ⋮ located next to the sensor module name.

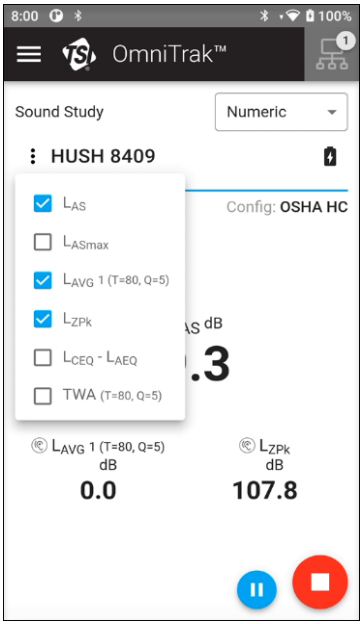

Figure 3-14. Selecting Measurement Parameters During Recording

2. Touch the checkbox next to the available measurement parameters to either select or deselect.

NOTICE
You can choose up to five parameters only.

Those parameters checked are shown in the data display window.

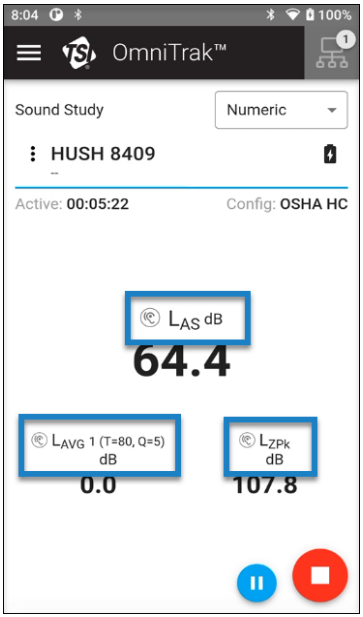

Figure 3-15. Displayed Measurement Parameters

How to Edit a Study

For each and every study recorded, you can edit:

- The study name
- The study location
- The notes associated with that study.

NOTICE
You cannot edit the recorded data, just the associated metadata for that recording.

To edit a study:

1. Touch the navigation drawer icon ☰ to display the top-level menu items.
2. From the drop-down list, touch **Study Manager**. The **Study Manager** window is displayed.
3. Next to the study you want to edit, touch the ellipsis icon ⋮.
4. Touch **Edit**. The details for that study are displayed.
5. Make the changes you want and touch **SAVE**.

How to upload to TSI Link™

TSI Link™ is software that allows you to send and receive study data to and from your TSI Link™ account. Using that account, you can use TSI Link™ Report Creator to access Microsoft® Excel® templates for your study, including graphs and smart visualizations, and to save time simplifying data analysis and reporting.

To upload files from the Smart Station to your TSI Link™ account:

1. Touch the navigation drawer icon ☰ to display the top-level menu items.
2. From the drop-down list, touch **Study Manager**. A list of previously recorded study files is displayed.
3. Touch the ellipsis menu ⋮ to the right of a study name, and touch **Upload to TSI Link**. You are prompted to upload to TSI Link™.
4. Touch **UPLOAD**. Your study is uploaded to your TSI Link™ account.

How to Create a CSV File

You can create a CSV file of any recorded study which can be accessed by your computer whenever the Smart Station is connected to it.

To create a CSV file:

1. On the Smart Station, touch the navigation drawer icon ☰ to display the top-level menu items.
2. From the drop-down list, touch **Study Manager**. A list of previously recorded study files is displayed.
3. Touch the ellipsis menu ⋮ to the right of a study name, and touch **Create CSV File**. You are prompted to save the file to **Documents | TSI OmniTrak** in the **TSI-5** drive.
4. Touch **SAVE**. The file is saved and you can open it with Microsoft® Excel® or similar office applications. The file is named with the study names given to it.

How to Delete a Study

You can delete any number of study files at any time. You may want to delete old studies or ones you have exported to save space on the Smart Station hard drive.

To delete a study on the Smart Station:

1. Touch the navigation drawer icon to display the top-level menu items.
2. From the drop-down list, touch **Study Manager**. A list of previously recorded study files is displayed.
3. Touch the ellipsis menu ⋮ to the right of a study name, and touch **Delete**. You are prompted to confirm you want to delete the study.

NOTICE
Deleted studies cannot be retrieved. Only delete study files if you are sure.

Viewing Previously Recorded Studies

All recordings made are stored as studies. These are readily available to view on the Smart Station in three different measurement formats:

Summary	Shows the study start and end time, the location and the values of each parameter measured.
Graph	Shows the study start and end time, the location and a graphical display of one of the measured parameters. Other measured parameters can be displayed on selection. You can turn the instrument into a landscape position to enable a landscape view.
Details	Shows the study start and end time, pause durations, notes, noise configuration sensor details and user calibration details.

To view study data on the Smart Station:

1. Touch the navigation drawer icon to display the top-level menu items.
2. From the drop-down list, touch **Study Manager**. A list of previously recorded study files is displayed.
3. Touch the ellipsis menu ⋮ to the right of a study name, and touch **View**. You are presented with the summary view of the study.
4. To switch between the three different measurement formats, touch the drop-down menu on the top-right of the screen and select the view you want.

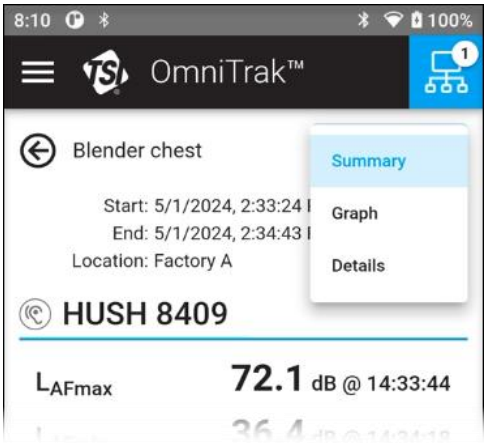

Figure 3-16. Measurement Formats

Changing System Settings and Presentations

You can change a number of presentation and system settings by following the procedures here.

Enabling and Disabling Airplane Mode on the Smart Station

Entering airplane mode (disabling Wi-Fi® without turning it off) allows you to:

- Extend the instrument battery life when you do not need to connect to Wi-Fi®
- Reduce the charging time
- Fix Wi-Fi® issues without restarting the instrument.

To enable Airplane mode:

1. Touch the navigation drawer icon to display the top-level menu items.
2. From the drop-down list, touch **Settings**.
3. Touch **WI-FI**. The **Internet Connectivity** window is displayed.
4. Under **Airplane mode**, touch the slider icon to enable airplane mode. Wi-Fi® is disabled.

NOTICE
To disable airplane mode, touch the slider again to re-enable Wi-Fi®.

Changing the Date and Time Format on the Smart Station

You can switch between a 12-hour and a 24-hour setting.

To change the date and time format:

1. Touch the navigation drawer icon to display the top-level menu items.
2. From the drop-down list, touch **Settings**.
3. Touch **DATE & TIME**. The **Date & Time** window is displayed.
4. Under **Use locale default**, touch the slider to disable the locale default.
5. Under **Use 24-hour format**, touch the slider to use a 12-hour or 24-hour format.

NOTICE
To re-enable the locale default, touch the **Use local default** slider to disable the 12-hour or 24-hour option.

Updating the Smart Station Software

Occasionally, TSI® releases software updates and these can be applied by following some simple steps.

To update the software:

1. Touch the navigation drawer icon to display the top-level menu items.
2. From the drop-down list, touch **About**. If a software update is available, you will see an update message in the **About** screen.

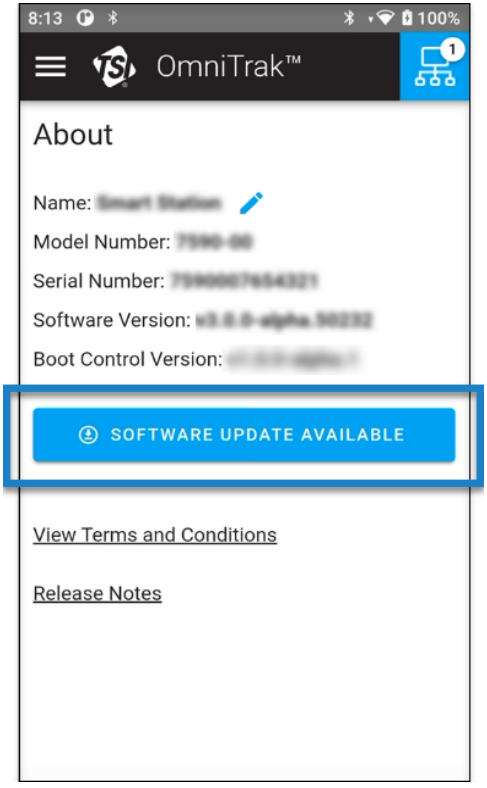

Figure 3-17. Software Update Available Message

3. Touch **SOFTWARE UPDATE AVAILABLE**. If you are not logged into your TSI® account, you are prompted to do so.

   Make sure you are logged into your **TSI®** account and touch **SOFTWARE UPDATE AVAILABLE.**

Changing the Name of a Module

You can change the name of any of the SLM modules connected to the Smart Station.

To change the name of a SLM module:

1. In the Smart Station home screen, touch the blue computer mesh button . A list of sensors within range of the Smart Station is displayed.
2. Touch the ellipsis menu ⋮ to the right of a study name,
3. Touch **Information**. The **Module Information** window is displayed.
4. Touch the pencil icon to the right of the current module name.

NOTICE
If a name has not been given to the module, its serial number is displayed.

5. In the name field, type the new name of the module.

NOTICE
You can use up to 16 characters for the module name.

6. Touch the green tick. The new module name is displayed in the **Module Information** window.

Editing or Deleting Customized Noise Configurations

You can create noise configurations on the Smart Station and edit or delete them.

For more information about creating noise configurations, see *Setting the Noise Configuration*.

To edit a customized noise configuration:

1. Touch the navigation drawer icon to display the top-level menu items.
2. From the drop-down list, touch **Settings**.
3. Touch **NOISE CONFIG**. The **Noise Configuration** window is displayed.
4. From the Configuration drop-down menu, select the configuration you want to edit.

NOTICE
You cannot edit the following pre-configured standards: ▪ OSHA HC ▪ OSHA PEL ▪ ACGIH ▪ DOD ▪ ISO

5. Touch **EDIT**. The **Edit Custom Set** window is displayed.

6. Make your changes and touch **SAVE**. The selected configuration carries forward your changes.

To delete a customized noise configuration:

1. Touch the navigation drawer icon  to display the top-level menu items.
2. From the drop-down list, touch **Settings**.
3. Touch **NOISE CONFIG**. The **Noise Configuration** window is displayed.
4. From the Configuration drop-down menu, select the configuration you want to delete.

NOTICE
You cannot edit the following pre-configured standards: ▪ OSHA HC ▪ OSHA PEL ▪ ACGIH ▪ DOD ▪ ISO

5. Touch **DELETE**. You are prompted to confirm the deletion.
6. Touch **DELETE**. The selected configuration is deleted.

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APPENDIX A

Specifications*

*All specifications are subject to change without notice.

Standards

- IEC 61672-1: 2013
- ANSI/ASA S1.4-2014/Part 1

Mechanical Characteristics

Housing	POLYCARBONATE - Flame Retardant (UL94-V0) for SLM Module
Size (W x H x D).....	83 mm x 333 mm x 37.5 mm (3.27 in. x 13.11 in. x 1.48 in.) (Dimensions include microphone and Smart Station)
Weight	570 g (1 lb. 4.1 oz)

Power/Electrical Characteristics

Battery Life.....	14 Hours
Type.....	Internal Li-Ion
Power Supply	USB-C

Installation Requirements

Overvoltage Category.....	CAT II
Stabilization Time	5s after unit has powered on.
Operating Temperature	0°C to 40°C (For Class 2 requirements)
Charging Temperature.....	5°C to 40°C
Storage Temperature.....	0°C to 60°C
Operating Barometric Pressure Range.....	65 kPa to 108 kPa
A.C. Power-Frequency and Radio-Frequency Fields	The instrument is designed and tested to comply with the requirements of ANSI/ASA S1.4-2014/Part 1 / IEC 61672-1:2013 clause 6.6
Electrostatic Discharge.....	During electrostatic discharge tests, short duration transients in the displayed value may be observed
Operating Humidity.....	Relative Humidity of 25% to 90% (non-condensing)
Storage Humidity	0 to 90% in the absence of condensation
Device Input Power……	5 VDC, 2A, 10W
Pollution Degree……..	2

Measurements

Measurement Parameters and Specifications

Measurement Parameters and Specifications	
Measurement Range.....	0 to 140.2 dB RMS (single range), 65 to 143.3 dB Peak. (Linearity range from 40 dB)
Frequency Weightings RMS	Simultaneous A, C & Linear (Z)
Frequency Weightings Peak	Simultaneous A, C & Linear (Z)
Time Weightings.....	Simultaneous Slow, Fast & Impulse
Thresholds.....	70 to 90 (dB) in 1 dB steps (applicable to L_{avg} only)

Measurement Parameters and Specifications	
LXY, LXYmax (+ time), LXYmin (+ time), LXeq, LXpeak (+ time), Lavg, LAIeq, LAEQT80, LAFTmn, LAITmn, LCEQ-LAEQ, LEX,8Hr, LEP,d, Proj. LEX, 8Hr, Proj. LEP,d, LAE, TWA(8hr), Proj. TWA(8hr), Dose%, Proj. Dose%.....	Where **X** is the frequency weighting **A**, **C** or **Z** and **Y** represents time weighting Fast (**F**), Slow (**S**) or Impulse (**I**). All weightings simultaneously measured where appropriate. For Taktmaximal parameters, **n** represents 3 or 5.
Exchange Rate (ER)	Q3, Q4 and Q5 (Only Q3 is applicable to $L_{Xeq;}$ Q3, Q4 & Q5 applicable to L_{avg} only)
Criterion Levels (Lc)	Fixed at 85dB or 90dB, or adjustable from 70 – 90 dB **NOTICE** This level must be greater than the threshold level.
Projected Work Duration	Adjustable from default 8 hours. Always shows displayed dose values to an 8 hour value.
Threshold Level (Lt)	Fixed at 80 dB or 90 dB, or adjustable from 70 – 90 dB
Noise Floor	Typical inherent noise including microphone thermal noise at 20°C: ▪ <31 dB (A)
Correction Filters	Built-in correction filter for random incidence sound pressure fields.
Microphone.....	CEL-252 – 1/2-inch Class 2, 30 mV/Pa pre-polarized back electret
Microphone Reference Direction	For free-field measurements the reference direction is perpendicular to the microphone diaphragm.
Reference conditions.....	▪ 23°C air temperature ▪ 50 % relative humidity (RH) ▪ 101.325 kPa atmospheric pressure ▪ Nominal reference level = 114.0 dB at 1 kHz
Effects of temperature	Electrical stability of the instrument <±0.2 dB over the range 0°C to +40°C.
Effects of humidity	Less than ±0.5 dB over the range 25% to 90% RH (non-condensing) relative to the value under reference conditions.
Display.....	Via the Smart Station unit, updated every second.

RMS Frequency Weightings

A, C and Z filter weightings satisfying IEC 61672-1:2013 Class 2.

Table A-1. RMS Frequency Weightings

Nominal Frequency (Hz)	Frequency Weighting		
	dBA	dBC	dBZ
10	-70.4	-14.3	0
12.5	-63.4	-11.2	0
16	-56.7	-8.5	0
20	-50.5	-6.2	0
25	-44.7	-4.4	0
31.5	-39.4	-3.0	0
40	-34.6	-2.0	0
50	-30.2	-1.3	0
63	-26.2	-0.8	0
80	-22.5	-0.5	0
100	-19.1	-0.3	0
125	-16.1	-0.2	0
160	-13.4	-0.1	0
200	-10.9	0.0	0
250	-8.6	0.0	0
315	-6.6	0.0	0
400	-4.8	0.0	0
500	-3.2	0.0	0
630	-1.9	0.0	0
800	-0.8	0.0	0
1000	0.0	0.0	0
1250	0.6	0.0	0
1600	1.0	-0.1	0
2000	1.2	-0.2	0
2500	1.3	-0.3	0
3150	1.2	-0.5	0
4000	1.0	-0.8	0
5000	0.5	-1.3	0
6300	-0.1	-2.0	0
8000	-1.1	-3.0	0
10000	-2.5	-4.4	0
12500	-4.3	-6.2	0
16000	-6.6	-8.5	0
20000	-9.3	-11.2	0

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APPENDIX B

Additional Requirements Needed for IEC61672-1, Section 9.3

*All specifications are subject to change without notice.

Reference Sound Pressure Level

The reference sound pressure level is 114 dB.

Reference Level Range

The OmniTrak™ Sound Level Meter (SLM) is a single level range instrument of 40 to 140 dB.

Microphone Reference Point

The microphone reference point is the center of the diaphragm of the microphone. The 0^{o} reference direction is perpendicular to the microphone diaphragm.

Acoustic Frequency Response Testing

The pressure to free field correction data for the OmniTrak™ SLM microphone used for periodic testing.

Table B-1. Acoustic Frequency Response Testing

Frequency	0° Free Field Corrections using a Bruel & Kjaer 4226 Calibrator	0° free Field Corrections with Wind Screen using a Bruel & Kjaer 4226 Calibrator	Expanded Uncertainty of Corrections at 95% Probability (k = 2)
Hz	**dB**	**dB**	**dB**
125	-0.03	0.1	0.11
1000	-0.05	0.05	0.25
8000	3.36	3.31	0.18

Linear Operating Range

The lower and upper limits of the linear operating ranges (dB) for electrical input, or using a CEL-252 microphone. The level linearity at an elevated air temperature of 40°C and a test frequency of 1kHz has a range of 34.0 – 140.0dBA.

Table B-2. Linear Operating Range

A-Weighted Fast-Time Level	31.5 Hz	1 kHz	4 kHz	8 kHz
Starting Point (dB)	94.0	114.0	114.0	114.0
Upper Limit (dB)	101.0	141.0	141.0	141.0
Lower Limit (dB)	30.0	30.0	30.0	30.0

Electrical Input

The input device to apply electrical signals to the pre-amplifier is a series 18 pF ±5% capacitor. The CEL-516 can be used for this purpose. The electrical self-generated noise can be measured with the supplied shorting plug attached to the CEL-516.

Self-Generated Noise

Combination of CEL-252 microphone thermal noise and meter electrical noise.

Table B-3. Self-Generated Noise

Weighting	Electrical Typical dB	Combined Typical dB
A	**22.1**	**23.7**
C	21.7	42.6
Z	29.1	52.3

Highest Level

The highest sound pressure level designed to be measured by the OmniTrak™ SLM sound level meter is 140 dB. The highest peak to peak voltage (when fitted with a 50 mV/Pa microphone) that can be applied to the pre-amplifier input via the CEL-516 is 28.5V.

Power Supply Voltage Range

The OmniTrak™ SLM contains an internal rechargeable and the module will stop a run and turn off when the batteries have discharged to a predetermined point in order to ensure no data is measured that does not meet the requirements of IEC 61672.

Display Device

The display device will display the complete linear operating range to a 0.1 dB resolution.

Environmental Stabilization Time

The typical time to stabilize after sudden changes in environment conditions.

- 5 minutes after a 10ºC change in temperature.
- 5 minutes after a 30% change in humidity (non-condensing).
- 15 seconds after a 5 kPa change in ambient pressure.

Electric Field Strength Greater than 10 V/m

The OmniTrak™ SLM has not been tested for field strengths greater than 10 V/m.

EMC Emissions

Emissions were no greater in any one plane or any mode of operation.

EMC Susceptibility

The OmniTrak™ SLM has slightly higher susceptibility with the Y plane facing the radiating antenna.

Figure B-1. SLM module plane illustration

X is in the direction of the microphone, **Z** is in the direction of the display, and **Y** is in the direction side-on to the case.

OmniTrak™ SLM with CEL-252 Microphone Free Field Response and Effects of Wind Screen

Table B-4. OmniTrak™ SLM with CEL-252 Microphone Free Field Response and Effects of Wind Screen

Frequency Exact (Hz)	Case Effect (dB)	Expanded UC (k=2)	Windscreen Effect (dB)	Expanded UC (k=2) (dB)
63.096	0	0.1	0.03	0.19
79.433	0	0.1	-0.21	0.14
100	0	0.16	-0.16	0.13
125.893	0	0.1	-0.13	0.12
158.489	0	0.1	-0.15	0.13
199.526	0	0.1	-0.2	0.15
251.189	0	0.1	-0.18	0.14
316.228	-0.3	0.1	-0.16	0.13
398.107	-0.04	0.11	-0.16	0.14
501.187	0.04	0.1	-0.19	0.14
630.957	0.1	0.1	-0.15	0.14
794.328	0.08	0.1	-0.08	0.14
1000	-0.38	0.1	-0.1	0.14
1258.93	-0.94	0.11	-0.05	0.15
1584.89	-0.17	0.1	0.12	0.14
1995.26	-0.29	0.1	0.2	0.14
2511.89	0.16	0.1	0.21	0.13
3162.28	-0.48	0.1	0.34	0.15
3981.07	0.08	0.11	0.28	0.16
5011.87	-1.22	0.1	0.23	0.15
6309.57	-0.32	0.1	0.16	0.14
7943.28	-0.17	0.1	0.05	0.16
10000	-0.28	0.12	-0.45	0.16
12589.3	-0.03	0.1	-0.95	0.16
15848.9	-0.26	0.11	-1.52	0.15

OmniTrak™ SLM with CEL-252 Microphone Directional Response (dB) Relative to Zero Degrees

Orientation of OmniTrak™ SLM - Display at 0 degrees relative to ground.

Table B-5. Directional Response (dB) Relative to Zero Degrees, Horizontal Plane (Display at 0 Degrees Relative to the Ground)

Freq,	Unit with CEL 252 microphone, Directional response relative to on axis response, dB																		
Hz	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	170°	180°
251.2	0	0	0	0	0	0	0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1
316.2	0	0	0	0	0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2
398.1	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0
501.2	0	0	0	0	0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1
631	0	0	0	0	0	-0.1	-0.1	-0.2	-0.4	-0.5	-0.6	-0.7	-0.8	-0.8	-0.8	-0.8	-0.7	-0.7	-0.7
794.3	0	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.2	0.1	0	-0.1	-0.1	-0.1	0	0	0.1	0.1
1000	0	0	0	0.1	0.1	0.2	0.2	0.2	0.1	0.1	-0.1	-0.4	-0.8	-1.1	-1	-0.8	-0.5	-0.4	-0.2
1258.9	0	0.1	0.1	0.1	0.1	0.3	0.5	0.6	0.6	0.5	0.7	1	1	0.7	0.4	0.4	0.5	0.5	0.5
1584.9	0	0	0.1	0.2	0.3	0.2	0	0	0.5	1.1	1.4	1.1	0.8	0.5	0	-0.1	0.2	0.4	0.4
1995.3	0	0	0	-0.1	-0.3	-0.5	-0.4	-0.2	-0.4	-0.5	-0.3	0.3	0.9	0.7	-0.2	-1.1	-1	-0.5	-0.3
2238.7	0	-0.3	-0.6	-1.1	-1.4	-1.5	-2	-2	-1.7	-1.8	-1.4	-1.8	-2.1	-1.8	-1.7	-1.9	-1.7	-1.5	-1.4
2511.9	0	0	0.2	0.4	0.2	-0.5	-0.8	-0.8	-0.5	-0.4	-0.9	-0.4	-0.6	-0.9	-1	-1.4	-1.1	-0.6	-0.4
2818.4	0	0.1	0.1	0	-0.1	0.1	-0.6	-1.1	-1.4	-1.3	-1.2	-1.7	-0.9	-0.5	-0.8	-1.5	-1.7	-1	-0.6
3162.3	0	0	0.1	0.2	0.6	0.5	0.4	0	-0.7	-0.7	-0.3	-0.3	-0.7	-0.5	-0.2	-1.2	-1.4	-0.4	0
3548.1	0	-0.1	-0.3	-0.3	0	0	0.2	-0.7	-0.8	-1	-0.9	-0.9	-0.4	-0.4	-0.3	-0.8	-1.5	-0.9	-0.5
3981.1	0	0	-0.2	-0.8	-1.1	-0.9	-0.5	-0.5	-1.3	-1.9	-1.9	-1.5	-1.7	-1.9	-2.1	-1.9	-2.9	-2.1	-1.6
4466.8	0	0.3	0.6	0.4	0.2	-0.5	-0.4	0.1	-0.4	-1.3	-1.6	-1.1	-1.4	-1.4	-1.2	-1.1	-2.2	-1.1	-0.6
5011.9	0	0.1	0.5	0.7	0.6	0	-0.8	-0.3	0.1	-0.6	-1.5	-1.5	-0.4	-0.9	-1.1	-0.4	-2	-1.2	-0.2
5623.4	0	-0.3	-1	-1.6	-1.9	-1.7	-2.6	-3.1	-2.4	-2.6	-3.8	-3.6	-3.1	-3.3	-3.6	-3.2	-4	-3.9	-2.7
6309.6	0	0.2	0.5	0.4	-0.4	-0.6	-0.6	-1.7	-1.9	-1.3	-2.3	-2.7	-3	-2.4	-3.2	-3	-2.6	-2.8	-1.3
7079.5	0	-0.4	-1	-0.9	-0.5	-1	-1.7	-1.7	-2.8	-2.1	-2.1	-3.8	-4	-3.6	-3.9	-4	-3.3	-4.2	-2.5
7943.3	0	0.2	0.4	-0.5	-1.6	-1.1	-1.8	-2.2	-3.2	-3.6	-2.7	-4.4	-4.6	-3.7	-3.4	-4.2	-3.7	-5.2	-3.2
8414	0	0	0.4	0.7	-0.5	-1.2	-1.2	-1.7	-1.9	-3.5	-2.5	-3.9	-4.6	-3.3	-2.9	-3.7	-3.3	-4.8	-3
8912.5	0	-0.3	-1	-0.6	-0.6	-2	-2	-2.9	-2.9	-4.9	-3.6	-4.6	-5.3	-4.8	-4.2	-4.9	-4.3	-6	-3.8
9440.6	0	0.1	-0.3	-1.4	-0.9	-1.8	-2.6	-3.4	-3.3	-5.3	-4.4	-4.6	-6.7	-5.6	-5.5	-5.7	-5.3	-6.7	-4.6
10000	0	0.2	0.8	0.2	-1	-0.7	-2.2	-2.5	-2.7	-3.8	-4.2	-3.9	-5.9	-4.8	-5.1	-5.4	-4.7	-5.8	-4.2
10592.5	0	-0.3	-0.9	-0.4	-1.3	-1.7	-2.6	-3.3	-4.1	-4.2	-6.4	-4.9	-7.1	-6.4	-6.5	-6.9	-6.2	-7.1	-5.1
11220.2	0	0.1	-0.5	-1.5	-1.3	-2.7	-2.6	-3.9	-5.1	-4.3	-7.5	-5.2	-7.6	-7.1	-6.7	-7.7	-6.9	-7.8	-6.1
11885	0	0	0.5	-0.2	-1.2	-2	-2.5	-3.6	-4.9	-4.3	-7.2	-5.5	-7	-7.1	-6.5	-7.3	-6.9	-7.2	-6.1
12589.3	0	-0.3	-1	-0.4	-1.5	-1.7	-3.3	-3.6	-4.6	-5.1	-6.5	-6.3	-7.2	-8.3	-7.3	-7.6	-7.5	-7.6	-6.8
13335.2	0	0.2	-0.1	-1.4	-1.3	-2.6	-3.6	-4.1	-5	-6.9	-6.5	-7.8	-7.6	-9.3	-8	-7.9	-8.1	-8.1	-7.4
14125.4	0	-0.1	-0.2	-0.2	-1.7	-2.2	-2.8	-4.3	-5	-7.1	-5.7	-8.7	-7.4	-8.9	-8	-8.2	-8.1	-8	-7.7
14962.4	0	0	-0.6	-1.2	-1.9	-2.8	-3.9	-5.6	-6.2	-7.8	-6.6	-10.9	-8.3	-10.7	-9.6	-9.5	-9	-8.8	-9
15848.9	0	-0.3	-0.3	-1	-1.5	-3.1	-4.1	-4.9	-6.3	-6.7	-7.6	-10.6	-8.5	-10.6	-10.1	-10.1	-9.4	-9	-9.6
16788	0	-0.1	-0.8	-1.5	-2.8	-3.3	-4.7	-5.6	-7.4	-7.5	-10.2	-11.1	-9.8	-12.2	-11.2	-11.2	-10.6	-9.9	-11.1
17782.8	0	-0.3	-0.3	-1.1	-1.8	-3.1	-4.5	-6	-7.3	-8.2	-11.5	-9.9	-10.1	-11.7	-11.3	-11.8	-11.1	-9.9	-11.8
18836.5	0	-0.1	-0.8	-1.5	-2.8	-4.2	-5.3	-7.1	-8.1	-10.3	-11.9	-10.1	-12.2	-12.9	-12.5	-12.9	-12.4	-10.9	-13.5
19952.6	0	-0.3	-0.8	-1.4	-2.6	-3.8	-5.5	-6.7	-8.2	-10.3	-10.1	-10.4	-13.8	-13.3	-13.6	-13.7	-13.3	-11.8	-14.6

Table B-6. EMC Susceptibility Directional Response (dB) Relative to Zero Degrees, Display at 0 Degrees Relative to the Ground

Orientation of OmniTrak™ SLM - Display at 90 degrees relative to ground.

Table B-7. Directional Response (dB) Relative to Zero Degrees, Vertical Plane (Display at 0 Degrees Relative to the Ground)

	Unit with CEL 252 microphone, Directional response relative to on axis response, dB																		
Freq, Hz	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	170°	180°
251.2	0	0	0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2
316.2	0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
398.1	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0	-0.1	-0.1	-0.1	-0.2
501.2	0	0	0	0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1
631	0	0	0	0	0	-0.1	-0.1	-0.3	-0.4	-0.6	-0.7	-0.8	-0.9	-0.9	-0.9	-0.8	-0.8	-0.7	-0.7
794.3	0	0	0	0.1	0.1	0.2	0.3	0.3	0.4	0.4	0.2	0.1	0	0	0.1	0.1	0.2	0.2	0.2
1000	0	0	0	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0	-0.3	-0.8	-1.2	-1.2	-0.9	-0.7	-0.4	-0.3
1258.9	0	0	0	0.1	0.2	0.4	0.6	0.8	0.7	0.6	0.6	0.9	0.8	0.4	0.1	0.1	0.3	0.3	0.3
1584.9	0	0	0	0.1	0.3	0.3	0.1	0.1	0.6	1	1.3	1.3	1.1	0.5	-0.1	-0.3	0	0.3	0.3
1995.3	0	0.1	0.2	0.1	-0.1	-0.6	-0.7	-0.4	-0.4	0	0.2	0	0.7	0.9	0	-1	-1.1	-0.6	-0.3
2238.7	0	-0.2	-0.6	-1.2	-1.5	-1.7	-2.4	-2.8	-2.5	-2.4	-1.2	-1.4	-2.3	-2.1	-2.3	-2.4	-2	-1.6	-1.5
2511.9	0	0	0.2	0.3	0.2	-0.5	-0.6	-1	-1.1	-0.7	-0.8	-0.1	-0.4	-0.7	-1.2	-1.9	-1.3	-0.6	-0.5
2818.4	0	0	0.1	0.1	0.1	0.4	-0.4	-0.8	-1.6	-1.6	-1.6	-0.8	-0.7	-0.4	-0.6	-1.7	-1.8	-0.9	-0.4
3162.3	0	0	0	0.2	0.6	0.8	0.9	0.2	-0.3	-1.1	-0.5	-0.4	0.6	-0.3	0.2	-1.2	-1.4	0	0.5
3548.1	0	-0.1	-0.3	-0.4	-0.6	-0.3	0.1	0.1	-0.8	-1.1	-2	-1.4	0.3	0.3	0.3	-0.9	-1.6	-0.4	0.3
3981.1	0	0	-0.1	-0.7	-1.4	-1.3	-1.4	-0.8	-0.4	-2.1	-2.5	-2.1	-1.5	-1.1	-1.7	-2.3	-3.4	-1.9	-1.3
4466.8	0	0.3	0.7	0.5	0.4	-0.4	-0.6	-0.7	-0.1	-0.3	-1.6	-2.3	-2.6	-0.3	-1	-1.1	-3.2	-1.4	-0.6
5011.9	0	0	0.2	0.2	0.3	0.4	-0.2	-0.9	-0.8	-0.4	-1.4	-2.1	-1.1	0	-1	-0.2	-2.9	-1.3	-0.1
5623.4	0	-0.2	-0.7	-1.3	-1.8	-1.7	-1.5	-2.5	-2.8	-1.9	-2.1	-3.5	-3.3	-3.6	-2.1	-2.4	-5.1	-4.1	-2.5
6309.6	0	0.1	0.4	0.6	0.3	-0.6	-0.4	-0.7	-2.1	-1.7	-1	-2.1	-3.2	-3.1	-0.9	-1.8	-4.1	-3	-1.2
7079.5	0	-0.1	-0.6	-0.9	-0.8	-0.7	-1.9	-1.4	-1.8	-4.1	-2.6	-2.1	-3.2	-3.5	-2.1	-3.2	-4.3	-5.3	-2.8
7943.3	0	0	0.1	-0.1	-1.2	-1.1	-1.3	-2.9	-2	-3.2	-3.6	-2.8	-4.9	-5.4	-3.3	-3.8	-4.2	-6.4	-3.2
8414	0	0	0.1	0.3	-0.1	-1.2	-0.7	-1.8	-2.2	-2.2	-4.3	-2.2	-4	-5.6	-3.8	-3.5	-3.2	-6.5	-2.8
8912.5	0	-0.1	-0.6	-0.7	-0.8	-1.8	-2	-2.1	-3.9	-2.9	-4.9	-4.2	-4.4	-5.8	-5.2	-4.2	-4	-8.3	-4.2
9440.6	0	-0.1	-0.4	-1.1	-1.2	-1.8	-3.6	-2.4	-4.5	-3.9	-5.7	-5	-4.5	-5.6	-6	-4.4	-4.6	-8.9	-4.8
10000	0	0.1	0.3	-0.1	-0.8	-0.4	-1.8	-2.4	-2.5	-3.7	-3.8	-4.2	-3.9	-5.6	-5.1	-3.7	-3.8	-8.7	-4.1
10592.5	0	-0.1	-0.6	-0.6	-1.5	-2.3	-1.7	-4.4	-3.3	-5.3	-4.6	-6.6	-4.6	-7.8	-5.8	-4.2	-4.7	-10.7	-5.1
11220.2	0	-0.1	-0.5	-1.2	-1.2	-2.8	-2.6	-3.7	-4.2	-5.5	-5.3	-7.6	-5.5	-8.4	-7.1	-5	-5.8	-11.9	-6.6
11885	0	0	0.1	-0.6	-1.3	-1.2	-3.4	-2.6	-5	-4.6	-5.1	-7.1	-6.2	-7.4	-7.8	-4.6	-5.6	-11.5	-6.3
12589.3	0	-0.1	-0.5	-0.4	-1.5	-2.1	-3.1	-3.6	-5.4	-5.4	-6.6	-7.1	-6.5	-7.4	-8.9	-5.7	-6.6	-13	-7.2
13335.2	0	0	-0.4	-1.3	-1.2	-2.8	-2.7	-4.8	-4.8	-5.5	-7.6	-7	-7.6	-7.3	-8.6	-6.5	-6.8	-13.3	-7.5
14125.4	0	0.2	0.1	-0.4	-1.8	-1.7	-3.6	-4.4	-4.6	-6.9	-7	-7.2	-8.8	-7.3	-8.2	-7.5	-7.4	-13.9	-7.9
14962.4	0	-0.1	-0.7	-1.1	-1.8	-3.1	-3.9	-4.6	-6	-7.4	-7.8	-7.8	-10.5	-8	-10	-9.6	-9.1	-15.2	-9.4
15848.9	0	-0.2	-0.4	-1.3	-1.8	-3.1	-3.8	-5.3	-7	-7.6	-7.9	-8.7	-11.2	-8.7	-11.5	-10	-10.1	-15.3	-10
16788	0	-0.2	-0.9	-1.4	-2.7	-3.2	-4.9	-6.3	-7.4	-7.6	-9.2	-11.3	-11.1	-10.6	-13.2	-10.8	-11.2	-15.5	-11.6
17782.8	0	-0.3	-0.4	-1.5	-2.2	-3.8	-4.8	-5.8	-6.9	-8.5	-10.4	-10.8	-11.3	-10.8	-14.1	-10.8	-11.6	-14.8	-12.5
18836.5	0	-0.3	-1.1	-1.6	-2.9	-3.9	-5	-6.7	-8.3	-10.1	-11.2	-11.8	-11.7	-11.3	-13.6	-12.2	-12.6	-15.4	-13.8
19952.6	0	-0.4	-0.8	-1.6	-2.9	-4.4	-6.1	-7.4	-8.9	-10.2	-11	-12	-11.9	-13.9	-12.9	-13.7	-12.7	-15	-15

Sound Calibrators – Level Correction

Sound level calibrators apply sound pressure to a microphone in a closed cavity. The response of a microphone in a free field at 1 kHz will be slightly different to that of a pressure field. However, in this case the difference (when rounded to 0.1 dB resolution) is 0.0 dB. Also some calibrators are affected by the volume of the microphone changing the volume of the calibrator cavity.

The windscreen has an effect on the free field response at 1 kHz and this can be compensated for during calibration.

Calibration corrections for the OmniTrak™ SLM and CEL-252 Microphones.

Table B-8. Sound Calibrators – Level Correction

Calibrator	Calibration Level Correction no Wind Screen	Calibration Level Correction with Wind Screen	IEC 60942
Casella CEL-120/1, TSI 7590-83	0.0dB	0.1dB	Class 1
Casella CEL-120/2, TSI 7590-80	0.0dB	0.1dB	Class 2

Examples:

The OmniTrak™ SLM can be calibrated at a nominal level of 94 dB or 114 dB dependent on the type of calibrator used.

If a CEL-120/1 (TSI 7590-83) is used and the certified output of the calibrator is 113.98 dB, and it is intended to use the sound level meter with the wind screen, then the calibration level will need to be set to 114.08, rounded to 114.1dB.

- Calibrator level 113.98
- Correction 0.1
- Calibration level 114.08 rounded to 114.1 dB

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APPENDIX C

Noise Parameter Definitions

Parameter	Definition
L_{AF}	The Sound Level with “A” Frequency weighting and Fast Time weighting.
L_{CF}	The Sound level with “C” Frequency weighting and Fast Time weighting.
L_{ZF}	The Sound level with “Z” Frequency weighting and Fast Time weighting.
L_{AS}	The Sound Level with “A” Frequency weighting and Slow Time weighting.
L_{CS}	The Sound level with “C” Frequency weighting and Slow Time weighting.
L_{ZS}	The Sound level with “Z” Frequency weighting and Slow Time weighting.
L_{AI}	The Sound Level with “A” Frequency weighting and Impulse Time.
L_{CI}	The Sound Level with “C” Frequency weighting and Impulse Time weighting.
L_{ZI}	The Sound level with “Z” Frequency weighting and Impulse Time weighting.
L_{AFmax}	The maximum Sound Level with “A” Frequency weighting and Fast Time weighting during the measurement period.
L_{CFmax}	The maximum Sound level with “C” Frequency weighting and Fast Time weighting during the measurement period.
L_{ZFmax}	The maximum Sound level with “Z” Frequency weighting and Fast Time weighting during the measurement period.
L_{ASmax}	The maximum Sound Level with “A” Frequency weighting and Slow Time weighting during the measurement period.
L_{CSmax}	The maximum Sound level with “C” Frequency weighting and Slow Time weighting during the measurement period.
L_{ZSmax}	The maximum Sound level with “Z” Frequency weighting and Slow Time weighting during the measurement period.
L_{AImax}	The maximum Sound Level with “A” Frequency weighting and Impulse Time weighting.

Parameter	Definition
L_{CImax}	The maximum Sound level with “C” Frequency weighting and Impulse Time weighting during the measurement period.
L_{ZImax}	The maximum Sound level with “Z” Frequency weighting and Impulse Time weighting during the measurement period.
L_{AFmin}	The minimum Sound Level measured with “A” frequency weighting and Fast Time weighting during the measurement period.
L_{CFmin}	The minimum Sound Level measured with “C” Frequency weighting and Fast Time weighting during the measurement period.
L_{ZFmin}	The minimum Sound Level measured with “Z” Frequency weighting and Fast Time weighting during the measurement period.
L_{ASmin}	The minimum Sound Level measured with “A” frequency weighting and Slow Time weighting during the measurement period.
L_{CSmin}	The minimum Sound Level measured with “C” Frequency weighting and Slow Time weighting during the measurement period.
L_{ZSmin}	The minimum Sound Level measured with “Z” Frequency weighting and Slow Time weighting during the measurement period.
L_{AImin}	The minimum Sound Level measured with “A” frequency weighting and Impulse Time weighting during the measurement period.
L_{CImin}	The minimum Sound Level measured with “C” Frequency weighting and Impulse Time weighting during the measurement period.
L_{ZImin}	The minimum Sound Level measured with “Z” Frequency weighting and Impulse Time weighting during the measurement period.
L_{AEQ}	Equivalent Continuous Sound Level. This is the most commonly used value used to describe sound levels that vary over time. An Leq is the level that would produce the same sound energy over a stated period of time when using a 3 dB exchange rate. It is defined as the sound pressure level of a noise fluctuating over a period of time T, expressed as the amount of average energy. Commonly written as Leq, LAeq, LAeq,t or LAT.
L_{CEQ}	An L_{EQ} value measured with “C” frequency weighting.
L_{ZEQ}	An L_{EQ} value measured with “Z” frequency weighting.
L_{AIEQ}	An L_{EQ} value measured with ‘AI’ frequency weighting.
L_{AEQT80}	An “A” Weighted 80 second L_{EQ} value.

Parameter	Definition
$L_{AVG}1$	The Time Averaged Sound Level with an exchange rate other than 3dB.
$L_{AVG}2$	The Time Averaged Sound Level with an exchange rate other than 3dB.
L_{APk}	The Peak Sound pressure level with “A” frequency weighting.
L_{CPk}	The Peak Sound pressure level with “C” frequency weighting.
L_{ZPk}	The Peak Sound pressure level with “Z” frequency weighting.
L_{AFTm3}	Integrated fast response noise over a 3 second period and produce an average level that assumes the highest level was present for the entire 3 second period.
L_{AFTm5}	Integrated fast response noise over a 5 second period and produce an average level that assumes the highest level was present for the entire 5 second period
L_{AITm3}	Integrated impulse response noise over a 3 second period and produce an average level that assumes the highest level was present for the entire 3 second period.
L_{AITm5}	Integrated fast response noise over a 5 second period and produce an average level that assumes the highest level was present for the entire 5 second period.
$L_{CEQ} – L_{AEQ}$	Difference between C- and A-weighted LEQ, used in HML calculations for hearing protection selection.
$L_{EX, 8Hr}$	Daily personal noise exposure. It is the average A-weighted noise exposure level for a nominal 8 hour working day. It is calculated from the measured sound exposure, the measurement time and the reference 8 hour day.
$L_{EP,d}$	Daily personal noise exposure. It is the average A-weighted noise exposure level for a nominal 8 hour working day. It is calculated from the measured sound exposure, the measurement time and the reference 8 hour day.
Proj. $L_{EX, 8Hr}$	Projected exposure of daily personal noise exposure of an 8 hour day.
Proj. $L_{EP,d}$	Projected exposure of daily personal noise exposure of an 8 hour day.
L_{AE}	Sound Exposure Level (SEL) with “A” frequency weighting.
TWA (8hr)	Using a 5 (or 4) dB exchange rate, the total amount of workplace noise exposure expressed as an equivalent standard 8 hour working day. Used by the OSHA specification.

Parameter	Definition
Proj. TWA (8Hr)	Projected TWA over a standard 8 hour working day.
Dose %	The % dose.
Proj. Dose %	The % dose projected forwards over an 8 hour period.
Projected Work Duration (hours)	Defaults to 8 (can be set to any value from 01:00 to 24:00 (HH:MM) for custom setup)

APPENDIX D

Glossary of Terms

LC-LA

The C-A measurement is an average that enhances the low-frequency components of the sound signal. It is the result of subtracting an A-weighted average from a simultaneously collected **C**-weighted average and is sometimes used as the NRR (noise reduction rating) or HML methods to determine if hearing protection devices are adequate for usage in the field.

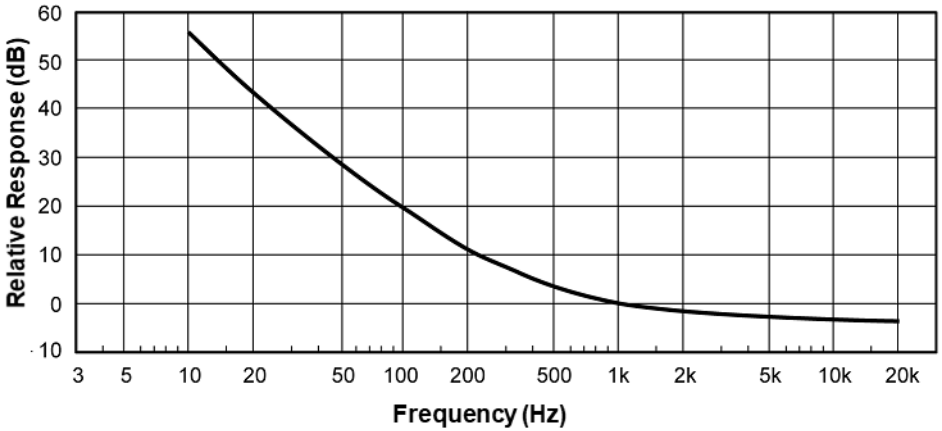

Figure D-1. C-A Weighting Response Curve

Center Frequency

The center frequency of each octave and third octave filter band.

Criterion Level

Criterion level is the average SPL that will result in a 100% dose over the Criterion time, usually 8 hours. The Criterion Level is typically set by a regulating agency, such as OSHA, and is not usually applicable for community noise monitoring. Examples: OSHA mandates the Criterion Level (maximum allowable accumulated noise exposure) to be 90 dB for 8 hours. For an 8-hour sample, an average level (Lavg) of 90 dB will result in 100% dose. For the OSHA HEARING CONSERVATION AMENDMENT, the “action level” is 85 dB for 8 hours. This would result in a 50% dose reading. Note that the Criterion Level has not changed. (If the Criterion Level were changed to 85 dB then an 8-hour average of 85 dB would result in 100% dose.)

Decibel (dB)

Sound Level Meters use the decibel as the unit of measure known as Sound Pressure Level (SPL). SPL uses the ratio between a reference level of 20 microPascals (.00002 Pascals) and the level being measured.

SPL = 20 log (measured level/reference level)

Example: The SPL for 1 Pascal is 20 log (1 Pascal/.00002 Pascal) = 94 dB 20 microPascals (.00002 Pascals) is considered the average threshold of hearing.

A whisper is about 20 dB. A normal conversation is typically from 60 to 70 dB, and a noisy factory from 90 to 100 dB. Loud thunder is approximately 110 dB, and 120 dB borders on the threshold of pain.

Dose

Related to the Criterion Level, a dose reading of 100% is the maximum allowable exposure to accumulated noise. For OSHA, 100% dose occurs for an average sound level of 90 dB over an 8-hour period (or any equivalent exposure). By using a TWA reading rather than the average sound level, the time period is no longer explicitly needed. A TWA of 90 dB is the equivalent of 100% dose. The dose will double (halve) every time the TWA increases (decreases) by the Exchange Rate.

- ☑ **Example**: OSHA uses an Exchange Rate of 5 dB. Suppose the TWA is 100 dB. The dose would double for each 5 dB increase over the Criterion Level of 90 dB. The resulting dose is therefore 400%. If the TWA was instead equal to 80 dB then the dose would halve for each 5 dB below the Criterion Level. The resulting dose would be 25%.
- ☑ When taking noise samples less than the full workday, dose is an easy number to work with because it is linear with respect to time.
- ☑ **Example**: If a 0.5-hour sample results in 9% dose and the workday is 7.5 hours long, then the dose for the full workday would be a 135% dose (7.5 / 0.5 x 9%). This is computed making the assumption that the sampled noise will continue at the same levels for the full 7.5-hour workday.

Dynamic Range

The range of input amplitudes on any given range setting over which the instrument can produce a meaningful response. The bottom of the dynamic range is above the instrument's Noise Floor for that range setting, and the top of the dynamic range is the maximum input signal that will not overload the instrument on that range setting.

Exchange Rate (ER– also known as the Doubling Rate)

Also known as the Doubling Rate, this refers to how the sound energy is averaged over time. Using the decibel scale, every time the sound energy doubles, the measured level increases by 3 dB. This is the 3 dB Exchange Rate that most of the world uses. For every increase of 3 dB in the time-weighted average, the measured dose would double.

Some organizations such as OSHA in the U.S. have argued that the human ear self-compensates for changing noise levels and they felt that the 3 dB Exchange Rate should be changed to more closely match the response of the human ear. OSHA currently uses a 5 dB Exchange Rate, which would mean that the reported dose would double with every 5 dB increase in the time-weighted average. The Exchange Rate affects the integrated reading L_{AVG}, Dose, and TWA but does not affect the instantaneous sound level.

Field Calibration (vs. Factory Calibration), Pre-calibration, Post-calibration

To be sure the meter is functioning within specified tolerance limits, it should be returned to the factory for a factory recalibration. To verify that the meter is measuring properly during normal use, field calibrations should be performed. Pre-calibration is performed prior to any data being recorded by the meter. During a pre-calibration, the meter level may be adjusted to match the calibrator output level. Post-calibration is a simple verification that the instrument has remained in calibration throughout the measurement period.

Lavg (Average Level)

Lavg is the average sound level measured over the run time. This becomes a bit confusing when thresholds are used. Any sound below the threshold is not included in this average. Remember that sound is measured in the logarithmic scale of decibels therefore the average cannot be computed by simply adding the levels and dividing by the number of samples. When averaging decibels, short durations of high levels can significantly contribute to the average level.

Example: Assume the threshold is set to 80 dB and the Exchange Rate is 5 dB (the settings of OSHA's Hearing Conservation Amendment). Consider taking a one-hour noise measurement in an office where the A- weighted sound level was typically between 50 dB and 70 dB. If the sound level never exceeded the 80 dB threshold during the one-hour period, then the L_{AVG} would not indicate a reading of zero. If 80 dB was exceeded for only a few seconds due to a telephone ringing near the instrument, then only those seconds will contribute to the L_{AVG} resulting in a level perhaps around 40 dB (notably lower than the actual levels in the environment).

$$L_{avg} = ER \left[log_2 \int_0^{RTIME} 2^{LS/ER} \, dt - log_2 (RTIME) \right] dB$$

Leq (Equivalent Level)

The true equivalent sound level measured over the run time. The term L_{EQ} is functionally the same as L_{AV} except that it is only used when the Exchange Rate is set to 3 dB and the threshold is set to none.

Logging

Also called Data Logging. In sound studies, the saving of measurements at fixed intervals during a study, where each measurement is determined from data processed in the previous logging interval. Certain measurements, such as average level (LAS) and maximum level (max), can be recorded by the meter at 1s intervals with the Smart Station in range of the SLM module.

For example: A meter is set to log Lavg and max at one minute logging intervals.

Noise

Unwanted sound.

Noise Floor

In a “Perfectly Quiet” room, the electrical noise produced by the microphone and electronics approximately 31 dB. These levels are known as the Noise Floor of the instrument. The Noise Floor can cause inaccurate measurements at low measurement levels.

Peak Level

Peak is the highest instantaneous sound level that the microphone detects. Unlike the Max Level, the peak is detected independently of the unit’s Response Time setting (Fast or Slow).

Example: The peak circuitry is very sensitive. Test this by simply blowing across the microphone. You will notice that the peak reading may be 120 dB or greater. When taking a long-term noise sample (such as a typical 8-hour workday sample for OSHA compliance), the peak level is often very high. Because brushing the microphone over a shirt collar or accidentally bumping it can cause such a high reading, the user must be careful of placing too much emphasis on the reading.

PEL (Permissible Exposure Level)

The **A**-weighted sound level at which exposure for a Criterion Time, typically eight hours, accumulates a 100% noise dose.

Overrange (OR)

An overload will occur whenever the input signal exceeds the dynamic range of the instrument.

Pascal (Pa)

Unit of pressure equal to 1 Newton per square meter.

Projected Work Duration

A time interval used in some calculations, usually different from the actual run time of a study or session. The overall exposure time, manually inputted, with which to calculate daily dose values.

Reference pressure

The sound pressure at the threshold of human hearing, as measured under standard conditions. This generally accepted magnitude of this pressure is 2 x 10-5 Pascals (Pa).

Response time (F,S)

Selectable time response settings used in the meter measurements. The response time is a standardized exponential time weighting of the input signal according to fast (F), slow (S) time response relationships. Time response can be described with a time constant. The time constants for fast, slow responses are 0.125 s, 1.0 s and respectively.

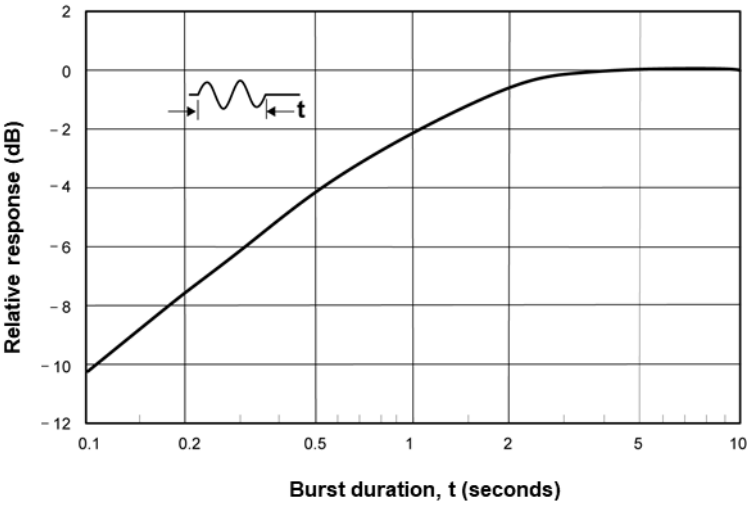

Figure D-2. Slow Response to a Tone Burst

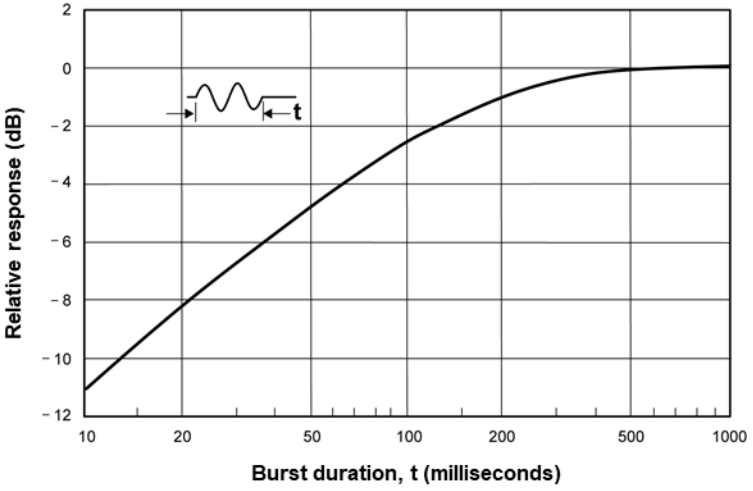

Figure D-3. Fast Response to a Tone Burst

RMS (Root Mean Square)

The RMS voltage of a signal is computed by squaring the instantaneous voltage, integrating over the desired time, and taking the square root. Simply put, the RMS values are the results from the meter with the response time and weighting settings taken into account.

SEL/Lxe (Sound Exposure Level)

The sound exposure level averages the sampled sound over a one second period. Assuming the sampled run time to be greater than one second, SEL is the equivalent one-second noise that would be equal in energy to the noise that was sampled. SEL is typically measured using a 3 dB exchange rate without a threshold. SEL is not used by OSHA.

Example: Suppose you wanted to measure in a location next to railroad tracks, which also happened to be in the takeoff path of an airport. A train passes by taking 10 minutes with an average sound level of 82 dB. A jet passes overhead taking 45 seconds with an average level of 96 dB. Which of these events results in more sound energy? You can answer the question by comparing their SEL readings, which compress each event into an equivalent one-second occurrence. SEL for the train = 109.7 dB, SEL for the jet = 112.5 dB.

$$\mathrm{SEL} = \mathrm{ER}\left[\log_2 \int_0^{\mathrm{RTIME}} 2^{\mathrm{L/ER}}\,\mathrm{dt}\right] dB$$

SPL

Sound pressure level. A ratio of one sound pressure to a reference pressure (See Reference Pressure). Because of the enormous dynamic range of the human ear, the ratio is calculated logarithmically by the formula below, where L_r is the reference pressure.

$$SPL = 20 \log\left(\frac{L}{L_r}\right) dB$$

Threshold

The threshold affects the Lavg, TWA, and Dose measurements. All sound below the threshold is considered nonexistent noise for the averaging and integrating functions. The threshold does not affect measurements in the sound level mode. OSHA uses two different thresholds. The original Occupational Noise Exposure Standard (1971) used a 90 dB threshold and called for engineering controls to reduce the noise levels if the eight-hour TWA was greater than 90 dB. The Hearing Conservation Amendment (1983) uses an 80 dB threshold and calls for a hearing conservation program to be put in place if the eight-hour TWA exceeds 85 dB (50% dose). The Hearing Conservation Amendment is the more stringent of the two rulings and is what most US industrial users are concerned with.

Example: With an 80 dB threshold, suppose you placed a 79 dB calibrator on the unit for a period of time. Because all of the noise is below the threshold, there would be no average (you can think of it as an average of 0 dB). If the calibrator were 80 dB instead, then the average would be 80 dB. On histogram printouts, typically 1 minute (or other specified increment) averages are printed. Because real noise fluctuates, it is quite possible to have an average level below the threshold. This also applies for the overall Lavg.

TWA

The Time Weighted Average (TWA) always averages the sampled sound over an 8-hour period. TWA starts at zero and grows. The TWA is less than the Lavg for a duration of less than eight hours, exactly equal to the Lavg at eight hours, and grows higher than Lavg after eight hours. TWA represents a constant sound level lasting eight hours that would result in the equivalent sound energy as the noise that was sampled.

Example 1: Think of TWA as having a large 8-hour container that stores sound energy. If you run a meter for 2 hours, your Lavg is the average level for those 2 hours - consider this a smaller 2-hour container filled with sound energy. For TWA, take the smaller 2-hour container and pour that energy into the larger 8 hour TWA container. The TWA level will be lower. Again, TWA is ALWAYS based on the 8-hour container. When measuring using OSHA's guidelines, TWA is the proper number to report provided that the full work shift was measured.

Example 2: If the work shift is 6.5 hours long, then measure for the entire 6.5 hours. TWA is the correct level to report to OSHA. It does not have to be modified.

$$\mathrm{TWA} = \mathrm{ER}\left[log_2 \int_0^{\mathrm{RTIME}} 2^{\mathrm{L}/\mathrm{ER}}\, \mathrm{dt} - log_2\,(\mathrm{CT}) \right] dB$$

Under Range (UR)

An under range will occur whenever the input signal is lower than the noise floor in the dynamic range of the instrument.

Weighting (A, C, Z)

"**A**", "**C**", "**Z**" are the standard weighting networks available. These are frequency filters that cover the frequency range of human hearing (20 Hz to 20 kHz). "**A**" weighting is the most commonly used filter in both industrial noise applications (OSHA) and community noise regulations. "**A**" weighted measurements are often reported as dBA. The "**A**" weighted filter attempts to make the meter respond closer to the way the human ear hears. It attenuates the frequencies below several hundred hertz as well as the high frequencies above six thousand hertz. The "**C**" weighting provides a fairly flat frequency response with only slight attenuation of the very high and very low frequencies. "**C**" weighting is intended to represent how the ear perceives sound at high decibel levels. "**C**" weighted measurements are often reported as dBC. "**Z**" is zero weighting, with no weighting across the frequency range of human hearing.

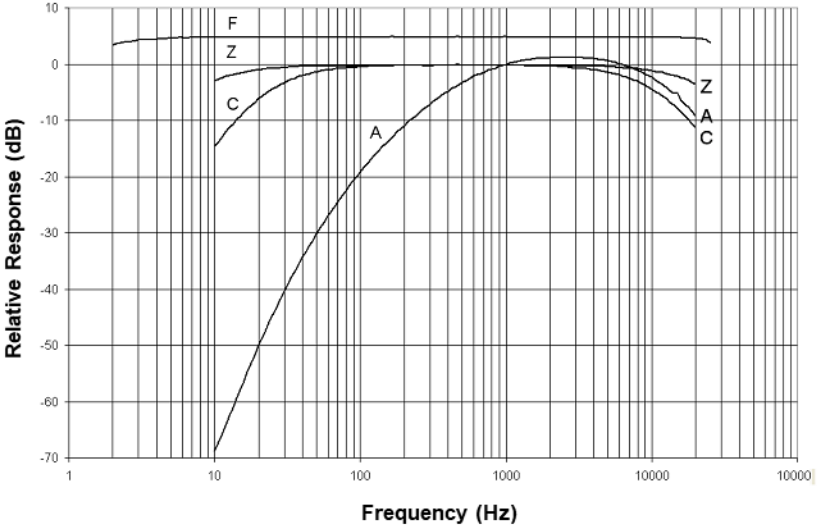

Figure D-4. All Frequency Weightings Plotted Together

Windscreen

A windscreen is a covering for the microphone that reduces disturbances caused by wind and direct contact with other surfaces. The windscreen is placed over the microphone when taking measurements to help prevent false high readings due to wind blowing across the microphone or objects (hair, clothing, etc.) brushing against the microphone. The windscreen will also help protect the microphone from dust and debris.

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