TrackSense® Pro
Hardware Manual

CONTENTS

1. Safety Information

Use this equipment only as specified in this manual. Otherwise, the protection provided by the equipment may be impaired.

- "Warning" identifies conditions and actions that may pose hazards to the user.
- "Caution" identifies conditions and actions that may damage the equipment being used.

1.1. Warnings

Disclaimer: Ellab manufactures equipment intended for use in thermal validation, monitoring and stability studies. Equipment used for applications other than these studies is used at the discretion and sole responsibility of the customer. Ellab cannot accept any responsibility for the use of equipment for any application other than thermal validation, monitoring and stability studies. The customer needs to verify the temperature range of the equipment being used before placing it into an application.

1.2. General

DO NOT use the equipment for any application other than its intended use e.g. thermal validation, monitoring and stability studies. Any other use of the equipment may cause unknown hazards to the user.

DO NOT use the equipment in environments other than those listed in this user's guide and follow all safety guidelines. Only trained personnel should use the equipment. Inspect the equipment for damage before each use.

DO NOT use the equipment if it appears damaged or operates abnormally. Before initial use, after transport, or after storage in humid or semi-humid environments the equipment needs to be dried for a period of at least 2 hours. If the equipment is wet or has been in a wet environment, take necessary measures to remove moisture prior to applying power. The equipment is intended for indoor use only.

1.3. Fire and explosive hazards

Usage of equipment at temperatures higher than those specified in chapter Error! Reference source not found.: Error! Reference source not found., may result in overheating, fire, or explosion. Always ensure that the battery operates within the specified temperature range to avoid serious hazards.

1.4. Electrical Hazards

These guidelines must be followed to ensure that the safety mechanisms in the equipment will operate properly. Equipment, when applicable, must be plugged into a 115 VAC (± 10%) or 230 VAC (± 10%) 50/60 Hz electric outlet as indicated on the label. The power cord of the instrument is equipped with a three‑pronged grounding plug for your protection against electrical shock hazards. It must be plugged directly into a properly grounded three‑prong receptacle. The receptacle must be installed in accordance with local codes and ordinances.

DO NOT use an extension cord. Consult a qualified electrician. Always inspect the power cord before use for any damage to the insulation due to contact with hot surfaces, cuts or abrasions. Always replace the power cord with an approved cord of the correct rating and type. If you have questions, contact an Ellab Authorized Service provider.

Cautions:
Always operate TrackSense® Pro Reader Stations at room temperature between 5 °C and 40 °C (41 °F and 104 °F).

DO NOT operate this equipment in an excessively wet, oily, dusty, or dirty environment. The equipment is a precision instrument. Although it has been designed for optimum durability and trouble free operation, it must be handled with care. The equipment including any probes or loggers are sensitive instruments that can be easily damaged. Always handle these devices with care. Do not allow them to be dropped, struck, stressed, or overheated.

TrackSense® Clock (Internal)
When using TrackSense® Frigo, Compact, Lab / Pro / Pro X / Pro XL / Pro Basic / Mini / Micro loggers, ValSuite® will start an internal clock in the logger. Beware that the max time deviation at 23 °C will be +/- 5 seconds over 24 hours.

Logger / Sensor Environment
Using TrackSense® Pro equipment, if the logger housing is not used in the same environment as the sensor this can have an impact on the measurement accuracy. One could experience a deviance of approximately 0.25 °C if the logger is exposed to ambient temperature and the sensor is at 121.1 °C. Calibrations should thus be performed based on the manner the loggers / sensors will be used.

1.5. Directives

1.5.1. EMC

Ellab equipment has been tested to meet the European Electromagnetic Compatibility Directive (EMC Directive, 2014/30/EU). The Declaration of Conformity for your instrument lists the specific standards at which the unit was tested.

1.5.2. Low Voltage (Safety)

In order to comply with the European Low Voltage Directive (LVD) 2014/35/EU), Ellab equipment has been designed to meet the EN 61010-1 standard.

1.5.3. Waste Electrical and Electronic Equipment

Ellab meets the European Community directive 2012/19/EU on waste electrical and electronic equipment (WEEE), and is in accordance with the RoHS Directive 2011/65/EU, which is European Law since February 2003.

1.5.4. ATEX

Ellab ATEX equipment has been tested to meet European requirements for equipment and protective systems intended for use in potentially explosive atmospheres (2014/34/EU). The Declaration of Conformity for your instrument lists the specific standards at which the unit was tested. All new TrackSense® Pro / Pro X / Pro XL / Pro Basic loggers and SKY modules are ATEX certified.

Special conditions for safe use:

- The battery must only be replaced with Battery delivered by ELLAB type: ELLAB TSP-BAT-150 or ELLAB TSP-BAT-150L.
- The battery must only be changed in the nonhazardous area.
- The TrackSense version mounted with the optional SKY module for RF communication cannot be used in category III – where combustible dust is present.
- When the TrackSense is mounted with optional SKY module and it is to be installed in Zone 0 where IIC gasses are present the module shall be earthed.
- The different sensors that can be mounted are classified as "simple apparatus". For flexible sensors of plastic materials the maximum surface area must not exceed 400 mm^2. Alternatively for long sensors the maximum diameter must be limited to 1 mm.

Schedule EC-Type Examination Certificate No. ExVeritas 18 ATEX 180411 X.

- The maximum pressure under which the TrackSense may be operated is 10 Bar.
- Permitted range of ambient temperature:
  "BASIC": $-30\ °C \leq T_{amb} \leq +105\ °C$
  "PRO": $-50\ °C \leq T_{amb} \leq +105\ °C$
  "SKY AND "PRO X": $-60\ °C \leq T_{amb} \leq +105\ °C$
  "SKY XL and "PRO XL": $-55\ °C \leq T_{amb} \leq +105\ °C$

1.5.5. Important Notice Regarding Ellab SKY Equipment

 & IC Compliance Information:

FCC ID: XUS‑SKYDL1, FCC ID: XUS‑SKYDL2 and FCC ID: XUS‑SKYAP1
IC ID: 8758A‑SKYDL1, IC ID: 8758A‑SKYDL2 and IC ID: 8758A‑SKYAP1

Ellab SKY equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules and Industry Canada ICES‑003.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instruction manual, may cause interference with radio and television reception. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference with radio or television reception, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the antenna of the radio/television receiver.
- Increase the distance between this equipment and the radio/television receiver.
- Plug the equipment into a different outlet so that the equipment and the radio/television receiver are on different power mains branch circuits.
- Consult a representative of Ellab A/S or an experienced radio/television technician for additional suggestions.

Ellab SKY equipment complies with part 15 Subpart B and C of the FCC Rules and Industry Canada ICES‑003 and RSS‑Gen.

Operation is subject to the following two conditions:
(1) The device may not cause harmful interference, and
(2) The device must accept any interference received, including interference that may cause undesired operation

Changes or modifications of the device can void the FCC and Industry Canada certification and user's authority to operate the equipment.

1.5.6. ARIB

Ellab SKY equipment has been tested to comply with the requirements in the Japanese standard ARIB STD‑T66 (Low‑Power Data Communication System/Wireless LAN System).

1.6. Ellab Service

Please contact your local Ellab sales representative for the proper service center location. Contact information can be found at www.ellab.com.

When contacting Ellab for support, please have the following information available:

- Model Number
- Serial Number
- Voltage
- Complete description of the problem
- ValSuite® Software Version

2. New Order Contents

When a new system (either TrackSense® Pro or SKY) is ordered, equipment is shipped in a custom Ellab suitcase. The contents of the suitcases are the following:

2.1. TrackSense® Pro Orders

- Suitcase
- Reader Station
- Power supply
- Software
- Accessories Box
- Pen for battery
- Logger opening tools
- O‑Ring Sealant
- USB Cable
- Quick Guide
- USB key

2.1.1. Supporting Plate (Optional Equipment)

Ordering Code	Type		
35900027	Supporting plate for Multi Reader Station		

Applying the Supporting Plate:

1. Clean the Reader Station surface.

2. Place 2 loggers on the Reader Station in opposite corners (see image).

3. Place the Supporting Plate over the Reader Station Surface, remove the tape and press the plate down.

2.2.   SKY Orders

- Suitcase
- SKY Access Point
- Accessories Box
- USB Cable
- Electro Static Discharge (ESD) Warning Sheet

Optional equipment for SKY orders:

Ordering code	Type	
31190702	Sky Access Point Remote Antenna ø7 x 500 mm with 3 m. cable.	

3. TrackSense® Pro Multi Reader Stations

3.1. Proper Use of Reader Stations

- Ellab reader stations are intended for use at room temperature. The stations should not be exposed to temperatures below 5 °C or above 50 °C.
- Do not immerse the reader station in water under any circumstances.
- Although TrackSense® Pro multi reader stations are quite robust; they should be handled with care. Dropping or expose them to heavy mechanical shock may loosen or damage the electronic connections.
- Only use cables (USB) and power supplies provided by Ellab.

Operating Temperature	5 to 50 °C
Environmental:	0 - 90% RH, non-condensing
Operating Voltage	External Adapter 100-240V AC, 50-60 Hz or USB
Weight:	550 g
Dimensions (H x W x L):	41 x 118 x 160 mm
Material:	Aluminum
Reader/Logger Communication:	Induction

3.2. Reader Station Types

Please contact your local Ellab sales representative with specific requests as custom configured stations can be supplied.

3.2.1. Master Reader Station

- Contains 4 logger positions
- Connected to PC via USB or LAN (ethernet)
- Only 1 master reader station can be used at once

Note: Beware that the Master Reader Stations for TrackSense Pro Frigo and Compact are different and have blue colored logger positions. Ordinary TrackSense Pro multi reader stations cannot be used for Frigo and Compact loggers.

3.2.2. Expansion Module

- Contains 4 logger positions.
- A power supply must be connected to a master reader station in order to function.
- A maximum of 3 expansion modules can be connected to any master reader station.
- Up to 16 loggers can be started simultaneously. A maximum of 160 loggers can be included in each session.

Note: Expansion modules for the reader station do not support hot plugging or hot swapping. Please disconnect power and USB cable, before changing the number of expansion modules.

3.2.3. Single Reader Station

- Contains 1 logger position
- Expansion module(s) are not available.
- Connected to PC via USB.

From left to right: Frigo/Compact, Mini, Micro and standard single reader station

Operating Temperature:	5 to 50 °C
Environmental:	0 - 90% RH, non-condensing
Operating Voltage:	5V AC via USB or power supply
Weight:	185 g
Dimensions (H x W x L):	30 x 60 x 100 mm
Material:	Aluminum
Reader/Logger Communication:	Induction

3.3. Communication Setup

All TrackSense® Pro Multi Reader Stations can be connected to PC via USB.

3.3.1. USB

- When using the multi reader station, the generic driver is automatically detected and installed.

Note: When using the USB connection on 1st. generation reader stations, such as Lab and single reader stations, install the Ellab USB driver first. The driver can be found on the ValSuite® disc (USB Driver folder). Run the file Ellab USBDrivers_ xxx.exe.

3.3.2. LAN

1. Connect the power supply and ethernet cable to the reader station

2. Connect the reader station to the PC using the USB cable

3. Read and note the reader station IP address located under the station

4. Open the ValSuite user menu, Tools → Communication Settings → TrackSense

5. Choose "Ethernet" and enter the IP address and Alias

6. Select "Close" and remove the USB cable from the reader station

7. Use "Test" to control functionality

8. The reader station should now function remotely

3.3.3. Installation for Windows 7, 8 and Windows 10
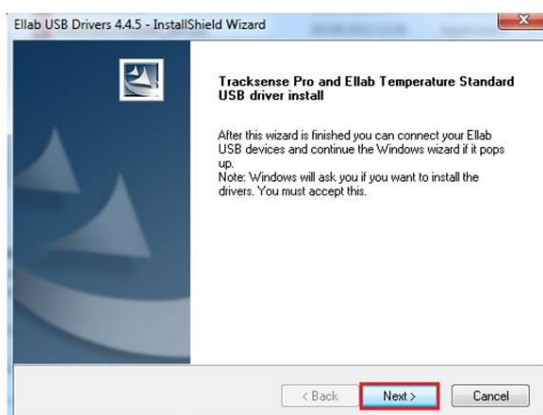
1. Click **Next**
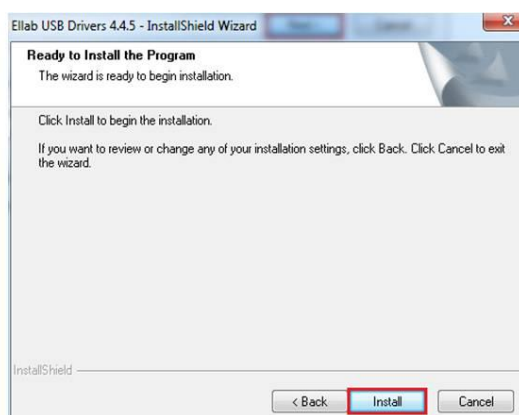
2. Click **Install**
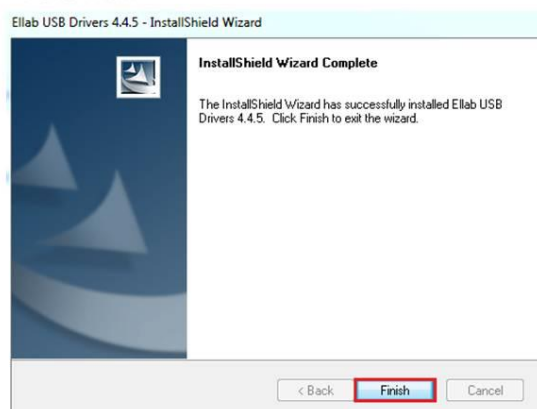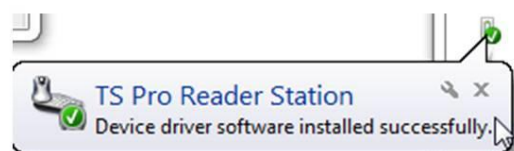
3. Driver is installed, Select **Finish**. Restart computer.

4. The first time the equipment is connected through the USB port, the message above will appear. The equipment is now ready to be used.

3.4. ValSuite® Software

ValSuite® Pro 5.X System Requirements or higher:

- Multi Core Processor i5/i7 2.0 GHz or higher
- 4GB Ram or higher (Scientific 8GB RAM)
- Resolution 1440 x 900 (with a fix resolution at 96dpi)
- Hard drive with 20GB of free space or more
- Software support 32 Bits on platform: Windows7 SP1, Windows 8.1, Windows10, Windows Server 2008 Service Pack 2, Windows server 2008 R2 and Windows server 2012 R2
- Software support 64 Bits on platform: Windows7 SP1, Windows 8.1, Windows10, Windows Server 2008 Service Pack 2, Windows server 2008 R2, Windows server 2008 SP2, Windows server 2012 R2 and Windows server 2016.

The ValSuite® software is validated using Windows 10 64 Bits, language version: English operating system. Installing and using this software requires a basic knowledge of software installation and the Windows operating systems.

Note: Windows server 2003, Windows XP, Windows VISTA, Windows 2000, Windows NT 4.00 and Windows ME are not supported.

Note: Do not update the ValSuite® software during active sessions. The logger list will be updated and replaced with a new, empty list.

4. TrackSense® Pro Loggers

WARNING: Substitution of components may impair the intrinsic safety of the equipment.

4.1. TrackSense® Pro / Pro X / Pro Basic / Pro Basic L

4.1.1. Logger Specifications 3rd Generation

Ordering codes	Logger type	Temp Range	Operating Pressure	Data Points	Dimensions	Min / Max. Sample rate	Sensor
31191093	BASIC L	-30 to 85 °C	0 mBar to 10 Bar abs.*	120,000	Ø25x68.8	Min. 1 sec. Max. 23:59 (Hours: Min)	Interchangeable
31191003	BASIC	-30 to +105 °C*	0 mBar to 10 Bar abs.*	120,000	Ø25×44mm	Min. 1 sec. Max. 23:59 (Hours: Min)	Interchangeable
31192003	PRO	-50 to +150 °C*	0 mBar to 10 Bar abs.*	120,000	Ø25×44mm	Min. 1 sec. Max. 23:59 (Hours: Min)	Interchangeable
31192103		-80** to +150 °C*	0 mBar to 10 Bar abs.*	120,000	Ø25×44mm	Min. 1 sec. Max. 23:59 (Hours: Min)	Interchangeable

Part No.	Product	Temperature	Pressure		Dimensions		Type
	PRO X						
31190500	SKY MODULE	- 80 to +140 °C*	10 Bar abs.*	-	Ø25×23mm	-	Add on
31190501	SKY MODULE 3G	- 80 to +140 °C*	10 Bar abs.*	-	Ø25x64.1 mm	-	Add on
31190520	SKY MODULE LAB 3G	- 30 to +100 °C*	10 Bar abs.*	-	Ø25x64.1 mm	-	Add on
31190531	SKY Module BASIC L 3G	-30 to +105 °C*	10 Bar abs.*	-	Ø25 x89.4mm	-	Add on

*In accordance with ExVeritas 18 ATEX 180411 X, the TrackSense® Pro, Pro X, Pro XL and Pro Basic loggers equipped with pressure sensors and relative humidity sensors cannot be exposed to more than 1.1 bar and 105 °C when working in an environment where intrinsically safe equipment is required.
**Sensor can measure down to ‑196 °C

Note: Accuracy depends on choice of sensor.

4.1.2. TrackSense® Pro X Long

4.1.2.1. Logger Specifications Pro X Long

Ordering codes	Logger type	Temp Range	Operating Pressure	Data Points	Dimensions	Min / Max. Sample rate	Sensor
31192203	PRO XL	- 80 to +150 °C*	0 mBar to 10 Bar abs.*	120,000	Ø25×68.8 mm	Min. 1 sec. Max. 24 hours. (Hours: Min)	Interchangeable
31190522	SKY MODULE PRO XL	-80 to + 140 °C*	10 Bar abs.*	–	Ø25×89.4 mm	–	Add on
31190523	SKY Module PRO XL 3G	-80 to + 140 °C*	10 Bar abs.*	-	Ø25 x89.4mm	-	Add on

4.1.3. Proper Use

- Never use the logger outside the temperature range. Damage may occur to the electronics and this can cause out‑gassing of the battery.
- Treat the loggers as you would any other sensitive electronic equipment. Dropping or exposing them to heavy mechanical shock may loosen or damage the electronic connections.
- Only use the special tool provided by Ellab to disassemble loggers. Never use any other tools, as this could damage the housing assembly or threads. Check the o‑rings and replace them when necessary.
- Do not remove loggers from the reader station while they are being read. Doing so may result in loss of data.
- Store the loggers in a dry and cool place.

- If corrosion is present near the battery contacts, verify that the logger is not leaking. Lightly clean area using a Q-tip and alcohol, then change the o-rings.
- Any logger with recurring problems should be returned to Ellab for service.
- When loggers have not been used for an extended period of time, they must be tested every three months by running a short test at room temperature.
- When loggers are not used for a period of two or more weeks, remove the batteries from the logger. If the batteries are removed from the loggers for more than one week, the activation tool will be needed to reactivate the battery.

4.1.4. Logger Serial Numbers

All loggers have unique serial numbers. The serial numbers allow compliance with GMP & GDP regulations. The serial numbers for TrackSense® Pro / Pro X / Pro XL / Pro Basic / Pro Basic L loggers are located on the black logger part inside the steel housing.
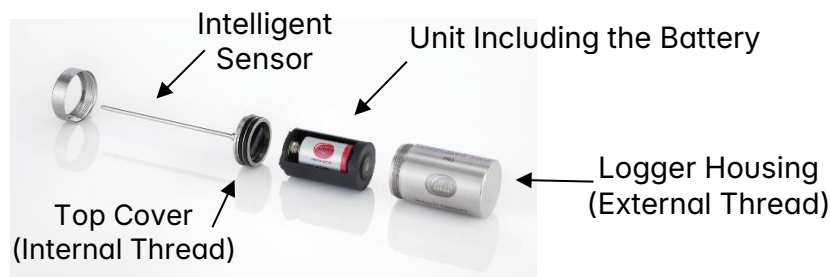
Logger serial number can be found here

4.1.5. Disassembling / Assembling Logger

Intelligent Sensor

Unit Including the Battery

Logger Housing (External Thread)

Top Cover (Internal Thread)

1. Disassemble the logger by unscrewing the top cover by hand. If the top cover is too tight, place the logger wrench over the top cover with the larger diameter of the circle touching the sides of the cover and twist counterclockwise. Place the logger wrench around the base of the sensor, which is exposed just above the logger case. The smaller diameter of the circle should touch the sides of the base of the sensor. Remove the logger unit and sensor from the logger housing by gently pulling the sensor vertically off the logger base. Do not twist or wiggle the sensor, as this can cause damage to the

pin connector on the sensor and/or the logger pins. See the image below.
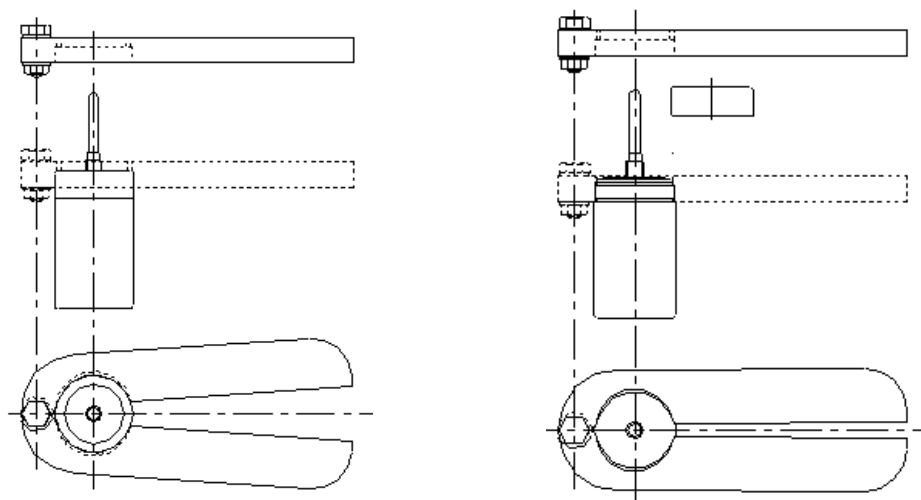
How to position the Ellab wrench tool to remove the top cover.

How to position the Ellab wrench tool to remove the sensor.

2. When assembling the logger, it is important to assemble the male and female connectors correctly, before they are placed in the logger house.

3. Please follow this procedure to obtain a secure logger assembly:

    See how to disassemble and reassemble a data logger here.

    a. Hold the sensor component containing the female connectors in one hand with the female connectors pointing up (picture 1).

    b. Hold the black unit component containing the male connectors in the other hand and let the male and female connectors gently join each other by carefully pushing the female and male connectors together (picture 2).

    c. Make sure this action keeps the pin connectors in proper condition.

    d.   Hold on to the sensor part and let the logger house slide on the black unit (picture 3).

    e.   Tighten the logger house and top cover firmly by hand.

Note: When assembling a logger with a SKY module, please refer to section 4.3.4.

4.1.6. Procedure for Cleaning TrackSense® Loggers

If any corrosion is present near the battery contacts, verify that no leaking is occurring. Lightly clean the contacts with a cotton bud (Q-tip) and alcohol. Change the o-rings if necessary. Let the area dry before placing a battery in the logger.

4.1.7. Maintaining/Cleaning TrackSense® Pressure Loggers

Description:
The TSP Pressure logger requires maintenance and cleaning. Under certain conditions i.e. "greasy" applications, dirt will build up on top of the membrane, which over time will damage the sensor or create false readings. It is therefore important that a regular cleaning procedure is in place.

Solution:
Removal of the protective cover allows free access, but due to the sensitivity of the membrane, it is prohibited to touch or use any tools to remove dirt, only spraying with (hot) rinsing water is permitted. This procedure will secure a fully functional and accurate sensor.

WARNING: Avoid exposing the pressure logger to thermal shock. Studies investigating the long-term quality of our pressure loggers have concluded that thermal shock can significantly degrade the accuracy of the sensor. Please handle the logger with care, especially during mounting and removal from the process. Do not put the pressure logger in a bowl with cold water to cool it faster, let the logger cool down slowly after use.

4.1.8. Maintaining/Cleaning TrackSense® Vacuum Loggers

Regular cleaning of the vacuum sensor is important to ensure accuracy. By removing the protection cap, the sensor air inlet gate can be cleaned by using a cotton swab with mild soap or alcohol.

If the inlet becomes completely blocked, the sensor must be sent back to Ellab for service/repair. The exterior of the logger may be cleaned with alcohol or mild detergent. Never use O3, H2O2 or any other oxidizing gas.

WARNING: Do not submerge the logger in any liquid. Do not pour liquid or insert anything through the air inlet gate (vacuum inlet) in the sensor housing. Do not subject to condensing gas conditions during operation.

4.1.9. Procedure for Changing the Logger O-Rings

The TrackSense® Pro / Pro X / Pro XL / Pro Basic loggers contain one o-ring, which is located at the base of the thread below the logger cap on the logger housing. The o-ring should be replaced with every battery or sensor change. Apply a light coat of grease to the o-ring. Be careful and keep the grease away from any battery contacts. Please refer to the instructional video guides for o-ring mounting and how to lubricate o-ring [found here](#).

4.1.9.1. Sensor O-Rings

TrackSense® Pro sensors contain three o-rings. Please see image below for
o-ring locations.

O-ring for rigid sensors (1 Piece)

Outer o-Rings (2 Pieces)

Inner o-Ring (1 Piece)

O-ring for TSP logger house. (1 piece)
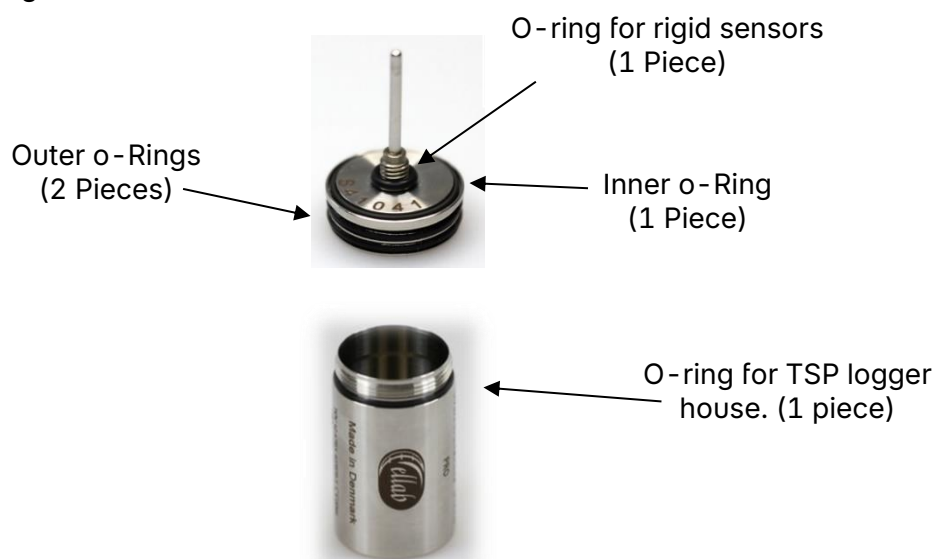
The inner o-ring should be changed with every battery change or calibration. The outer black silicon o-rings should be changed with each battery change and calibration as well. With every o-ring change, be sure to apply a light coat of silicon grease on the o-rings. This helps prevent any moisture intrusion.

WARNING:
Please note that the RH 5.2 sensor has a RED silicone o-ring, which should never have grease applied as this may damage the sensor.

When a Pro X or Pro XL logger is used in applications from -30 to -80 °C and require calibration via liquid bath, the rings should be replaced with a special PTFE cold resistant o-ring.

Sensor O-Rings:

Ordering code	O-Ring	
35900008	Outer o-ring (set of 20)	
35900009	Inner o-ring (set of 10)	
35900018	PTFE o-ring TSP (set of 2)	
25810022	Black o-ring for TSP rigid sensors with tread (set of 10)	
35900007	O-ring for TSP logger house (set of 10)	

4.1.10. Extended Warranty

Ellab offers an extended warranty on all new TrackSense® Pro / Pro X / Pro XL / Pro Basic loggers. The extension is from 2 to 5 years. The warranty needs to be purchased together with the logger. Please contact your local Ellab sales representative for pricing.

4.1.11. Sensors

All TrackSense Pro data loggers can be equipped with interchangeable sensors Interchangeable sensors are sensors that can easily be switched and replaced on the go. The interchangeability is part of a unique electronic design, in which each sensor includes an e-prom that containing the sensor ID number and calibration constants. This data is then recognized by the software.

Furthermore, the design includes an A/D converter, which transforms

analog data into digital data that is saved in the data logger memory during the acquisition and later uploaded to ValSuite. As all intelligence, this way is linked uniquely to the sensor that can be interchanged easily with any available TrackSense Pro data logger without compromising any data.

As an additional advantage, it is only the sensor that needs to be returned for factory recalibration when the time is up.

4.1.11.1. Proper Use

- Never use the sensors outside the measuring range
- Only use the special tool provided by Ellab to remove sensors from the loggers. Never use any other tools as this can damage the pin connector on the sensor and/or the threads on the logger
- Lubricate the sensor o-rings (seals) frequently with silicone grease in order to avoid water intrusion, or if necessary, change the o-rings. Always lubricate the o-rings when loggers are opened for a battery or sensor change
- Ensure that the sensors are kept clean. Use a damp cloth to remove any dirt or stains from the surface of the sensors
- Any sensor with recurring problems should be returned to Ellab for service
- In order to maintain the accuracy of the TrackSense® Pro sensors, it is recommended that they are re-calibrated by Ellab at least once every 12 months. Please see section 0 for calibration types
- Test all new sensors before using them in any application
- Do not immerse RH sensors in liquid
- Always hold logger/sensor by the logger and not the sensor
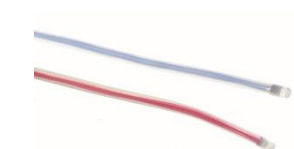
4.1.11.2. Sensor Serial Numbers

All sensors have a unique serial number. The serial numbers allow compliance with GMP & GDP regulations. The sensor serial number is found on the top or the side of the sensor.

Serial number
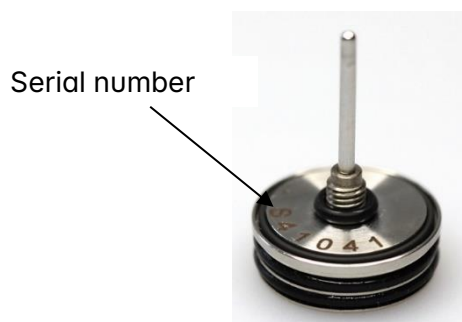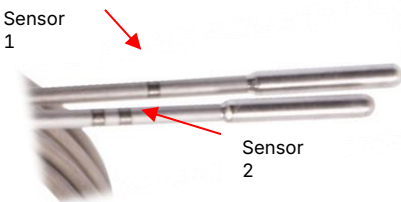
4.1.11.3. Sensor Types - TrackSense® Pro

Ordering code	Lengths	Type	Measuring Range	Accuracy
TEMPERATURE				
35121000 35121010 35121025 35121050 35121075 35121100 35121150 35121200 3512XXXX	0mm 10mm 25mm 50mm 75mm 100mm 150mm 200 mm Custom lengths available	Rigid Temperature Sensors 	-80 to +150 °C	± 0.05 °C* * -25 to +150 °C
351227XX	Custom lengths available.	Double Rigid Temperature Sensor 	-80 to +150 °C	± 0.05 °C* * -25 to +150°C

35121905 35121910	50 mm (5 mm between each measuring point) 100 mm (10 mm between each measuring point)	Rigid Multipoint Temperature Sensors	-80 to +150 °C	± 0.05 °C* * -25 to +150 °C
35124527 35124526 351245XX	SmartFlex Temperature Sensor 30 cm 50 cm. Custom lenghts	SmartFlex Temperature Sensors (1.8 mm diameter)	-196 to 140 °C	± 0.1 °C*
35124935 35124936 351249XX	Double SmartFlex Temperature Sensor 30 cm 50 cm Custom lenghts			
35124819 351248XX	Rigid and SmartFlex Temperature Sensor 30 cm Custom lengths To have add-on steel tips order TAJ, TNJ, TKJ or TRJ tip system.			* -40 to +140 °C
Proper Handling		- Use caution as sensors are sensitive to stretching, especially when hot. - Minimum cable curl diameter is 30 mm. - Do not make sharp cable bending of 90° or more. - Do not twist or pull cable. - Do not bend cable any closer than 20 mm from the tip. - Do not use sharp instruments when handling. - Do not carry by Flexible leads. - Measuring point is 3mm from tip.		
Color of Flexible Sensors		The sensor number (1) is blue, number (2) is red. **(LC01)** **(LA02)**		
Proper Handling		- Use caution as sensors are sensitive to stretching, especially when hot. - Minimum cable curl diameter is > 25 mm. - Do not twist or pull cable. - Do not bend cable any closer than 20mm from the tip. - Do not use sharp instruments when handling.		

		• Do not carry by the leads.		
351225322 351225321	Semi Flexible Temperature Sensor 30 cm 50 cm	Semi Flexible Temperature Sensors (1.5 mm diameter)	-196 to +150 °C	± 0.1 °C* * -40 to +150 °C
351229692 351229691	Double Semi Flexible Temperature Sensor 30 cm 50 cm			
351225XX 351229XX 351226XX	Semi Flexible Temperature Sensor Double Semi Flexible Temperature Sensor Rigid and Semi Flexible Temperature Sensor (Custom lengths available)	Semi FlexibleTemperature Sensors (2.0 mm diameter)	-196 to +150 °C	± 0.1 °C* * -40 to +150 °C
	Proper Handling	• Stainless steel flexible sensors should never be bent at a sharp angle. Bend probes around the TC35 bending tool, a logger or thermal barrier to avoid sharp bends on the sensor. See image • Avoid bending the last 20 mm of the sensor tip, as this can ruin the sensor		
25000104	TC35	Bending tool Ø 35 mm		

		High Temperature Sensors		
351232XX	Rigid High Temperature Sensor Custom lengths available, ø3mm			
35123200 35123205 35123262 35123263 3512326x	Semi Flexible High Temperature Sensor 30cm, ø2.5mm 50cm, ø2.5mm 30cm, ø2.0 x 12mm 50cm, ø2.0 x 12mm Custom lengths available		0 to +400 °C	± 0.5 °C
35122800 35122804 35122850 35122851 351228XX	Double Semi Flexible High Temperature Sensor 30cm, ø2.5mm 50cm, ø2.5mm 30cm, ø2.0 x 12mm 50cm, ø2.0 x 12mm Custom lengths available			
		Rugged Flexible Temperature Sensor		
35124000 35124001	500 mm 1,000 mm		‑196 to +140 °C	± 0.1 °C* *‑40 to +140 °C
Proper Handling		• Rugged flexible sensors should never be bent at a sharp angle, but with a diameter of minimum 7,5 cm.		
Indication of Sensor numbers on all double sensors		• The sensor marked with a dot is sensor number 1, the other sensor is number 2. 		

Special indication of sensor numbers on double high temperature sensors. The sensor with one ring is sensor no. one, while the sensor with two rings is sensor no. two.		Sensor 1 Sensor 2	
Proper handling		• Stainless steel flex sensors should never be bent at a sharp angle. Bend probes around a logger or thermal barrier to avoid sharp ends on the sensor. See the image above. Note: When using the sensors at temperatures higher than 150 °C, a thermal barrier is required. Confirm the temperature range of the logger before utilizing it in any application.	
Resolution		Resolution of standard temperature sensors are 12mK per bit. Resolution of high temperature sensors is 24mK per bit.	

PRESSURE

		Pressure Sensors		
35127024	4 Bar Pressure Sensor		10 mBar to 4 Bar Absolute	± 0.25 % FS
35127018	6 Bar Pressure Sensor		15 mBar to 6 Bar Absolute	± 0.25 % FS
35127021	8 Bar Pressure Sensor		20 mBar to 8 Bar Absolute	± 0.25 % FS
35127019	Pressure and Rigid Temperature Sensor (20mm)		15 mbar to 6 Bar Absolute 0 to +150 °C	± 0.05 °C

Proper handling	• To clean the pressure sensor membrane, remove the protective cap and spray it with water. Do not touch the membrane itself.

VACUUM

		Vacuum Sensor		
35127900	Vacuum Sensor		0.001 – 0.005 mBar:	±0.005 mBar
			>0.005 – 0.01 mBar:	±0.003 mBar
			>0.01 – 0.025 mBar:	±0.005 mBar
			>0.025 – 0.1 mBar:	±0.01 mBar
			>0.1 – 0.5 mbar:	±0.05 mBar
			>0.5 – 1.0 mBar::	±0.1 mBar
			>1.0 – 5.0 mBar:	±0.5 mBar
			>5.0 – 10 mBar:	±2 mBar
			>10 – 100 mBar:	±20 mBar

Proper handling	• Do not submerge the logger in any liquid. • Do not pour liquid or insert anything through the upper hole (Vacuum inlet) in the sensor housing. • Do not subject to condensing gas conditions during operation. • The Vacuum sensor may be cleaned using autoclaves. The inlet can be cleaned using a cotton swab. If inlet becomes blocked, the sensor must be sent back to Ellab for cleaning and service. <u>Do not</u> clean the logger in 0_3, H_2O_2 vapor or any other oxidizing gases.

RELATIVE HUMIDITY

35128013	Combined sensor (ValSuite® 5.2.10 or later)	Relative Humidity and Temperature Sensor	0 to 100% 0 to +90 °C	± 2%* *10-90% / 25 °C
Proper handling		• The RH sensing element is very sensitive, which is why the PEEK protection cap and/or protection filter should never be removed or touched • The outer RED sensor silicone o‑ring should never have silicone grease applied as this may damage the sensor • To protect the RH sensing element against contamination, be sure to keep the sensor away from "dusty" areas and environments. Also, be careful when using the sensor in aggressive chemical environments. When using the sensor, store it in a clean and stable area • When not using the sensor, store it in a clean and stable environment. Use the antistatic type 3M Static Shielding Bag SCC 1000 delivered with the sensor for shipping whenever possible • Do not immerse RH sensors in liquid		

CONDUCTIVITY

35132000 35132001	Combined sensor 0‑200 µS/cm (ValSuite® version 3.0 or later) Combined sensor 200‑2000 µS/cm (ValSuite® version 3.0 or later)	Conductivity and Temperature Sensor	0‑200 µS/cm 200 ‑2000 µS/cm 0 to 100 °C	± 1 µS/cm or ± 2.5% of reading whichever is worse. 0.05 °C
Proper handling		• If the sensor does not look clean, follow this procedure: Before using it in a process, put the sensor in a beaker with carbon dioxide‑free distilled water that complies with the pharmaceutical demands that are written in the ph.EUR or USP demand. Then stir the logger for a minimum of 1 minute, to ensure that the sensor is clean. Do not let the sensor touch the beaker. Repeat this procedure at least two times. • After measuring, clean the sensor again, and repeat. Interference of measurement:		

	Be aware that the measured values of the electrical conductivity can be affected by contamination if the sensor is not clean.

Co$_2$ SENSOR				
35127921	(ValSuite® version 5.2.0.9 or later)	CO$_2$ Sensor	0-10%	± 0.2%
35127922			0-20%	± 0.4%
BOWIE DICK SENSOR				
35127022	Bowie Dick Sensor including Protective Adaptor	Bowie Dick Sensor	0 to 140 ˉC	± 0.05 °C
35000500	Process Challenge Device (PCD)			
AUTOMARKER SENSOR				
35131000	AutoMarker sensor with 1 sensor (ValSuite® Version 2.6 or later)	AutoMarker Sensor	+5 to +50 °C Sensor is placed outside of application	N/A

4.1.11.4. Thermocouple Sensor

The TC sensor is equipped with a screw terminal that allows users to replace damaged thermocouples. Simply apply the blue cable to the + terminal, and the red cable to the – terminal, then proceed by tightening the screw slots located on the side of the sensor with a small screwdriver. See the image below:

Connect the blue wire to the + terminal.

Connect the red wire to the - terminal.

Tighten the cables here using a screwdriver.
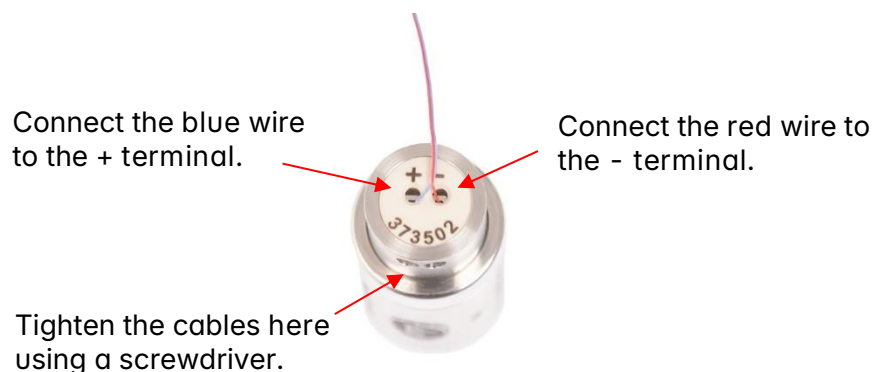
4.1.11.5. Sensor LED

LED indicators can be optionally purchased with all TrackSense® temperature sensors (1 and 2 channel). The color of the LED indicates the different status' for the TrackSense® Pro temperature sensors with or without the SKY module. See the difference below:

TrackSense® Pro/Pro X/Pro Basic loggers with SKY module:

- 🟢 Green Blink: The logger is active and the SKY module is communicating with the Access Point.
- 🔴 Red Blink: Loss of communication between the SKY module and the Access Point.
- ⚪ No Blink: The battery is dead or logger is inactive

TrackSense® Pro / Pro X / Pro Basic loggers without SKY module:

- 🟢 Quick Green Blink: The logger is active.

- 🟢 Slow Green Blink: Delayed start and the logger is not collecting data.

- 🔵 Blue Blink: The memory is full or the battery voltage is low.

- 🔴 Red Blink: Sensor error.

- ⚪ No Blink: The battery is dead or the logger is inactive.

4.1.11.6. Smart Flex

Intended use:
Smart Flex does not have the same robustness as the steel sensors and must therefore be treated with extra care.

 - Sensor tip cannot withstand compression and must therefore not be pinched.
 - Never use the logger/sensor device as a handle to pull a sensor out of an application/test medium.

Dark/black spots may appear inside the Smart Flex sensor to a greater or lesser extent.
 These spots do not affect the measuring precision or durability and are therefore not covered by the complaint/warranty.
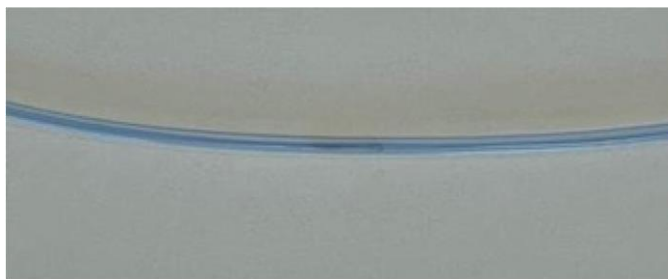
Photo example of dark/black spot

4.1.11.7. CO2 sensor

Sensor handling, environment and storing:
CO_2 sensors are an optical sensor which, among other things, contains a small mirror.
CO_2 sensors are very sensitive to mechanical shock, impact and drop, so it is extra important to handle the sensor extra carefully. Shock, impact and drop can misalign the optic parts, thereby affecting the sensor measurement tolerance and drift.
CO_2 sensor measurement tolerance and drift are affected if the mirror becomes contaminated. Measurement in condensing humidity can contaminate the mirror, thereby affecting the sensor measurement tolerance and drift. Never use the sensor in condensing environment. Never use the sensor in a polluted environment.
CO_2 sensors are best stored in an antistatic bag. This to avoid contamination.

4.1.11.8. -30 to -80 °C Application Recommendations

When using the TrackSense® Pro X loggers in -30 to -80 °C applications, Ellab offers a few recommendations to ensure that the validation/calibration process is successful:

- Verify that the Pro batteries being used have not previously been used in hot applications, as the chemical structure of the battery changes, which greatly reduces the voltage at lower temperatures.
- If there is uncertainty as to how much battery life is left, it is important that the battery voltage is tested before the batteries are used in -30 to -80 °C applications. In order to get the most accurate voltage reading, cool the batteries in a freezer for 1 hour. Immediately insert the battery into the activator unit and use a voltmeter to measure the voltage over the two poles of the battery. At temperatures between -30 and -80 °C the battery voltage should ideally be 3.2 V or above.
- When a Pro X logger is used in applications from -30 to -80 °C, please use special PTFE o-rings.

4.1.12. -30 to -80 °C Application Recommendations

When using the TrackSense® Pro X loggers in -30 to -80 °C applications, Ellab offers a few recommendations to ensure that the validation/calibration process is successful:

- Verify that the Pro batteries being used have not previously been used in hot applications, as the chemical structure of the battery changes, which greatly reduces the voltage at lower temperatures.
- If there is uncertainty as to how much battery life is left, it is important that the battery voltage is tested before the batteries are used in ‑30 to ‑80 °C applications. In order to get the most accurate voltage reading, cool the batteries in a freezer for 1 hour. Immediately insert the battery into the activator unit and use a voltmeter to measure the voltage over the two poles of the battery. At temperatures between ‑30 and ‑80 °C the battery voltage should ideally be 3.2 V or above.
- When a Pro X logger is used in applications from ‑30 to ‑80 °C, please use special PTFE o‑rings.

4.1.13. Temperature/Relative Humidity in Smokehouses with TSP

For measurements in batch and continuous smokehouses, a special TS Fixture for holding a TrackSense® Pro logger, including a plastic water reservoir, is available.

The TrackSense® Pro logger is furnished with a special RH PRO DW rigid double dry and wet double sensor, and the relative humidity is measured psychrometrically.

Note: The water reservoir and the logger should not be exposed to direct sunlight.

Installation information:
1. Place the TS FIXTURE for Dry/Wet in a well‑ventilated location, where the wind flow is 2.4 m/s.

2. Do not place the unit near any heat or vapor sources.

3. Locate the bulbs, approximately 1.2 to 2 meters above the ground.

Procedure – how to measure:
1. Open the water reservoir and fill it up.

2. A cotton sock is connected to the bent sensor. The sock needs to be wet. The other (straight) sensor is measuring the ambient temperature of the chamber (dry).

Water reservoir with logger placed in TS FIXTURE for Dry/ Wet

3. Start the logger in the ValSuite® software. See the ValSuite® manual for more information. Place the other end of the wet sock into the water reservoir (wet).
When running a SKY application, add the Dry/Wet Report once the measurements are shown.

4. Insert the logger in the TS FIXTURE for Dry/Wet and place it in the chamber. It needs to be placed in a location where the wind flow has a velocity of 2.4 m/s.

5. Read the logger in the ValSuite® software and add the Dry/Wet Report. The report will calculate the relative humidity (RH%) of the chamber automatically. See the ValSuite® manual for more information.

4.1.14. Thermal Barriers

The wireless data logger acquisition system is designed to collect data, even at high temperatures. The logger's upper temperature limit is 150 °C (Pro and Pro X), in order to exceed this limit, the logger requires special protection. The protection, a thermal barrier, consists of a metal cylinder or flat pack with ceramic inserts and a metal lid. If a dual sensor is used, the appropriate dual sensor PEEK protection block must be used. The ceramic material must be saturated with distilled water before use. The system is designed to meet the requirements for measuring temperatures between 0 to +400 °C. Of course, a high temperature sensor must be used in combination with the logger and the thermal barrier.

4.1.14.1. Functioning Principle

The Thermal Barrier is filled with distilled water at room temperature. The system utilizes the effect of evaporating water: As long as there is water left in the thermal barrier, the temperature of the logger will remain at approximately 100 °C. When all the water has evaporated, the temperature of the logger will quickly rise to the ambient temperature. Follow the instructions for Thermal Barrier Preparation below.

Note: All specifications, graphs and time calculations are based on using distilled water at room temperature (+23 °C (±2 °C)) when introduced into a thermal barrier.

4.1.14.2. Thermal Barrier Types

The required size of the thermal barrier depends on the temperature and exposure time in the application.

Ordering codes	Sensor	Type	Dimensions	
25901503	Single or Double	TTB 35‑2	Ø35 x 150 mm	
25901502	Single or Double	TTB 64‑2	Ø64 x 150 mm	
25901514	Double SKY	TTB 64‑2 SKY		
25901529	Single or Double	TTB 85‑2	Ø85 x 175 mm	
25901530	Double SKY	TTB 85‑2 SKY		
25901520	Single or Double	TBF 40‑2	40x100x153mm	
25901521	Double SKY	TBF 40‑2 SKY		
25901524	Single or Double	TBS 40‑2	40x40x153mm	
25901525	Double SKY	TBS 40‑2 SKY		
25901507	Single	TTB 65	Ø65x86mm	

4.1.14.3. Proper Use & Safety

- Verify the logger temperature range before placing it in a thermal barrier.

- When using the 35‑mm thermal barrier, please note that the ceramic wall is unprotected, and can therefore crack very easily due to its delicate nature.
- Overheating the logger can result in the out‑gassing of the battery, which will cause serious damage to the logger.
- If there is a risk of overheating, remove the thermal barrier unit(s) from the heating zone, and cool it down in water immediately. Users must protect themselves against water back‑splash and should therefore use eye protectors.
- The thermal barrier may only be filled with distilled water to avoid any mineral deposits. The amount of water depends on the thermal barrier type, this is described in the accompanied instructions.
- Use thermal protecting gloves when removing a thermal barrier from an application.
- Avoid getting ceramic fibers in the eyes or on the skin when using the 35‑mm thermal barrier.
- Avoid inhalation of ceramic fibers, especially when using the 35‑mm thermal barrier.
- Wash hands thoroughly after use.
- First aid: Rinse with cold water.
- Adult operators only.

Warning: In some cases, applications cause the thermal barriers to give off some white ceramic liquid (powder). Please note that this powder will not come off once it has come in contact with a surface. We therefore recommend that thermal barriers that leak ceramic liquid are placed in aluminum (foil) trays when applied to a process. This will ensure that the leaking liquid remains within the tray, which can then be thrown out.

The white ceramic powder is almost impossible to remove. Ensure that an aluminum tray is placed under the thermal barrier to avoid leakage.

4.1.14.4. Preparation

1. Remove the lid from the barrier (threaded).

2. Remove PEEK insert.

Type	Empty Weight (g) +/- 5g	Water Absorption (g) Min	Water Absorption (g) Max
TBS40	450	65	80
TBF40	1100	240	310
TTB35	180	55	70
TTB64	510	225	300
TTB80	1200	225	300

3. Check and ensure that the empty base weight is in accordance with the table shown above.

4. Fill the barrier with demineralized water to avoid deposition of calcium. Refill to ensure that the ceramic insulation is fully saturated.

5. Wait for a minimum of 15 minutes to ensure full soaking.

6. Drain the excess water from the barrier, weigh the base again and ensure that the actual water absorption is within the limits shown in the table above.

7. Never use the thermal barrier if the minimum absorption requirements are not met.

8. Carefully insert the sensor(s) through the hole of the PEEK insert and place it on top of the logger. It is important that the logger goes first and is placed at the bottom before the PEEK insert (see the image below).

Correct order:
Logger first, then PEEK Insert

9. Carefully insert the activated data logger mounted with high temperature sensor(s) and a PEEK insert into the thermal base.

10. Screw the lid on lightly by hand. Do not tighten further once it is attached.

11. Place the unit in the process environment.

4.1.14.5. Remove Thermal Barriers from Application

Note: Remember to use protection gloves during the following steps.

1. Remove the High Temperature System from the heating zone while using protecting gloves.

2. Screw the lid off and remove the logger unit.

3. Allow the logger unit to cool down before downloading the data. If the logger is too hot to touch with bare hands, it is too hot to be placed in the reader station.

4. Let the ceramic material dry naturally before screwing the lid back on.
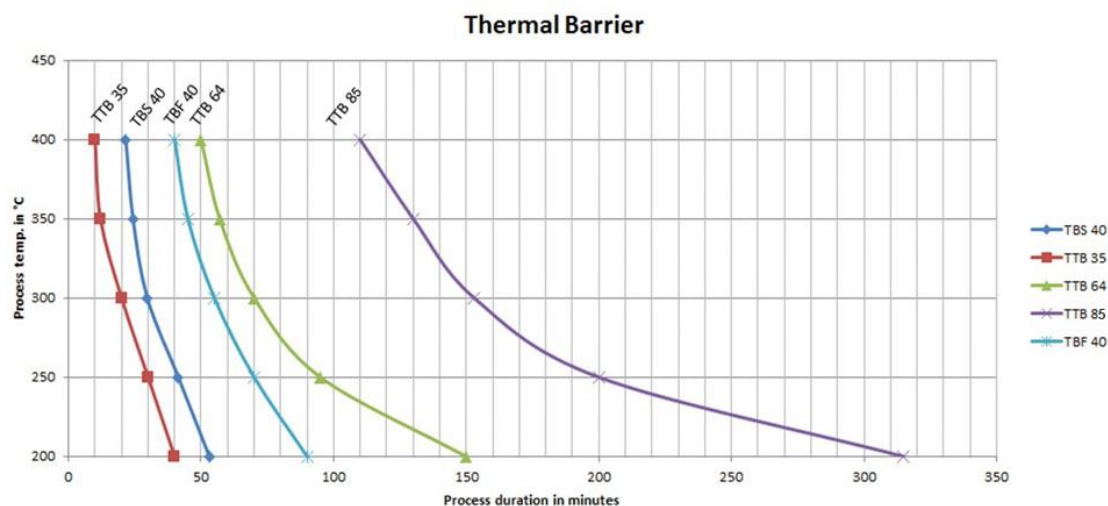
4.1.14.6. Specifications

Thermal Barrier

Diagram:
Looking at the 85‑mm thermal barrier, the diagram shows that at a 250 °C process temperature will have a protection time of 200 minutes. At a 400 °C process temperature the protection time will be reduced to 110 minutes.

Thermal barrier TTB65

4.1.14.7. Process Times

40‑mm flat pack thermal barrier
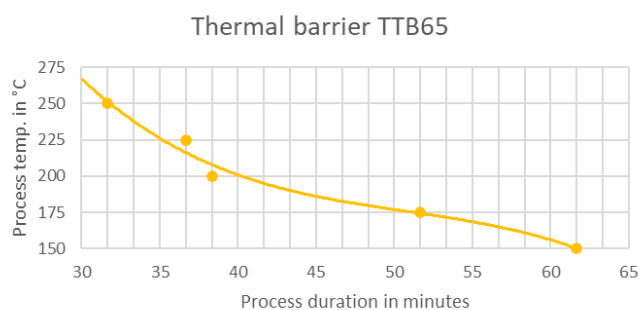
WARNING: It is extremely important that the data logger does not exceed the exposure times shown above. Overexposure will severely damage the loggers and may cause the battery to explode. In the case of process equipment malfunction that may cause the logger to overheat, move the thermal barrier units from the heating zone and cool them down in water immediately. Users should protect themselves against water back-splash and use eye protectors.

4.1.14.8. Thermal barrier & SKY

TrackSense Pro loggers configured with a Sky Module can also be used in conjunction with the thermal barrier, this is however exclusive to the 64-mm and 80-mm diameter cylinders, as well as the 40-mm flat pack. In order to use the TrackSense Pro Sky module together with the thermal barriers, a special Sky kit for thermal barriers is required.

Metal Plate for Multi Reader Station and Sky kit.
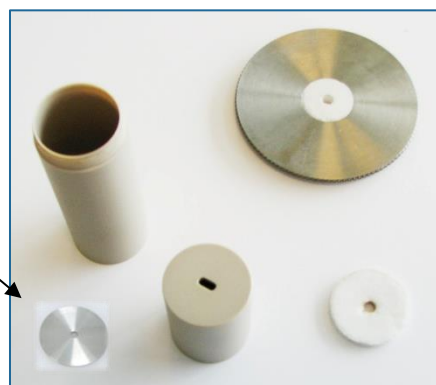
When using the Multi Reader station, remember to place the metal plate in the Multi Reader Station while programming the SKY logger in the peek housing.

When dealing with high temperatures, the sensor must be of a special type. Ellab A/S can supply single or double flexible high temperature sensors in various lengths.

4.2.   TrackSense® Lab Logger

Please reference section 4.1 for proper use, disassembling / assembling the logger, changing the battery, changing the o-rings and the procedure for cleaning the loggers. The processes are identical for the Lab / Pro / Pro X / Pro Basic loggers.

4.2.1. Logger Specifications

Ordering code	Logger type	Temp. Sensor	Range	Operating Pressure	Temp. Accuracy	Samples	Dimensions	Min / Max. Sample rate
36303000	Internal Temperature Sensor	0 mm						
36303035	Rigid Temperature Sensor	35 mm	-30 to +100 °C	10 mBar to 1.2 Bar Abs.	± 0.1 °C	120,000 or continuous	Ø25×44mm + Sensor	Min. 1 sec. Max. 23:59 (Hours: Min)
36303100	Relative Humidity and Temperature Sensor*	Internal	0 to +90 °C, 0 to 100% RH	10 mBar to 1.2 Bar Abs.	± 0.1 °C	60,000 per channel or continuous	Ø25×44mm	Min. 1 sec. Max. 23:59 (Hours: Min)
36303200	Quad Flexible Temperature Sensor*	50 cm	-30 to +100 °C	10 mBar to 1.2 Bar Abs.	± 0.1 °C	30,000 per channel or continuous	Ø25×44mm + Sensor	Min. 1 sec. Max. 23:59 (Hours: Min)

Note: Continuous sampling cannot be used when a Lab logger is used in conjunction with a SKY module.

* LAB with a Quad Flexible Temperature Sensor cannot be used with SKY and has no LED light.
* LAB with a Relative Humidity and Temperature Sensor has no LED light.

Proper Handling:
- Use caution as sensors are sensitive to stretching, especially when hot.
- Minimum cable curl diameter is > 25 mm.
- Do not bend the cable at a sharp (<90°) angle.
- Do not twist or pull the cable.

- Do not bend the cable within 20 mm of the tip.
- Do not use sharp instruments when handling.
- Do not carry by PTFE leads.
- The measuring point is located 3 mm from the tip.
- Color of Lab Quad Sensor (Flexible):
  The sensor sequences are: Blue (1), Red (2), Orange (3), Yellow (4)

(LA01)

(LA02)

(LA03)

(LA04)

- Lab RH / Temperature:
  Internal temperature sensor only.

4.2.1.1. Sensor LED

The LED indicator is integrated in all Lab loggers (except for Lab Quad). Please see the list of LED indicators for the logger status below:

🟢 The logger has been started and is collecting data.

🔵 The memory is full, or the battery voltage is low.

🔴 A low or high temperature alarm.

⚪ The battery is dead, or the logger is inactive.

4.3. SKY System

4.3.1. SKY Components

The TrackSense® Pro SKY system concept facilitates radio frequency data transmission and is compatible with the existing TrackSense® Pro single or double temperature sensors, as well as 2nd generation Pressure, Relative Humidity, Conductivity and CO_2 sensors.

The TrackSense® Pro SKY system consists of the following:

- 3rd Generation Logger (TrackSense® Pro / Pro X / Pro XL/ Pro Basic / Pro Basic L / Lab)
- SKY Module
- Access Point

Note: All loggers produced after January 2019, are 3rd Generation loggers. Contact your local Ellab sales representative if there is uncertainty regarding a specific logger generation. If the serial number can be read on the outside of logger housing, the logger is not a 3rd generation logger.

4.3.2. SKY Module

The Sky module contains all the necessary components for wireless communication between the logger and the Sky Access Point, allowing collection of real-time measurements. An external antenna is available for more difficult transmission environments.

4.3.3. SKY Module 3G

The SKY Module 3G has improved stability of live data transmission through an increased range performance.
The module is still compatible with all existing SKY system parts, including the SKY Access Point and the optional SKY External Antenna.

The SKY Module 3G requires that the TrackSense loggers have the following firmware:

- Pro2 – 28.8 or newer
- Pro3 – 91.7 or newer

4.3.4. Specifications

- Temperature range: -80 to +140 °C.

  Note: The module can be used down to -80 °C when used with a Pro X logger. When used with a Pro Basic or Lab logger, the module will have the same temperature range as the logger.

- Operating pressure between 0,001 bar and 10 bar ABS

  Note: Other limits may apply for sensors

- Communication range up to 15 meters (50 ft).
  SKY 3G modules has a range up to 180 meters (600 ft) in free line of sight.*

- Compatible with 3rd Generation Pro, Pro X, Pro XL, Pro Basic, Pro Basic L and Lab loggers.

- Compatible with existing TrackSense® Pro temperature sensors (Quad excluded) and 3rd Generation pressure, Relative Humidity, CO_2 and Conductivity sensors

- Module includes an internal antenna.

  *Range performance is a reliable indicator of strength and connection stability but will naturally be impacted by obstructions (like steel or concrete), other active radio signals, and environmental factors. Due to this, it's recommended to test the system under the conditions its planned to be used in.

4.3.5. Connecting SKY Module to Logger

1. Following the disassembly procedures shown earlier, disassemble the Pro / Pro X / Pro XL / Pro Basic / Lab logger, and remove the logger from its housing.

2. Attach the SKY module by carefully connecting the male and female connectors at the base of the module and the top of the logger.

3. Attach the sensor by carefully connecting the male and female connectors at the base of the sensor and the top of the module.

4. Insert the logger with the attached sensor and module into the extended housing, and gently press down until the o‑rings on the side of the sensor are no longer visible.

   Note: When inserting, ensure that the pin connectors are aligned with the housing metal bars.

5. Screw the logger top cover on tight by hand. Never use tools and do not over‑tighten, as this might damage the threads and bend the housing.

SKY Module

4.3.6. Maintaining SKY Logger Houses

Ellab recommends yearly replacement of o‑rings placed under the black polymer cover for all SKY logger housings.

If the replacement is carried out by an Ellab laboratory, the laboratory can offer to leakage test the housing after the o‑ring replacement.

4.4. Access Point

4.4.1. Specifications

- Temperature Range: +5 to +50 °C.
- Anodized aluminum housing
- LED indicators.

- Supports up to 64 loggers with a maximum of 128 channels. (Requires ValSuite® 3.1.3.3. or later)
- Up to 1‑12 Access Points per session. Using multiple Access Points requires the use of a separate power supply and LAN hub.
- PC connection by either USB or Ethernet (either crossed Ethernet cable or standard Ethernet cable).
- Antenna included in Access Point as standard, but remote antennas are available for more difficult transmission environments

Note: If the Access Point shows a red light, this means that the internal buffer is filled and must be emptied by loading the data into ValSuite.

Access Point

Operating Temperature	0 to 50 °C
Environmental:	0 – 90% RH, non‑condensing
Operating Voltage	External Adapter 100‑240V AC, 50‑60 Hz or USB
Weight:	990 g
Dimensions (H x W x L) :	45 x 200 x 140 mm
Material:	Aluminum

4.4.2. Access Point: Sensitivity to ESD

The Access Point system is sensitive to Electro Static Discharge (ESD) when the antenna connector is open. The following techniques should be used to help reducing the risk of component damage caused by static electricity.

1. Before handling any antenna / Access Point, immediately drain any electro static charge on your body by touching a grounded object. Alternatively, obtain and wear a commercially available wrist strap

device, which should be removed for potential shock reasons prior to applying power to the unit.

2. The antenna should be removed / connected only when the Access Point is powered off and no other cables are connected to the Access Point.

3. Never touch the center pin in the open antenna connector.

4. Leaving the antenna attached to the Access Point, even during transportation, helps avoiding damage to the connector and is therefore highly recommended.

Note: In the event of a failure due to ESD, the Access Point will obtain a permanently reduced sensitivity.

4.4.3. SKY Remote Antenna

The SKY remote antenna is designed for extremely challenging applications such as large autoclaves, with thick walls where communications could be difficult.

1. Fit the SKY remote antenna in the autoclave chamber via a feedthrough*
2. Make sure the antenna is placed just inside the chamber wall:
    a. avoid too deep in the entry tube which could give limited transmission range
    b. avoid too far into chamber with any contact to inside moving parts (e.g. crates)
3. Unscrew the black standard antenna on the SKY access point and replace it with the SKY remote antenna cable
    a. The power must be off before disconnecting and replacing the antennas
    b. Avoid touching the golden connector pins
4. The communication set follows the same procedure as when using the access point standard antenna

* For a ½" connection to the autoclave, you need a single hole ø7.5mm rubber stopper and packing gland.

Ordering code	Description	
31190701	SKY remote antenna ø7x300mm with 3m cable	

31190702	SKY remote antenna ø7x500mm with 3m cable	

4.4.4. Communication Setup

4.4.4.1. USB

1. Connect the USB cable to the Access Point and PC.

2. Verify that the USB is providing power to the Access Point (power light should be green).

3. Once a SKY session has been started, verify that the Wireless LED light on the Access Point is blinking green, i.e. indicating that communication between the logger and Access Point has been established.

4.4.4.2. LAN

Note: When setting up an IP address on the Access Point, a USB cable must be connected between the Access Point and PC.

1. Connect the Ethernet cable to the Access Point and LAN network.

2. Connect a power supply and USB cable to the Access Point. Reference the software manual in order to properly setup the IP address in the ValSuite® software.

3. Once a SKY session has started, verify that the Wireless LED light on the Access Point is blinking green, i.e. indicating that communication between the logger and Access Point has been established

Note: A 12V power supply must be purchased separately when connecting the Access Point to a PC via Ethernet.

4.5. TrackSense® Pro Micro Logger

4.5.1. Logger Specifications

Ordering codes	Logger type	Lengths	Measuring Range	Data Points	Dimensions	Min / Max. Sample rate	Accuracy
31196210	Rigid Temperature Sensor	10 mm	-20 to +140 °C	14,500	Ø15×22mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C
31195200	Pressure and Temperature Sensor	Internal	-20 to +140 °C 10mBar to 6 Bar Abs	30,000 / 10,000 samples	Ø15×30mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C ± 15mBar

4.5.2. Proper Use

- Never use the logger outside the measuring range.
- Treat the loggers as you would treat any other sensitive electronic equipment. Dropping or causing heavy mechanical shock will loosen or damage the electronic connections.
- Only use the special tool provided by Ellab in conjunction with the battery removal tool to disassemble / assemble loggers. Never use any other tools as this can damage the housing assembly and the threads.
- Do not remove the logger from the reader station while the loggers are being read. Loss of data may occur.
- Store loggers in a dry, cool place.
- If corrosion is present near the battery contacts, verify that the logger is not leaking. Lightly clean the area with a Q-tip and alcohol. Change o-ring if necessary.
- Any logger with recurring problems should be returned to Ellab for service.
- If loggers have not been used for an extended period of time, they must be tested by running a short test at room temperature.

4.5.3. Logger Serial Numbers

All loggers have a unique serial number. The serial numbers allow for compliance within the GMP & GDP regulations. The serial number for Micro loggers appear on the top and/or on the side of each logger.

4.5.4. Disassembly / Assembly of Micro Logger

1. Place the Micro logger in the battery removal tool and affix the logger wrench around the outside of the removal tool.

2. Ensure that the bottom of the Micro logger is visible when placed in the tool. Turn the tool with containing the Micro logger around and screw/unscrew the bottom lid of the logger with the Ellab opening coin.

4.5.5. Procedure for Cleaning Micro Loggers

To assure proper contact between the Micro logger and battery, it is necessary to clean the contact point inside the logger.

Moisten a cotton bud with alcohol and clean the contacts contained inside the logger carefully. Leave the logger open to dry for 120 seconds. The battery and o‑ring thread of the lid can be cleaned this way as well.

4.5.6. Special Maintenance/Cleaning for Micro Pressure Loggers

Description:
TSP Micro Temperature/Pressure logger requires maintenance and cleaning. Under certain conditions i.e. "greasy" applications, dirt will build up on top of the membrane, which over time will damage the sensor or create false readings. It is therefore important that a regular cleaning procedure is in place.

Solution:
Removal of the protective cover allows free access, but due to the sensitivity of the membrane, it is prohibited to touch or use any tools to remove dirt. This is why only spraying with (hot) rinse water is permitted. This procedure will ensure a fully functional and accurate sensor.

4.5.7. Procedure for Changing Micro Logger O-Rings

The Micro o-ring is non-reusable due to the possible deformation, and should therefore be replaced by a spare (multiple rings included with delivery) every time the logger is opened.

Ordering code	Micro o-ring	
35900011	(set of 10 pcs.) Generation 1	
35900022	(set of 10 pcs.) For 2nd Gen.	

1. Use the tool for Micro loggers to remove the o-ring. At the end of the tool legs, there is a small recess. Place the lid in the recess and keep it firm. Push the tool against the edge of the lid until the o-ring is loose. Pull the o-ring off the lid and throw it out.

2. Clean and grease the o-ring thread of the lid. Grease the new o-ring and place it in the thread. The o-ring is very flexible and can be mounted without a tool.

3. Wash hands before insertion of the battery and before the logger is closed.

4. For the 2nd generation Micro logger, it is important to remember to use the correct o‑ring when changing the battery and o‑ring.

4.6. TrackSense® Pro Mini Logger

4.6.1. Logger Specifications

Ordering code	Logger type	Lengths	Range	Data Points	Dimensions	Min / Max. Sample rate	Accuracy
35211000		0 mm	0 to +140 °C	30,000	Ø20×12mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C
35221010		10 mm	0 to +140 °C	30,000	Ø20×12mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C
35221025		25 mm	0 to +140 °C	30,000	Ø20×12mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C
35221035		35 mm	0 to +140 °C	30,000	Ø20×12mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C
35221040		40 mm	0 to +140 °C	30,000	Ø20×12mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C
35221050		50 mm	0 to +140 °C	30,000	Ø20×12mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C
35221075		75 mm	0 to +140 °C	30,000	Ø20×12mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C

35221100		100 mm	0 to +140 °C	30,000	Ø20×12mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C
35221XXX	-	Custom lengths	0 to +140 °C	30,000	Ø20×12mm	Min. 1 sec. Max. 23:59 (Hours: Min)	± 0.05 °C

4.6.2. Proper Use

- Never use the logger outside the measuring range.
- Treat the loggers as you would treat any other sensitive electronic equipment. Dropping or causing heavy mechanical shock will damage the electronic connections.
- Only use the special tool provided by Ellab in conjunction with the battery removal tool to disassemble / assemble loggers. Never use any other tools, as this can damage the housing assembly and the threads.
- Do not remove the logger from the reader station while the loggers are being read. Loss of data may occur.
- Store loggers in a dry, cool place.
- If corrosion is present near the battery contacts, verify that the logger is not leaking. Lightly clean the area with a Q-tip and alcohol. Change the o-ring if necessary.
- Any logger with recurring problems should be returned to Ellab for service.
- If loggers have not been used for an extended period of time, they must be tested by running a short test at room temperature.

4.6.3. Logger Serial Numbers

All loggers have a unique serial number. The serial numbers allow for compliance with GMP & GDP regulations. The serial number for Mini loggers appears on the top and/or on the side of each logger.

4.6.4. Disassembling / Assembling Mini Logger

1. Place the Mini logger in the battery removal tool and affix the logger wrench around the outside of the removal tool.

2. Ensure that the bottom of the Mini logger is visible when placed in the tool. Apply minimum pressure and turn the tool containing the Mini logger around and screw / unscrew the lid of the logger with the Ellab opening coin.

4.6.5. Procedure for Cleaning Mini Loggers

To assure proper contact between the Mini logger and battery, it is necessary to clean the golden contact points inside the logger.

Moisten a cotton bud with alcohol and clean the contacts inside the logger carefully. Leave the logger open to dry for 120 seconds. The battery and o-ring thread of the lid can be cleaned this way as well.

4.6.6. Procedure for Changing Mini Logger O-Rings

The o-ring is placed around the lid for Mini logger. It is crucial for the lifetime of the Mini logger that the o-ring is kept in proper condition. To avoid leakage, the o-ring must be changed every time the battery is changed.

Ordering code	Mini o-ring	
35900010	(set of 10 pcs.)	

1. Use the tool for Mini Loggers to remove the o-ring. At the end of the tool legs there is a small recess. Place the lid in the recess and keep it firm. Push the tool against the edge of the lid until the o-ring is loose. Pull the o-ring off the lid and throw it out.

2. Clean and grease the o‑ring thread of the lid. Grease the new o‑ring and place it in the thread. The o‑ring is very flexible and can be mounted without   the   tool.

    Note: Only use the necessary amount of grease. It is important that the o‑ring is NOT over‑greased and that the screw thread is free of all grease.

3. Wash hands before inserting the battery and the logger is closed.

4.7. TrackSense® Compact Logger.

Description:
TrackSense® Compact logger designed with integrated sensors.

4.7.1. Logger Specifications

Ordering codes	Logger type	Sensor length	Measuring Range	Operating Pressure	Accuracy	Data Points	Dimensions	Min / Max. Sample rate
31191202 31191203 31191204 31191205	Rigid Temperature Sensor	35 mm 50 mm 75 mm 100 mm	-30 to +140 °C	0 mbar to 10 bar abs.	± 0.1 °C	30,000*	Ø25×35mm	Min. 1 sec. Max. 23:59 (Hours: Min)
31191250 31191251	SmartFlex Temperature Sensor	30 cm 50 cm	-30 to +140 °C	0 mbar to 10 bar abs.	± 0.1 °C	30,000*	Ø25×35mm	Min. 1 sec. Max. 23:59 (Hours: Min)
31191270 31191271	Semi Flexible Temperature Sensor	30 cm 50 cm	-30 to +140 °C	0 mbar to 10 bar abs.	± 0.1 °C	30,000*	Ø25×35mm	Min. 1 sec. Max. 23:59 (Hours: Min)
311912XXX	Rigid Temperature Sensor (Compact X)	Standard temp. lengths	-50 to +140 °C	0 mbar to 10 bar abs.	± 0.3 °C* ± 0.1 °C** *-50 to -40 °C **-40 to +140 °C	30,000*	Ø25×35mm	Min. 1 sec. Max. 23:59 (Hours: Min)

311912XXUX	Rigid Temperature Sensor (Compact Ultra X)	Standard temp. lenghts	-80 to +140 °C Note: TSF BAT 85L: -80 to +85 °C TSF BAT 150L: -50 to +140 °C	0 mbar to 10 bar abs.	± 0.3 °C* ± 0.1 °C** *-80 to -40 °C **-40 to +140 °C	60,000*	Ø25x60mm	Min. 1 sec. Max. 23:59 (Hours: Min)
31191103	6 Bar Pressure Sensor	-	10 mbar to 6 bar abs.	0 mbar to 10 bar abs.	± 15mBar	30,000* / 15,000 samples	Ø25×55mm	Min. 0,333 sec. Max. 23:59 (Hours: Min)
31191104	Pressure and Rigid Temperature Sensor	20 mm	-30 to +140 °C 10 mbar to 6 bar abs.	0 mbar to 10 bar abs.	± 0.1 °C ± 15mBar	30,000* / 10,000 samples	Ø25×55mm	Min. 1 sec. Max. 23:59 (Hours: Min)

* Data Points: Requires ValSuite® 5.0.

4.7.2. Proper Use

- Never use the logger outside the measuring range.
- Treat the loggers as you would treat any other sensitive electronic equipment. Dropping or causing heavy mechanical shock will loosen or damage the electronic connections.
- Only use the 2 special tools provided by Ellab to disassemble loggers. Never use any other tools as this can damage the housing assembly as well as the threads. See image below.

- Do not remove the loggers from the reader station while the loggers are being read. Loss of data may occur.
- Store loggers in a dry, cool place.
- If corrosion is present near the battery contacts, verify that the logger is not leaking. Lightly clean the area with a Q-tip and alcohol. Change the o-ring if necessary.
- Any logger with recurring problems should be returned to Ellab for service.
- If loggers have not been used for an extended period of time, they must be tested by running a short test at room temperature.

4.7.3. Logger / Sensor Serial Numbers

All loggers have a unique serial number. The serial numbers allow for compliance with GMP & GDP regulations. The serial number for Compact loggers appears on the top of each logger.

4.7.4. Disassembling / Assembling Logger

Disassemble the logger by unscrewing the top cover by hand. If the top cover is too tight, place the logger wrench over the top cover with the larger diameter of the circle touching the sides of the cover and twist counter clockwise, see image for more information.

The assembling is the same process, but now requires the users to twist the tool counter clockwise.

Note: It is important that the o-ring is completely covered/hidden.
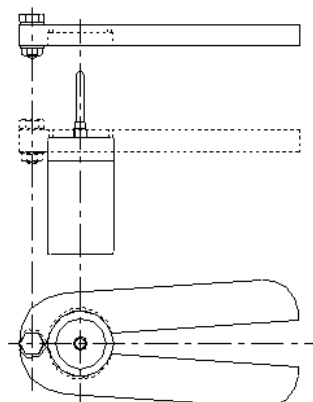
How to position the Ellab wrench tool to remove the sensor/ logger top.

Logger assembled properly

4.7.5. Procedure for Cleaning TrackSense® Compact Loggers

If any corrosion is present near the battery contacts, verify that leaking is not occurring. Lightly clean that contacts with a cotton bud and alcohol. Change the o-rings if necessary. Let area dry before placing the battery in the logger.

4.7.6. Maintain/Cleaning TrackSense® Compact Pressure Logger

Description:
Track Sense Pro Compact Pressure loggers require maintenance and cleaning. Under certain conditions, i.e. "greasy" applications, dirt will build up on top of the membrane, which over time will damage the sensor or create false readings. It is therefore important that a regular cleaning procedure is in place.

Solution:
Removal of the protective cover allows free access, but it is prohibited to touch or use any tools to remove the dirt due to the sensitive membrane. Therefore, spraying with (hot) rinsing water is the only permitted action. This procedure will secure a fully functional and accurate sensor.

4.7.7. Procedure for Changing Compact Logger O-Rings

TrackSense® Compact loggers contain one o-ring, which is located on the logger house. The o-ring should be replaced with every battery change. Apply a light coat of grease to the o-ring.

4.7.8. Smart Flex

Intended use:
Smart Flex does not have the same robustness as the steel sensors and must therefore be treated with extra care.

- Sensor tip cannot withstand compression and must therefore not be pinched.
- Never use the logger/sensor device as a handle to pull a sensor out of an application/test medium.

Dark/black spots may appear inside the Smart Flex sensor to a greater or lesser extent.
These spots do not affect the measuring precision or durability and are therefore not covered by the complaint/warranty.
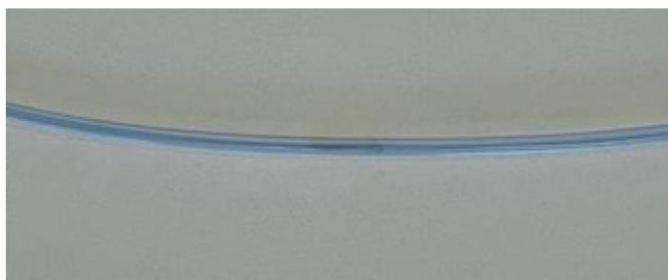
Photo example of dark/black spot

4.7.8.1. Sensor O-Rings

See the image below for o-ring locations.
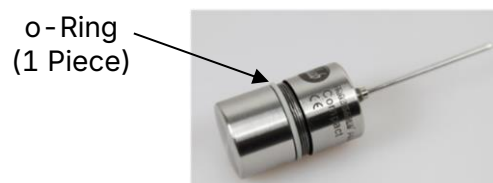
o-Ring
(1 Piece)

The o-ring should be changed with every battery change or calibration. With every o-ring change, apply a light coat of silicon grease on the o-rings. This helps prevent any moisture intrusion.

Sensor o-rings:

Ordering code	O-Ring	
35900019	Outer o-ring (set of 10)	

4.8.   TrackSense® Frigo Logger

Description:
The TrackSense® Frigo logger is designed specifically for COLD applications. Using a special larger AA battery, this logger can operate at temperatures down to -90 °C in up to 12 months.

Note: Users cannot change the sensors on the Frigo logger, since the Frigo logger is only available with integrated sensor(s).

4.8.1. Logger Specifications

Ordering codes	Logger type	Sensor	Range	Operating Pressure	Data Points	Dimensions Logger/Sensor	Min / Max. Sample rate	Accuracy
31191500 31191501	Internal Temperature Sensor Rigid Temperature Sensor 	0 mm 35 mm	-90 to +85°C	0 mBar to 1,2 Bar Abs	60,000	Ø25×60mm/Ø2 mm	Min. 1 sec. Max. 15 min.	± 0.1 °C
31191570 31191571	Semi Flexible Temperature Sensor 	30 cm 50 cm	-90 to +85°C	0 mBar to 1,2 Bar Abs	60,000	Ø25×60mm/Ø1 ,5mm	Min. 1 sec. Max. 15 min.	± 0.1 °C
31191550 31191551	SmartFlex Temperature Sensor 	30 cm 50 cm	-90 to +85 °C	0 mBar to 1,2 Bar Abs	60,000	Ø25×60mm/Ø1 ,8mm	Min. 1 sec. Max. 15 min.	± 0.1 °C

4.8.2. Proper Use

- Never use the logger outside the measuring range.
- Treat the loggers as you would treat any other sensitive electronic equipment. Dropping or causing heavy mechanical shock will loosen or damage the electronic connections.
- Only use the 2 special tools provided by Ellab to disassemble loggers. Never use any other tools as this can damage the housing assembly and threads. See image below.

- Do not remove loggers from the reader station while the loggers are being read. Loss of data may occur.
- Store loggers in a dry, cool place.
- If corrosion is present near the battery contacts, verify that the logger is not leaking. Lightly clean the area with a Q-tip and alcohol. Change o-ring if necessary.
- Any logger with recurring problems should be returned to Ellab for service.
- If loggers have not been used for an extended period of time, they must be tested by running a short test at room temperature.

4.8.3. Sensor LED

The LED indicator is only integrated in Frigo loggers with internal or 35mm rigid sensors. Please see the list of different logger status below:

🟢 The logger has been started and is collecting data.

🔵 The memory is full, or the battery voltage is low.

🔴 Low or high temperature alarm.

⚪ The battery is dead, or the logger is inactive.

4.8.4. Logger / Sensor Serial Numbers

All loggers have a unique serial number. The serial numbers allow for compliance with GMP & GDP regulations. The serial number for Frigo loggers appears on the top and the side of each logger.

4.8.5. Disassembling / Assembling Logger

Disassemble the logger by unscrewing the top cover by hand. If the top cover is too tight, place the logger wrench over the top cover with the larger diameter of the circle touching the sides of the cover and twist counter clockwise, see image for more information.
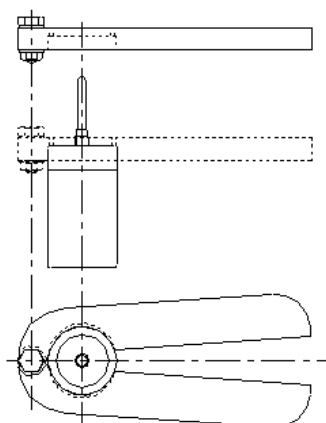
How to position the Ellab wrench tool to remove the sensor/ logger top.

Logger assembled properly

Note: It is important that the o‑ring is covered/hidden.

4.8.6. Procedure for Cleaning TrackSense® Frigo Loggers

If any corrosion is present near the battery contacts, verify that leaking is not occurring. Lightly clean the contacts with a cotton bud and alcohol. Change the o‑rings if necessary. Let the area dry before placing a battery in logger.

4.8.7. Procedure for Changing Frigo Logger O‑Rings

TrackSense® Frigo loggers contain one o‑ring, which is located on the logger house. The o‑ring should be replaced with every battery change. Apply a light coat of grease to the o‑ring – this helps prevent moisture intrusion.

Warning: When mounting, do not roll the o‑ring over the thread as this could damage/curl the ring

4.8.8. Smart Flex

Intended use:
Smart Flex does not have the same robustness as the steel sensors and must therefore be treated with extra care.

 - Sensor tip cannot withstand compression and must therefore not be pinched.
 - Never use the logger/sensor device as a handle to pull a sensor out of an application/test medium.

Dark/black spots may appear inside the Smart Flex sensor to a greater or lesser extent.
These spots do not affect the measuring precision or durability and are therefore not covered by the complaint/warranty.
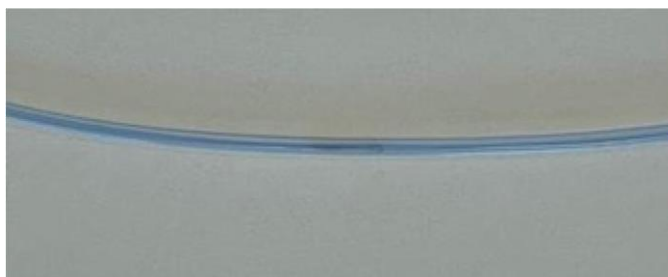
Photo example of dark/black spot

4.8.8.1. Sensor O-Rings

See the image below for o-ring locations.
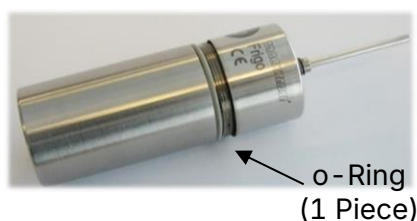
o-Ring
(1 Piece)

The o-ring should be changed with every battery change or calibration. With every o-ring change, apply a light coat of silicon grease on the o-rings. This helps prevent any moisture intrusion.

Sensor o-rings:

Ordering code	O-Ring	
35900019	Outer o-ring (set of 10)	

5. Battery

5.1. TrackSense® Pro Batteries

Ordering code	Type	Temp. Range	Expected lifetime	Battery type	Shelf time	
35900050	TSP-BAT-150 with Activator	-50 to +150 °C -80 to +150 °C *	2,000 hours**	Lithium	10 years	
35900051	TSP-BAT-150 without activator	-50 to +150 °C -80 to +150 °C *	2,000 hours**	Lithium	10 years	
35900053	COLD TSP-BAT-150 with activator	-50 to +150 °C -80 to +150 °C *	2,000 hours**	Lithium	10 years	
35900054	COLD TSP-BAT-150 without activator	-50 to +150 °C -80 to +150 °C *	2,000 hours**	Lithium	10 years	

*This temperature range is only when combined with a TrackSense® Pro X logger, as this logger is designed to work with a battery that has a lower voltage.
**2,000 hours in applications at 121 °C with a 10 second sample rate (single sensor).

Note: Do not directly touch the battery poles and ensure that unused batteries are placed at moderate ambient temperatures under +25 °C.

Note: The ValSuite® software has a battery time manager feature that provides an estimate of how much battery power is remaining. The feature cannot be utilized if multiple batteries are being used in one logger.

Note: Batteries used from -30 to -80 °C with a Pro X logger using a 10 second sample rate have an estimated life span of 1,000 hours (single sensor).

Note: Even though the batteries have a temperature range of -80 to +150 °C, verify that the loggers are not used outside their temperature range. Please reference section 4.1.1 for specifications.

Note: Do not directly touch the battery poles and ensure that unused batteries are stored at ambient temperatures below +21 °C with a maximum fluctuation of +/- 2 °C - and at maximum of 40% relative humidity (RH).

5.1.1. Battery Life in Hours – Schedule

Normal Expected use – ½ channel:

Sample Rate / Temperature	23 °C	121 °C	-50 °C	-80 °C
1 sec.	2,000/1,500	1,500/1,000	1,500/1,000	1,000/750
10 sec.	3,500/3,000	2,000/1,750	1,500/1,500	1,000/1,000
10 min.	4,000/3,500	N/A	1,500/1,500	1,000/1,000
1 hour	4,000/3,500	N/A	1,500/1,500	1,000/1,000

Theoretical Continual Use – ½ channel:

Sample Rate / Temperature	23 °C	121 °C	-50 °C	-80 °C
1 sec.	2,500/1,600	2,200/1,400	1,500/1,000	1,000/750
10 sec.	4,750/4,400	3,400/3,000	2,000/1,700	1,500/1,250
10 min.	5,500/5,400	3,700/3,500	2,000/1,700	1,500/1,250
1 hour	5,500/5,400	3,700/3,500	2,000/1,700	1,500/1,250

WARNING: All lithium batteries must always be stored separately before and after use.

5.1.2. Proper Use of TrackSense® Pro Batteries

- The TrackSense® Pro loggers have a standby battery usage that will empty the battery in approx. 12 months, even if the logger is not used. It is therefore recommended to remove the battery from the logger when it is not used for several weeks.
- If the battery is removed from the logger for a longer period of time (more than one week), it is necessary to reactivate the battery again.
- Use separate batteries for hot and cold applications.
- When changing the battery, only use the special tool provided by Ellab to disassemble the loggers. Never use any other tools as this can damage the housing assembly as well as the threads.
- Only use Ellab batteries. Use of other batteries will void any warranty on equipment. Other batteries have not been tested in extreme temperatures / environments and they can potentially cause damage to the logger.
- When the voltage of the battery gets to a critically low level, the logger will perform a controlled shutdown in order to preserve the data stored in the memory.
- Ellab recommends that only batteries with more than 3.2V (if the voltage is tested at ambient) are used for all applications excluding studies between -30 and -80 °C.
- The voltage level of the battery can be checked by inserting the battery into the activator unit and then using a voltmeter to measure the voltage over the two poles of the activator.
- Stored batteries should not be exposed to temperatures over +25 °C and they should be kept in a dry place prior to use.

Note: Always change o-rings when changing batteries.

Note: For -30 to -80 °C applications, voltage requirements are different.

5.1.2.1. Proper Storage and Handling

WARNING: It is of utmost importance that batteries are stored separately in bags or trays to avoid short circuit. Leaving batteries in bundles where they come in contact with each other is highly risky as it may cause a short circuit and thereby a small-scale explosion or fire hazard.

DO   DO NOT

Note: Please do note, this also includes used batteries, be sure to dispose of used batteries in a safe and clean manner.

5.1.3. Activating and Testing TrackSense® Pro Batteries

- TrackSense® Pro loggers do not use enough power to activate the battery by itself. Therefore, the activator unit must be used.
- New batteries must be activated in the start for exactly 1 hour. See image below. The same procedure applies if the battery has not been installed/used in a logger for more than 1 week. A new battery has a voltage of approximately 3.6V. Over time, the voltage will drop a little, and towards the end it will increase to around 3.7V before it drops to zero.
- When testing the battery with a voltmeter, it is important to do this while the battery is inserted in the activator/starter. A new battery will show 3.2 - 3.3V the first time it is inserted into the activator, and during the first 30 minutes in the voltmeter, the voltage will begin to increase to approximately 3.3 - 3.4V. This means that the battery it ok, and ready to be used after 1 hour in the activator.
- A weak battery will typically show less than 3.1V when inserted into the activator, at the end of its lifespan, it can also show 3.5 - 3.7V. In both cases, the initial voltage will begin to drop after a few minutes in the activator.

Battery and Activator →

Note: Leaving the battery in the activator for more than 1 hour will cause the battery to drain at a rate of 2.0 mAh an hour.

5.1.4. TrackSense® Pro Battery for Cold Applications

Due to the design and chemical structure of the battery, and to extend the life time, it is highly recommended to use separate batteries for hot (sterilization) and cold (freezing) applications.
Therefore, Ellab offers a battery with a blue label, which should only be used for cold applications. This battery is identical to the standard red battery with the red label, but by color coding them, they can easily be identified to avoid a mix up.

Users will have to manually keep track of the number of hours each battery has been used. In the battery time manager, 100% of the battery power would be equivalent to the default values in ValSuite®. For example, expected lifetime of the battery is 2,000 hours in applications at 121 °C with a 10 second sample rate (single sensor).
The expected lifetime changes to 1,000 hours when used in applications at -80 °C with a 10 second sample rate (single sensor). If there is uncertainty as to how much battery life is left, it is important that the battery voltage is tested before the batteries are used in -30 to -80 °C applications.
In order to get the most accurate voltage reading, cool the batteries in a freezer for 1 hour. Immediately insert the battery into the activator unit and use a voltmeter to measure the voltage over the two poles of the activator. For use at -80 °C, the battery voltage should be 3.5 V or above.

5.1.5. Changing TrackSense® Pro, Pro X, Pro Basic, Pro XL and Pro Basic L Batteries

1. It is very important that the battery is activated before changing.

2. Disassemble the logger by unscrewing the top cover and removing the logger unit and sensor from the logger housing using the Ellab wrench tool. The battery will then be clearly visible in the logger unit.

3. Remove the old battery and wait one minute before replacing. The software will not detect a battery change if users do not wait at least one minute.

4. Insert the battery. Ensure that the battery is inserted in the correct orientation. The positive side of the battery, which is indicated with a red or blue ring, should face the bottom of the logger.

5. When changing the battery, the low/critical low battery warnings do not go away until after the logger has been started and read. Once the battery has been changed, start the logger for a few minutes and then read it.

5.1.6. TrackSense® Pro Micro Battery

Ordering code	Type	Temp. Range	Estimated battery life	
35500001	TSP Micro Battery 1 set=(2pcs)	-20 to 140 °C	TMP: 75 hours* TMP 2G: 75 hours* PRS/TMP: 50 hours* PRS/TMP 2G: 50 hours* ROT: 40 hours**	

*Expected lifetime in applications at 121 °C with a 10 sec. sample rate.
**(With 1 sec sample rate).

Note: Do not directly touch the battery poles and ensure that unused batteries are placed at moderate ambient temperatures below +25 °C.

5.1.6.1.   Changing Micro Batteries

Note: Do not directly touch the Micro batteries. Use a cloth or forceps to place them in the correct position. If tools are unavailable, wash hands to avoid getting grease on the battery surface.

1. Place the Micro logger in the battery removal tool and affix the logger wrench around the outside of the battery removal tool. Be sure that the bottom of the Micro logger is visible when placed in the tool. Turn the tool containing the Micro logger around and unscrew the lid of the logger with a suitable coin. Release the Micro logger from the tool.

2. The o-rings are non-reusable due to the possible deformation, they therefore need to be replaced with every battery change.

3. If needed, clean the inside of the logger. Once the old battery has been removed, leave the Micro logger without a battery for 120 seconds.

4. Insert the new battery (minus pole against the bottom) in the Micro logger and close the housing carefully. When closing the Micro logger after inserting the new battery, ensure that the lid is sealed tight. If the o-ring is still visible, tighten further.

5. For the 2nd generation Micro logger, remember to use the correct o‑ring when changing the battery and o‑ring.

5.1.7. TrackSense® Pro Mini Battery

Ordering code	Type	Temp. Range	Estimated battery life	
35300001	TSP Mini Battery (Single)	0 to 140 °C.	Mini: Max 100 hours* Mini 2G: Max 200 hours*	

*In applications at 121 °C with a 10‑sec sample rate.

Note: Due to the proportionality between the sample rate and battery lifetime, changing the sample rate to e.g. 1 second will reduce the battery's lifetime to 81 approx. 10 hours for a Mini logger and 81 approx. 20 hours for a Mini 2G logger.

Note: Do not directly touch the battery poles and ensure that unused batteries are placed at moderate ambient temperatures below +25 °C.

Note: If the logger is not detected by the software, attempt to clean the battery and the inside contact points of the Mini logger. When inserting the battery, hold the battery down to ensure contact.

5.1.7.1. Changing Mini Batteries

1. A warning massage will be displayed when there is 25% battery capacity left.

2. Place the Mini logger in the battery removal tool and affix the logger wrench around the battery removal tool. Ensure that the bottom of the Mini logger is visible when placed in the tool. Turn the tool containing the Mini logger around and unscrew the lid of the logger with a suitable coin. Then proceed by releasing the Mini logger from the tool.

3. Remove the old battery and leave the Mini logger without a battery for 120 seconds. It is very important to click YES when the software comes up with a message, concerning whether the battery has been changed or not. If one of the two actions mentioned above is performed incorrectly, the

logger will proceed with the 25% battery capacity (or lower) that was left.

4. Change the o‑ring.

5. Wash hands before inserting the battery and before the logger is closed. Insert the new battery (+ pole facing the bottom of the housing) in the Mini logger and press it for a few seconds to insure proper contact.

6. When closing the Mini logger after inserting the new battery, make sure that the lid is sealed tight.

If the o‑ring remains visible, tighten further.
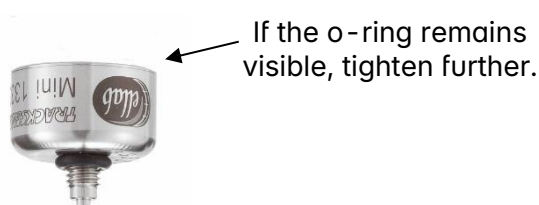
5.1.8. Compact Batteries

Ordering code	Type	Temp. Range	Expected lifetime	Battery type	Shelf time	
35900050	TSP‑BAT‑150 with activator	‑50 to +140 °C	2,000 hours*	Lithium	10 years	
35900051	TSP‑BAT‑150 without activator	‑50 to +140 °C	2,000 hours*	Lithium	10 years	

*2,000 hours in applications at 121 °C with a 10‑second sample rate (single sensor).

Note: Do not directly touch the battery poles and ensure that unused batteries are placed at moderate ambient temperatures below +25 °C.

5.1.9. Batteries for Compact Ultra X and Pro X Long

Ordering code	Type	Temp. Range	Expected lifetime	Battery type	Shelf time	
3590005 6	TSP-BAT-150L without activator	-80 to +150 °C**	3,000 hours*	Lithium	10 years	
3590005 5	TSP-BAT-150L with activator	-80 to +150 °C**	3,000 hours*	Lithium	10 years	

*3,000 hours in applications at 121 °C with a 10-second sample rate.
** max. +140 °C for Compact Ultra X.

5.1.9.1. Changing Compact Batteries

The Compact loggers have a standby battery usage that will empty the battery in 83 approx.12 months, even if the logger is not used. It is therefore recommended to remove the battery from the logger when it is not used for several weeks.

1. The Compact batteries are generally sold with an activator unit. The battery must be placed in this unit for one hour prior to being used in Compact loggers. Lithium batteries have a very long shelf life, but the Compact logger does not use enough power to activate the battery by itself. The activator unit must therefore be used.

   Note: Leaving the battery in the activator for more than one hour will cause the battery to drain at a rate of 2.0 mAh an hour.

2. Disassemble the logger by unscrewing the top cover and removing the logger housing.

3. Remove the old battery and wait one minute before replacing it. The software will not detect a battery change if users do not wait at least one minute.

4. Insert the battery and ensure that it is inserted in the correct orientation. The positive side of the battery, which is indicated with a red ring, should face the top of the logger.

5.1.10. Frigo and Basic L Battery

Ordering code	Type	Temp. Range	Estimated battery life	Shelf time	
35900061	TSF‑BAT without activator With special o‑ring	‑90 to +85 °C.	3,000 hours or 13 months *	10 years	
35900081	TSF‑BAT without activator	‑90 to +85 °C.	3,000 hours or 13 months *	10 years	
35900060	TSF‑BAT with activator With special o‑ring	‑90 to +85 °C	3,000 hours or 13 months*	10 years	
35900080	TSF‑BAT with activator	‑90 to +85 °C	3,000 hours or 13 months*	10 years	

*When sampling every 10 minutes at ‑80 °C continuously.

Note: Do not directly touch the battery poles and ensure that unused batteries are placed at moderate ambient temperatures below +25 °C

5.1.10.1. Changing Frigo Batteries

The Frigo batteries are in general sold with an activator unit. The battery must be placed in this unit for one hour prior to being inserted in Frigo loggers. The Frigo logger does not use enough power to activate the battery by itself. The activator unit must therefore be used.

Note: Leaving the battery in the activator for more than one hour will cause the battery to drain at a rate of 2.0 mAh an hour.

1. Disassemble the logger by unscrewing the sensor top and removing the logger housing.

2. Remove the old battery and wait one minute before replacing it. This enables the software to detect the battery change.

3. Insert the battery and ensure that the battery is positioned correctly. The positive side of the battery, which is indicated with a blue ring, should face the top of the logger, like the image shown above.

6. Calibration

6.1. Ellab Factory Calibration

It is recommended that all Ellab sensors are returned to Ellab at least once a year for factory calibration. Ellab performs the factory calibration, which adjusts and writes a new calibration date in the sensor. A certificate is generated, and the as found / as left data are included by default. All calibrations performed by Ellab are NIST and NPL traceable. If received, the Logger, SKY module and ETS firmware will also be updated. The software will (by default) automatically warn users 12 months* after the last calibration date, which should be considered a recommendation for temperature sensors built on Ellab's experience. The factory calibration date can only be changed by Ellab, this means that the factory calibration cannot be affected by any of the possible user calibration procedures performed in the ValSuite® software. Please note that the calibration certificates express an instant view of the performance, this is why the Ellab factory calibration certificates do not include recalibration due date.

*6 months for CO_2 sensors.

Note: When shipping equipment back to Ellab for calibration / inspection; please ensure that the equipment is packaged well. Use extra care when shipping Relative Humidity sensors and keep dust particles away from any sensor. Ellab is not responsible for any equipment damaged in shipments sent from customers.

6.1.1. Calibration Types: TrackSense® Pro

6.1.1.1. Standard Calibration (Single, Dual, Compact, Mini or Micro)
- Calibration Points: 0, 60, 90, 120 and 140 °C.

6.1.1.2. Low Temperature Calibration (Single, Dual or Quad Sensors)
- Calibration Points: 0, 25, 50, 90 and 100 °C.

6.1.1.3. High Temperature Calibration (Single or Dual Sensors)
- Calibration Points: 0, 90, 160, 240, 360 and 400 °C.

6.1.1.4. Relative Humidity / Temperature Calibration

- Relative Humidity Calibration Points:10, 30, 50, 70 and 90%RH.
- Temperature Calibration Points: 10, 30, 50, 75 and 90 °C.

6.1.1.5. Additional Temperature Checkpoints

- Standard Additional Checkpoints: ‑30, ‑50, ‑80* and ‑196 °C.
- Additional custom checkpoints can be added.

WARNING: When a TrackSense® Pro X logger is inserted in a ‑80 °C bath, two things will occur: Vacuum is generated, and the o‑rings will grow slightly rigid and smaller. Together, these two occurrences can create possible leakage. It is therefore recommended that the loggers are placed in a ‑80 °C freezer for one hour, before placing them in the ‑80 °C bath.

Note: When used at ‑80 °C, the battery voltage should be 3.5 V or above.

Note: There is an additional cost per checkpoint, which is per channel. There is an additional start‑up fee for additional checkpoints other than ‑50 and ‑80 °C. Please contact your local Ellab sales representative for more information.

6.1.1.6. Conductivity Calibration

- Temperature Calibration Points: 10, 30, 75, and 90 °C.
- Conductivity Calibration Points: 5, 20, 100, 1000 and 1500 µS/cm.

6.1.1.7. Chronometric Calibration: Time Accuracy of Loggers

- Standard: at +23 °C for approximately 16 hours.
- Special: at +70 °C for approximately 5 hours.

6.1.1.8. CO_2 Calibration (Recommended Every 6 Months)

- 0‑10% CO_2:
  Calibration points: 0, 5, 7.5 and 10%
- 0‑20% CO_2:
  Calibration points: 0, 5, 10, 15 and 10%

6.1.1.9. Pressure Calibration: TrackSense Pro

There are two types of pressure calibrations. One is for pressure sensors used in conjunction with the ValSuite® software version 2.3.10 (2006) or older, and the other is for new pressure sensors.

- Pressure Calibration Points (newer sensors): 1000, 3500, 6000, 7000 and 50 mBar.
- Temperature Calibration Points (newer sensors): 0, 90 and 140 °C.
- Additional calibration points can be added.

6.1.1.10. Rotation Calibration (Micro)

- Calibrated using 1,000 rotations.

6.1.2. Calibration Types: TrackSense® Lab

6.1.2.1. Temperature Calibration (TrackSense® Lab)

- Calibration Points: -30, 0, 40, 70 and 100 °C.

6.1.2.2. Relative Humidity / Temperature Calibration

- Temperature Calibration Points: 10, 30, 60, 75 and 90 °C.
- Relative Humidity Calibration Points: 10, 30, 60, 70 and 90%.

6.1.3. Calibration Types: TrackSense® Frigo

6.1.3.1. Temperature Calibration

- Temperature Calibration Points: -80*, -30, 0, 40 and 85 °C.

WARNING: When a TrackSense® Frigo logger is inserted in a -80 °C bath, two things will occur: Vacuum is generated, and the o-ring will grow slightly rigid and smaller. Together, these two occurrences can create a possible leakage. It is therefore recommended that the loggers are placed in a -80 °C freezer for two hours, before placing them in the -80 °C bath.

Note: When used at -80 °C, the battery voltage should be 2.2V or above.

6.2. In-House Calibration Solutions

WARNING: Prior to calibration it is important to remove the sky module and use the smaller pro housing. This action should be performed before immersing the logger into the liquid bath, as liquid could penetrate the logger housing otherwise.

6.2.1. Ellab Temperature Standard (ETS)

The ETS can be operated as an integrated part of the ValSuite® software. It is a temperature standard that can be started, stopped and used in report analysis and calibrations.

6.2.1.1. ETS Versions and Measuring Ranges

Ordering code	Type	Temp. Range	Accuracy	
20000195	ETS10	-80 to +250 °C	± 0.025 °C ± 0.015 °C*	
20000196	ETS20	-50 to +150 °C	± 0.020 °C	
20000197	ETS25	-196 to +420 °C	± 0.025 °C	
20000198	ETS25-A182	-45 to +150 °C	± 0.025 °C	
20000199	ETS25-A213	-95 to +150 °C	± 0.025 °C	

*Accuracy between -50 and +150 °C

6.2.1.2. Proper Use

- Although the ETS is quite robust, it should be handled with care. Dropping or causing mechanical shock will loosen or damage the electronic connections. The platinum resistor is

extremely sensitive, drift can therefore occur if not handled properly.

- Only use cables (USB) provided by Ellab.
- The ETS system must be properly grounded.
- Never use the ETS outside the measuring range.
- Any ETS with recurring problems should be returned to Ellab for service.
- In order to maintain the accuracy of the ETS, it is recommended that they are recalibrated by Ellab at least once every 12 months.

WARNING: When returning an ETS to Ellab for service or recalibration, please use the suitcase delivered with the product in order to avoid damage. If the product does not arrive at Ellab in a case, all warranty is lost and Ellab reserves the right to include a suitcase at the user's expense upon returning the product.

Note: In order to protect the ETS, the upper part of the sensor stem (see picture below) should never be exposed to temperatures outside -50 °C to +200 °C (transition limit).

6.2.1.3. Setting up the ETS (Old Version)

The ETS can be setup in 2 different ways. It can be used as a standalone unit with a display, in connection with the ETS Suite software or it can be setup in connection with the ValSuite® software.

Set up for Stand Alone Unit w/ Display:

1. Connect the ETS using a USB cable to the ETS display

2. Connect the display to the power supply

Set up for ETS using ValSuite®:

1. If using the USB connection, install the Ellab USB driver first

2. Disconnect all the equipment

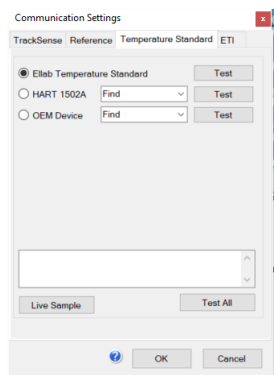3. The driver can be found on the ValSuite® disc (USB Driver)

4. Run the file Ellab USBDrivers_xxx.exe
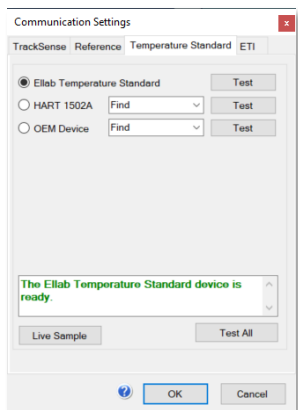
6.2.1.4. Setting up the ETS (New Version)

ETS can be connected to a PC via USB. The generic driver is automatically installed when plugged in.

In ValSuite, open the Communication Settings > Temperature Standard and select Ellab Temperature Standard as shown below:

Press Test to see whether the installation was successful.

6.2.1.4.1. LAN / Ethernet Connection (Requires ValSuite 6.3.x or Later)

1. Connect the USB and Ethernet cable to the ETS unit

2. Read and note the ETS IP address shown on the display when connecting to the PC. The display will show startup information before permanently switching to showing temperature
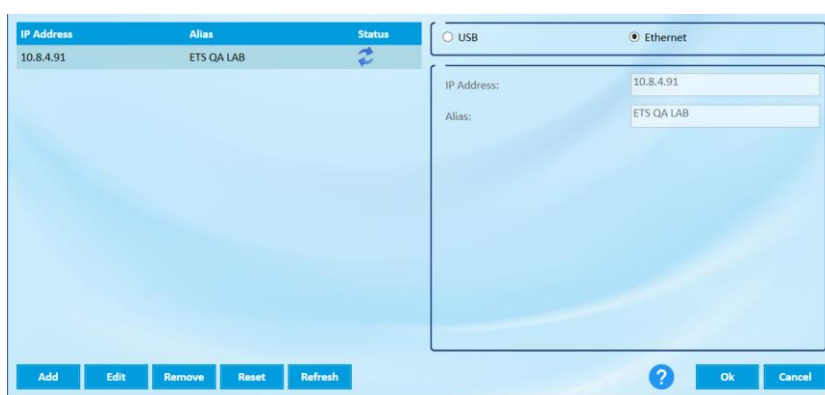

3. Open the ValSuite user menu ETS > Hardware Settings

4. Choose Ethernet > Add and enter the IP address obtained from the unit as well as an Alias
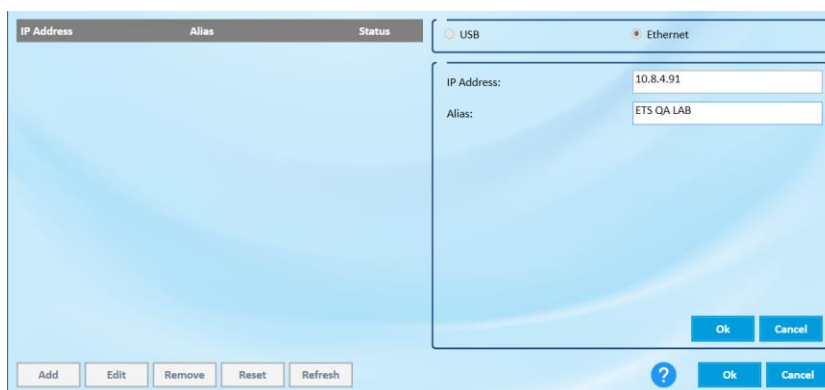
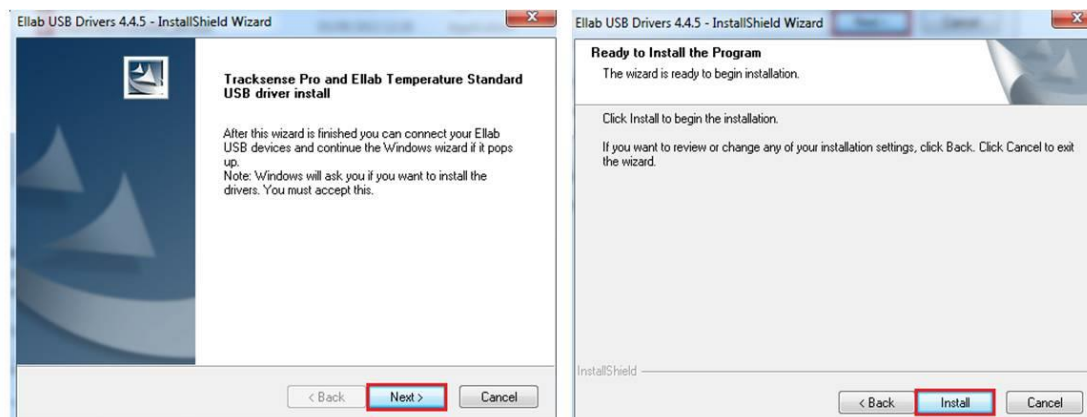5. Select OK and the settings will be saved as a reusable template

6. The USB cable can now be removed from the ETS unit, which will now function remotely
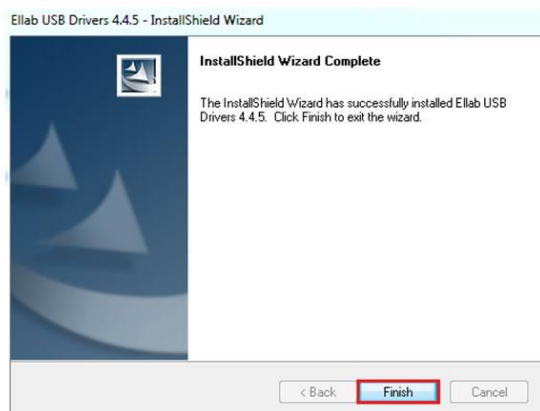

6.2.2. Installation for Windows 7, 8 and Windows 10

Note: This section is only relevant for users with ETS firmware older than 2.0.

1. Click **Next**

2. Click **Install**
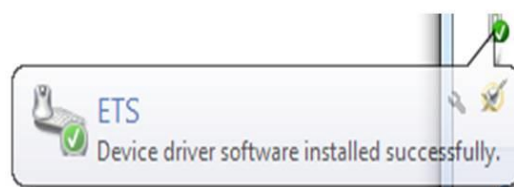
3. Driver is installed, Select **Finish**. Restart computer.

4. The first time the equipment is connected through the USB port, the message above will appear. The equipment is now ready to be used.

6.2.3. LiquiCal™ Baths

6.2.3.1. Standard Calibration Bath and Measuring Ranges

Ordering code	Type	Power	Temp. Range	
20100140	LiquiCal™LL	115V/60Hz	-80 to +110 °C	
20100150	LiquiCal™LL	230V/50Hz	-80 to +110 °C	
20100151	LiquiCal™SL	115V/60Hz	-40 to +150 °C	
20100141	LiquiCal™SL	230V/50Hz	-40 to +150 °C	
20100152	LiquiCal™HL	115V/50-60Hz	+40 to +300 °C	
20100142	LiquiCal™HL	230V/50-60Hz	+40 to +300 °C	

6.2.3.2. Logger Fixture for LiquiCal LL/HL/SL

Logger fixture designed to be merged into calibration zone in order to ensure correct positioning and optimal results.

Ordering code	Type	Description	
20000054	Fixture Std. Logger	Fixture for LiquiCal SL/HL/LL incl. stand & Holder for 10 std. loggers + ETS	
20000048	Fixture Mini	Fixture for LiquiCal SL/HL/LL incl. stand & Holder for 16 mini loggers + ETS	
20000058	Fixture Micro	Fixture for LiquiCal SL/HL/LL incl. stand & Holder for 20 micro loggers + ETS	
20000072	Add. Holder 10	Additional holder for 10 std. loggers	
20000073	Add. Holder 16	Additional holder for 16 mini loggers	
20000074	Add. Holder 20	Additional holder for 20 micro loggers	
20000147	Lid for fixture	Lid for bath when using fixture and ETS	

6.2.3.3. ETI Fixture for LiquiCal LL/HL/SL

Ordering code	Type	Description	
20000115	Fixture ETI Large	Insert for LiquiCal LL, HL, SL. Holds 8 ETI sensors and 1 ETS.	

6.2.3.4. Fixture for LiquiCal SM/HM

Sensor fixture designed to be merged into calibration zone in order to ensure correct positioning and optimal results.

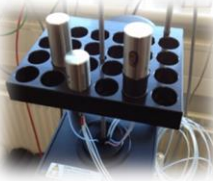| Ordering Code	Type	Description	
20000103	Insert for microbath, LiquiCAl HM/SM	Fixture for LiquiCal SM/HM holding ETS and 16 holes for probes/sensors.	

6.2.3.5. Proper Use and Bath Setup

1. Reference the LiquiCal user manual before the unpacking and setup.

2. Connect the Ellab RS232 cable from the COM port on the computer to the RS232 port on the bath.

3. Use the Hardware Manager in the ValSuite® software to select the appropriate serial port.

4. Connect the power cable to an appropriate outlet and turn the bath on.

Note: Ensure that the power supply is grounded and connected to the bath COM port and PC before connecting the power.

5. Verify that the liquid in the bath is circulating

6.2.4. Ellab Dry Blocks

Ordering code	Model	Power	Measuring Range	
20000155	PTC 155A	115 to 230 VAC / 50-60Hz	-25 to +155 °C	
20000425	PTC 425A	115 to 230 VAC / 50-60Hz	+33 to +425 °C	
20000156	RTC 156A	115 to 230VAC / 50-60HZ	-30 to 155 °C	
20000159	RTC 159A	115 to 230 VAC / 50-60 HZ	-100 to 155 °C	
20000168	RTC 156A	115 to 230 VAC / 50-60 HZ	-30 to +165 °C	
20004100	Logger support for RTC/PTC Dryblock. Holds up to 24 loggers and 1 ETS. (185 x 170 mm)		-	

Note: The dry blocks do not support Windows 8, but they support Windows 7, 32 & 64 bit.

6.2.4.1. Proper Use and Setup

1. Reference the user manual before the unpacking and setup.

2. Before the dry blocks can be used in conjunction with the ValSuite® software, JofraCal needs to be installed.

3. Connect the USB cable from the USB port on the computer, to the USB port on the dry block.

4. Connect the power cable to an appropriate outlet and turn the bath on.

   Note: Ensure that the power supply is grounded and connected to the bath USB port and PC before connecting the power.

5. Using the software manual, verify that ValSuite® is detecting the dry block.

6.3. ValSuite® Calibration Options

ValSuite® software includes three different methods for calibrating loggers: Manual Calibration, Semi‑Automatic (only for temperature) and Full Automatic (only for temperature).

6.3.1. Manual Calibration

First enter the reference values (temperature, relative humidity (RH%), vacuum, pressure, conductivity or CO_2), then select the time of the reference reading, and the software will calculate the offsets.

Note: Please reference the software manual for setting up and running a manual calibration in the ValSuite® software.

Note: The conductivity sensor can only be calibrated up to 1999.9 µS/cm at 25 °C and attempting to use a higher reference value will generate an error.

6.3.2. Procedure – How to Manually Calibrate a Pressure Sensor

1. Turn on the nVision pressure calibrator.

2. Close the small air release valve.

3. Start the logger in the ValSuite® calibration menu.

4. Unscrew the protection cap on the pressure sensor.

5. Connect the pressure sensor to the nVision adaptor.

6. Use the manual pump to generate the required pressure of 0‑7000 mBar.

7. Wait until the pressure stabilizes – if necessary, adjust with by fine tuning the large valve.

8. Measure the pressure over a period of 96pprox.. 10 minutes.

9. Record the corresponding time and pressure data shown on nVision.

10. Read the logger and stop the calibration.

11. Use the recorded time / pressure data in the ValSuite® calibration setup menu.

Ordering code	Model	Power	Measuring Range	
20003100	nVision	Battery operated	0‑7Bar absolute	

6.3.3. Procedure – How to Manually Calibrate a Conductivity Sensor

1. Place the sensor in a beaker with carbon dioxide‑free distilled water that complies with the pharmaceutical demands written in the ph.EUR or USP demands.

2. Stir the logger for a minimum of one minute, to ensure that the sensor is clean. Do not let the sensor touch the beaker. Repeat this procedure at least two times.

3. Start the logger and the manual calibration session. See the ValSuite® software manual for more information.

4. Place the sensor in the standard solution (from the pharmacopeia or from a certified producer) and stir slowly for five minutes. Ensure that there is no air in the cell when measuring. Note down the reference value and the time for input in the software.

5. Repeat step 1‑4 for more calibration points if required. You can use double distilled water as zero point and ready‑to‑use solution like HI‑7033L (84 μS/cm from Hanna Instruments http://hannainst.com/) or similar solutions.

6. Read the logger and stop the calibration, place the calibration markers where the measuring was stable and type in the standard value.

7. Clean the sensor after the measurement.

Note: Be aware that the temperature is critical and needs to be kept stable.

6.3.4. Procedure – How to Manually Recondition a Humidity Sensor

To eliminate / reduce the drift of a sensor, it is possible to recondition it by following one of the procedures below:

Procedure 1 – RH Digital & Old EtO:
- Place the sensor in an oven at 100 °C 12 hours.
- Rehydrate the sensor at 100% for 8 hours.
- Leave sensor at ambient temperature for 48 hours.

Procedure 2 – RH & Temperature Sensor (EtO/Stability):
- Place in oven at 120 °C for 1 hour.
- Leave sensor at ambient temperature for 48 hours.

6.3.5. Semi-Automatic Calibration

The temperature standard and the sensor data are collected by the software and saved in the session file. The software will instruct the operator when to change the set point of the bath. The calibration offsets are automatically calculated.

Note: Please reference to the software manual for setting up and running a semi-automatic calibration in the ValSuite® software.

6.3.6. Full Automatic Calibration

The temperature standard and the sensor data are collected by the software and saved in the session file. ValSuite® controls the bath set points and the calibration is fully automated by the software.

Note: Please reference to the software manual for setting up and running a full automatic calibration in the ValSuite® software.

6.3.7. Calibrating Flexible Sensors

When the logger base and the sensor are at the same temperature (simultaneously immerged in a bath or dryblock), the accuracy according to the specifications mentioned in the literature (± 0.1 °C), is expected. But when separating the logger base and sensor (where the logger base is outside of the bath or dryblock), there can be a larger variation depending on the temperature differences. This typically occurs when using flexible sensors.
Since 2014, a new design on all flexible sensors have reduce this variation to ± 0.2 °C or better.

7. Accessories

Ellab manufactures a wide range of packing glands and tools, which enable proper mounting in an array of containers / packaging. Please contact your local Ellab sales representative for a complete list of accessories, instructions on using the accessories or for more product information.

7.1. Packing Glands for Food and Pharmaceutical Applications

The packing gland is the device that enables the measuring sensor to be introduced into the product, which in turn allow users to measure the cold spot without compromising the packaging system. Packing glands are available for inserting sensors into any variety of packaging. The glands are threaded to accept sensors and will maintain the seal when pressurized.

7.1.1. Packing Glands for Filled Containers – Type HUJ

Ordering code	Description	
25901005	Packing gland for filled containers	

7.1.2. Packing Glands for Bottles – Type GVK

Ordering code	Description	
25900041	Packing gland for Crown Cork bottle, 29mm neck	
2590xxxx	Packing gland for bottle. Custom sizes available	

Ordering code	Description	
35901xxx	Packing gland with stainless steel tube	
35901000	Packing gland without stainless steel tube	
25800064	Rubber washer outer 10 pcs	
25810476	Finger screw	
25810065	Rubber washer inner, 10 pcs	

7.1.4. Distance Piece & Space Bar

Ordering Code	Description	
259011xx	Distance piece for use with GKJ	
259040xx	Space bar in PEEK	

7.1.5. Packing Gland Type PAJ Pro Pressure

Ordering code	Description	
35510002	Pressure connection system for pressure sensor	
25520003	Rubberseal, set (for PAJ Pressure system)	
25810037	O-ring set, ø9.00 x 1.50 mm (for PAJ Pressure system)	
25810036	O-ring set, ø7.00 x ø1.50 mm (for PAJ Pressure system)	
25810044	O-ring set, ø10.50 x ø1.50 mm (for PAJ Pressure system)	

7.1.6. IV Bags External Mounting – Type GLK & GLJ

Ordering code	Description	
25810066 25902002	Gland for IV bags, stainless steel Gland for IV Bags, for 8mm Ø neck, peek	
25810707	Gland for plastic ampoules, syringe barrels, with cone in peek	

7.1.7. Packing Gland for Different Products – Type HBJ

Ordering code	Description	
35000003	Fixture for sausages	
35000002	Fixture for shrimps	

7.1.8. Packing Gland Type GNK for Ampoules

Ordering code	Description	
2590002x	Packing gland for ampoules	

7.1.9. Packing Glands for Vials type GPK

Ordering code	Description	
25810441	Glands for vials with neck diameter 14 mm	
25810480	Glands for vials with neck diameter 20 mm	
25810479	Glands for vials with neck diameter 32 mm	

7.1.10. Packing Glands for Ampoules and Vials type GVJ

Ordering code	Description	
25810109	New vacuum tight design, for mounting of rigid or flexible sensors in ampoules and vials.	

7.1.11. Contact Puck

Ordering code	Description	
35900072	Contact Puck	

7.1.12. LyoShuttle for Freeze Dryers

Ordering code	Description	
359032XX	LYO Shuttle fixture for vials	

7.2.   Cutting Tools

Use of Ellab's packing glands requires perforation of the container / pouch being used.

7.2.1. Cutting Tool Types

7.2.1.1.   TC89 – Can Punch

Ordering code	Description	
25000018	Can punch for all kinds of containers	

7.2.1.2. TC41 and TC40S – Perforation and Pre-Perforation Tool

Ordering code	Description	
25000010	Pre-perforator for TC40S	
25000044	Cutting tool for metal containers	

7.2.1.3. TC42 – Cutting Tool

Ordering code	Description	
25000012	Cutting tool for plastic containers. Ø8mm	

7.2.1.4. TC25 Cutting Tool and TC26 Spanner

Ordering code	Description	
25000009	Cutting tool for HUJ and GUJ	
25000014	Spanner for HUJ and GUJ	

8. Activating ValSuite®

The first time a user opens ValSuite®, the software needs to be activated.

8.1. Online Activation - The PC is Connected to the Internet.

1. If the PC is connected to the internet, select the Online activation option.

2. Write the license key (38 digit) from the Ellab E‑mail, using the copy and paste function.

3. License key example:
   B1U10‑10R01‑GHJ2K‑M8N7P‑3Q4ST‑MG4XM‑8GVHT‑DU34E‑M

Evaluation of a License key format:

Icon	Description
	The License Key is valid and ready to be activated, go to next step.
	The License Key is invalid, try to copy and paste the key again or retype the code.
	The License Key has expired.
	The License Key is a trail and will expire.

4. Select Activate.

If the activation went well, the License window will close automatically.

The evaluation of the License key can have the following remarks:

Icon	Description
	The License Key is valid and can be activated
	The License Key has already been activated on another PC.

5. The License window will close if the key is valid, and the ValSuite® software will be open.

8.1.1. Manual Activation – The PC is Not Connected to the Internet.

1. Select the Manual activation option if the PC is not connected to the internet.

2. Send an e-mail to Ellab with the computer ID.

    Example of computer ID: F0DEF14E64E41

3. In the ValSuite® activation field, write the License key and receive the Computer key from Ellab.

4. Select Activate. If the activation went well, the License window will close automatically. The evaluation of the License key can have the following marks.

Icon	Description
	The License Key is valid and ready to be activated
	The License Key has already been activated on another PC.

5. The License window will close automatically if the key is valid and the ValSuite® software will open.

8.1.2. Releasing the License

Users who wish to release the license, so that it may be used on another PC, must follow the procedure below:

1. Select Help/About ValSuite.

2. Click License.

3. Click Clear License. This will remove the license from this PC. The license will then be released and ready to be used again on another PC.

9. Firmware Update

9.1. Reader Station, Loggers & SKY module

Purpose:
Firmware updater for reader station, logger and SKY module. Install the TSP firmware updater located on the provided USB.

Note: The firmware updater does not include updates for the Mini loggers or Single Reader Stations. These products must be returned to Ellab for firmware updates. Ellab will also update the firmware upon performing factory calibrations.

Procedure for installing the firmware upgrading tools for Reader Stations, Loggers and SKY Modules:

1. Double click the TSProFirmwareUpdate_XXXXXXXX programme.
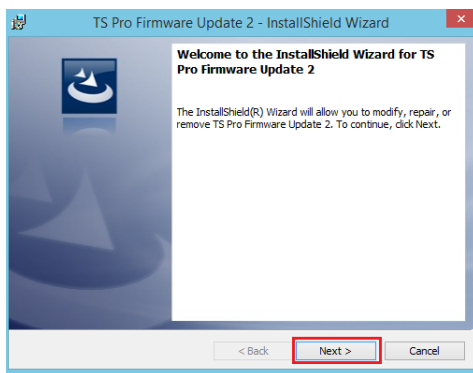
2. Select Next.

3. Select a folder in the Change Directory if necessary and click select Next.
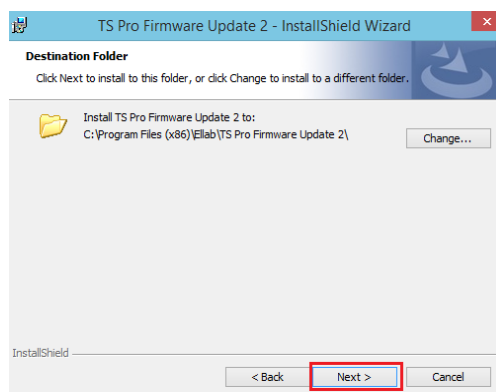
4. Select Install.
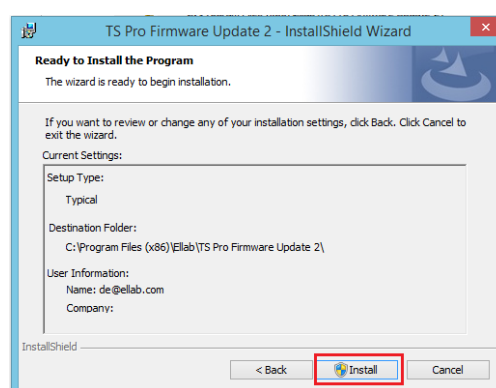
5. Select Finish.
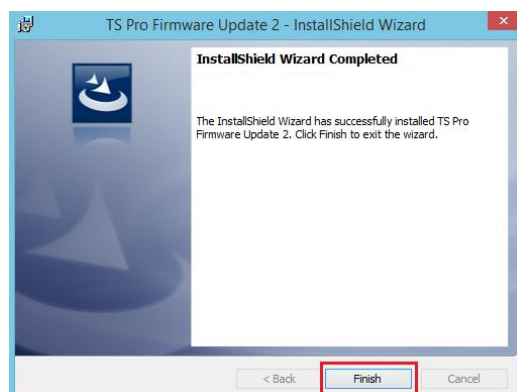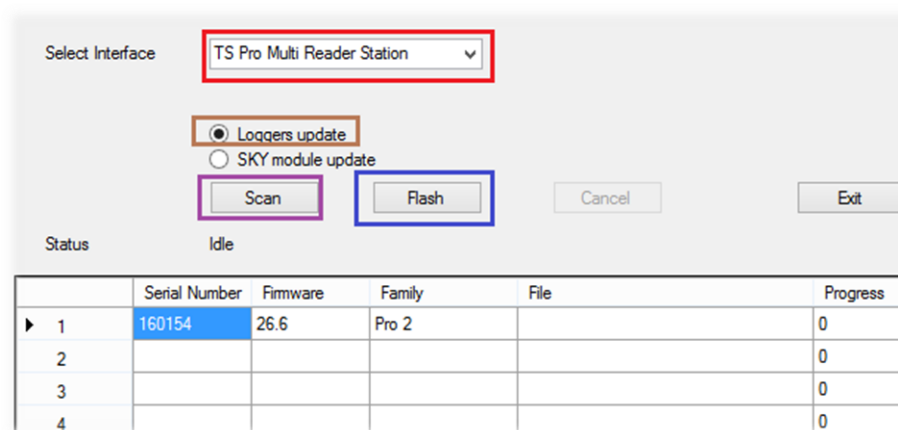
Note: User with a high access level will need to select yes, before finishing the installation.

9.1.1. Procedure for Updating the Logger Firmware

WARNING: Before updating, users must check the current battery power, since updating loggers will use a lot of battery power. If the battery power is depleted in this process, the logger will need to be shipped to Denmark in order to be re-flashed, as it cannot be restarted manually.

Note: The firmware updater does not work for Mini loggers.

1. Open the firmware updater, which is placed under Programme (x86) by default, and select Ellab → TS Pro Firmware Update 2.

2. Select the TS Pro Logger button.

3. Select the reader station type, this is by default set to multi reader station (see red highlight).

4. Select the TS Pro Logger button.

		Serial Number	Firmware	Family	File	Progress
▶	1	160154	26.6	Pro 2		0
	2					0
	3					0
	4					0

5. Check the Loggers update option (see brown highlight).

6. Select Scan (see violet highlight).

7. Select Flash (see blue highlight).

8. Select the required firmware update.

9. Select Open and the firmware will start to flash to the logger. During this progress, the right corner will indicate how far the update process has come (the logger will need to go to 100 twice, as it has to upload to memory and download to memory).

10. Once done, the logger will appear with the new firmware.

9.1.2. Procedure for Updating the SKY Firmware

WARNING: Before updating, users must check the current battery power, since updating loggers will use a lot of battery power. If the battery power is depleted in this process, the logger will need to be shipped to Denmark in order to be re-flashed, as it cannot be restarted manually.

1. Open the firmware updater, which is placed under Programme (x86) by default, and select Ellab → TS Pro Firmware Update 2.

2. Select the TS Pro Logger button.

3. Select the reader station type, this is by default set to multi reader station (see red highlight).
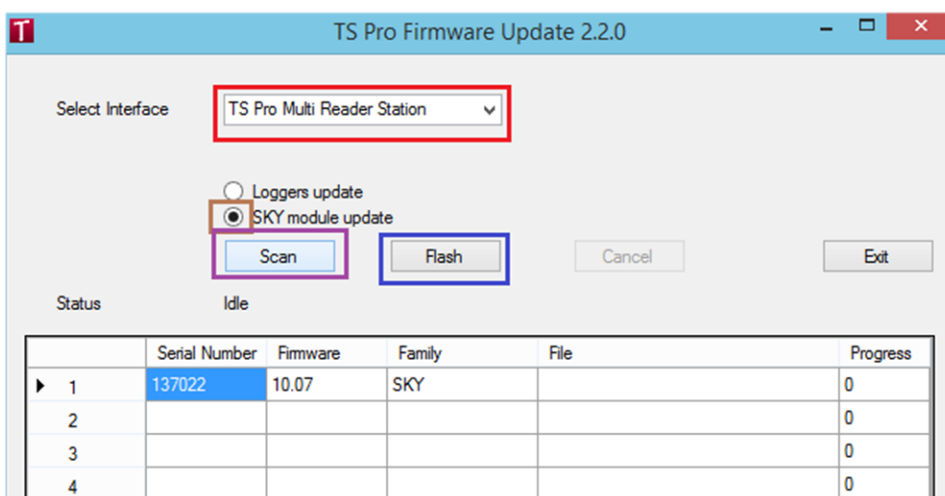
4. Mark the SKY module update (see brown highlight).

5. Select Scan (see violet highlight).

6. Select Flash (see blue highlight).

7. Select the required firmware update.

8. Select Open and the firmware will start to flash to the logger. During this progress, the right corner will indicate how far the update process has come (the module will need to go to 100 twice, as it has to upload to memory and download to memory).

9. Once done, the SKY module will appear with the new firmware.

9.1.3. Procedure for Updating the Reader Station firmware

Note: This procedure is not available for Single Reader Stations.

1. Open the firmware updater, which is placed under Programme (x86) by default, and select Ellab → TS Pro Firmware Update 2.

2. Select the TS Pro Reader Station button.

3. Select the reader station in the selection interface, this is by default set to the TS Pro Multi Reader Station.

4. Select Update.

5. A popup window will display the reader station's Master and Expansion Module firmware, select yes to proceed (selecting "no" will stop the firmware update).

6. The firmware flash will begin.

7. When the firmware has finished uploading to the reader station, a popup window will display the new Master and Expansion Module firmware. Select OK to close the popup window.

9.2. SKY Access Point

Purpose:
The firmware updater covers the SKY access point, hardware module and RF module. Install the SKY firmware updater located on the provided USB.

Note: Before starting the program, connect the SKY access point to the USB port.

Procedure for installing the SKY firmware upgrade tool:

1. Double click the SKYFirmwareUpdate_XXXXXXXX programme

2. Select Next

3. Select Install

4. The firmware updater will now install

5. Select Finish when the installation is complete

Procedure for updating the SKY Access Point firmware:

1. Open the SKY Firmware Update from the Ellab Folder. The window below will appear
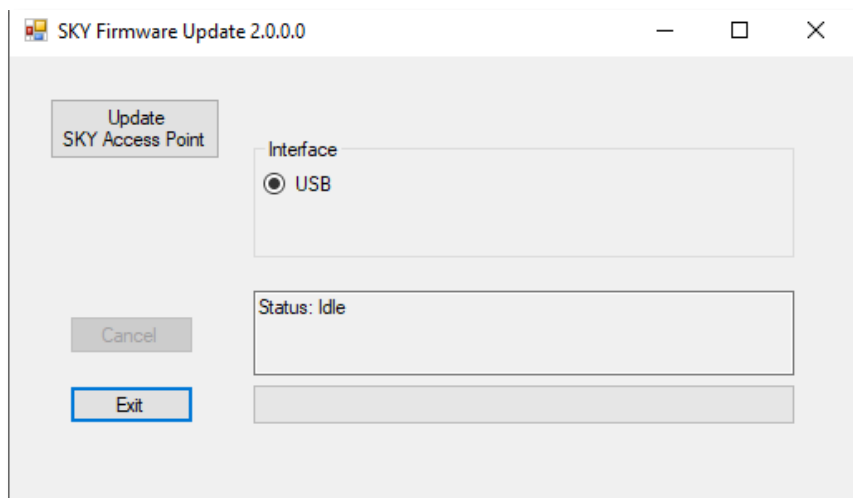
2. Click Update SKY Access Point

3. Click Yes when prompted
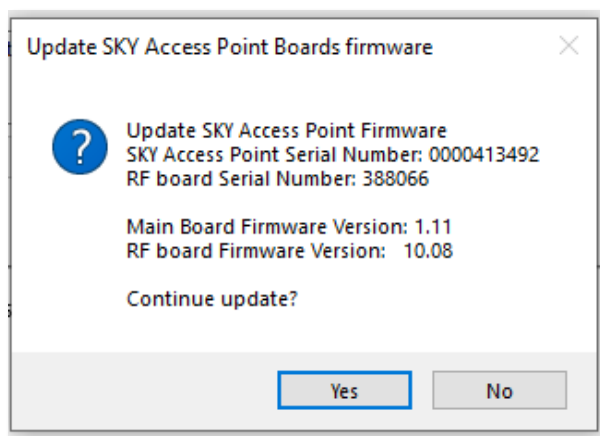
4. Select file RF_Board_10_08.trb and open it
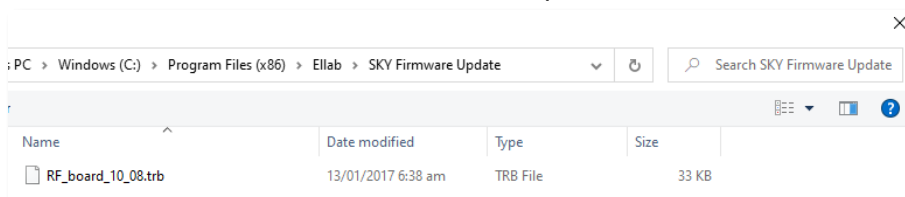
5. Select file SKY_AccessPoint_1_11.hex and open it
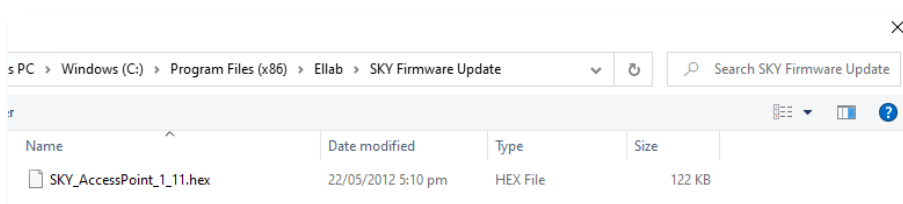
6. The update will commence. The process will be indicated by the bar shown in the window below – do not close the updater
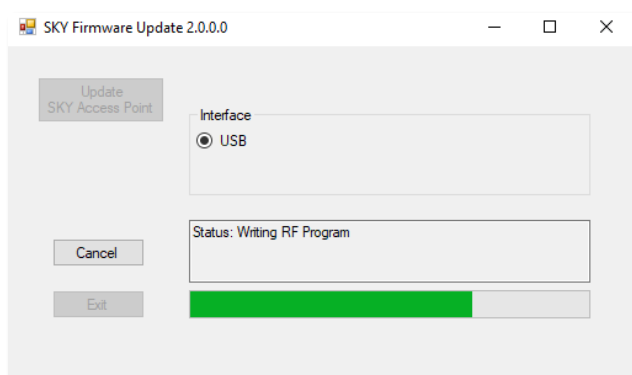
7. The following pop‑up message will appear upon completion. Click OK
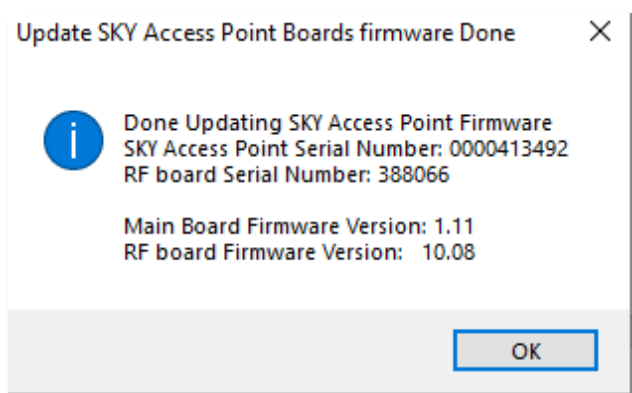
10. Ellab Service Contract

Ellab offers annual service agreements. Contact your local Ellab sales representative for pricing and details.

10.1. TrackSense® Pro Equipment Warranty

Ellab offers an industry leading 2-year warranty on loggers, stainless steel non-flexible sensors, SKY components and reader stations. Physical damage is not covered by the warranty.

10.2. Extended Warranty

Ellab also offers an extended warranty on all new TrackSense® Lab/Pro/Pro X/Pro Basic loggers. The extension is from 2 to 5 years. The extended warranty needs to be purchased together with the logger. Contact your local Ellab sales representative for pricing.

11. FAQ

For additional questions and answers (FAQ), visit Ellab's FAQ page at: www.ellab.com/contact/faq.

What could be the cause of a spike in a temperature channel in ValSuite® while all other channels remain constant?
A battery failure and a disconnected sensor have similar results in ValSuite®. The temperature will spike just before the logger shuts down. One way to differentiate between the two is to check the temperature just before the spike. It is a good indication that the battery is dead, if the temperature drops just before the spike. If the temperature immediately spikes, a disconnected sensor may be the issue. This pertains to all loggers and sensors. Before sending a sensor / logger in for service, verify the results in ValSuite® first and, if necessary, run a voltage test on the battery.

When running a SKY session, does the Access Point need to have a USB cable connected too when using the LAN setup?
When setting up an IP address on the Access Point, both an Ethernet and USB cable need to be utilized. If the IP address has already been determined, only the Ethernet cable needs to be used.

What temperature should the loggers be at before being returned to the reader station?

If the loggers are too hot to be held by hand, they are too hot to be placed in the reader station.

Why does the reader station not recognize the Mini Logger after a battery change?
Make sure that the battery was held down before replacing the cap.

When I read my logger, it gave me no data. What can cause this?
Option 1 – Broken Sensor:
If the reader station slot turned green and the data appears in graph, the logger read ok. Check the data and see if there is 1 sample around 160 °C. If this is the case the sensor must be returned to Ellab.

Option 2 – Dead battery:
It is possible for a battery to have enough power to be recognized, but not enough power measure and store samples. Test the battery in the activator and replace it if necessary.

Option 3 – The logger was refreshed:
If the logger was started and had turned green, but was refreshed while still in the station, it will stop before being placed in the process. Therefore, any logger that turns green should not be refreshed.

I replaced the battery in my Pro Logger, but I still get a low / critical low battery warning when I try to start it.
The error messages are collected on the loggers last read. If the battery was replaced, start the logger for a few minutes and then read it. If the error goes away the unit is ready to be used.

Can I use my computer for other jobs while running a TrackSense® session?
During data logging studies containing real time data transmission (SKY) you can run multiple applications on your computer, as long as you keep the ValSuite® software open. If the SKY functionality is not involved in the session, you can completely close your computer down if necessary. Upon reopening the ValSuite® software, the software will automatically allocate the loggers to the session that they were started in.

12. Change Log

Edition	Section	Change	Date:	Author
1.0	New	New	2009-06-12	MB
2.0	12 Change log, page 62 is missing	Section 12, page 62 Change log has been added	2009-12-07	LT
2.0	1.4 Directives – ATEX, page 7	Revision of the sentence "The certificate will tell the ATEX...." To "As end-user you shall read the certificate including "Special Conditions for Safe Use" in accordance with "Intertek – report no: RETS(Q)3844/A/1"	2009-12-07	LT
3.0	1.5 Important Notice regarding Ellab Sky Equipment – FCC & IC, page 7	Information about Industry Canada Compliance Information inserted.	2009-12-16	LT
4.0	3.3.2 USB 4.4.2.1 6.2.1.3 Setting up the ETS	Update to new driver Update color of Lab Quad Sensor Update to new driver	2010-11-14	LT / DE
5.0	4.2.10	Section 4.2.10 is added	2011-06-09	LT / DE
6.0	4.1 TrackSense® Pro Mini Logger 4.3.10.4 Sensor Types 4.6 TRACKSENSE® FRIGO 4.6.5 Changing FRIGO Batteries	Update with 2 Gen mini Update with new sensor pH and conductivity Update with Frigo logger Update with FRIGO logger	2012-01-10	LT / DE
7.0	All	Update ALL	2012	DE/SWH
8.0	4.1.8.3 4.9.4 4.9.5 4.10.4 4.10.5	New chapter´s added New manual file name MAN_TP_HW_20090612_8.0 → MAN-1-8.0 – Hardware manual TSP	2013-02-25	DE/LT
9.0	4.1.6.1 4.2.1 4.9.1 4.9.2 4.9.6.1 4.10.2 4.10.6.1	New pictures added New text added	2013-05-15	SWH
10.0	4.1.6 4.1.8.3 4.1.10.2 4.1.10.4 4.2.1.1 4.10.3	New reference to handling videos on webpage New section added "Indication of sensor numbers on all double sensors" New Teflon barrier. New picture Changes in preparation New picture of sensor LED New section for "Sensor LED" for Frigo	2013-10-15	SWH
11.0	4.6 4.7 4.7.7 4.1.10 4.1.10.7 5.1.1 5.1.5 5.1.9	New access point New 2nd Gen. Micro logger New o-ring for the new 2nd Gen. Micro Logger New picture of water reservoir New section – Thermal Barrier and Sky New battery specifications for TSP New battery specifications for Micro New battery specifications for Compact	2013-11-20	SWH
12.0	4.1.6 4.7.4 6+4.8.4 4.9 4.9.6 5.1.5 6.2.3 6.3.4 7.1.9 7.1.10 8. – 8.1 – 8.1.1	Special maintain/cleaning for TSP Pressure New Ellab Opening coin for Micro/ Mini New Compact Ultra X Special maintain/cleaning for Compact Pressure Update: micro battery specifications New Ellab dry block New section : Calibration of flexible sensors New TRJ Internal fixture " Lyotray" New Protective Holder for TPS & Compact New section : Activation of Valsuite	2014-04-04	SWH

13.0	1.4.4 6.2.3	New information added in ATEX section "special conditions for safe use" Ellab dry blocks set up information	2014-05-14	SWH
14.0	6.3.1 7.1.5	New nVision Pressure Calibrator New shuttle fixture for lyophilization	2014-07-11	SWH
15.0	4.1.10.3 4.1.7	New Vacuum Sensor Maintain/cleaning for TSP Vacuum Loggers	2014-08-22	SWH
16.0	2.2 4.1.2.1 4.1.11.3 4.1.11.3 4.1.11.3 + 4.2.1 4.1.13.2 4.1.13.4 6.2.2.2 6.2.2.3 6.2.2.5 6.2.3 6.3.1 9.	Updated Remote Antenna specifications New Pro X Long logger Updated conductivity specifications New Rugged flexible sensor Updated RH specifications New thermal barrier Update: Thermal barrier section Fixture for LiquiCal LL/HL/SL ETI fixture for LL/HL/SL Fixture for Liquical SM/HM New support for Ametek Dry Blocks Manually calibration of humidity sensor New "firmware update" section	2015-04-10	SWH
17.0		Windows 10 installation	2015-11-05	SWH
18.0	1.4 1.4.4 4.3.4 6.1	Directive update Update in ATEX section NOTE inserted about SKY mounting Text update	2016-04-07	SWH/J ER
19.0	5.1	Lithium battery warning	2016-06-02	SWH
20.0	5.1.9 5.1.1	Change in table for UX/Pro X batteries Battery life in hours schedule added Sample Rates edited for combined Pressure sensors	2016-10-11	SWH
21.0	3.4 4.1.7 4.1.11.3 4.1.13.4	ValSuite Requirements Pressure sensors: Warning about Thermal Shock. Proper handling of Rugged flexible sensor. Thermal Barrier Safety	2016-11-09	SWH
22.0	1.4.4 4.1.11.3 4.1.13.5 4.7.1 6.2.1.2 6.3.1	TÜV updated CO_2 sensor added Added text about 40mm square thermal barrier Updated Data Points for Compact loggers Proper Use NOTE inserted with Temperature limit for ETS. (-50 °C to +200 °C) Deleted Calibration section about humidity – changed to "how to recondition humidity sensor"	2017-01-23	SWH/J ER
23.0	3.4	ValSuite Requirements for 5.X updated. VISTA not supported and 8 GB RAM for Scientific.	2017-01-27	SWH
24.0	1.4 3 3.2.3 4.4 7.1.8	Directives updated Table added Table added Table added Correction to table (Internal mounting Micro)	2017-02-07 2017-03-14 2017-06-13	SWH/T WF
24.1	4.1.14 – 4.1.14.8 4.1.11	Updated thermal barrier section Updated version and ordering code for RH sensor	2017-08-11 2017-09-01	TWF
24.2	5.1.9	Updated battery temperature range in the table	2017-09-26	TWF
25	All 4.1.14.3	Cosmetic changes to format and tables Proof read	2018-01-22	TWF

	4.1.14.4	Note added regarding white ceramic powder/liquid in thermal barriers		
	4.6.4	Picture added showcasing the correct order to insert logger and PEEK insert into thermal barrier		
	9.1	Updated pictures		
	5.1.7	Updated installation and update process. Sections 9.1.1, 9.1.2 and 9.1.3 added.		
		Note added regarding the relationship between sample rate and battery lifetime.		
25.1	4.1.11.4	Section on TC sensor added.	2018-02-19	TWF
	4.1.11.3	T35 Bending Tool added to table.	2018-03-19	
25.2	6.3.4	RH reconditioning chapter updated.	2018-05-22	TWF
	4.1.14.3	Picture added and text updated in regard to ceramic powder.		
26	3.2.4	Section removed (Lab reader station)	2018-09-13	TWF
	4.1	Basic L data logger added		
	4.1.1	Basic L data logger added		
	4.1.11.3	Updated with new CO2 and Pressure sensors		
		Added bullet regarding not immersing RH sensors in liquid		
	4.1.14.1	Thermal barrier updated with distilled water requirements		
	4.4.1	Number of access points per session updated		
	5.1.2.1	Section added on the explosion and fire hazards of batteries stored in poor conditions		
	5.1.10	Basic L added to the use of Frigo batteries		
	6.2.4	PTC350A replaced by PTC425A		
	6.2.1.3	Note updated regarding USB driver installation requirements		
	6.2.2	Note added regarding firmware requirements		
27	4.1.14.6	80-mm thermal barrier updated to 85-mm in text and image	2019-01-11	TWF
	3.2.3	Image and technical specifications updated with the new single reader station. Note removed		
	3.1	Table expanded with additional specifications		
	4.1.9.1	Text edited to accommodate the Pro XL data logger		
	4.8.5	Comment deleted regarding using the logger opening tool for closing the logger		
	4.1.11.3	The out-phased low temperature sensors have been removed from the table as they have been replaced by the Thermocouple Temperature Sensor		
	6.2.3.2	Lid for fixture added to table		
	4.3.1	Old single reader removed from image		
	4.1.2.1			

	Section	Description	Date	Initials
	4.1.1	Updated data points to accommodate TSP 3rd Generation		
	4.2.1	Updated data points to accommodate TSP 3rd Generation		
	4.1.11.3	Updated data points to accommodate TSP 3rd Generation		
	4.2.1	Updated logger images and names		
	4.5.1	Updated logger images and names		
	4.7.1	Updated logger names		
	4.8.1	Updated logger names		
	6.2.1.1	Updated logger names		
	4.1.1	Added missing °C icon to table		
	4.1.2.1	Changed from 2nd Generation to 3rd Generation. Ordering codes updated to accommodate for 3rd Generation		
	4.2.1	Ordering codes updated to accommodate for 3rd Generation		
	4.1.4	Ordering codes updated to accommodate for 3rd Generation. Note added regarding RH sensor not supporting LED light.		
	4.3.1	Pro Basic L added to text		
	4.3.3	Changed from 2nd Generation to 3rd Generation. Pro Basic L added to text		
	4.1.11.3	Changed from 2nd Generation to 3rd Generation. Pro Basic L added to text		
	4.4.1			
	4.5.1	Technical Specifications changed for low temperature rigid sensors		
	4.7.1	Table expanded with additional specifications		
	All	Data points updated		
	4.1.5	Data points updated		
	3.2.2	ValSuite changed from ValSuite™ to ValSuite®		
	Front Page	Removed old pin connector images and added TSP 3rd Generation pin connectors		
	4.3.4	Image updates with the new Relative Humidity and Temperature Sensor		
		Image updates with the new Relative Humidity and Temperature Sensor		
		Updated image with TrackSense 3rd Generation		
28	4.1.11.3	Updated section on proper handling of RH sensor Updated section on proper handling of semi flexible sensors	2019-04-10 2019-06-04	TWF
	4.1.14.2			
	4.1.9	Changed the 80 mm thermal barrier to 85 mm		
	7.1.14	Updated link		

		Updated table with new contact puck and ordering code		
	7.1.15			
	7.1.8, 7.1.9, 7.1.10, 7.1.15 and 7.1.16 (former)	Edited picture to remove old contact puck		
	2.1	These former sections have been deleted		
	6.2.1.2	Quick guide point added TSP Battery Management Sheet removed USB Warning Information Sheet removed		
	3.1 and 3.2.3	Added a warning regarding the handling of the ETS for recalibration or service		
		Temperature range corrected to 5 to 50 °C		
29	All	New logo implemented	2019‑09‑30	TWF
	1.4.4	ATEX no. updated		
	4.1.14.2	Updated thermal barrier ordering codes and names		
	5.1	Self‑discharge column removed from table		
	4.1.11.3	Line added regarding proper handling of RH 5.2 sensor. Silicone grease may not be applied to o‑ring		
	4.1.9.1	Warning added. Silicone grease may not be applied to RH 5.2 o‑ring		
	4.7.7	Minor text correction		
	4.8.7	Minor text correction		
	4.8.7.1	Image and ordering code updated in table		
	5.1.10	Battery names updated in "type" field in table		
	5.1.9	Battery names updated in "type" field in table		
	5.1.8	Battery names updated in "type" field in table		
	5.1	Battery names updated in "type" field in table		
	4.1.1	ATEX statement updated		
	4.7.7.1	O‑ring picture updated in table		
	4.8.7	Text corrected to include Frigo and not Compact		
29.1	3.2.1	Added LAN connection via ethernet to reader station	2019‑10‑16	TWF
	3.3.2	New section		
	4.1.12	3.5 V changed to ideally 3.2 V		
30	6.1	Comment regarding CO2 Calibration dates	2020‑03‑06	TWF
	6.1.1.8	New section on CO2 Calibrations		
	4.4.1	Note regarding the red light on the SKY Access Point		
	4.1.14.2			
	4.1.11.3	Table updated with TTB 85‑2 and TTB 85‑2 SKY Added Bowie Dick Sensor to the table Updated the names for the dual flex sensors Added image and section about identifying high range temperature sensors 4 Bar Pressure Sensor added, and pressure ranges and accuracies corrected		

	4.2.1	Updated the names for the quad sensor image		
	3.1	Added communication specification to the table		
	3.2.3	Added communication specification to the table		
	5.1.5	Changed the title of the section		
	5.1.10	Added new ordering numbers to table		
31	3.1	Updated reader station temperature range	2021-05-11	TWF
	4.6.1	Added 35 mm rigid sensor option		
	4.8.7	Warning added		
	5.1	Note regarding the storage of batteries added		
	6.2.1.1	Added new angled ETS products to table		
32	4.1.11	Added a description to the chapter regarding interchangeable sensors	2021-11-03	TWF
	4.1.11.3	Updated image for Bowie Dick Sensor and added mention of the Protective Adapter		
	6.2.1.1	Updated ETS images and ordering codes		
	6.2.1.2	Removed section on transition limit for ETS sensor		
	6.2.1.3	Removed mention of ETS Suite		
	6.2.1.4 + 6.2.1.4.1	New Sections on ETS setup		
	6.2.4	Added RTC 158A to Dry Block table		
	9.2	Updated section on SKY firmware updates		
33	4.4.3	New section	2022-04-27	TWF
	4.6.6	Added note about limiting the use of grease and keeping screw thread clear		
	6.2.3.4	Section deleted – product out-phased		
	6.2.6	Replaced RTC 158A with RTC 158A		
	7.1.12	New section		
33.1	4.1.8	Remove reference to autoclave	2023-04-21	IR
	4.1.11.3	Amendments to Vacuum Sensor accuracy Values		
	4.1.11.6	Addition of information on Smart Flex sensor		
33.1a	1.4.5	Added FCC ID: XUS-SKYDL2 and IC ID: 8758A-SKYDL2		
33.2	4.1.1	Added new SKY module part numbers.		
	4.1.2.1	Inserted a new section describing the SKY Module 3G, and specifying what firmware versions works with the updated SKY Modules.		
	4.3.2			
	4.3.3	Updated the SKY module description to include the new improved range of the module.		
	4.3.4			
33.3	4.1.13.6	Added diagram for thermal barrier TTB65	2024-05-07	HLF
33.4	4.1.11.6 4.1.11.7 4.7.8 4.8.8	Smart Flex Intended use added. CO2 sensor handling, environment and storing added.	2024-09-23	JJA

33.5	4.1.11.3	SmartFlex cable curl diameter and cable bending specified.	2025-02-06	HLF
33.6	4.1.11.3	Temperature resolution specification added for high and standard temperature sensors.	2025-02-17	HLF
34	1.3	Added warning for fire and explosive hazards	2025-04-2	HLF
	4.3.6	Added Ellab recommendation of yearly changing of o-rings for all sky housings		
	All of document	Updated layout to fit new Ellab design rules		