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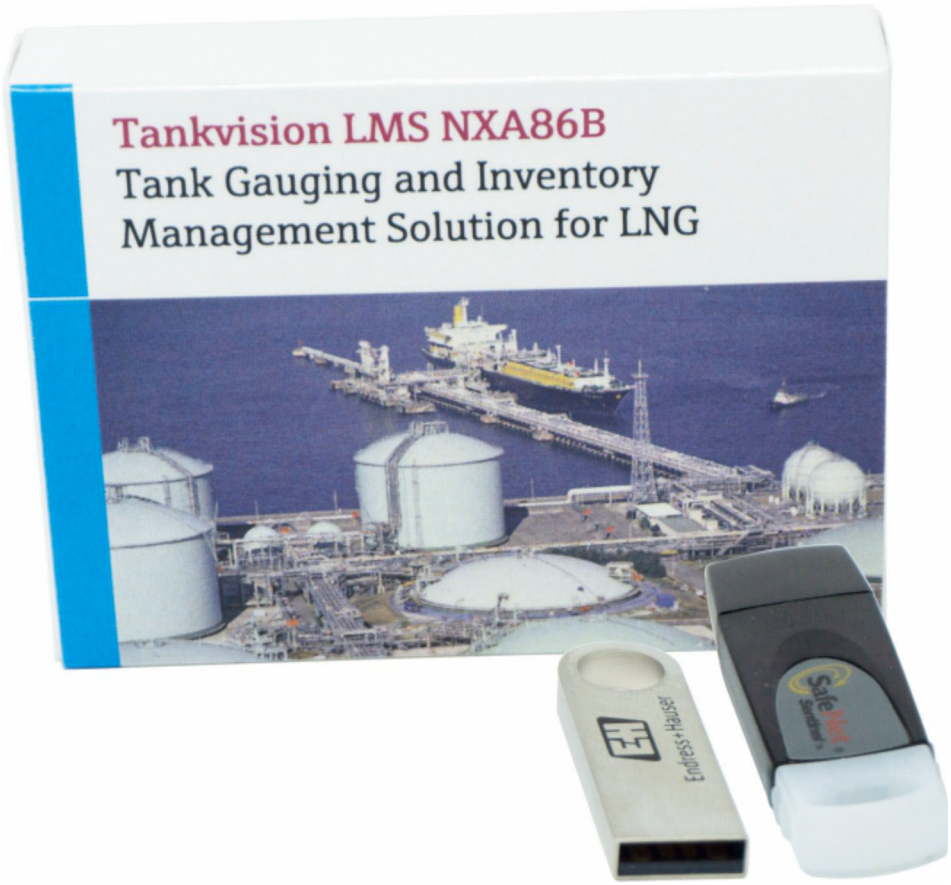
71654083
2024-04-03

Valid as of version
18.3.3

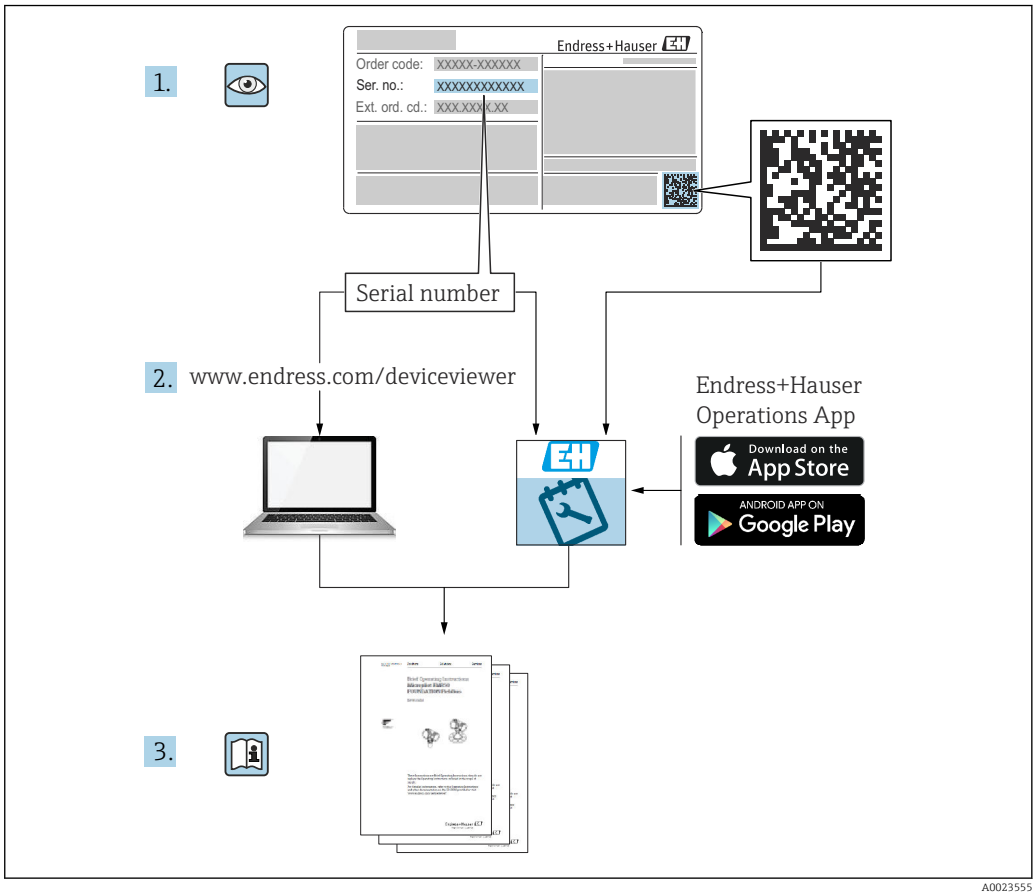
Operating Instructions
Tankvision LMS NXA86B

LNG Stratification Detection



Endress+Hauser
People for Process Automation

- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To avoid danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser sales organization will supply you with current information and updates to this manual.


1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX.XXXX XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
A0023555

Change history

BA01704G/01.17
- Valid for software version: 18.0.2 and 18.0.3
- Initial version

BA01704G/02.18
- Valid for software version: 18.1.1
- Changes to the previous version:
  Compatibility with Windows 10 and Windows Server 2016

BA01704G/03.24
- Valid for software version: 18.3.3
- Changes to the previous version:
  Compatibility with Windows 11 and Windows Server 2022. Minor changes to existing functionality.

Table of contents

1 About this document

1.1 Document function

This manual should support during the installation of Tankvision LMS NXA86B.

Beside basic PC operating knowledge no special training is needed to perform the Tank Gauging System operations. Nevertheless it is recommended receiving a training on the system by Endress+Hauser.

1.2 Symbols

1.2.1 Safety symbols

⚠ DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

⚠ WARNING
This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION
This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE
This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Symbols for certain types of information and graphics

Tip
Indicates additional information

Reference to documentation

Reference to graphic

▶
Notice or individual step to be observed

1., 2., 3.
Series of steps

Result of a step

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

1.3 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

1.4 Registered trademarks

1.4.1 Microsoft®, Windows®

Microsoft and Windows are registered trademarks of the Microsoft Corporation

1.4.2 Modbus™

Modbus is a registered trademark of Schneider Electric USA, Inc.

1.4.3 Java®

Java is a registered trademark of Sun Microsystems, Inc.

1.4.4 Mozilla® Firefox®

Mozilla and Firefox are registered trademarks of the Mozilla Foundation

1.4.5 Android®

Android, Google Play and the Google Play logo are registered trademarks of Google Inc.

1.4.6 iPhone®, iPad®

iPhone and iPad are trademarks of Apple® Inc., registered in the U.S. and other countries.

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Intended use

2.2.1 Intended use of Tankvision LMS NXA86B software

Tankvision LMS is a total LNG Tank Storage and Management solution for Peak Shaving, Receiving and Production LNG facilities. The LMS system has been designed to interface to all instruments commonly found on LNG storage tanks, and to collect and present the instrument data through a range of intuitive graphical user interfaces. A typical LNG Tank will have a wide range of measurement instruments to measure Liquid Level, Liquid Density, Liquid and Vapour Temperature, Liquid and Vapour Pressure, Skin Temperature and much more.

Typically each tank would be fitted with an LTD gauge, two further level gauges configured as a Primary and Secondary, and an Alarm Gauge. The LTD gauge is a servo operated unit mounted on the tank roof. The purpose of the LTD gauge is to take accurate profiles of temperature and density throughout the liquid, and whilst not profiling provide continuous liquid level, temperature and density measurement. The Primary and Secondary gauges can be either servo and or radar operated units also mounted on the tank roof. The purpose of these gauges is to provide continuous liquid level measurement, and average liquid temperature measurement. They provide redundancy on the measurement of level and temperature. The average liquid temperature is derived from a multi point temperature sensor device. The alarm gauge is often a servo or radar based gauge configured to provide volt free contact alarm status to an independent system.

An LMS system can operate in a simple standalone configuration or as a fully redundant system where security and integrity are of paramount importance. The LMS system has a flexible and scalable architecture allowing it to be tailored to a number of different applications easily.

2.3 IT security

Our warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

3 Incoming acceptance and product identification

3.1 Incoming acceptance

On receipt of the delivery:

1. Check the packaging for damage.
   ↳ Report all damage immediately to the manufacturer.
   Do not install damaged components.
2. Check the scope of delivery using the delivery note.
3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.

If one of the conditions is not satisfied, contact the manufacturer.

3.2 Product identification

The following options are available for identification of the software:

- Nameplate specifications
- Order code with breakdown of the software features on the delivery note
- Enter serial numbers from nameplates in *Device Viewer* (www.endress.com/deviceviewer): All information about the software is displayed.

For an overview of the technical documentation provided, enter the serial number from the nameplate in the *Device Viewer* (www.endress.com/deviceviewer).

3.2.1 Nameplate

The information that is required by law and is relevant to the product is shown on the nameplate, e.g.:

- Manufacturer identification
- Product name
- Order code
- Extended order code
- Serial number
- Barcode

3.2.2 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany

Place of manufacture: See nameplate.

3.2.3 Order code and product version

To find out the version of your software, enter the order code indicated on the nameplate in the search screen at the following address:
www.products.endress.com/order-ident

4 Stratification Detection

4.1 What is stratification?

Everyone has an intuitive idea about what stratification is; the name of the phenomena itself suggests horizontal layers of material within a body, however describing it in terms a computer can understand is more challenging.

In general terms a stratified body exhibits localised differences in state. In tank gauging we are forced to identify those differences in state in terms of temperature and density, as we are limited to these pieces of localized data by the instruments provided. We are also forced to assume that the column of material that is sampled by the gauge is indicative of all material at that level; this is not always a safe assumption, particularly in LNG tanks.

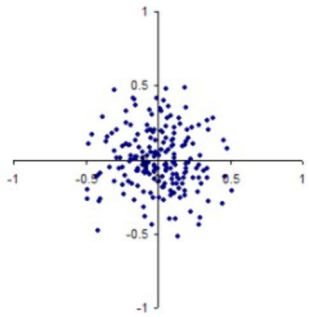
4.2 Consequences of stratification

In LNG tanks stratification is of importance as it is one of the key processes that leads to rollover. The appearance of strata indicates that a barrier to the free movement of fluids within the body has formed and it is this that can prevent heat entering the body from leaving it through evaporation at surface of the liquid. Obviously, if heat can't leave the body at the same rate as it enters it, energy is built up; it is this energy that is released catastrophically during rollover.

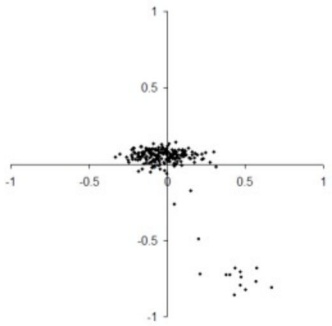
4.3 Identifying stratfication

If we could measure the temperature and density of the tank contents with infinite accuracy, it would be easy to identify strata as each consecutive point within a stratum would have exactly the same temperature and density. Unfortunately, we equip our LNG storage tanks with real world devices that have a limited accuracy. The readings of density and temperature, collectively known as a profile, produced by the gauge will generally deviate from the actual density, which we can never actually know, by a random amount. The figures (a) and (b) below show plots of two different profiles, the horizontal axis represents density and the vertical axis temperature. The data has been transposed by the mean and scaled by the range for each set of data.

(a) Homogenous
The figure below shows a profile from a homogenous tank. Notice how the profile points form a single circular cluster centered on the origin.



(b) Strata
The figure below shows a profile from a tank with two strata. The points are arranged in 2 clusters, as 90 % of the points are in one of the clusters, the mean is pulled over toward that cluster. The 10 % of the points in the smaller cluster are colder and denser than the bulk of the points. The few points between the two clusters indicate that the interface between the two strata is indistinct.

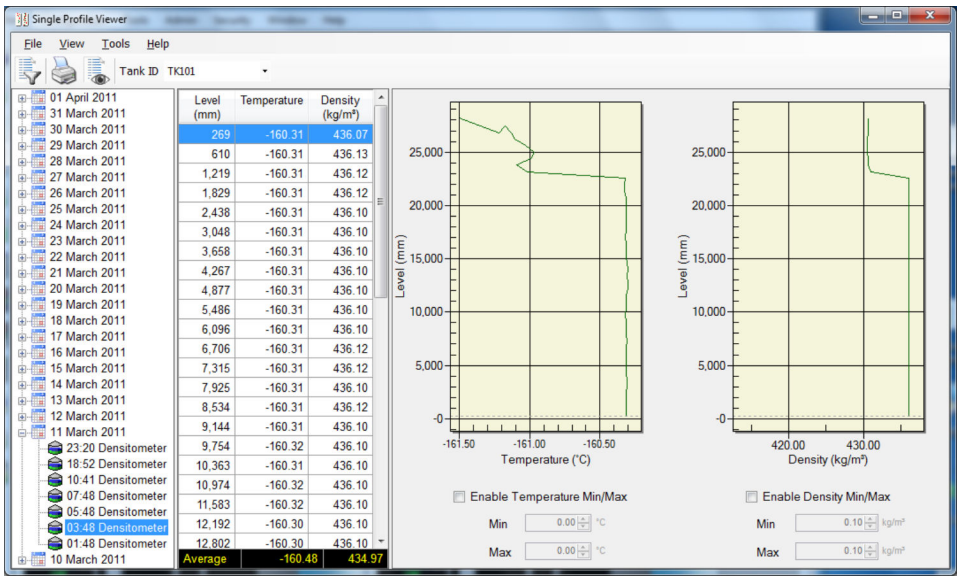


When examining profiles such as the ones illustrated, the computer examines consecutive readings (by level) and given the accuracy of the gauge will group those that differ by an amount less than can be explained by gauge inaccuracies into one stratum.

Average density and temperature can then be calculated for the strata discovered in the above process.

4.4 Examining Strata

Once the points in the profile data have been assigned to a stratum, by sorting them by level you can calculate the position, depth and the mean temperature and density. The following figure shows such a display, the graph allows you to correlate the computer's analysis of the profile data back to the original data. The table of data shows the calculated details of the strata.



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