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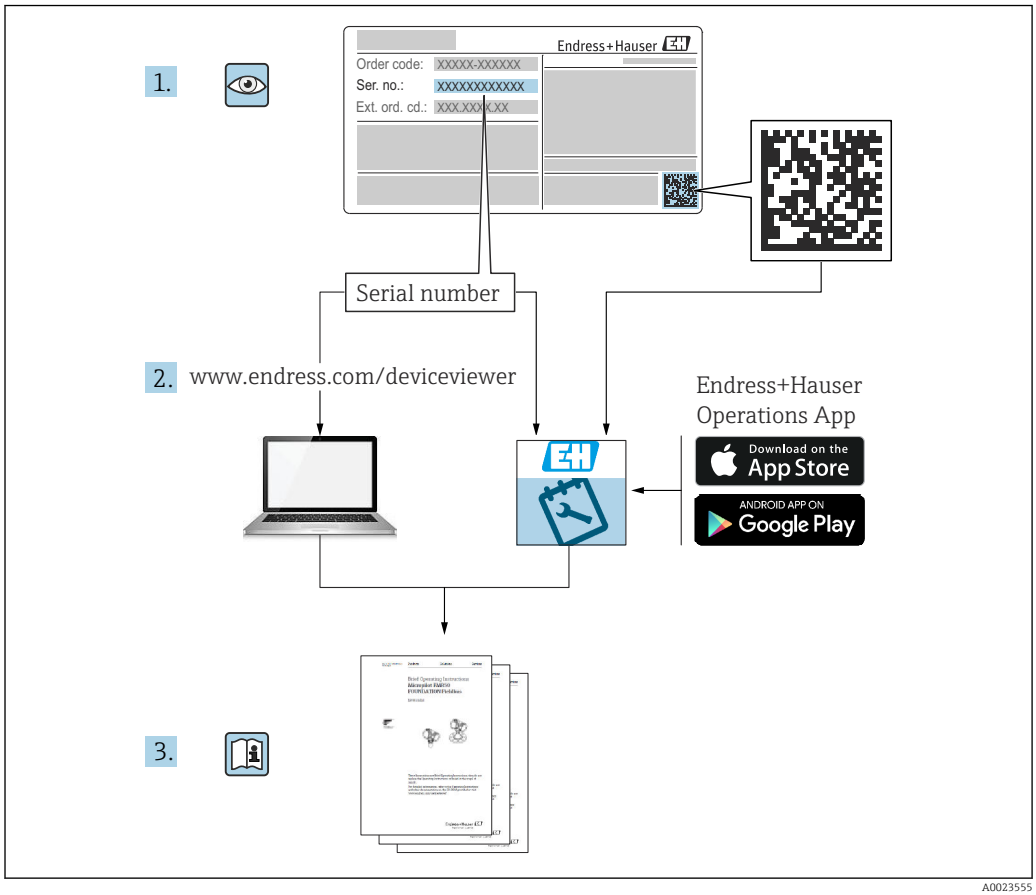
Valid as of version
1.1.x (Device firmware)

Operating Instructions
Tankvision Gauge Link NXA20

Tank Gauging
Installation, Operation and Maintenance Manual

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
- 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. The Endress+Hauser sales organization will supply you with current information and updates to these instructions.

Change history

BA01335G/00/EN/01.14
- Valid for software version: 1.1.0
- Initial version

BA01335G/00/EN/02.15
- Valid for software version: 1.1.x
- Changes to the previous version:
  Minor changes

BA01335G/00/EN/03.25
- Valid for software version: 1.1.x
- Changes to the previous version:
  Minor changes

Table of contents

1 About this document

1.1 Document function

This manual should support during the installation of the NXA20 units. It deals with the mechanical, electrical and signal line installation. The first commisioning steps are described as well.

1.2 Target audience

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.

1.3 Symbols

1.3.1 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.

1.3.2 Electrical symbols

Alternating current

Direct current

Ground connection

A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

Protective earth (PE)

Ground terminals that must be connected to ground prior to establishing any other connections.

The ground terminals are located on the interior and exterior of the device:
- Interior ground terminal: protective earth is connected to the mains supply.
- Exterior ground terminal: device is connected to the plant grounding system.

1.3.3 Symbols for certain types of information

Tip
Indicates additional information

Reference to documentation

▶
Notice or individual step to be observed

1., 2., 3.
Series of steps

Result of a step

1.3.4 Symbols in graphics

1, 2, 3, ...
Item numbers

1., 2., 3.
Series of steps

A, B, C, ...
Views

1.4 List of abbreviations

- BPM
  Bi-Phase Mark
- CIU
  Communication Interface Unit
- CRC
  Cyclic redundancy check
- EIA
  Electronic Industries Alliance
- GPU
  Graphics Processing Unit
- ISP
  Internet Service Provider
- RST
  Reset Flag
- TIA
  Telecommunications Industry Association

1.5 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.

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

1.6 Registered trademarks

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

Microsoft®, Windows® and Edge®
Microsoft®, Windows®, Edge® and the Microsoft logo are registered trademarks of the Microsoft Corporation.

Java®
Registered trademark of Sun Microsystems, Inc.

Mozilla® Firefox®
Registered trademark of the Mozilla Foundation

Enraf, Honeywell, Rosemount, Emerson, L&J, GPE, Varec, Ensite are registered trademarks and trademarks of these organizations and companies.

All other marks are property of their respective owners.

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 Application

The Tankvision Gauge Link is a tank gauging protocol converter to allow integration of third party gauging equipment into the Tankvision system. The Tankvision Gauge Link is available with a range of different fieldbus interface options. Most fieldbus interfaces will support connection of a number of gauges in a “multi-drop” or bus configuration. The number of gauges which may be configured in the Tankvision Gauge Link is limited to 32 (limited to 15 when used in combination with NXA820), which should be adequate for most typical tank gauging fieldbusses, however electrical and/or protocol limitations may reduce this number. The functionality which obtains will be determined by that offered by the connected gauge(s) and the interface/protocol.

Connection to the host system is via EIA/TIA-485 (formerly RS485) Modbus. This is primarily intended for “one-to-one” connection with the Tankvision Tank Scanner or similar device.

The Tankvision Gauge Link must only be used in “safe” areas where there is no hazard from the presence of potentially explosive or flammable atmospheres.

The Tankvision Gauge Link has not been assessed in respect of functional safety.

Accordingly it is not intended to be used as a safety critical component or part of a safety critical system or in the implementation of any safety function.

2.3 Workplace safety

For work on and with the device:

- Wear the required personal protective equipment according to federal/national regulations.

Before connecting or disconnecting the device:

- Switch off the supply voltage.

2.4 Operational safety

Risk of injury!
- In normal operation the Tankvision Gauge Link contains hazardous voltages. Connectors on the front panel, accessible behind the front cover or door are “touchproof”, but care must be exercised when carrying out service work with the door open. The device must not be operated with any other cover removed.
- If (or it is suspected that) any liquid or conductive object or debris has entered the enclosure of the Tankvision Gauge Link, the mains supply to the equipment must immediately be isolated.

Damage to the device!
- Operate the device in proper technical condition and fail-safe condition only.
- The operator is responsible for the interference-free operation of the device.

Proper operation of the Tankvision Gauge Link is dependent upon correct installation and configuration. The equipment must be operated and maintained by suitably trained and competent personnel who are aware of and fully understand the instructions provided herein.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers!
- If modifications are nevertheless required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:
- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to the repair of an electrical device.
- Use only original spare parts and accessories.

The Tankvision Gauge Link contains no user-serviceable parts. Other than the mains supply fuse, the Tankvision Gauge Link contains no user replaceable parts. Any modification or repair work must only be performed by the manufacturer or its authorised agents.

2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It left the factory in a condition in which it is safe to operate.

2.6 IT security

The manufacturer 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 device:
- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter the serial number from the nameplate in the *Device Viewer* (www.endress.com/deviceviewer): all the information about the device and an overview of the Technical Documentation supplied with the device are displayed.
- Enter the serial number on the nameplate into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: all the information about the device and the technical documentation pertaining to the device is displayed.

3.2.1 Nameplate

Do you have the correct device?

The nameplate provides you with the following information on the device:
- Manufacturer identification, device designation
- Order code
- Extended order code
- Serial number
- Tag name (TAG) (optional)
- Technical values, e.g. supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols
- Reference to Safety Instructions (XA) (optional)

▶ Compare the information on the nameplate with the order.

3.2.2 Manufacturer address

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

Place of manufacture: See nameplate.

4 Technical specification

4.1 Environmental conditions

The Tankvision Gauge Link enclosure is rated IP20 to BS EN 60529. Further protection against dust and water and moisture ingress must be provided by the location in which the Tankvision Gauge Link is installed.

Operating Temperature
−40 to +60 °C (−40 to +140 °F)

Storage Temperature
−40 to +85 °C (−40 to +185 °F)

Relative humidity
max. 90 % at +25 °C (+77 °F), non-condensing

4.2 Electrical ratings

Supply voltage
90 to 250 V_{AC}

Frequency
50/60 Hz

Power
23 VA

Overvoltage
Category II

Fuse (mains supply)
T 400 mA HBC 250 V AC, 20 × 5 mm (0.79 × 0.2 in)

5 Installation

5.1 Mechanical installation and mounting

Prior to installation, visually inspect the Tankvision Gauge Link for any signs of damage. Confirm that the type label shows the correct fieldbus interface for the intended application.

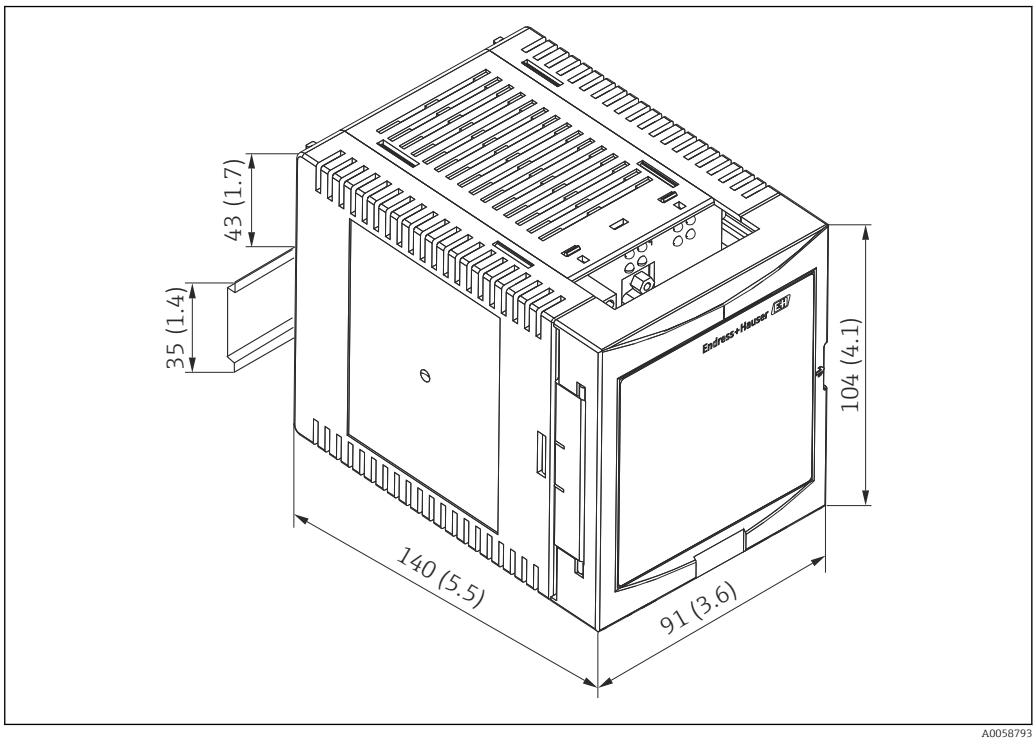
The Tankvision Gauge Link must only be installed in a “safe” area where there is no hazard from the presence of potentially explosive or flammable atmospheres.

The Tankvision Gauge Link must be installed in a cabinet or similar enclosure which provides protection against dust and water ingress. The location must also provide protection against moisture or the formation of condensation.

Ensure that the temperatures likely to be encountered at the installation location lie within the relevant minimum /maximum operating and storage temperature ratings of the Tankvision Gauge Link.

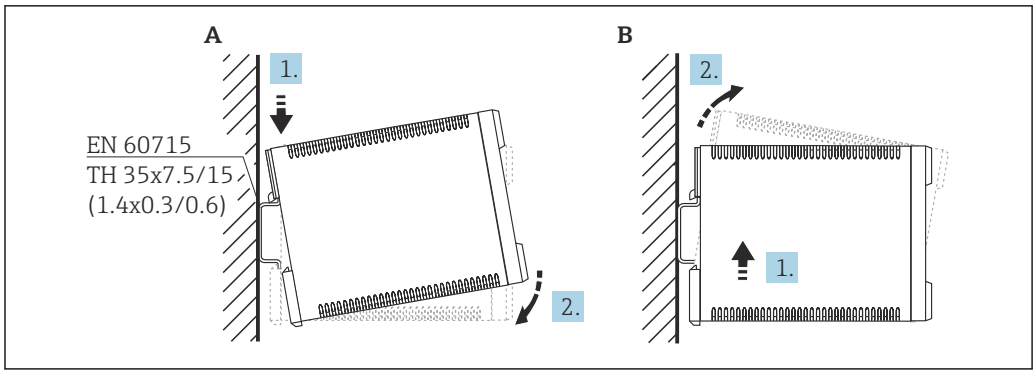
The Tankvision Gauge Link should not be installed near to high voltage circuits or to cables feeding motors or other high current loads, or near to contactors, variable frequency drives, inverters or frequency converters or other switchgear / controlgear which may emit significant electromagnetic interference.

A clear space of about 50 mm (1.97 in) above and below the Tankvision Gauge Link enclosure should be allowed for ventilation. A gap of 10 mm (0.39 in) to either side of the Tankvision Gauge Link will ease mounting and opening of the front cover of the enclosure.



Unit of measurement mm (in)

The enclosure of the Tankvision Gauge Link is intended to be mounted onto “top hat” DIN rail, T35 to BS EN 60715 (or BS 5584/EN 50022/DIN 46277-3). The rail should be mounted on a vertical surface, with the rail running horizontally, so that the Tankvision Gauge Link connection plate/access cover is to the front and in a readily accessible location. To attach the Tankvision Gauge Link to the mounting rail, first hook the enclosure over the top of the rail, then turn downwards until the spring clip on the back of the enclosure latches onto the lower edge of the mounting rail (view A below).

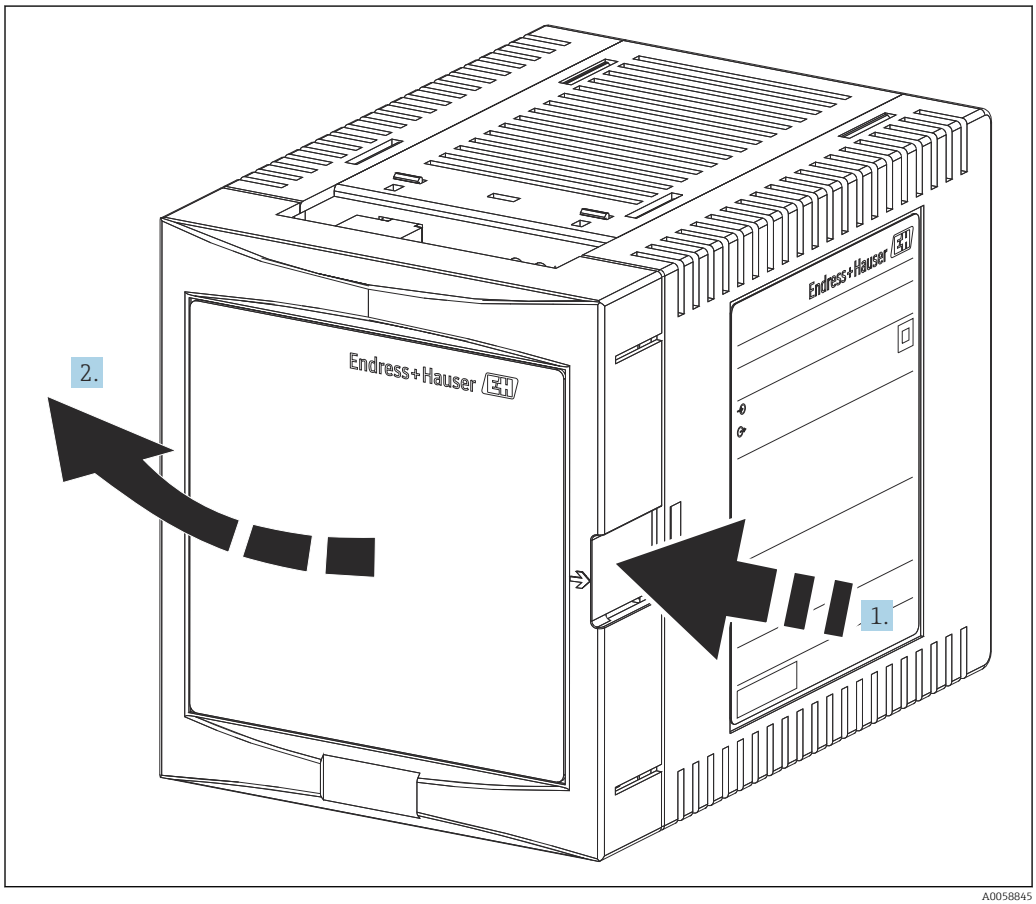


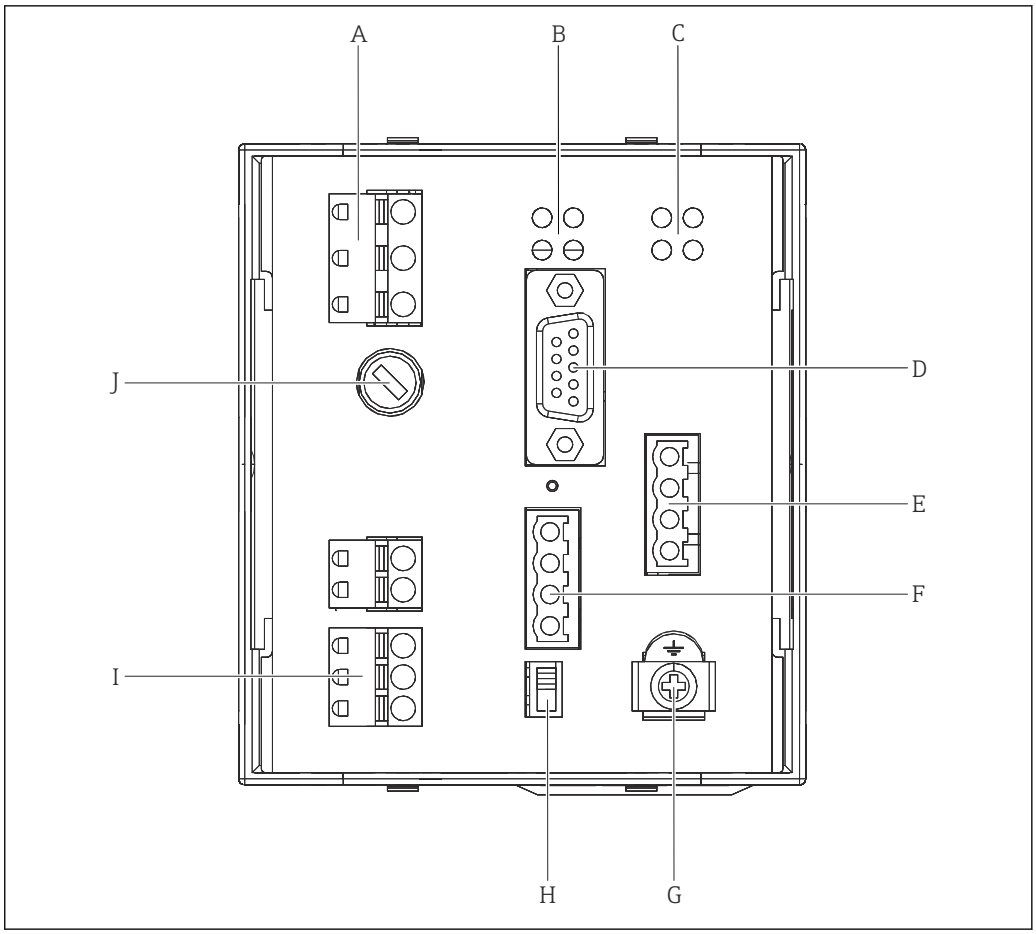
Unit of measurement mm (in)

A Attaching the device to the rail
B Detaching the device from the rail

To remove the Tankvision Gauge Link from the mounting rail (view B above), first push the enclosure upwards against the spring clip until the body of the enclosure is released from the top of the rail, then turn the enclosure forwards, away from the mounting rail.

All electrical connections and controls are available on the front panel of the Tankvision Gauge Link in the terminal compartment, accessed by opening the front cover or door. This is hinged at the left and clicks shut. Press on the arrowed area at the right side of the door to release and open.





A Mains supply connector
B Host port status LEDs
C Field port status LEDs
D Diagnostic/Service port connector
E Field port connector
F Host port connector
G Functional earthing terminal
H Weights & Measures sealing switch
I Status relay connector (Not used)
J Mains supply fuse

5.2 Electrical installation

Two-part connectors are used for permanently connected wiring. The free (or cable end) connector may be unplugged from the panel to assist wiring. Terminals are of the cage clamp quick connect type; use a screwdriver or similar implement to press down on the orange tab to open the clamp and allow the stripped wire end to be inserted. The terminals will accept 0.2 to 2.5 mm^2 (24 to 14 AWG) insulated wires, which should be stripped 10 mm. After insertion of the wire, ensure that no bare conductor is visible, no strands of the conductor are protruding from the wire entry of the terminal and that the conductor is held securely in the terminal.

Cables should be routed to pass out through the slot at the bottom of the door. Ensure cables are not trapped when closing the door.

5.2.1 Mains power supply connections

Mains power supply connection is at the upper left of the front panel.

The Tankvision Gauge Link is double insulated, and thus does not require connection of a protective earth for safety reasons. An earth terminal is included in the mains supply

connector for EMC purposes. This should be connected to the earth or equipotential conductor of the supply.

The Tankvision Gauge Link is regarded as permanently connected equipment. An integral fuse is provided for overcurrent protection. Protection against electric shock is by double insulation. It is recommended that the mains supply terminals be connected to the source of supply by means of an approved flexible cord/cable.

The supply for the Tankvision Gauge Link should be taken from a circuit breaker or switch/ fuse combination to provide electrical isolation external to the Tankvision Gauge Link and overcurrent protection for the supply cable. This means of isolation should be clearly labelled as to its function and should be located within easy reach of the Tankvision Gauge Link and be easy to operate.

5.2.2 Functional earthing terminal

A functional earthing terminal is provided at the lower right of the front panel. This terminal is used for non-safety earthing of the electronic interface circuits of the Tankvision Gauge Link, e.g. for EMC purposes.

The functional earthing terminal is electrically separate from and not connected to the earth terminal of the mains power supply connector.

The functional earthing terminal should be connected to the plant equipotential “ground” using wire of 4 mm^2 (12 AWG) or larger section, with a resistance less than 1 Ω.

5.2.3 Status relay connections

The status relay connection at the lower left of the front panel is not used by the Tankvision Gauge Link. No connection should be made to these terminals.

5.2.4 Host port connections

Host port connection is towards the centre of the front panel. The Modbus host port uses EIA/TIA-485 (RS485) “two wire” interface. This provides the “A” / “B” data signal lines and the “C” common connection.

Note that the polarity of the “A” / “B” data signals is in accordance with the EIA/TIA-485 standard. Many third party devices with “RS485” interfaces have the sense of the “A” / “B” lines reversed. When connecting to such devices, it may be necessary to “cross” the “A” and “B” connections between the devices to obtain the correct signal polarity.

The “S” terminal is provided for connection of the cable screen. This terminal is internally connected to the functional earthing terminal of the Tankvision Gauge Link (at lower right of front panel).

Bus termination and biasing are controlled by software selectable settings in the Tankvision Gauge Link. By default, these are enabled for point-to-point links or the devices in a multidrop network that are at the outer “ends” of the cable. If the Tankvision Gauge Link is part of a multi-drop network and is not the “end” device on the cable, the termination and biasing may be disabled. For details of these settings, see chapter "Configuration".

The host RS485 connection offers transient overvoltage protection compatible with RS485 signal level.

5.2.5 Field port connections

Field port connection is towards the right of the front panel. The connections will depend upon the interface.

For Enraf Bi-Phase Mark and “SAAB” Rosemount TRL/2, the fieldbus uses a two wire connection. The polarity of the connection is not important.

The “S” terminal is provided for connection of the cable screen. This terminal is internally connected to the functional earthing terminal of the Tankvision Gauge Link (at lower right of front panel).

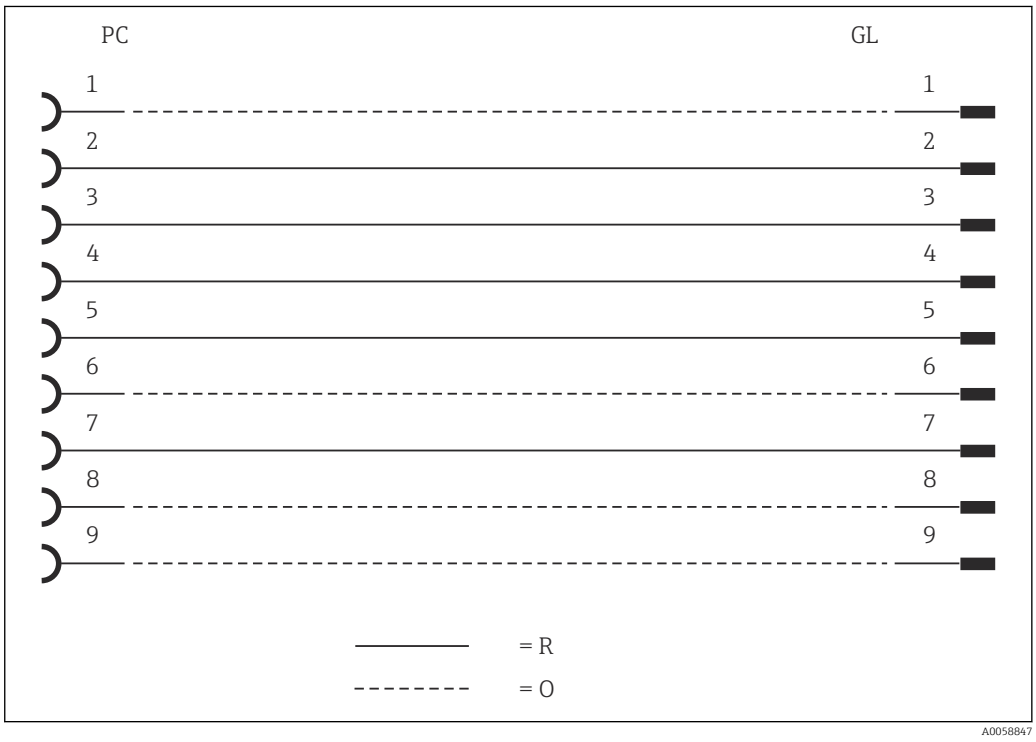
Both the Enraf Bi-Phase Mark and "SAAB" Rosemount TRL/2 fieldbuses are galvanically isolated and offer over voltage protection commensurate with the original gauge manufacturers’ equipment.

The Tankvision Gauge Link will be supplied as two different versions, one supporting the Enraf Protocol and the other supporting the "SAAB" Rosemount TRL/2 protocol.

5.2.6 Diagnostic/service port connections

The diagnostic/service port generally remains unconnected during normal operation of the Tankvision Gauge Link. The port has a 9 way “D” type socket connector. A suitable cable with mating plug will be required for local connection of a service laptop PC or similar.

A “standard” serial port, a 9 way fully wired plug – socket cable will be required. The cable should be wired pin-to-pin, i.e. 1-1, 2-2, 3-3, ... 9-9. Proprietary cables will generally have all pins wired, though only pins 2, 3, 4, 5 and 7 are actually used. Cable length should not exceed 2 m (6.6 ft).



PC Service laptop PC or similar
GL Tankvision Gauge Link
R Required connection
O Optional connection

Note that in the case of Tankvision Gauge Links on a multi-dropped network, the service port provides local access to the individual Tankvision Gauge Link only. It is not possible to communicate with other Tankvision Gauge Links on the network through this service port.

5.2.7 Internal jumper links

The Print circuit boards within the plastic enclosure of the Tankvision Gauge Link are fitted with Jumper links, all the jumpers don’t need to be accessed apart from one jumper

link. LK_TS on the BPM module which only needs to be fitted if the fieldbus baud rate is 2400.

TRL/2 module
Jumper link:
LK_P link: Used to feed 5 V_{DC} supply to board. (default:- open)

BPM module
Jumper link:
- LK_P link: Used to feed 5 V_{DC} supply to board. (default:- open)
- LK_TS link: Fitted for 2400 baud rate. (default:- open)
- Gain can be achieved using LK_G links (gain is described in detail further in the manual).
- A link: Gain control (bit 0) (default:- open)
- B link: Gain control (bit 1) (default:- open)
- C link: Gain control (bit 2) (default:- open)

Main Processor module
Jumper link:
- LK_SG: RS485 signal ground (default:- closed)
- ISP: Firmware update control (default:- open)
- RST: Firmware update control (default:- open)
- JTAG: Debug control (default:- open)

6 Controls and indicators

6.1 Reset

A small pushbutton switch is provided to allow the user to reset the Tankvision Gauge Link without the need to cycle the power. The switch is recessed to prevent inadvertent operation. A pointed object such as a pen may be used to operate the reset switch.

When the Tankvision Gauge Link is reset, the red FAULT (ϟ) LED will flash once while the unit carries out software initialisation. If this LED flashes repeatedly after power up then this indicates a fault and will need to be investigated.

This reset button behaves the same as turning the Tankvision Gauge Link off and back on again.

6.2 Weights & measures seal

This switch is used to disable any configuration through the Modbus port and the engineering port, such as HyperTerminal. When this switch is set, any attempted configuration changes via Modbus will result in timeouts for the host via HyperTerminal and the following message will appear: 'config disabled'.

6.3 Power

The Tankvision Gauge Link has 2 POWER (⊙) LEDs, one for the main processor and one for the fieldbus interface. The main processor LED is green and the fieldbus LED is yellow. These should both be lit during normal operation. A flashing or unlit POWER LED indicates the presence of a power supply fault.

6.4 Transmit/receive

The host port and fieldbus interface port both have yellow TRANSMIT (⇨) and RECEIVE (⇦) LEDs. These flash to indicate activity on the respective communication port data lines.

Note that the TRANSMIT and RECEIVE LEDs indicate only electrical activity on the data lines, but do not give any indication as to the validity of the data.

6.5 Communications

A yellow COMMUNICATIONS (↕) LED is provided for the fieldbus interface port. This flashes to indicate that a valid query – response cycle has been performed by the Tankvision Gauge Link and that the response from the gauge or field device has been understood by the Tankvision Gauge Link.

Note that the COMMUNICATIONS LED indicates that the response received was correctly framed according to the fieldbus protocol and was thus able to be accepted and decoded by the Tankvision Gauge Link. It does not give any indication as to the meaning of the data contained within the response. This yellow LED does not flash when an engineering software tool is connected to the Tankvision Gauge Link, such as Ensite.

7 Operation

7.1 Configuration

7.1.1 Connecting to the diagnostic/service port

Connect a laptop PC with a terminal emulation program (e.g. HyperTerminal) to the service port using a straight-through “null modem” cable.

Set the terminal emulation program to the following communications settings:
- Baud rate: 9600 Baud
- Data bits: 8
- Parity: none
- Stop bits: 1
- Flow control: none

When the ‘HyperTerminal’ terminal emulation programs are not available, for example windows 7 or later is being used, a program such as Tera Term can be used. This program has been tested, free and is open source.

If the PC doesn’t have a serial port and USB-RS232 can be used. A recommend USB-RS232 is the ULinx USO9ML2DR-2 converter.

7.1.2 Configuration using a terminal emulation program

Using this configuration only allows the Tankvision Gauge Link to be configured, configuration of Honeywell Enraf and Emerson "SAAB" gauges must be done separately by a competent engineer.

Once the Tankvision Gauge Link has been connected the diagnostic port and the terminal emulation program has been set up, the Tankvision Gauge Link can be powered up. When the Tankvision Gauge Link is powered up a message is printed and is similar to the message shown below.

NVRAM STATUS- GOOD
P0264
VERSION – V1-0-0
CHECKSUM – 726E9AE7
FIELD - GPU
MODE - TERMINAL
HTS - 9600
FTS - 1200
HPA - NONE
GPU GAIN – 0
RS485 +VE BIAS - OFF
RS485 -VE BIAS – OFF
RS485 TERM - OFF

The data shown above gives general status and information on the basic configuration, such as the status of none volatile (flash) memory, the project number of this model and the firmware version number.

A checksum is also created when the Tankvision Gauge Link is powered up, this number can be used to confirm the validity of the firmware.

The mode is the terminal emulation mode on the RS232 port.

The type of Field driver is also displayed which will be either GPU (Honeywell Enraf protocol) or TRL (Emerson protocol). The Host baud rate (HTS), Field baud rate (FTS) and Host parity (HPA) are also displayed.

The GPU gain is displayed, this gain will only take affect if the fieldbus is GPU. The termination and bias resistors are also shown if they are enabled or not.

The above information can be displayed by typing in the INFO command.

7.1.3 Typing and entering a command

Entering a configuration command into Tankvision Gauge Link is done by simply typing the text into the terminal emulation software and pressing **return key** at the end of the command.

E.g. to print general status and information type: "INFO". This command will print the information shown in the above section.

After most valid commands an 'OK' message will be printed. If an 'INVALID COMMAND' or 'OUT OF RANGE' message is printed, then re-type the command or investigate the 'out of range' message.

All valid commands are saved in Tankvision Gauge Link flash memory, so when the unit is powered down and back up the configuration will remain.

7.1.4 Commands

INFO

This command prints the information shown in the above section.

FTS=XXXX

Where XXXX is a 4 digit number.

This command sets the fieldbus baud rate. If the field driver selected was a TRL driver, then this command will not have any effect on the fieldbus baud rate, because the TRL/2 fieldbus is always set to 4800 baud. If the Field driver selected is a GPU driver then there is a choice of 2 baud rates, 1200 and 2400 baud.

When setting the BPM baud rate to 2400 the jumper link (LK_TS) on the BPM communication needs to be fitted.

To configure the GPU fieldbus with a 1200 baud rate, type:
FTS=1200

To configure the GPU fieldbus with a 2400 baud rate, type:
FTS=2400

Any other baud rate and an 'INVALID COMMAND' message will be printed.

HTS=XXXX

Where XXXX is a 4 digit number.

This command sets the host RS485 fieldbus baud rate. There are a range of different baud rates which this command supports, see below the baud rates with the command to set the baud rate.

Baud rate	Command
1200	HTS=1200
2400	HTS=2400
4800	HTS=4800
9600	HTS=9600
19200	HTS=1920

Any other baud rate and an 'INVALID COMMAND' message will be printed.

HPA=X

Where X is represents the parity.

The Host fieldbus can be configured to support 3 different parities. To configure the parities is shown below:

Parity	Command
None	HPA=N
Even	HPA=E
Odd	HPA=O

Any other letter typed and an 'INVALID COMMAND' message will be printed.

GPUGAIN=X

This command is only used for Enraf Gauges. This command increases the received data sensitivity. If the communication is poor and the BPM cabling is long, by increasing this value the communication should improve.

Where X represents a number between 0 and 7. 0 is the lowest gain and 7 is the highest gain.

For example for the GPU BPM fieldbus to have a gain of 7, type in the following command:
GPUGAIN=7

RS485+=X/RS485-=X

Where X is represents Y (yes) or N (no).

These commands allow the user to enable the 910R bias resistors to pull the A and B lines to +5 V and 0 V. This is sometimes referred to as "fail-safe" biassing mode. Generally these are set to ON when the RS485 comms is point to point and OFF when devices are multi-dropped on the RS485 comms.

To enable the bias resistors type:
RS485+=Y and **RS485-=Y**

To disable the bias resistors type:
RS485+=N and **RS485-=N**

Any other letter typed and an 'INVALID COMMAND' message will be printed.

RS485T=X

Where X is represents Y (yes) or N (no).

This command allows the user to enable the 120R terminator resistor between the A and B lines.

To enable the terminator resistor type:
RS485T=Y

To disable the terminator resistor type:
RS485T=N

Generally this is set to ON when Tankvision Gauge Link is at the end of a RS485 multi-drop line.

Any other letter typed and an 'INVALID COMMAND' message will be printed.

CONFIG

This command enables gauge address's, registers and functions to be written directly to the modbus holding registers which hold the gauge parameter address's/registers. Please refer to document TankVisionFieldLinkModbusMapV1-3-1.

Once this command has been entered values can then be written directly to the holding registers, using the below command.

Z=X or
Z=XX or
Z=XXX or
ZZ=X or
ZZ=XX or
ZZ=XXX or
ZZZ=X or
ZZZ=XX or
ZZZ=XXX or
ZZZZ=X or
ZZZZ=XX or
ZZZZ=XXX

Where Z represents the modbus holding register and *X* represents the value to be put into this holding register.

After every command, enter the value into the holding register, the cursor in the terminal emulation program will go to the start of the next line and wait for another value to be entered into the holding register. If no more values are to be entered press return key and the message 'DOWNLOAD COMPLETE' message will be printed.

For example:

Two gauges are required to be polled by the Tankvision Gauge Link, these gauges are an 873 radar gauge and an 854 servo gauge. Level, temperature and temperature elements are required from both of the gauges. The 873 gauge also requires a live water value to be read from it. The 873 gauge has an address of 1 and the 854 gauge has an address of 15. Type the following bold letters to enter values into the modbus holding registers to poll for the above parameters.

Enter	Result
CONFIG	Enable configuration
0=1	Level address = 1
100=1	Temperature address = 1
200=1	Temperature elements address = 1
300=1	Live water address = 1
1100=82	Gauge type is a radar (82)
1=15	Level address = 15
101=15	Temperature address = 15
201=15	Temperature elements address = 15
1101=83	Gauge type is a servo (83)

The numbers 78, 82 and 83 in Modbus holding register 1 100 to 1 131 represent:
- 78 = decimal value for ascii 'N' (Where N = NRF590)
- 82 = decimal value for ascii 'R' (Where R = RADAR)
- 83 = decimal value for ascii 'S' (Where S = SERVO)

When setting a value of 82 in holding registers 1 100 to 1 131 causes the Tankvision Gauge Link to poll for the ZQR command, which is the radar status register.

When setting a value of 83 in holding registers 1 100 to 1 131 causes the Tankvision Gauge Link to poll for the ZQS command, which is the servo status register.

When setting a value of 78 in holding registers 1 100 to 1 131 causes the Tankvision Gauge Link to not poll for any status registers and it will pick its status value from the 'B' record.

If holding registers 1 100 to 1 131 are set to anything other than 78, 82 and 83 then the status of the gauge will be picked up from the 'B' record and ZQR and ZQS will NOT be polled for.

DEVICES

The devices and configuration parameters for the gauges which have been configured can be viewed at any time. This command allows you to look at the Modbus holding registers.

The data displayed lists the Modbus holding registers in columns of 100 registers. The first block to the left lists all the level addresses configured, the second block lists the temperature addresses configured, these blocks are the blocks of registers detailed in the Tankvision Gauge Link Modbus Map document. It can be seen at the top of each column shows which block of 100 registers is detailed. Down the left side the block register is incremented.

The example print out shows the configuration done in the above example:

DEVICES

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
+ 00	001	001	001	001	255	255	255	255	255	255	255	082
+ 01	015	015	015	255	255	255	255	255	255	255	255	083

A0058853

As it can be seen the registers configured in the above example marry up with the data shown above.

The first, left most block of registers, shows the values of 001 and 015. These are the level addresses. The second block (0100) show the values of 001 (+00) and 015 (+01) these are the temperature addresses. This pattern is repeated up to block 1100, where it can be seen block 1100 (+00) contains the value 82 and block 1100 (+01) contains the value 83. All the unused registers contain the value 255, which represents values which are out of range.

When connecting to Enraf gauges holding registers 600 to 631 are reserved and not used. When connecting to "SAAB" Rosemount gauges holding registers 200 to 231, 400 to 431, 500 to 531, 600 to 631 and 1 100 to 1 131 are not used. All holding registers above 31 to the next 100 in the block are un-used.

The diagram below shows in more detail what each column and row represents. The below is configures to poll for 3 gauges.

1st gauge	Gauge address 01, Modbus address 01, Radar (82)	
	Level	(Reg 0000)
	Temperature	(Reg 0100)
	Temperature elements	(Reg 0200)
	Live water	(Reg 0300)

2nd gauge	Gauge address 15, Modbus address 15, Servo (83)	
	Level	(Reg 0001)
	Temperature	(Reg 0101)
	Temperature elements	(Reg 0201)

3rd gauge	Gauge address 16, Modbus address 16, None Enraf gauge (78)	
	Level	(Reg 0002)

	Temperature	(Reg 0102)
	Temperature elements	(Reg 0202)

The modbus address is always the same as the level address stored in holding registers 0 to 31.

So for example the gauge address to read level for the 1st gauge is address 01 in holding register 0000.

The gauge address to read temperature elements for the 3rd gauge is address 16 in holding register 202.

	A	B	C	D	E	F	G	H	I	J	K	L	M
First holding register →		0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
Addresses in 1st holding register →	+00	001	001	001	001	255	255	255	255	255	255	255	082
Addresses in 2nd holding register →	+01	015	015	015	255	255	255	255	255	255	255	255	083
Addresses in 3rd holding register →	+02	016	016	016	255	255	255	255	255	255	255	255	078
	A: Holding register index B: Level address C: Temperature address D: Temperature element address E: Live water address F: Water dip address G: Density address H: Reserved address I: Vapour temperature address J: Base pressure (P1) address K: Liquid pressure (P2) address L: Vapour pressure (P3) address M: Gauge type												

ALLDEVICES

This command basically does the same command as above, but all 32 registers for each block are displayed.

This command is useful in troubleshooting, to check if there are no random registers containing values.

BLANKXX

Where XX represents a row of gauge parameters between 0 and 32. XX must be entered as a 2 digit number. E.g. 3 must be entered as 03.

This command blanks all the parameters for a gauge and defaults all the parameters back to 255. This parameter is used if you require to remove a gauge from the system. All gauges above this gauge will be automatically shuffled down and fill the space which was originally blanked.

For example:

It is required that the second gauge needs to be removed from the system, type the following: **BLANK01**

FULLBLANK

This command removes all the gauges and parameters from the Tankvision Gauge Link and defaults the holding register database back to no gauges in the system. This command is used if you require to start configuration from a fresh.

ENG=ENSITE

This command allows Honeywell Enraf configuration PC tool, Ensite, to be connected to Tankvision Gauge Link engineering port and support all the features that the Ensite software require.

Once the above command has been set, a 4 minute timer is set to allow time for the engineer to disconnect the terminal emulation software and connect the Ensite software. If no data has been seen after four minutes on the RS232 port of the Tankvision Gauge Link, the port will then switch back to its normal mode of operation and allow the terminal emulation software to be used. Once data has been seen on the RS232 port, the timer will reset and if no data is then seen for 2 minutes the Tankvision Gauge Link will default back to the terminal emulation mode.

If the Tankvision Gauge Link is powered down and back up when in Ensite mode, it will power back up in normal, terminal emulation mode, and will need to be set back to Ensite mode by using the above command.

If Ensite is not polling for data when in this mode, the Tankvision Gauge Link will then starting poll for normal data as configured in its database, this allows the Tankvision Gauge Link to keep the data in its database as live as possible, if Ensite then starts polling for data, the Tankvision Gauge Link will then switch to tunnelling mode and pass the data through from Ensite to the gauges on the BPM fieldbus.

The CIU address of the Tankvision Gauge Link is always set to 0 (zero). The baud rate of the Ensite port can run at either 1200 or 2400, this baud rate is determined by what the fieldbus baud rate is set to using the FTS command. Both the fieldbus and Ensite baud rates need to be the same.

The COMMUNICATIONS LED of the fieldbus module will not light up when Ensite is tunnelling data, but it will light if the Tankvision Gauge Link polls for valid data. This can be useful to determine what is driving the BPM fieldbus, Ensite or the Tankvision Gauge Link.

ENG=ENGAUGE

This command offers all the features that the Ensite mode offers, including the Honeywell Enraf Flexconn configuration tool. Disabling, CIU address etc are the same as the Ensite mode.

For optimum Engauge operation with the Tankvision Gauge Link, set Engauge as follows:

1. New site.
2. Enter the units of the parameters.
3. Add a device to the comms.
4. Add a field connector. Choose **smartlink** and give it a name.
5. Select the SmartLink and change its comms parameters.
   ↳ GPU: 1200, 7, O, 1
   Flexconn: 1200, 8, N, 1
6. Add a Tank.
7. Add a gauge.
8. Edit gauge properties.
   ↳ GPU Gauge address (Example 02)
   FlexConn address (Example 0101)
9. Once ENG=ENGAUGE in Tankvision Gauge Link scan for boards within the actual gauges and use the Engauge commands.

ENG=WINSETUP

This is a similar command to the Ensite and Engauge mode, in that it will drop back after 2 or 4 minutes, if the RS232 port sees no data. When Winsetup is NOT polling for data, Tankvision Gauge Link will start polling for data until the Winsetup then starts polling for data. The COMMUNICATIONS LED does not light up when Winsetup polls for data. If the Tankvision Gauge Link is powered down and back up, the unit will default back to normal, terminal emulation software. The baud rate for this port when in Winsetup mode is always set to 4800 and no other baud rate can be used.

DEBUG

This command is used to print the data transmitted and received on the fieldbus port. This feature can be useful when commissioning a system. To cancel the debug mode, press the return key a few times or power the Tankvision Gauge Link down and back up.

If the fieldbus port is a BPM port, then the data printed will be the raw ASCII data, generally the transmitted and received data will be printed on the same line per gauge, a new line will be printed for a different gauge.

If the Field port is a TRL/2 port, then the data printed will be the raw decimal data. If a long message is received, then serial port may not be able to handle all the data so quickly, so the received data can be shorted, so only the address, function and CRC is viewed, all the rest of the viewed data will be replaced with a **#**. To set this command type **S** when in debug mode. This feature is only supported for the TRL/2 fieldbus mode.

7.1.5 Quick list of commands

INFO
FTS=XXXX
HTS=XXXX
HPA=X
GPUGAIN=X
CONFIG
ZZZZ=XXX
DEVICES
ALLDEVICES
BLANKX
FULLBLANK
ENG=ZZZZZ
DEBUG
S

Where X and Z represent letters or numbers.

7.1.6 Configuration practices

Configuring the Tankvision Gauge Link using terminal emulation software is straight forward to do but a few practices need to be carried out.

When configuring the Tankvision Gauge Link to communicate with Honeywell Enraf, the type of gauge must be setup in the 1100 block of holding registers, if the type of gauge isn't configured, the Tankvision Gauge Link will treat the gauge as a basic Honeywell Enraf 811 gauge.

No type of gauge is required to be configured if connection to Emerson "SAAB" gauges.

When adding gauges to the Tankvision Gauge Link it is important that the gauges are added in consecutive order, otherwise the Tankvision Gauge Link will only poll for the first addresses until it reaches a level holding register which contains 255, then it will go back and repeat polling for the first gauges.

For example:

If level and temperature are required from 6 of 854 Honeywell Enraf gauges, having addresses 01, 02, 03, 04, 05 and 06 respectively, then it is advised that configuration to be done as follows:

Enter	Result
CONFIG	Enable configuration
0=1	Level address = 1
100=1	Temperature address = 1
1100=83	Gauge type is a servo (83)
1=2	Level address = 2
101=2	Temperature address = 2
1101=83	Gauge type is a servo (83)
2=3	Level address = 3
102=3	Temperature address = 3
1102=83	Gauge type is a servo (83)
3=4	Level address = 4
103=4	Temperature address = 4
1103=83	Gauge type is a servo (83)
4=5	Level address = 5
104=5	Temperature address = 5
1104=83	Gauge type is a servo (83)
5=6	Level address = 6
105=6	Temperature address = 6
1105=83	Gauge type is a servo (83)

If the above was configured but the last gauge with address 6 was mapped to as follows:

Enter	Result
8=6	Level address = 6
108=6	Temperature address = 6
1108=83	Gauge type is a servo (83)

This gauge with address 6 will not be polled for because it is not directly preceeding the gauge before it.

Each parameter can have a different address within the modbus holding registers. The reason for this is that different parameters can come from different devices with different addresses. This allows data from different addresses to be mapped to the group of input registers, where the address of the input registers is derived from the level address of the device.

For example:

If a system requires a level from an Enraf 854 (address 1) and average temperature and temperature elements from an 864 (address 11) then configuration can be done as shown below:

Enter	Result
CONFIG	Enable configuration
0=1	Level address = 1
100=11	Temperature address = 11
200=11	Temperature elements address = 11
1100=83	Gauge type is a servo (83)

All the data will be picked up from input registers with an address of 1.

If a system requires a level from an Emerson REX (address 1) and average temperature and temperature elements from a DAU (address 101) then configuration can be done as shown below:

Enter	Result
CONFIG	Enable configuration
0=1	Level address = 1
100=101	Temperature address = 101

All the data will be picked up from input registers with an address of 1. As it can be seen, the element temperature is automatically mapped to address 101 because the elements is associated with average temperature. No gauge type is required for the TRL/2 fieldbus.

7.1.7 Honeywell Enraf Fieldbus

Configuration of the Tankvision Gauge Link to poll for Honeywell Enraf gauges has been covered in the above examples and explanations. Configuring the Tankvision Gauge Link to poll for Emerson "SAAB" gauges is slightly different.

7.1.8 Emerson "SAAB" Fieldbus

Configuration of the Tankvision Gauge Link to poll for level and temperature from Emerson "SAAB" devices is the same as configuring Honeywell Enraf devices, in that the level address comes from holding registers 0 to 31 and temperature address comes from holding registers 100 to 131.

The temperature elements address automatically comes from the address in holding registers 100 to 131, so there is no need to configure any addresses in holding registers 200 to 231.

Live water, vapour temperature, base pressure, liquid pressure and vapour temperature can be mapped back to the input registers with an address of the level address. The TRL/2 protocol doesn't specifically have a register for the above parameters, but the Emerson REX gauge has analogue and HART inputs which can be mapped and scaled within the Emerson REX gauge. These inputs can then be picked up on the TRL/2 protocol and mapped within the Tankvision Gauge Link.

The Tankvision Gauge Link will not scale the above parameters which come back on the TRL/2 protocol, this must be done in the gauge and this is the usual practice when working with Emerson equipment.

The below inputs to the Emerson REX gauge are mapped to the TRL/2 registers. These will only be picked up from the gauge with the address in holding registers 0 to 31. These will not be picked up from a DAU.

Emerson REX input	TRL/2 Register
Analogue input current 1	06
Analogue input current 2	07
Analogue input current 3	08
Analogue input 1	30
Analogue input 2	32
HART Input 3	36
HART Input 2	38
HART Input 1	40

For example:

A system has a REX gauge with an address of 2 and a DAU for temperature of 102. Live water and vapour temperature is also required, these will be mapped to Analogue input current 1 and HART input 1 respectively in the REX gauge. Configure the Tankvision Gauge Link as follows:

Enter	Result
CONFIG	Enable configuration
0=2	Level address = 2
100=102	Temperature address = 102
300=06	Live water from register 06 with address 2
700=40	Vapour temperature from register 40 with address 2

7.1.9 Worked examples

Example 1

A system requires to be connected to 5 of Honeywell Enraf gauges. GPU baud rate is 1200. The modbus interface is 9600, None, 8, 1.

- Gauge address = 1, needs level and temperature. Gauge type 854.
- Gauge address = 2, needs level and temperature. Gauge type 873.
- Gauge address = 5, needs level, temperature, temperature elements, water dip and density. Gauge type 854.
- Gauge address = 9, needs level. Temperature and its elements are from an 864 with address 19. Gauge type 873.
- Gauge address = 20, needs level and temperature. Gauge type is an Enraf emulation coming from a none Enraf gauge.

Ensure the Tankvision Gauge Link is the Enraf version.

Enter	Result
FTS=1200	Enable
HTS=9600	Enable
HPA=N	Enable
CONFIG	Enable configuration
0=1	Level address = 1 (modbus address = 1)

Enter	Result
100=1	Temperature address = 1
1100=83	Gauge type is a servo (83)
1=2	Level address = 2 (modbus address = 2)
101=2	Temperature address = 2
1101=82	Gauge type is a radar (82)
2=5	Level address = 5 (modbus address = 5)
102=5	Temperature address = 5
202=5	Element temperature address = 5
402=5	Water dip address = 5
502=5	Density = 5
1102=83	Gauge type is a servo (83)
3=9	Level address = 9 (modbus address = 9)
103=19	Temperature address = 19
203=19	Temperature address = 19
1103=82	Gauge type is a servo (82)
4=20	Level address = 20 (modbus address = 20)
104=20	Temperature address = 20
1104=78	Gauge type is basic (78)

Once the above has been done type in **DEVICES** to confirm your configuration is correct.

Example 2

A system requires to be connected to 5 of Emerson gauges. The modbus interface is 19200, None, 8, 1.

- Gauge address = 1, needs level and temp.
- Gauge address = 2, needs level and temp.
- Gauge address = 7, needs level, temperature, temperature elements, live water from gauge register analogue input current 2 and product pressure from gauge register HART input 2.
- Gauge address = 8, needs level. Temperature and its elements is from a DAU with address 108.
- Gauge address = 21, needs level and temperature. Gauge type is an TRL emulation coming from a none Emerson gauge.

Ensure the Tankvision Gauge Link is the TRL/2 version.

Enter	Result
HTS=1920	
HPA=N	
CONFIG	Enable configuration
0=1	Level address = 1 (modbus address = 1)
100=1	Temperature address = 1
1=2	Level address = 2 (modbus address = 2)
101=2	Temperature address = 2
2=7	Level address = 7 (modbus address = 7)
102=7	Temperature address = 7

Enter	Result
302=7	Live water register 07 from address 7
902=38	Product pressure register 38 from address 7
3=8	Level address = 8 (modbus address = 8)
103=108	Temperature address = 108
4=21	Level address = 21 (modbus address = 21)
104=21	Temperature address = 21

Once the above has been done type in **DEVICES** to confirm your configuration is correct.

Example 3

A system requires to be connected to 6 of NRF590 gauges (emulating Enraf GPU) with address 01 to 06.

Level and temperature are required from all gauges.

Host baud rate is 9600, with a parity of none. BPM baud rate is 1200.

Enter	Result
FTS=1200	
HTS=9600	
HPA=N	
CONFIG	Enable configuration
0=1	Level address = 1 (modbus address = 1)
100=1	Temperature address = 1
1100=78	Gauge type is a NRF590 (78)
1=2	Level address = 2 (modbus address = 2)
101=2	Temperature address = 2
1101=78	Gauge type is a NRF590 (78)
2=3	Level address = 3 (modbus address = 3)
102=3	Temperature address = 3
1102=78	Gauge type is a NRF590 (78)
3=4	Level address = 4 (modbus address = 4)
103=4	Temperature address = 4
1103=78	Gauge type is a NRF590 (78)
4=5	Level address = 5 (modbus address = 5)
104=5	Temperature address = 5
1104=78	Gauge type is a NRF590 (78)
5=6	Level address = 6 (modbus address = 6)
105=6	Temperature address = 6
1105=78	Gauge type is a NRF590 (78)

Example 4

A system requires to be connected to 4 of NRF590 gauges (emulating Enraf GPU) with address 01 to 04.

Level only is required.

Host baud rate is 9600, with a parity of none. BPM baud rate is 1200.

Enter	Result
FTS=1200	
HTS=9600	
HPA=N	
CONFIG	Enable configuration
0=1	Level address = 1 (modbus address = 1)
1100=78	Gauge type is a NRF590 (78)
1=2	Level address = 2 (modbus address = 2)
1101=78	Gauge type is a NRF590 (78)
2=3	Level address = 3 (modbus address = 3)
1102=78	Gauge type is a NRF590 (78)
3=4	Level address = 4 (modbus address = 4)
1103=78	Gauge type is a NRF590 (78)

Example 5

A system requires to be connected to 4 of 873 gauges and 2 of 854 gauges with address 01 to 06.

Level and temperature are required from all gauges.

Host baud rate is 9600, with a parity of none. BPM baud rate is 1200.

Enter	Result
FTS=1200	
HTS=9600	
HPA=N	
CONFIG	Enable configuration
0=1	Level address = 1 (modbus address = 1)
100=1	Temperature address = 1
1100=82	Gauge type is a RADAR (82)
1=2	Level address = 2 (modbus address = 2)
101=2	Temperature address = 2
1101=82	Gauge type is a RADAR (82)
2=3	Level address = 3 (modbus address = 3)
102=3	Temperature address = 3
1102=82	Gauge type is a RADAR (82)
3=4	Level address = 4 (modbus address = 4)
103=4	Temperature address = 4
1103=82	Gauge type is a RADAR (82)
4=5	Level address = 5 (modbus address = 5)
104=5	Temperature address = 5
1104=83	Gauge type is a SERVO (83)
5=6	Level address = 6 (modbus address = 6)
105=6	Temperature address = 6
1105=83	Gauge type is a SERVO (83)

Example 6

A system requires to be connected to 2 of 873 gauges and 2 of 854 gauges with address 01 to 04.

Level only is required.

Host baud rate is 9600, with a parity of none. BPM baud rate is 1200.

Enter	Result
FTS=1200	
HTS=9600	
HPA=N	
CONFIG	Enable configuration
0=1	Level address = 1 (modbus address = 1)
1100=82	Gauge type is a RADAR (82)
1=2	Level address = 2 (modbus address = 2)
1101=82	Gauge type is a RADAR (82)
2=3	Level address = 3 (modbus address = 3)
1102=83	Gauge type is a SERVO (83)
3=4	Level address = 4 (modbus address = 4)
1103=83	Gauge type is a SERVO (83)

Example 7

A system requires to be connected to 5 of "SAAB" rosemount gauges address 01 to 05.

Level and temperature are required.

Host baud rate is 9600, with a parity of none.

Enter	Result
HTS=9600	
HPA=N	
CONFIG	Enable configuration
0=1	Level address = 1 (modbus address = 1)
100=1	Temperature address = 1
1=2	Level address = 2 (modbus address = 2)
101=2	Temperature address = 2
2=3	Level address = 3 (modbus address = 3)
102=3	Temperature address = 3
3=4	Level address = 4 (modbus address = 4)
103=4	Temperature address = 4
4=5	Level address = 5 (modbus address = 5)
104=5	Temperature address = 5

Example 8

A system requires to be connected to 4 of "SAAB" rosemount gauges address 01 to 04.

Level only is required.

Host baud rate is 9600, with a parity of none.

Enter	Result
HTS=9600	
HPA=N	
CONFIG	Enable configuration
0=1	Level address = 1 (modbus address = 1)
1=2	Level address = 2 (modbus address = 2)
2=3	Level address = 3 (modbus address = 3)
3=4	Level address = 4 (modbus address = 4)

7.1.10 Configuring through the Modbus Map

The holding registers which contain the gauge addresses etc can also be configured through the RS485 Modbus host port using function code 3 of the Modbus protocol. Writing into these registers is done using function code 6 or 16.

The purpose of this feature allows gauges to be added or deleted from a system remotely, which allows host packages which have a configuration tool as part of it's software suit to do the configuration. This feature also allows its configuration to be stored remotely and the configuration to be downloaded to the Tankvision Gauge Link on power up of a whole system if required.

Refer to the Tankvision Gauge Link Modbus Map document for configuring the Tankvision Gauge Link through the Modbus interface. The same principles apply when configuration is done through the terminal emulation program, such as the gauges much be configured in consecutive order, see chapter "Configuration practices".

The address when configuring the Tankvision Gauge Link is default 247 or any of the addresses configured in holding registers 0 to 31.

The only parameters which can not be configured through the modbus link are parameters, such as the engineering mode, field mode, baud rates, parity, GPU gain.

7.2 Operation

The operation of the Tankvision Gauge Link is straight forward, the Modbus interface complies with the Modbus specification. Refer to the document Tankvision Gauge Link Modbus Map. In general data from each gauge and auxiliary device is mapped to an address which is assigned in holding registers 0 to 31. The data will be picked up from the input registers using function code 4. The Tankvision Gauge Link can support up to 32 Modbus addresses, so in theory 32 gauges and auxiliary devices can be connected, but in practice the electrical limitations of the BPM and TRL/2 fieldbus wouldn't allow for this.

The Tankvision Gauge Link supports a range of different units, which are detailed in the Tankvision Gauge Link Modbus Map. The Tankvision Gauge Link reads the units on power up from the gauges, it is important that the Modbus host has been configured to calculate the different units. The Tankvision Gauge Link can support gauges on the same fieldbus with different units, but in practice, all the gauges on the fieldbus would typically have the same units.

The scan cycle is the level is polled on a frequent basis, temperature is polled for approximately half to a quarter the level depending on the gauge type. Other parameters are polled once every cycle. The cycle time is dependent on the number of gauges and parameters configured.

If a gauge was lost the Tankvision Gauge Link would do a number of polls for that gauge, if still no gauge was detected, it would set all the registers associated with that gauge to 0xFFFF hex. It would then move on and poll for the rest of the gauges. Depending on the

gauge setup, if an auxiliary device was connected such as a DAU and comms was lost to the gauge but not DAU, the data from the DAU would still be returned, this would also apply if comms was lost from the DAU but not the gauge.

If a parameter from the gauge had an error, the last valid reading would be returned to the Modbus map, but the status bit(s) would be set to indicate an error, the last valid reading can be useful to know when troubleshooting.

Commands can be issued from the Tankvision Gauge Link, if the gauge supports it, such as stow, density dip etc.

A range of other data can be read from the gauges as detailed in the Modbus specification document. These parameters must be setup in the appropriate gauge, such as the high and low alarms.

The Tankvision Gauge Link has a heartbeat and various information registers, these are detailed in the Modbus map manual.

Generally the status register offset 21 is used to read the status of the gauge such as 'is the gauge doing a water dip?' etc. The status register for each parameter is generally used to test whether the parameter is healthy or not.

7.3 Engineering mode

This mode allows, Ensite, Engauge or Winsetup to be connected to the RS232 port and used to interface directly to the gauges.

When using these tools a trained engineer must be familiar with the tools.

Data, such as level, temperature etc, can still be read from the gauges when using the tunnelling engineering tools, but if the tools are running for long periods of time an update of new date to the Tankvision Gauge Link may take some time. It is important that the control room must be made aware that the data from the modbus link may not be live. It is the responsibility of the engineer to ensure that the data read from the Tankvision Gauge Link may not be live when using the engineering tools and advise the control room of this.

If the engineering tool stops communicating through the Tankvision Gauge Link for 1 second, then the Tankvision Gauge Link will then start polling for data. As soon as the engineering tool starts sending data to the gauges, the Tankvision Gauge Link then stops polling for live data.

The COMMUNICATIONS LED will not flash when the engineering tool is passing data through the Tankvision Gauge Link. This can be useful to determine which device is polling for data.

8 Troubleshooting

8.1 Diagnostics

8.1.1 Use of fully wired serial cables

Use the cable as described in previous section and connect to the RS232 port of the Tankvision Gauge Link and connect the other end to a laptop PC with a terminal emulation program (e.g. Hyperterminal).

Set the terminal emulation program to the following communications settings:
- Baud rate: 9600 Baud
- Data bits: 8
- Parity: none
- Stop bits: 1
- Flow control: none

Use the command **DEBUG** to print the raw GPU (Enraf) or TRL/2 (SAAB) data on the fieldbus. If the fieldbus is TRL/2 then the command **S** may be required as the TRL/2 messages maybe too long so the **S** command will shorten the data printed to hyperterminal.

If for any reason a firmware update is required, links (ISP and RST) within the Tankvision Gauge Link need to be fitted and the use of flash magic to update the firmware. Details of firmware updates will be supplied if firmware updates are required in the future.

8.2 Fault finding

No LED indications: POWER (⊙) LED not lit

Possible cause	Solution
Mains power failure	Investigate and rectify
Mains supply fuse ruptured	Investigate 1. If no fault evident, replace fuse with new one of same rating. 2. If fuse immediately ruptures or Tankvision Gauge Link does not operate normally, return unit for repair.
Internal fault	Return unit for repair

FAULT (ϟ) LED lit

Possible cause	Solution
Internal fault	Return unit for repair

FAULT (ϟ) LED flashes repeatedly

Possible cause	Solution
Internal fault	Return unit for repair

Host port RECEIVE (⇩) LED appears to be “permanently” lit, possibly flickers off for very short time

Possible cause	Solution
EIA-485 “A” / “B” data signal lines “crossed”	Swap “A” / “B” connections at host port connector

Host port RECEIVE (⇩) LED does not flicker / no activity

Possible cause	Solution
No requests from host	Investigate and rectify
Wiring fault between host and Tankvision Gauge Link	Investigate and rectify

Host port RECEIVE (⇩) LED flickers but no activity on TRANSMIT (⇧) LED

Possible cause	Solution
Incorrect configuration: wrong communications parameters (Baud rate, etc.), protocol or Modbus slave address	Investigate and rectify 1. Host and Tankvision Gauge Link must be set to same comms parameters. 2. Protocol is Modbus RTU 3. Modbus requires 8 data bits for RTU. Parity is usually “none” (not needed for RTU).

Host port RECEIVE (⇩) LED flickers, intermittent or no TRANSMIT (⇧) LED activity

Possible cause	Solution
Garbled communications: loose connection, noise/ interference or Baud rate too high	Check communications 1. Check wiring 2. Check for sources of noise and interference 3. Try slower Baud rate

Field port TRANSMIT (⇧) LED flickers but no activity on RECEIVE (⇩) LED

Possible cause	Solution
Incorrect configuration: wrong fieldbus interface, communications parameters (Baud rate, etc.), protocol or gauge addresses	Investigate and rectify 1. Tankvision Gauge Link must be set to same comms parameters as gauges. 2. Protocol must suit fieldbus interface option.
Wiring fault between Tankvision Gauge Link and gauges	Investigate and rectify 1. Check wiring

Field port TRANSMIT (⇆) LED flickers, RECEIVE (→) LED flickers normally except periodic gaps in activity at evenly spaced regular intervals

Possible cause	Solution
Incorrect configuration: wrong data parameters, requesting parameters that are not supported by the gauge or one or more wrong gauge addresses	Investigate and rectify 1. Tankvision Gauge Link must be set to only request parameters that are available from the gauges. 2. Check for incorrect or conflicting gauge address.

Field port TRANSMIT (⇆) LED flickers, intermittent or no RECEIVE (→) LED activity

Possible cause	Solution
Garbled communications: loose connection, noise/ interference, Baud rate too high or excessive bus loading	Check communications 1. Check wiring 2. Check for sources of noise and interference 3. Try slower Baud rate (subject to protocol limitations) 4. Reduce number of gauges on fieldbus. (see note below)

Field port TRANSMIT (⇆) and RECEIVE (→) LEDs flicker, intermittent or no COMMUNICATIONS (↕) LED activity

Possible cause	Solution
Garbled communications: loose connection, noise/ interference, Baud rate too high or excessive bus loading	Check communications 1. Check wiring 2. Check for sources of noise and interference 3. Try slower Baud rate (subject to protocol limitations) 4. Reduce number of gauges on fieldbus. (see note below)

If the Tankvision Gauge Link is being installed to replace an existing tank gauging host, it may be possible to verify the prevailing fieldbus communications conditions before attempting to install the Tankvision Gauge Link. This will assist in tracing subsequent communications problems if they relate to incorrect configuration, or poor communications/intermittent comms failures resulting from field conditions (bus loading, noise/interference, etc.).

9 Maintenance

The Tankvision Gauge Link normally requires no routine or preventive maintenance other than periodically checking for signs of the enclosure ventilation slots becoming blocked with dust, etc.

9.1 Foreign object/liquid ingress

If (or it is suspected that) any liquid or conductive object or debris has entered the enclosure of the Tankvision Gauge Link, the mains supply to the equipment must immediately be isolated.

The enclosure is not intended to be opened or dismantled by the user. If possible the foreign object may be retrieved by dismounting the Tankvision Gauge Link and gently tilting and shaking the enclosure until the object falls out.

In the case of water ingress, place the Tankvision Gauge Link in a warm location and allow the enclosure to thoroughly dry out.

Do not reinstall the Tankvision Gauge Link until it is certain that all foreign object / debris or contamination has been completely removed from the enclosure. On first power-up check for signs of unusual or incorrect operation, burning smells or smoke emanating from the enclosure.

If there is any doubt that debris or contamination remains within the Tankvision Gauge Link enclosure or that the internal parts may have been damaged, the unit should be returned to the manufacturer or one of its authorised agents for repair.

9.2 Insulation/Hi-Pot testing

The Tankvision Gauge Link undergoes all necessary tests during manufacture. It is not necessary, and indeed undesirable, to perform routine high voltage insulation testing on the unit after installation. Repeated high voltage testing may cause degradation of insulation characteristics which may impair safety.

If it is desired to perform high voltage insulation testing on the electrical installation/ cabling then it is recommended that the mains supply connector is unplugged at the Tankvision Gauge Link and placed away from the enclosure.

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