Operating Instructions
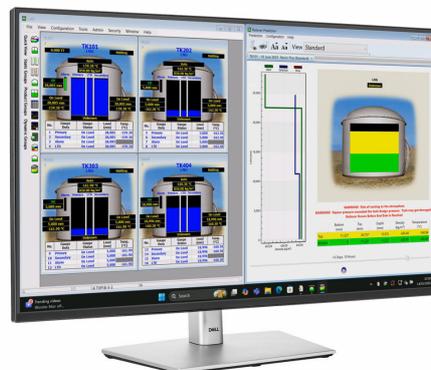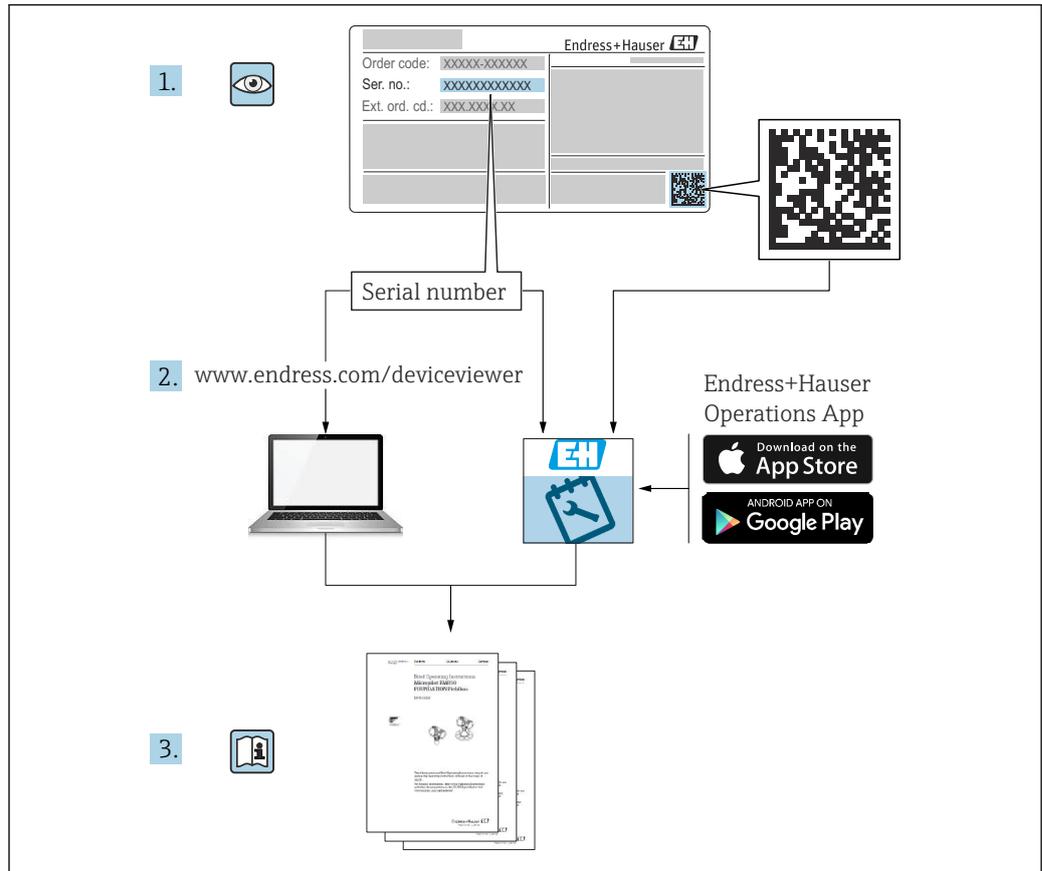# Tankvision Professional NXA85
Tankvision LMS NXA86B
Terminalvision NXS85

OPC UA Data Server
Inventory Gauging

Endress+Hauser

People for Process Automation

A0023555

- 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.

Table of contents

1 About this document

1.1 Document function

These Operating Instructions contain information that is useful for installation, operation and maintenance.

1.2 Introduction

This manual documents the OPC interface the Tankvision Professional and Terminalvision system provides to enable third-party vendors to access internal system data. 2 interfaces are available:

- OPC
- Modbus
  The system includes a Modbus interface which is documented in the document SD02624G.

   ℹ️ A full list of all available data items is available on request. Please contact your supplier for details.

1.3 List of abbreviations

- API
  Application programming interface
- BOL
  Bill of Lading
- OPC UA
  Open Platform Communications Unified Architecture

1.4 Symbols

1.4.1 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 dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION

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

NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.

1.4.2 Symbols for certain types of information

ℹ️ Tip
Indicates additional information

📖 Reference to documentation

📑 Reference to another section

1. , 2. , 3. Series of steps

1.4.3   Symbols in graphics

1, 2, 3 …   Item numbers

⚠ Hazardous area

⚰ Safe area (non-hazardous area)

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   Change history

BA02061G/00/EN/01.20
- Valid for software version: 18.3.1
- Changes to the previous version:
  Initial version

BA02061G/00/EN/02.22
- Valid for software version: 18.3.2
- Changes to the previous version:
  Pipeline volumes as part of tank volumes selectable

BA02061G/00/EN/03.23-00
- 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

BA02061G/00/EN/04.25-00
- Valid for software version: 18.3.3
- Changes to the previous version:
  No change in software or document content, only changed digital document structure

BA02061G/00/EN/05.26
- Valid for software version: 18.3.4
- Changes to the previous version:
  Movement control via OPC. Tables with additional status values added

1.7 Registered trademarks

The following trademarks are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries:

Microsoft®

Windows®

Windows Server®

1.7.1 Legal notice concerning trademarks

All company/product names and/or all company logos may be trade names, trademarks and/or registered trademarks of Endress+Hauser, its affiliates or of their respective owners with which they are associated.

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 OPC UA Data Server

The servers allow access to data in the real-time database of our software systems. This includes reading live data, updating manual data and performing gauge control commands.

2.2.2 Intended use of Tankvision Professional NXA85 software

Tankvision Professional is specifically designed for operators of bulk storage facilities, marketing terminals, refineries and pipelines. It is designed to handle all the data acquisition, supervisory control and monitoring required in a single fully integrated solution.

Tankvision Professional integrates all major types of tank measurement instruments into one system.

All measured and calculated tank parameters are accessible to your tank farm and terminal operators as well as to connected host systems.

Multi-user operation is provided by the inbuilt Web Server offering the opportunity to access data at any connected location (local/remote) e.g. for administrative and accounting purposes.

2.2.3 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.

2.2.4   Intended use of Terminalvision NXS85 software

Terminalvision is a terminal management and loading monitoring software designed to meet the requirements of depots and terminals. Interfacing to most vendor devices used for access control, batch controllers, flow computers, and weighbridges, Terminalvision provides a secure and controlled loading and off-loading procedure for all movement types. Terminalvision also enables site control and overview, allowing operators to access details of all gantries, loading arms, vehicles, drivers, and products in use on site.

Terminalvision can be provided as a simple standalone station for small depots, or be configured on larger sites as a full Client/Server system where multiple operator stations are required. Printers can be distributed throughout the system, for example placed within the terminal control room and control rooms for internal reporting, as well as at the exit gate for the automatic printing of BOLs.

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   Product description

3.1   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 W@M 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 W@M Device Viewer (www.endress.com/deviceviewer).

3.1.1   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

3.1.2   Manufacturer address

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

Place of manufacture: See nameplate.

3.1.3   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

3.2   Software function

This version of the software introduces a new OPC UA service which contains extra functionality compared to the previous legacy OPC DA and UA server implementations. The main new features are as follows:

- Support for terminal automation scenarios is now available
- Many more data points can be accessed
- Configuration is synchronised across redundant servers
- More configurable
- New configuration tool

The servers allow access to data in the Real-Time database of our software systems. This includes reading live data, updating manual data and performing gauge control commands.

The OPC UA service is a licensable feature. Once licensed, any number of clients may connect to the service. If this option is not licensed then the functionality will stop after 30

minutes of usage forcing a restart of the DCC communications services to re-enable the functionality.

The legacy DA and UA OPC servers are deprecated and will be removed in a future release. Due to necessary changes to support the new OPC UA server there are some changes in the legacy versions:
- Although writing values to the legacy OPC servers works as expected, the new value may not be reflected back to the OPC server which may continue to show the previous value.
- Changes to configuration from within the main product screens may not be reflected in the OPC server. This does not affect live tank data which continues to be updated as expected.

4   Installation

4.1   Installing the software

4.1.1   Main installation

The OPC UA server is installed as standard with all our Tank Management and Terminal Automation systems but will only allow clients to connect with the correct licensing details.

In addition to OPC UA server, an OPC Component provided by the OPC foundation will be installed on the system. This is the **OPC UA Local Discovery Server** which provides a windows service which permits discovery of installed OPC-UA servers.

4.1.2   OPC UA Server Post-Installation

The OPC-UA server relies on Windows certificates to provide secure connections between clients and servers. This is somewhat simpler than the security model of DA-type servers. The certificate configuration should be carried out by a suitably qualified Windows administrator.

Certification Requirements

- The OPC UA Local Discovery Server certificate must be imported into the Windows certificate store. The certificate is located at:
  C:\ProgramData\OPC Foundation\UA\pki\own\certs\ualdscert.der
- A certificate must be produced for the OPC-UA server and copied into the LDS trusted servers certificate folder at:
  C:\ProgramData\OPC Foundation\UA\pki\trusted\certs
  The certificate is produced referencing the OPC-UA server configuration file
- Each client wishing to connect must trust the server certificate created in the previous point. This can be achieved by importing the server certificate into the client's trusted root certificate store.

A simplified method to do this is as follows:

1. After installation restart the system as normal.

2. Navigate to the C:\ProgramData\OPC Foundation\UA\pki\rejected\certs
   ↳ This folder should contain a certificate (.der) file. If there are more than one, double-clicking on each one will show the issuer details. The required certificate should be issued by TFA Data Server

3. Copy the certificate identified above into the C:\ProgramData\OPC Foundation\UA\pki \trusted\certs

4. Double-click on the copied certificate and choose **Install Certificate**.

5.
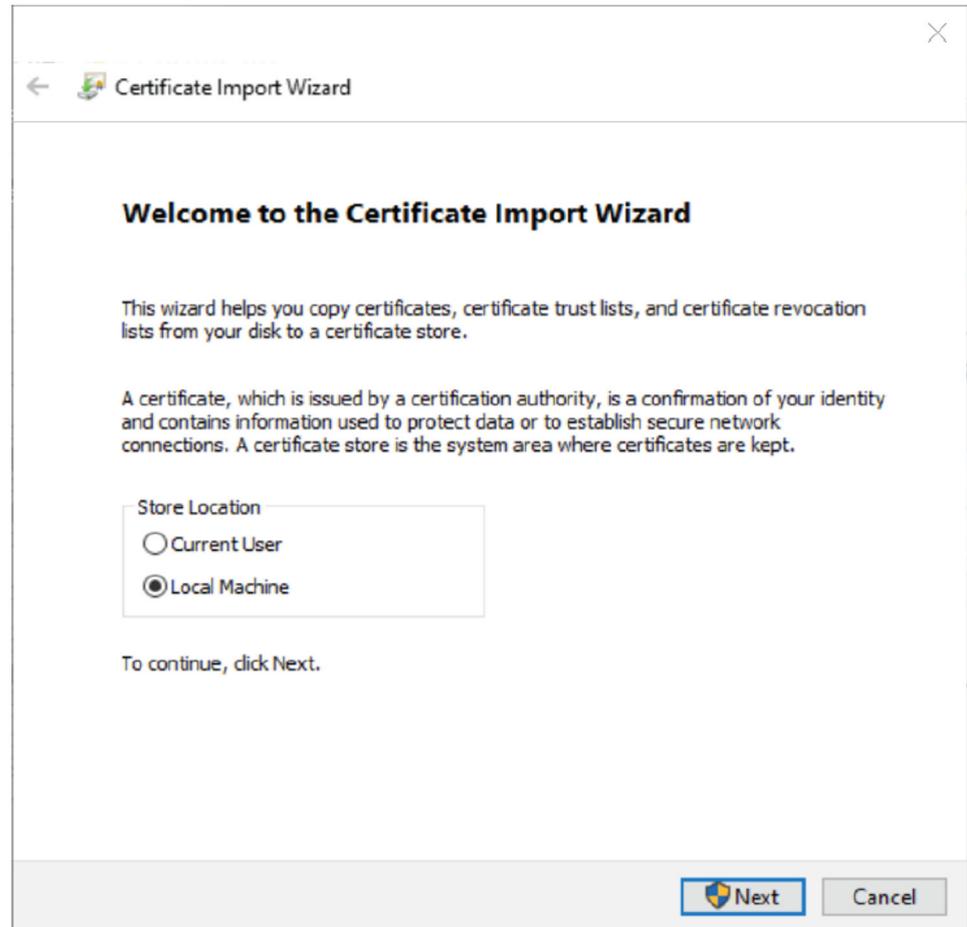
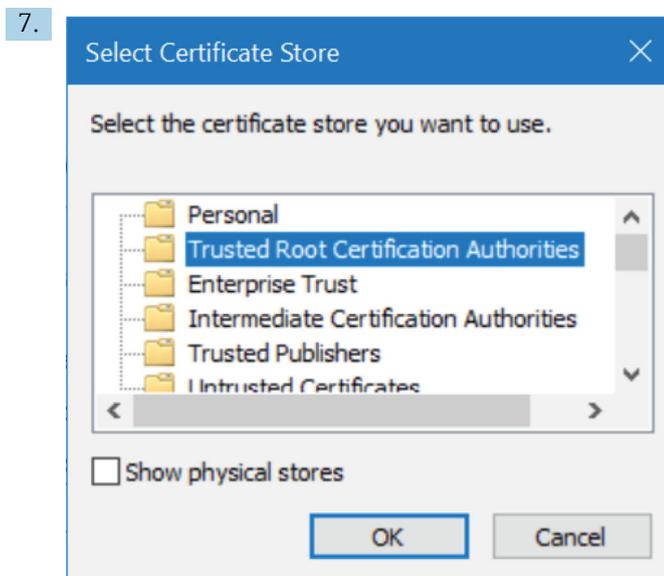Select **Local Machine** and click **Next**.

6.
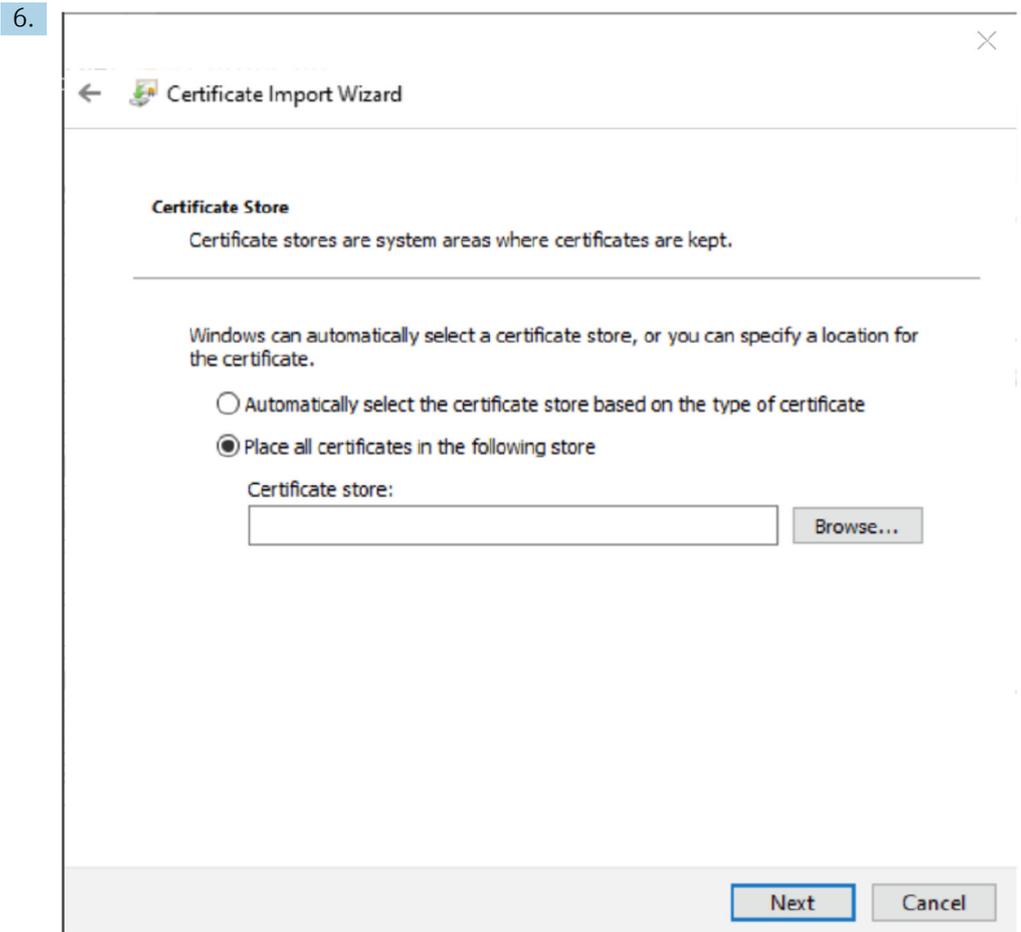
Select **Place all certificates in the following store**... and click **Browse...**.

7.

Choose the **Trusted Root Certification Authorities** option and click **OK**.

8. Click **Next** to install the certificate on the current system.

As specified above, each client wishing to connect to the OPC-UA server must **trust** the server certificate.

5   System integration

5.1   Configuration

The OPC UA server is configured using the OPC Slave Configuration tool.
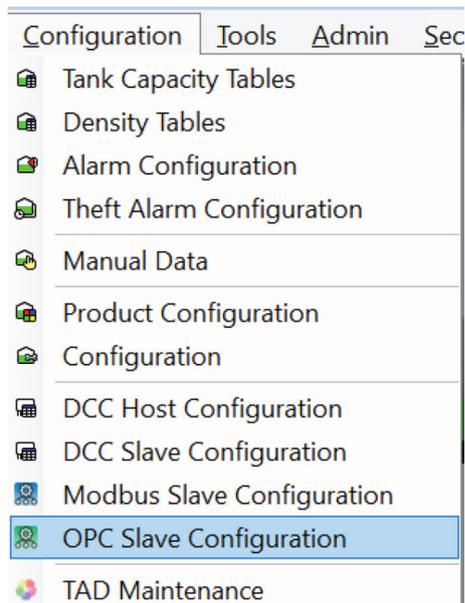
🖼 1   OPC Configuration Tool Menu Option

🖼 2   OPC Slave config

5.1.1   General settings

▶

🖼 3   General settings cog icon

Open the general settings page by clicking the cog icon at the top of the window.

🖼 4   *General Settings*

The available settings are as follows:

- **Legacy Mode**
A flag which affects the operation of the OPC quality for each item. In the OPC standard the OPC quality of an item refers to the quality of the read operation to retrieve that item; it does not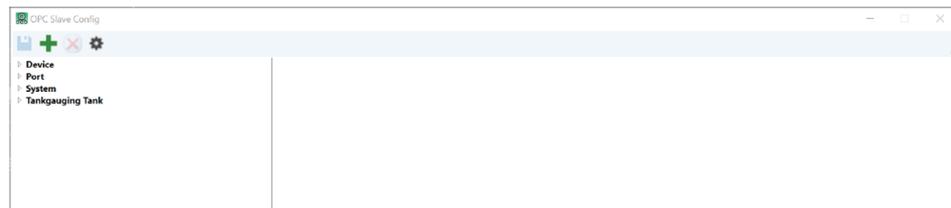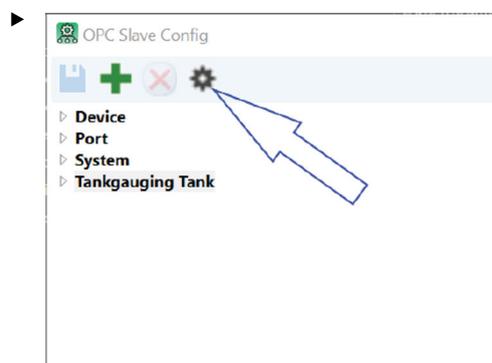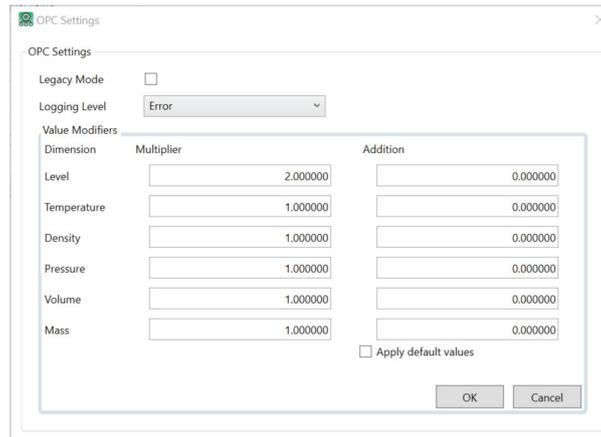 imply any quality for the actual value of the item. For example, it is possible to have a value for product level which is invalid because the gauge is in a no-reply state; in this case the OPC quality would still be 'Good' since the value would be read successfully. By setting this flag to true it is possible to force the OPC server to imply OPC quality for an item from its associated status value. So a product level status of 4 (which signifies an invalid product level) would force OPC quality for product level to be 'Bad'.
- **Logging Level**
The logging level. The default setting is **Error**. This can be any of:
  - **Error**
  Only errors are logged.
  - **Warning**
  Warnings and errors are logged.
  - **Information**
  Warnings, errors and all information messages are logged.
  - **Verbose**
  All output messages are logged.
  - **Value Modifiers**
  This section allows default addition and multiplication modifiers to be applied to OPC data items. The settings made in this section do not take effect unless the **Apply default values** option is ticked. When ticked, all OPC data items supporting the dimensions available will be reset to the currently set default modifiers after clicking **OK**.

5.1.2   Individual Data Item Configuration

The configuration tool organises OPC data items into logical groups. Most items apply to multiple physical entities (for example**Tankgauging Tank** items apply to all tankgauging tanks, **Device** items apply to all devices). **SystemSettings** is common to all entities so is only applied once.

▶
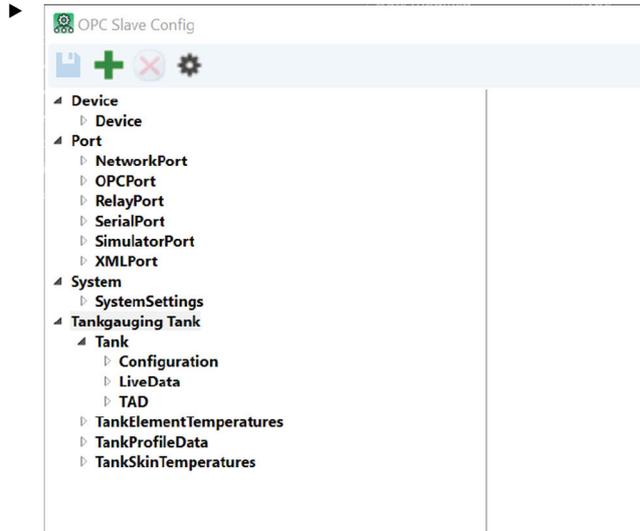
🖼 5   *Data Item Groups*

To modify an individual data item, navigate to the desired item.

ℹ️ Items shown in **bold** are selected to be displayed. Items not shown in bold are not. By default, certain advanced items are configured to be hidden.
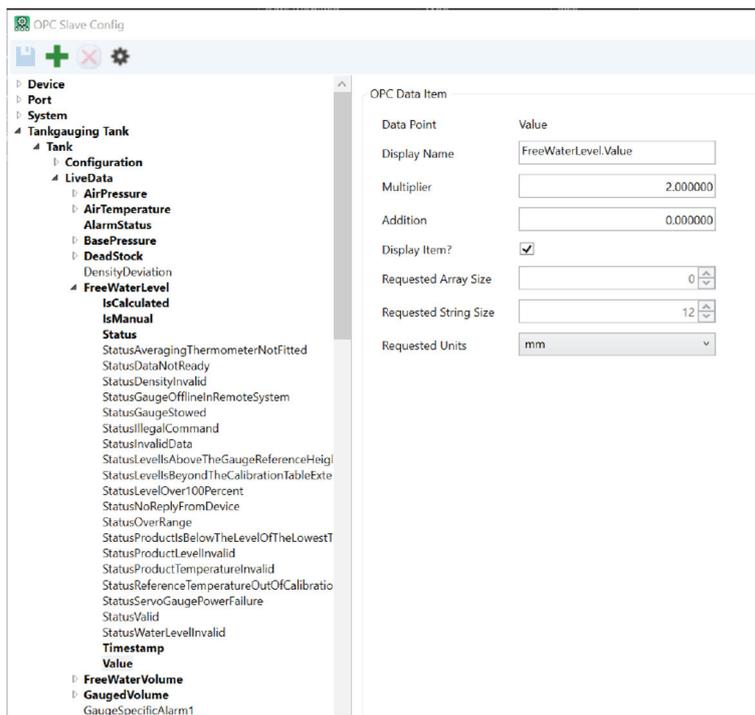
🖼 6   *Data Item Configuration*

ℹ️ An example is shown in fig 3.6. This example shows the configuration options for FreeWaterLevel. As can be seen in the example, FreeWaterLevel has a number of properties available. The selected item is the Value property. In an OPC client this data item would be visible as:

TankGaugingTank.Tank.LiveData.FreeWaterLevel.Value

So if a specific tank is named "TK001" then the path to this item for that specific tank would be:

TankGaugingTank.TK001.LiveData.FreeWaterLevel.Value

It can also be seen that a number of FreeWaterLevel properties are not selected for output by default - these are advanced properties seldom used by users.

The **OPC Data Item configuration** options are the same for every OPC data item. Some options however will be disabled if the data item is not of the correct type. For example string size can not be changed unless the data item is a string.

🖾 *7   Data Item Configuration*

The available options are as follows:

- **Display Name**
  The name of the item (as it will be presented to an OPC client). This can be changed as required.
- **Multiplier / Addition**
  If the data item is of a type that supports numerical modification then it is possible to set a multiplier and/or an addition. The system will apply the multiplication first followed by the addition. Both values can be +ve or -ve.
- **Display Item**
  If ticked the item will be made available to OPC clients.
- **Requested Array Size**
  If the item represents an array of data it is possible to set the number of elements of the array to make available to OPC clients. For example, profile levels are an array of level data which may be up to 256 data points long. This setting could be used to limit the array to just the first 64 items.
- **Requested String Size**
  If the item represents a textual data point, it is possible to set the maximum string size to be offered to OPC clients.
- **Requested Units**
  If the item supports units then it is possible to select the unit to display this item in.

ℹ️ Unit conversions are always done **before** applying any multiplication/addition modifiers.

Default units are shown in the following table:

Unit type	Default unit
Level	mm
Temperature	℃
Density	kg/l
Mass/Weight	kg
Pressure	bar (absolute)
Volume	ltr
Level Flow	mm/min
Mass Flow	t/hr
Volume Flow	m^3

5.1.3 Custom Items

In addition to the configured default data items it is possible to duplicate any existing item. This may be useful for example if an OPC client wishes to see the same data item with different units or with different modifiers applied.

▶
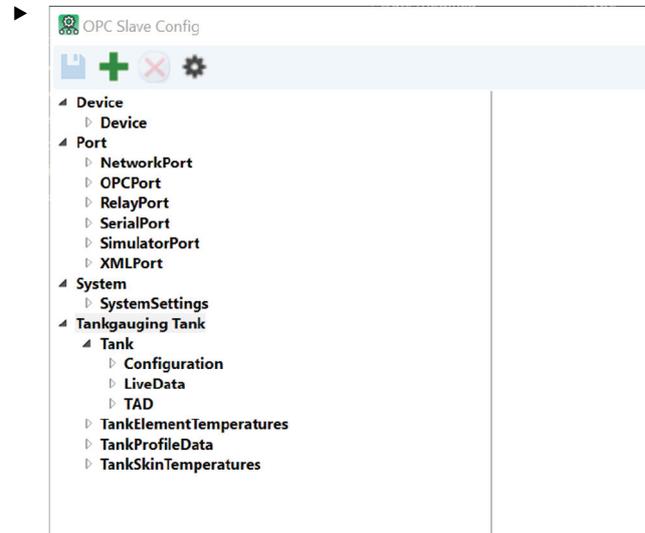
🖻 *8*   *Data Item Groups*

To add a custom item click the **Add** icon ➕.

↳   This opens up a selection box as shown in the following figure:
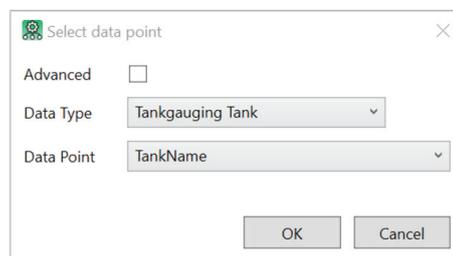
🖻 *9*   *Adding a custom data item*

By default advanced items are automatically hidden from the available selections. To show all advanced items click the **Advanced** check box.

1. Choose the logical group for the item you wish to duplicate (such as Tankgauging Tank).
2. Next choose the item from within that group that you wish to add.
3. Click **OK**.
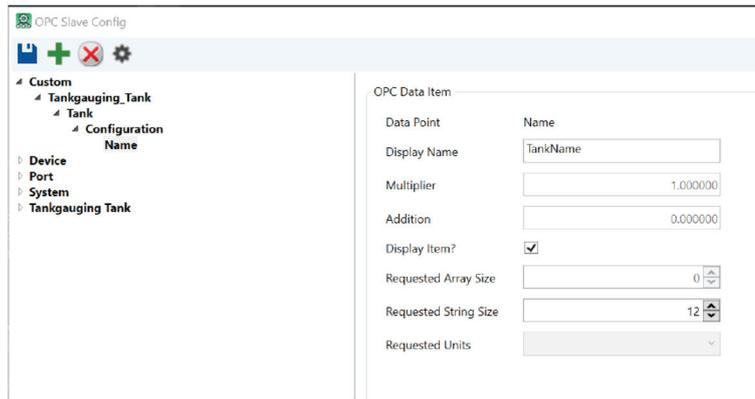
🖼 10   Custom Item Added

As seen in the example shown in figure → 🖼 10, 📖 19 the newly added item appears in a new logical group called **Custom**. Items in the **Custom** group can be deleted by clicking the **Delete** icon ❌ whilst the item to be deleted is selected.

ℹ️ Items not in the **Custom** group can not be deleted - they can only be hidden from display.

5.2   OPC Client Licensing

- The OPC Data Access server will allow multiple OPC clients to connect simultaneously.
- Any number of clients may browse the OPC namespace and connect to access data.
- If the OPC UA option is not enable in the software license then the service will abort after 30 minutes of usage forcing a restart of the **DCC communications** services to re-enable the functionality.

▶ To view the licensing details, run the License Management tool from the Windows System Tray and select the Options tab → 🖼 11, 📖 19.
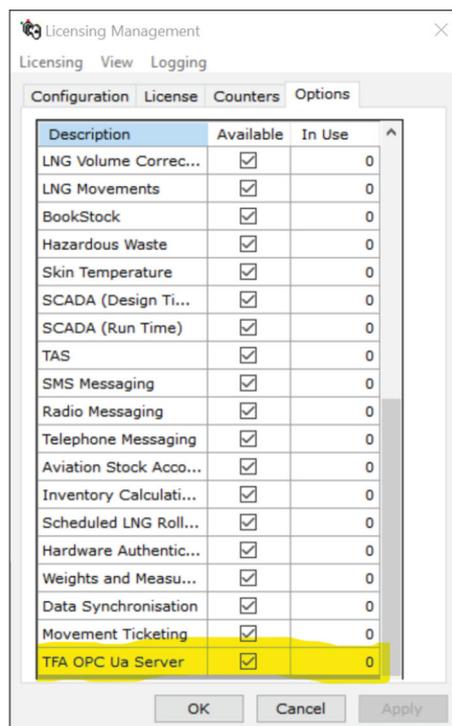
🖼 11   License Details

6   Operation

6.1   Starting/Stopping the OPC server

The OPC UA server runs as part of the **Olympus** windows service.

▸ To stop the OPC UA server stop and restart the **DCC Communications** service group using the service manager utility in the Windows System Tray → ⊡ 12, 🕮 20.
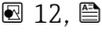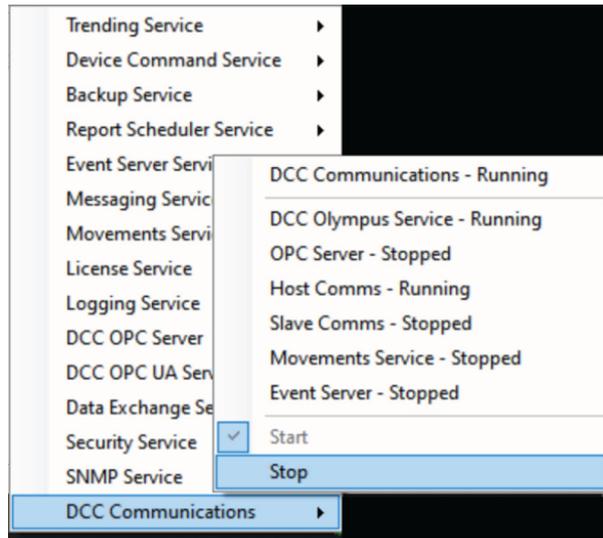
⊡ 12   *DCC Config*

6.2   Device commands

The Device Commands section contains data items that may be written to by a client, and are used to issue commands to control a gauge.

The Device Command data field should be written to with a control code to activate a command. Simply enter the decimal value into the short-int.

The other items are arguments that supply further information for the command being activated. They **must** be written to **before** sending the control code to the Device Command item if required for the command.

The Device Command data item consists of an ASCII character which may be one of the following:

A
Alternate (Fast) Scan
(decimal 65)

B
Basic (Normal) Scan
(decimal 66)

O
Single Scan (for Off-Scan gauge)
(decimal 79)

X
Exclude from Scan / Off-Scan
(decimal 88)

T
Test Gauge (Servo Check)
(decimal 84)

C
Cancel Test
(decimal 67)

F
Freeze
(decimal 70)

N
Un-Freeze
(decimal 78)

S
Stow
(decimal 83)

U
Un-Stow
(decimal 85)

R
Raise
(decimal 82)

L
Lower
(decimal 76)

Q
Calibrate
(decimal 81)

1
Interface 1 (air - product)

2
Interface 2 (tank bottom)

3
Interface 3 (product - water)

M
Store current Level, Temperature and Alarm Status

E
Update Element Temperatures

I
Update Tank / Interface Profile Levels

K
Update Tank / Interface Profile Temperatures

P
Update Tank / Interface Profile Densities

D
Dip mode (level / temperature dip)

V
Profile Scan (temperature / density / water / datum, etc.)

W
Water Dip

Y
Datum Dip (zero level)

Z

Initialise Gauge (Initialise Gauge Comms – does not reset the gauge itself)

-

Cancel current command

(sp)

No command active (status indication - not actually sent as a command)

If the device command is stow (S) then the following items may be used to set any options:

Stow Command: Type
- 0 = Stow Gauge to Top Limit Cut-out
- 1 = Lock Test to Level
- 2 = Stow Gauge to Top Limit Cut-out then return to Product Level
- 3 = Lock Test to Level then return to Product Level

Stow Command: Lock Test Level

0 = Lock Test to Top Limit Cut-out, otherwise use level in mm

If the device command is servo (T) then the following items may be used to set any options:

Stow Command: Test Distance

0 = use default 300 mm, otherwise use distance in mm

Stow Command: Test Tolerance

0 = use default ±5 mm, otherwise use tolerance ± mm

Stow Command: Test Timeout

0 = use default 90 seconds, otherwise use timeout in seconds

If the device command is profile (V) then the following items may be used to set any options:

Profile Command: Topscan
- 0 = Tank (Full) Profile
- 1 = Interface Profile (Topscan)

Command: Scan Upwards
- 0 = Downwards Scan
- 1 = Upwards Scan

Command: Include Water
- 0 = Exclude Water Level Dip
- 1 = Include Water Level Dip

Command: Include Datum
- 0 = Exclude Datum Level Dip
- 1 = Include Datum Level Dip

Command: Exclude Temperature
- 0 = Include Temperature Profile Scan
- 1 = Exclude Temperature Profile Scan

Command: Exclude Density
- 0 = Include Density Profile Scan
- 1 = Exclude Density Profile Scan

Command: Positions are Relative
- 0 = Profile Scan Limit Levels Use Absolute Positions
- 1 = Profile Scan Limit Levels Use Relative Positions

Command: End Position

0 = use value pre-configured in gauge, otherwise use position in mm

Command: Start Position

0 = use value pre-configured in gauge, otherwise use position in mm

Command: Interval

- >= 1 <= 64 Number of Profile Points
- >= 65 Profile Interval (mm)
- 0 = use value pre-configured in gauge

6.3   Data items

A full list of all available data items is available on request. Please contact your supplier for details.

6.4   Globals

ApplyDefaultValues
Applies settings in the DefaultxxxxxMultiplier and DefaultxxxxxAddition to all relevant items.

ComputerName
The hostname of the computer running the OPC server.

DefaultxxxxxMultiplier
The default multiplication modifier to be applied to values of dimension xxxxx.

DefaultxxxxxAddition
The default addition modifier to be applied to values of dimension xxxxx.

The previous two items show multiplier and addition modifiers which may be applied to values which support unit configuration to scale the value as required. By default these are set to **1** for the **multiplier** and **0** for the **addition**.

When a value that supports units is displayed it will first be converted to the specified unit, then multiplied by the multiplier value and finally have the addition value added before being displayed.

When writing a value, the reverse is applied.

DemoExpiryTime
If the server is in demo mode this shows the remaining time before server shutdown. When fully licensed defaults to a maximimum value.

DemoRemaining
If the server is in demo mode this shows the remaining time in the format dd : hh : mm : ss:sss. When fully licensed defaults to a maximum value.

InDemoPeriod
This is True if the server is not licensed but still within the 30 minute demo period.

IsLicensed
This is true if the OPC UA server is licensed.

LegacyModeEnabled
a flag which affects the operation of the OPC quality for each item. In the OPC standard the OPC quality of an item refers to the quality of the read operation to retrieve that item; it does not imply any quality for the actual value of the item. For example, it is possible to have a value for product level which is invalid because the gauge is in a no-reply state; in this case the OPC quality would still be **Good** since the value would be read successfully. By setting this flag to true it is possible to force the OPC server to imply OPC quality for an item from its associated status value. So a product level status of 4, which signifies an invalid product level, would force OPC quality for product level to be **Bad**.

Logging Level

The level of diagnostic logging to record. The OPC server is capable of logging diagnostic information in three different modes:

- Error
  Only error conditions are logged
- Warning
  Both errors and warnings are logged
- Information
  Errors, warnings and information messages are logged
- Verbose
  All messages are logged

UpTime

Shows the length of time the server has been running for.

Watchdog

This is an Integer value which increments whilst the system communications are valid. The actual value is not important; as long as it is incrementing then the data in the DCC subsystem is valid. If it stops incrementing then this indicates that there is a problem with the DCC sub-system (for instance the Olympus service may have stopped) and **all** tank data should be assumed to be invalid.

WritePadx

The WritePad items offer a location to store transient custom user data. This data is not stored permanently by the system. There are 6 WritePad items in total.

6.5   Movement control via OPC

6.5.1   Introduction

In the OPC server a single "Movement" section has been created. This allows the user to configure and control one specific movement. The functionality allows the creation of a single tank to tank transfer. It also allows that same transfer to be opened and closed. Once closed the transfer will no longer be accessible via OPC and a new transfer must be created.

6.5.2   Process Flow

OPC Movement Item

A transfer is represented in OPC as an object that can be manipulated. It is located at the root of the OPC namespace. See the example below.
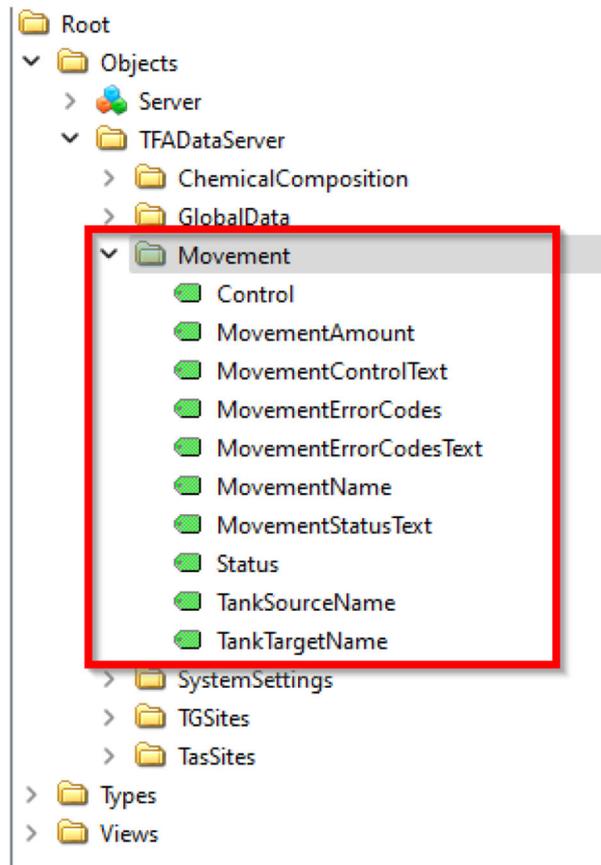
🖼 *13   Movement Items*

The object contains the fields listed below. Please see the "Tables" section for a description of the status, error and control codes.

Control
Used to control a movement once it has been created.
- Type: Int32
- R/W: Writable

MovementAmount
The amount of product to move. This is currently stated as GOV and is always expressed in litres.
- Type: Double
- R/W: Writable

MovementControlText
Textual representation of the Control value.
- Type: String
- R/W: Read-only

MovementErrorCodes
Specifies the current validation errors.
- Type: Int32
- R/W: Read-only

MovementErrorCodesText
Textual representation of the MovementErrorCodes.
- Type: String
- R/W: Read-only

MovementName

A description for the transfer.
- Type: String
- R/W: Writeable

MovementStatusText

Textual representation of the Status.
- Type: String
- R/W: Read-Only

Status

Specifies the current state of the movement.
- Type: Int32
- R/W: Read-Only

TankSourceName

Name of the source tank.
- Type: String
- R/W: Writeable

TankTargetName

Name of the target tank.
- Type: String
- R/W: Writeable

OlympusError

Last error (if any) from Olympus following change to Control value.
- Type: String
- R/W: Read-Only

6.5.3 Text Description

🖼 *14   Process flow*

In the initial state all values are unset except MovementErrorCodes. All error codes are set.
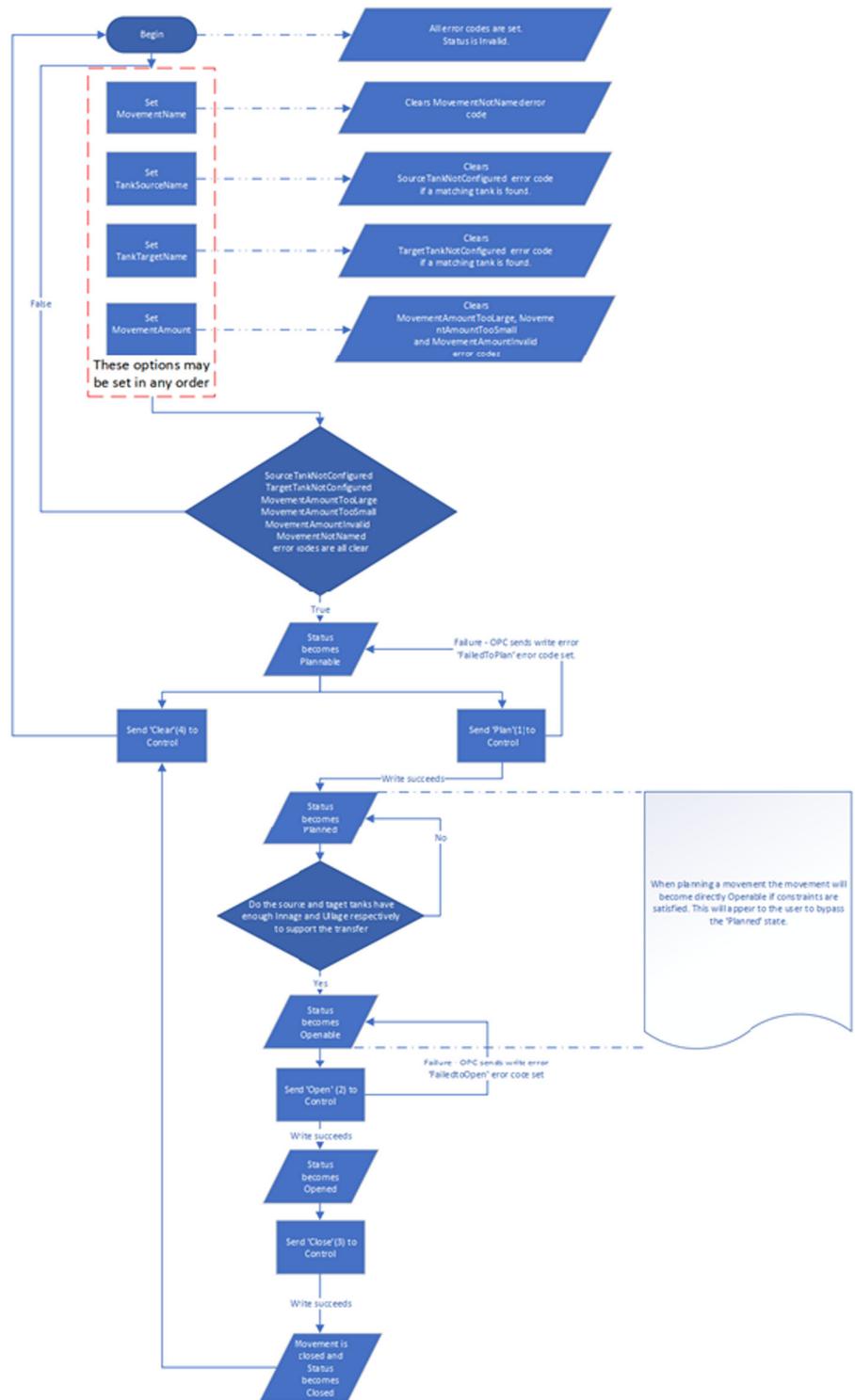
1. Set the movement name.
   ↳ Once set the MovementNotNamed error code is cleared.

2. Set the source and target tank.
   ↳ If the 2 names match exactly to configured tanks in Tankvision Professional , the SourceTankNotConfigured and **TargetTankNotConfigured** error codes are cleared.
   If the 2 names represent different tanks, then the SourceAndTargetAreSame error code is cleared.

3. Set the movement amount. This is currently forced to be GOV specified in litres.
   ↳ If the amount is a valid number, the MovementAmountInvalid error code is cleared.
   If the amount is greater than or equal to zero, the MovementAmountTooSmall error code is cleared.
   If the amount is less than or equal to $1\,000\,000\,000$ litres (1 million m³), the MovementAmountTooLarge error code is cleared.

If the MovementNotNamed, SourceTankNotConfigured, TargetTankNotConfigured, SourceAndTargetAreSame, MovementAmountInvalid, MovementAmountTooSmall and MovementAmountTooLarge error codes are all clear, the Status will change from **0** (**Invalid**) to **1** (**Plannable**).

4. Write **1** (**Plan**) to the Control OPC item.
   ↳ This will create a planned movement in the tank gauging system (Audit entries are maintained throughout the interaction with the tank gauging system). Once a movement has been planned it cannot be edited further. To make changes it must be cleared and the process started again.
   The system monitors the state of the two configured tanks. Whilst the source innage and target ullage are valid and sufficient for the planned movement, the SourceTankNotEnoughInnage, SourceTankInnageInvalid, TargetTankNotEnoughUllage and TargetTankUllageInvalid error codes are cleared accordingly. If the state of the tanks changes before the movement is opened then these error codes will also change appropriately.

Whilst the SourceTankNotEnoughInnage, SourceTankInnageInvalid, TargetTankNotEnoughUllage and TargetTankUllageInvalid error codes are clear, the Status will change to **3** (**Openable**). If any of these error codes become active, then the status will also be updated accordingly. A movement can only be opened when the Status is Openable.

5. Write **2** (**Open**) to Control.
   ↳ This will open the planned movement ready for the physical movement to take place. Alarms will be suppressed in exactly the same manner as they would with human interaction in the movement system.
   Once a movement is Opened the only further option is to close the movement. If an error has been observed, the system must be cleared and the process started again.

6. Write **3** (**Close**) to Control.
   ↳ This will close the open movement in tank gauging and set the status to Closed.

7. Write **4** (**Clear**) to Control.
   ↳ This will reset the OPC data values.

At any point in the process, the system can be cleared down if necessary, by writing **4** (**Clear**) to Control. Any planned or opened movement will be closed and the data in OPC will be cleared down back to the initial state.

6.5.4 Tables

MovementErrorCodes

This value is a flag bit-field (Multiple errors may be set).

Text	Value	Meaning
None	0	No errors present
SourceTankNotConfigured	1	The source tank has not been chosen
TargetTankNotConfigured	2	The target tank has not been chosen
SourceAndTargetAreSame	4	The source and target tank are the same tank
SourceTankNotEnoughInnage	8	The source tank innage is insufficient
SourceTankInnageInvalid	16	The source tank innage is invalid
TargetTankNotEnoughUllage	32	The target tank ullage is insufficient
TargetTankUllageInvalid	64	The target tank ullage is invalid
MovementAmountTooLarge	128	The amount to move is too large
MovementAmountTooSmall	256	The amount to move is too small
MovementAmountInvalid	512	The amount to move is invalid
MovementNotNamed	1024	The movement has not been named
FailedToPlan	2048	The attempt to plan the movement failed
FailedToOpen	4096	The attempt to open the movement failed
FailedToClose	8192	The attempt to close the movement failed

Status

Text	Value
Invalid	0
Plannable	1
Planned	2
Openable	3
Opened	4
Closed	5

Control

Text	Value
None	0
Plan	1
Open	2
Close	3
Clear	4

7 Appendix A: Notes on output data types

Although most data types available as output data types are self-explanatory, there are are some data types with specific formats as shown below.

7.1 Fractional

The fractional data type exposes numeric data in two distinct parts - the integral portion and the fractional portion. When this data type is selected the integral portion of the value is exposed in one register and the fractional part (as an integral value) in the next register. For example: The value 10234:546 would be exposed as one register containing the value 10234 and the next register containing the value 546.

7.2 DateTime

The **DateTime** data type exposes a date and time in the following format as a string value.

ddMMyyyy:HHmmss.fffff zzz

Where:

- **dd** two-digits representing the day
- **MM** two-digits representing the month
- **yyyy** four-digits representing the year
- **HH** two-digits representing the hour
- **mm** two-digits representing minutes
- **ss** two-digits representing seconds
- **fffff** five-digits representing fractional seconds
- **zzz** six characters representing the time zone offset (eg. +01:00)

7.3 DateTimeMulti (NXA85 and NXS85 only)

The **DateTimeMulti** data type exposes a date and time in the following format as a collection of registers.

The following list covers the Register Offset and its respective value using the scheme:
- **Register Offset** its respective value
- **0** Day
- **1** Month
- **2** Year
- **3** Hour
- **4** Minutes
- **5** Seconds
- **6** Milliseconds
- **7** TimeZone Offset (in hours)

7.4 Short dates/times

In addition to the above **dateTime** format, date-times can also be exposed in a shorthand form.

7.4.1 Date

The **Date** data type exposes a date and time in the following format as a string value.

ddMMyyyy

Where:

- **dd** two-digits representing the day
- **MM** two-digits representing the month
- **yyyy** four-digits representing the year

7.4.2   DateMulti (NXA85 and NXS85 only)

The **DateMulti** data type exposes a date and time in the following format as a collection of registers.

The following list covers the Register Offset and its respective value using the scheme:
- **Register Offset** its respective value
- **0** Day
- **1** Month
- **2** Year

7.4.3   Time

The **Time** data type exposes a date and time in the following format as a string value.

HHmmss.fffff zzz

Where:

- **HH** two-digits representing the hour
- **mm** two-digits representing minutes
- **ss** two-digits representing seconds
- **fffff** five-digits representing fractional seconds
- **zzz** six characters representing the time zone offset (eg. +01:00)

7.4.4   TimeMulti (NXA85 and NXS85 only)

The **DateTimeMulti** data type exposes a date and time in the following format as a collection of registers.

The following list covers the Register Offset and its respective value using the scheme:
- **Register Offset** its respective value
- **0** Hour
- **1** Minutes
- **2** Seconds
- **3** Milliseconds
- **4** TimeZone Offset (in hours)

8   Appendix B: Status values

8.1   Gauge status

Bit Position	Value	Description
0	1	ConfigComplete
1	2	ConfigExecuting
2	4	Complete
3	8	Executing
4	16	Initialising
5	32	FastScan
6	64	ManualScan
7	128	OffScan

8.2   Servo status

Bit Position	Value	Description
0	1	ServoUp
1	2	ServoDown
2	4	ServoTopLimit/Stowed
3	8	ServoBottomLimit
4	16	OffLevel
5	32	WaterInterfaceMode
6	64	Testing/Stowing/Calibrating
7	128	Blocked/Frozen

8.3   System status

Bit Position	Value	Description
0	1	TestPassed
1	2	TestFailed
2	4	ConfigFailed
3	8	CommandFailed
4	16	GaugeFault
5	32	RedundancyPassive
6	64	RedundancyFixed

8.4   Alarm status

Bit Position	Value	Description
0	1	HardwareHiHiLevel
1	2	HardwareHiLevel
2	4	HardwareLoLevel

Bit Position	Value	Description
3	8	HardwareLoLoLevel
4	16	SoftwareRoofAlarm
5	32	SoftwareVariableAlarm
6	64	SoftwareDifferenceAlarm
7	128	UnauthorisedMovement
8	256	SoftwareHiHiLevel
9	512	SoftwareHiLevel
10	1024	SoftwareLoLevel
11	2048	SoftwareLoLoLevel
12	4096	SoftwareHiTemperature
13	8192	SoftwareLoTemperature
14	16384	SoftwareHiFlow
15	32768	SoftwareLoFlow
16	65536	LoDensity
17	131072	HiDensity
18	262144	LoTemperature
19	524288	HiTemperature
20	1048576	SoftwareHiDensity
21	2097152	SoftwareLoDensity
22	4194304	SoftwareDensityDeviation
23	8388608	SoftwareTempDeviation
24	16777216	SoftwareHiWater
25	33554432	SoftwareLoWater
26	67108864	TempDeviation
27	134217728	DensityDeviation
28	268435456	TimeToVariable
29	536870912	NoReplyFromGauge
30	1073741824	TheftAlarm
31	2147483648	Rollover
32	4294967296	SoftwareNoFlow
33	8589934592	UnauthorisedLevelMovement
34	17179869184	TankModeTimerAlarm
40	1099511627776	GaugeSpecificAlarm1
41	2199023255552	GaugeSpecificAlarm2
42	4398046511104	GaugeSpecificAlarm3
43	8796093022208	GaugeSpecificAlarm4
44	17592186044416	GaugeSpecificAlarm5
45	35184372088832	GaugeSpecificAlarm6
46	70368744177664	GaugeSpecificAlarm7
47	140737488355328	GaugeSpecificAlarm8
48	281474976710656	ProgUserDefinedAlarm1
49	562949953421312	ProgUserDefinedAlarm2
50	1125899906842620	ProgUserDefinedAlarm3

Bit Position	Value	Description
51	2251799813685240	ProgUserDefinedAlarm4
52	4503599627370490	ProgUserDefinedAlarm5
53	9007199254740990	ProgUserDefinedAlarm6
54	18014398509481900	ProgUserDefinedAlarm7
55	36028797018963900	ProgUserDefinedAlarm8
56	72057594037927900	SkinSensorLowTempAlarm
57	144115188075855000	SkinSensorHighTempAlarm
58	288230376151711000	SkinSensorHotSpotAlarm
59	576460752303423000	SkinSensorLeakAlarm

8.5   Short Alarm Status

Bit Position	Value	Description
0	1	HardwareHiHiAlarm
1	2	HardwareHiAlarm
2	4	HardwareLoAlarm
3	8	HardwareLoLoAlarm
4	16	SoftwareRoofAlarm
5	32	SoftwareVariableAlarm
6	64	SoftwareDifferenceAlarm
7	128	UnauthorisedMovement
8	256	SoftwareHiHiAlarm
9	512	SoftwareHiAlarm
10	1024	SoftwareLoAlarm
11	2048	SoftwareLoLoAlarm
12	4096	SoftwareHiTemperature
13	8192	SoftwareLoTemperature
14	16384	SoftwareHiFlow
15	32768	SoftwareLoFlow

8.6   Extended Alarm Status

Bit Position	Value	Description
0	1	LoDensity
1	2	HiDensity
2	4	LoTemperature
3	8	HiTemperature
4	16	SoftwareHiDensity
5	32	SoftwareLoDensity
6	64	SoftwareDensityDeviation
7	128	SoftwareTempDeviation
8	256	SoftwareHiWater

Bit Position	Value	Description
9	512	SoftwareLoWater
10	1024	TempDeviation
11	2048	DensityDeviation
12	4096	TimeToVariable
13	8192	NoReplyFromGauge
14	16384	TheftAlarm
15	32768	Rollover

8.7   Extended Alarm Status2

Bit Position	Value	Description
0	1	SoftwareNoFlow
1	2	UnauthorisedLevelMovement
2	4	TankModeTimerAlarm
3	248	SpareAlarmBits
4	256	GaugeSpecificAlarm1
5	512	GaugeSpecificAlarm2
6	1024	GaugeSpecificAlarm3
7	2048	GaugeSpecificAlarm4
8	4096	GaugeSpecificAlarm5
9	8192	GaugeSpecificAlarm6
10	16384	GaugeSpecificAlarm7
11	32768	GaugeSpecificAlarm8
12	65536	ProgUserDefinedAlarm1
13	131072	ProgUserDefinedAlarm2
14	262144	ProgUserDefinedAlarm3
15	524288	ProgUserDefinedAlarm4
16	1048576	ProgUserDefinedAlarm5
17	2097152	ProgUserDefinedAlarm6
18	4194304	ProgUserDefinedAlarm7
19	8388608	ProgUserDefinedAlarm8
20	16777216	SkinSensorLowTempAlarm
21	33554432	SkinSensorHighTempAlarm
22	67108864	SkinSensorHotSpotAlarm
23	134217728	SkinSensorLeakAlarm
24	4026531840	SpareAlarmBits1

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