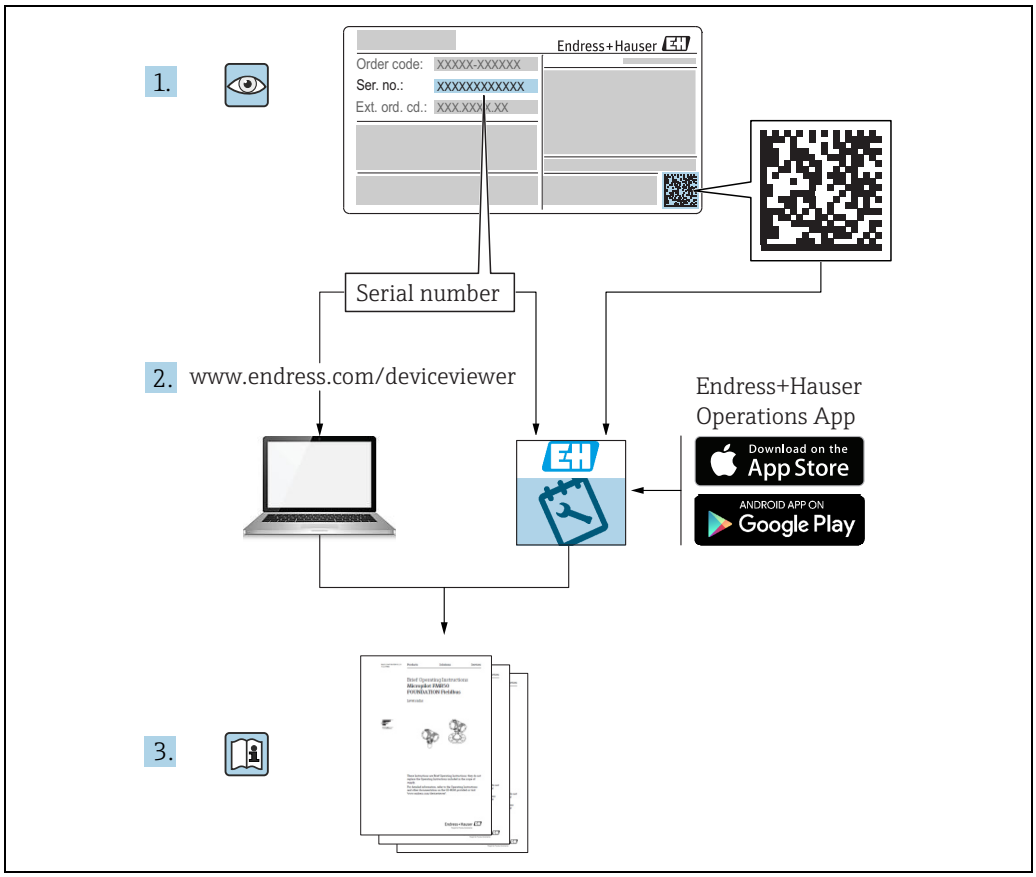
BA01289G/00/EN/06.23-00
71611397
2023-06-19

Valid as of software version:
5.1.0

Operating Instructions
Tankvision
Multi Scan NXA83B
OPC Tank Data Server

Endress+Hauser
People for Process Automation



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

Version history

Document version	Valid for SW version	Changes to the previous version
BA01289G/01.14	3.0.10	Initial version
BA01289G/02.15	3.0.12	Change of order code structure
BA01289G/03.16	3.1.0 and 4.0.0	Old V1 support and simplified configuration
BA01289G/04.18	3.4.0 and 4.4.0	Changes to V1 Driver and GBT calculations
BA01289G/05.21	5.0.0	Migration to Windows 10 IoT operating system
BA01289G/06.23-00	5.1.0	Introduction of a new Webserver

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1 About this document

1.1 Document function

This manual is giving detailed information on the system capabilities and architecture. It supports project and sales engineers in designing the system architecture during acquisition and execution phase. Furthermore during operation time of the system all servicing personnel in need of detailed knowledge about the system capabilities.

1.2 Symbols

1.2.1 Safety symbols

Symbol	Meaning
A0011189-EN	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
A0011190-EN	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
A0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
A0011192-EN	**NOTICE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Symbols for certain types of information and graphics

Symbol	Meaning
A0011193	**Tip** Indicates additional information.
A0011195	**Reference to page** Refers to the corresponding page number.
1. , 2. , 3. ...	Series of steps
A0018373	Result of a sequence of actions

1.2.3 Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1. , 2. , 3. ...	Series of steps
A, **B**, **C** ...	Views
A0011187	**Hazardous area** Indicates a hazardous area.
A0011188	**Indicates a non-hazardous location** Safe area (non-hazardous area)

1.3 Documentation

The following documentation types are available in the Downloads area of the Endress+Hauser website: www.endress.com/downloads

For an overview of the scope of the associated Technical Documentation, refer to the following:

- *W@M Device Viewer:* www.endress.com/deviceviewer - Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the nameplate

1.4 Registered trademarks

Microsoft®, Windows® and Internet Explorer®
Registered trademarks of the Microsoft Corporation

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

Java®
Registered trademark of Sun Microsystems, Inc.

Mozilla® Firefox®
Registered trademark of the Mozilla Foundation

Enraf, Honeywell, Rosemount, Emerson, Saab, L&J, VAREC, GPE 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 personnel must fulfill the following requirements for its tasks:
- 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 Applications

Inventory control

By using Tankvision Multi Scan to monitor the tank level and stored volume of valuable liquids remotely, owners or operators of tank farms or terminals for petroleum products and chemicals (liquids) can visualize the volume of the stored medium in real time. The data can be used to plan the inventory and distribution. The data can also be used to manage tank farm operations like pumping or transferring products. Tankvision has its unique concept using network technology. Without using proprietary software, the users can visualize and manage their valuable liquids stored in the tanks by a web browser. Tankvision Multi Scan is a flexible and cost effective solution due to its scalable architecture. The application coverage goes from small depots with only a few tanks up to refineries.

Inventory Calculations

Tankvision Multi Scan calculates based on measured variables and tank capacity tables:
- Observed or gross volumes
- Net volumes and
- Mass

of products like
- Hydrocarbons,
- Liquefied gases,
- Asphalt.

They are corrected according to international standards, including API/ASTM tables 5A, 5B/6, 53A, 53B/54, 23/24, LPG.

This includes temperature corrections at 15 °C, 60 °F and alternative temperatures. Additionally, available pump able volumes and water volume are calculated.

Remote configuration of measuring equipment

Some on-site operations can be avoided using remote configuration of measuring equipment during commissioning or maintenance (the availability of this feature may depend on the system configuration).

Application areas

- Tank farms in refineries
- Ship loading terminals
- Marketing and distribution terminals
- Pipeline terminals
- Logistic terminals for tanks storing products like crude oils, refined white and black products, chemicals, LPG

2.3 Workplace safety

For work on and with the device:
- Wear the required personal protective equipment according to federal or national regulations.

Before connecting or disconnecting the device:
- Switch off the supply voltage.

2.4 Operational safety

Risk of injury!
- Operate the device only if it is in proper technical condition, free from errors and faults.
- The operator is responsible for interference-free operation of the device.

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.

2.5 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. It meets general safety standards and legal requirements. It also complies with the EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.
Furthermore, the device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards.
By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark.

Contact address Endress+Hauser UK:
- Endress+Hauser Ltd.
  Floats Road
  Manchester M23 9NF
  United Kingdom
  www.uk.endress.com

2.6 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 Identification

3.1 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
- *W@M Device Viewer:* www.endress.com/deviceviewer - Enter the serial number from the nameplate

The following documentation types are available in the Downloads area of the Endress+Hauser website: www.endress.com/downloads

3.2 Nameplate

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

Manufacturer identification
Device name
Order code
Extended order code
Serial number
Degree of protection
Barcode
CE mark
Admissible ambient temperature
Supply voltage

3.3 Manufacturer address

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

Place of manufacture: See nameplate.

3.4 Order code and device version

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

4 Introduction

The OPC Data Access Server provides users of tank gauging systems with facilities for monitoring and controlling their equipment using an industry standard that is growing in its adoption rate.

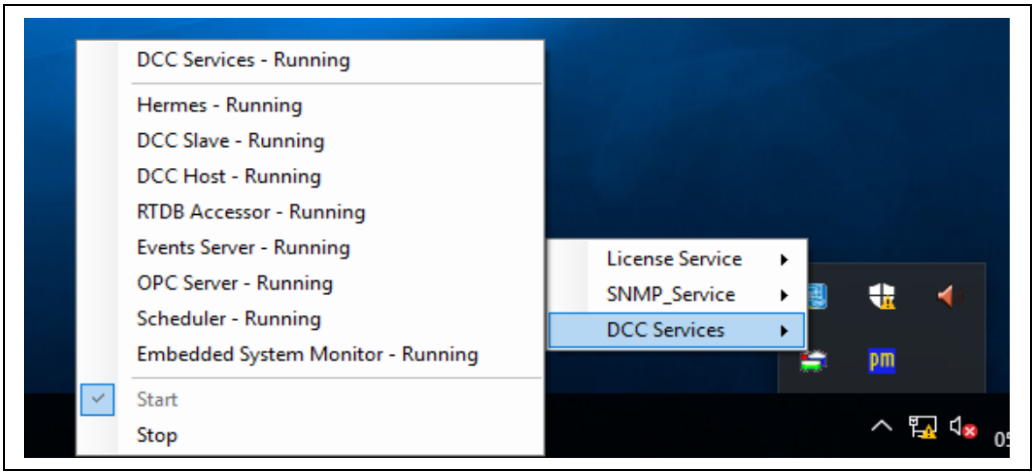
The server allows access to data in the Real-Time database of our Tank Management systems for such items as live tank data, configuration data and profile data. Gauges may also be controlled via the gauge commands items in the OPC server.

Multiple OPC clients may be connected simultaneously to the server, up to a maximum limit defined in the run-time license purchased by a user.

The server supports OPC clients using versions 1.0, 2.0 and 3.0 of the OPC Data Access specification.

5 Starting and stopping the OPC server

The OPC Data Access server runs as a system service, and will be automatically started when a client attempts to connect. However it may be manually stopped or started using the **DCC Services** menu options in the Start Menu.



NXA83_OPC_Server_001

Selecting these menu items will affect all the DCC Communications services, not just the OPC Server.

6 OPC Client Licensing

The OPC Data Access server will allow multiple OPC clients to connect simultaneously, up to a limit defined in the licensing details for the site. Clients above this limit may still browse the server namespace, viewing properties and certain configuration data, but as soon as they connect to live tank data they will be disconnected by the server.

Details of the current number of connected clients are available in the OPC server **GLOBALS** namespace (for more details → 14).

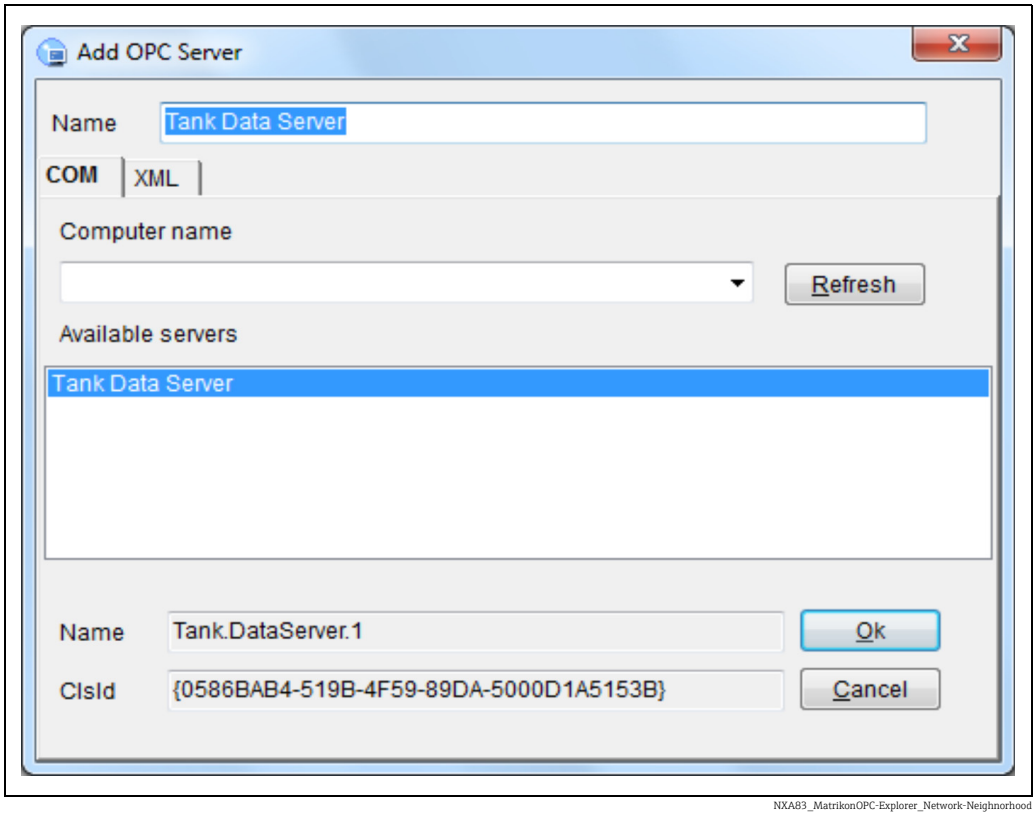
The server supports OPC clients using versions 1.0, 2.0 and 3.0 of the OPC Data Access specification.

All modes of accessing data items are supported (i.e. synchronous, asynchronous, refresh and subscription), however when creating groups in the client there are some recommendations for the value of the update time when setting up a group to contain data items from the namespace sections:
- Profile Data
- Gauge Commands
- Alarm Setpoints
- Units
- Gauge Configuration Items
- Inventory Configuration Items

It is recommended that the update time of the group should be set to zero seconds. This is because these items rarely change in the database and are updated in the OPC server only when they change. The other sections in the namespace contain live data items that should be polled at regular intervals i.e. 1 second.

7 OPC Server Name

When using a test client (e.g. MatrikonOPC Explorer from Matrikon Inc.), the OPC server will appear in the list of all OPC servers supported by the system, under the name **Tank Data Server** or **Tank.DataServer.1**.



NXA83_MatrikonOPC-Explorer_Network-Neighnorhood

The actual name of the OPC server (i.e. the COM Program ID) is **Tank.DataServer.1**. This is the name that should be used when manually entering item paths in a client.

8 OPC Server Namespace

All data parameters from the Tank Gauging database (Levels, Temperatures, Volumes etc.) will be structured in a **NAMESPACE** in the OPC Server, which will be generated dynamically from the configuration of the Tank Gauging System.
This namespace can then be used by OPC Clients to access any data parameters they require. Data parameters are grouped in a hierarchy of Tank Name, then Gauge (duty), then Data Section, then Data Item: **Tank Name.Gauge Duty.Data Section.Data Item**
e.g. to access the Level for TK001 primary gauge, the name would be: **TK001.Primary.Tank Parameters.Product Level**

8.1 Globals

There is always one fixed section in the namespace, called **Globals**.
This contains items which do not apply to an individual tank, but to the system as a whole.

Current data items in this group are:
- **Watchdog**: This is an integer value which increments every second when the system communications are valid. The actual value is not important, as long as it is changing the data in the DCC subsystem is valid. The value will reset back to 0 when it reaches the maximum value for an integer. If the Watchdog stops incrementing this would indicate a problem with the DCC sub-system (e.g. the Hermes or DCCHost services may have stopped) and the validity of ALL tank data should not be trusted.
- **ComputerName**: The unique identifier used to locate the Multi Scan NXA83B on a network.
- **ConnectedClients**: This is an integer value which contains a count of the total number of client systems that have connected to the server. This includes clients that are only browsing the OPC namespace, and those clients that have created OPC groups and are receiving live data from the server system.
- **MaxDataClient**: This is an integer value which contains the licensed maximum number of clients that can be connected AND requesting live data, at the same time. Clients that connect merely to browse the namespace (i.e. do not create OPC Groups for live data) are not restricted by the license.
- **ConnectedDataClients**: This is an integer value which contains the number of clients that are connected and receiving live data from the server. It will never exceed the licensed maximum allowed, and when this figure is reached any new clients attempting to obtain live data from the server will be disconnected.
- **GaugeCount**: This is an integer value which contains the total number of devices in the system.
- **GaugeNoReplyCount**: This is an integer value which contains the number of devices in the system which are marked as 'No Reply' (error code DN00)
- **WritePadOne (to Six)**: These are freeform fields that the client may write to (and read back from) to store useful information about the Multi Scan NXA83B.

8.2 Tank Name

The tank name will be the tank name in the tank gauging database, with a maximum length of 12 characters.

8.3 Gauge Duty

Each tank may have multiple gauges installed, with each gauge being configured as a different duty.

Gauges may be configured with one of the following duties:
- **Primary**: The main gauge on the tank, used to calculate tank volumes, weights etc. A tank MUST have a primary gauge configured.

- **Secondary**: Reserve gauge which is mainly used to check against the primary gauge values for levels, temperatures etc.
- **Backup** (alarm): Used to generate hihi level shutdown alarms
- **Densitometer**: An advanced gauge used on LNG systems to carry out density profiles

A tank will ALWAYS have a primary gauge configured, whereas the other gauges are optional. LNG systems will generally have all four gauges installed on each tank.

8.4 Data Section

The **Data Section** nodes divide Data Items into logical sections of related items.

The Data Section nodes currently supported for each gauge are:
- **Tank Parameters**: Live data usually from the gauge
- **Status Bits**: Gauge status bits, alarms etc.
- **Profile Data**: Profile data tables from the gauge
- **Calculated Parameters**: Volumes, mass etc.
- **Gauge Commands**: Commands to the gauge
- **Alarm Setpoints**: User configurable values used to generate software alarms
- **Units**: Parameter units
- **Gauge Configuration Items**: Configuration data
- **Inventory Configuration Items**: Configuration data used to calculate volumes

8.4.1 Data Scanning

The update rates, deadbands etc. may be set by the client, however as some data rarely changes Endress+Hauser recommends the following guidelines:
- The data sections **Tank Parameters**, **Status Bits** and **Calculated Parameters** all contain data items that may change regularly therefore should be on a relatively high update rate, possibly as low as every 5 seconds.
- The section **Profile Data** contains data that will only change when a new profile has been carried out and thus should have a much lower update rate or be updated on demand only.
- The sections **Alarm Setpoints**, **Gauge Configuration Items** and **Inventory Configuration Items** contain data items that only change when the user enters new data and should be not be updated regularly. One suggestion is to set the update time in the client for these items to **0** so that the server will update the client only when these items change.
- The data items in the **Units** section are fixed and will never change. These are made available for reference only.

8.5 Data Item

Each **Data Item** is a tank parameter from the Tank Gauging database and may be a level, temperature, density, volume or similar parameter. The list of Data Items available is defined later in this document.
Many live data parameters have an associated status parameter which defines whether the parameter is valid or in error. e.g. **Product Level** has an associated field called **Product Level Status**.

The status will have the following values:
- −1 = parameter is valid
- 0 or above = parameter is invalid and the status is the DN code

Unless otherwise stated, all data items are READ ONLY, that is, they may only be read by the client.

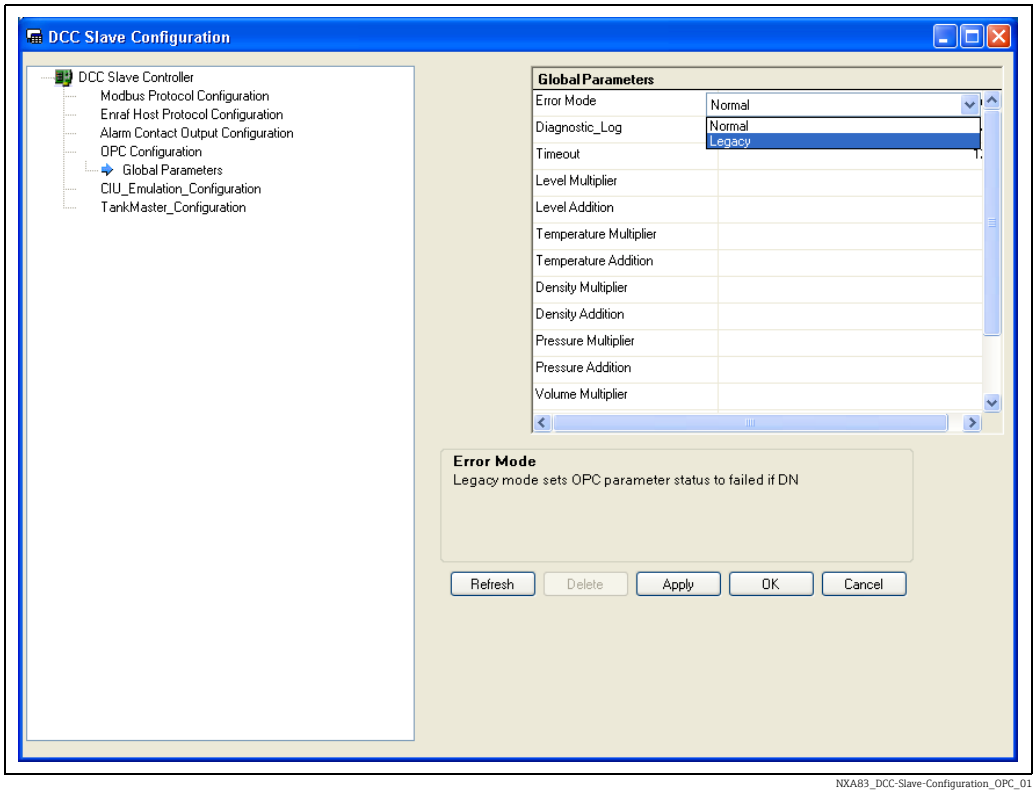
8.5.1 Legacy Error Mode

In NORMAL mode when a parameter (level, temperature etc.) is invalid this will be indicated by the associated status field (level status, temperature status etc.) being set to the error code
(−1 = valid, 0+ = DN error code).

The actual parameter field will retain its last known value. The OPC Quality for the parameter and status fields will remain GOOD (→ 16).

There is a LEGACY mode where the parameter field will be set to an OPC Quality of BAD if the parameter is invalid.

By default the error mode will be NORMAL. To switch to LEGACY mode for data errors, start the **DCC Slave Configuration** utility and change the item
OPC Configuration → Global Parameters → Error Mode.

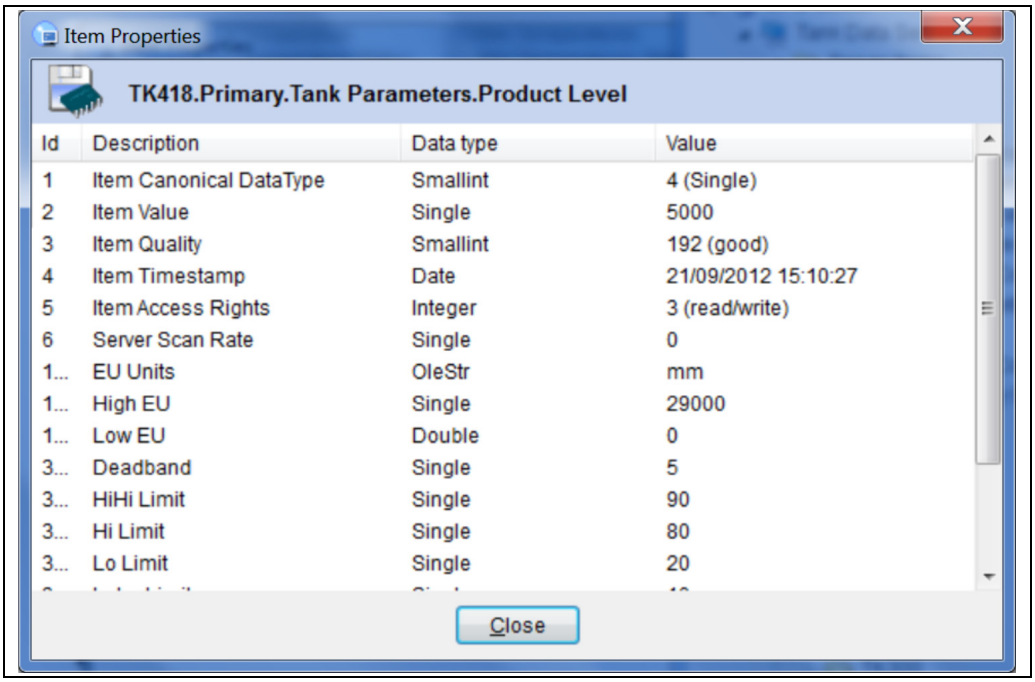


NXA83_DCC-Slave-Configuration_OPC_01

8.5.2 Data Item Properties

All Data Items will have an associated set of OPC Data Properties.

These will always include the six standard OPC properties:
- 1. Data Type
- 2. Value
- 3. Quality
- 4. Timestamp
- 5. Access Rights
- 6. Scan Rates



NXA83_MatrikonOPC-Explorer_Item-Properties_Product-Level

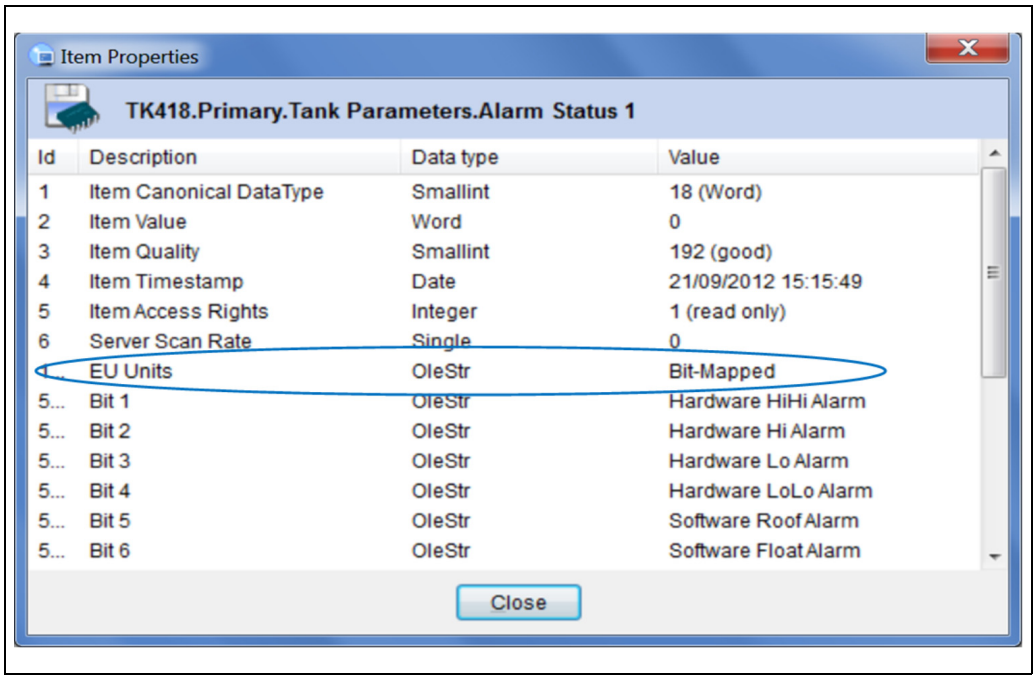
The standard **Timestamp** property is the time the data item was read from the RTDB, not the time of update from the gauge.

Unless otherwise stated, all data items have Access Rights of READ ONLY.

Many items will also have extra properties defining configuration data which only applies to that item. These generally define certain configuration data that is usually fixed or change very infrequently, such as alarm limits, units, manual values etc.

8.5.3 Bit-Mapped Data Items

Certain data items are available as bit-mapped integers; these include **Alarm Status**, **Gauge Mode** etc. Such items will have the property **EU Units** set to **Bit-Mapped**.
A further set of properties will then define the bit definitions.



NXA83_MatrikonOPC-Explorer_Item-Properties_Alarm-Status

The following bit-mapped items in the **Tank Parameters** block have also been made available, split into separate Boolean data items and located in the **Status Bits** block:
- Alarms Status 1
- Alarm Status 2
- Servo Status
- Gauge Status
- System Status

The most efficient way to access these items is through the bit-mapped field, however if the client does not support bit manipulations the Boolean data items may be used instead.

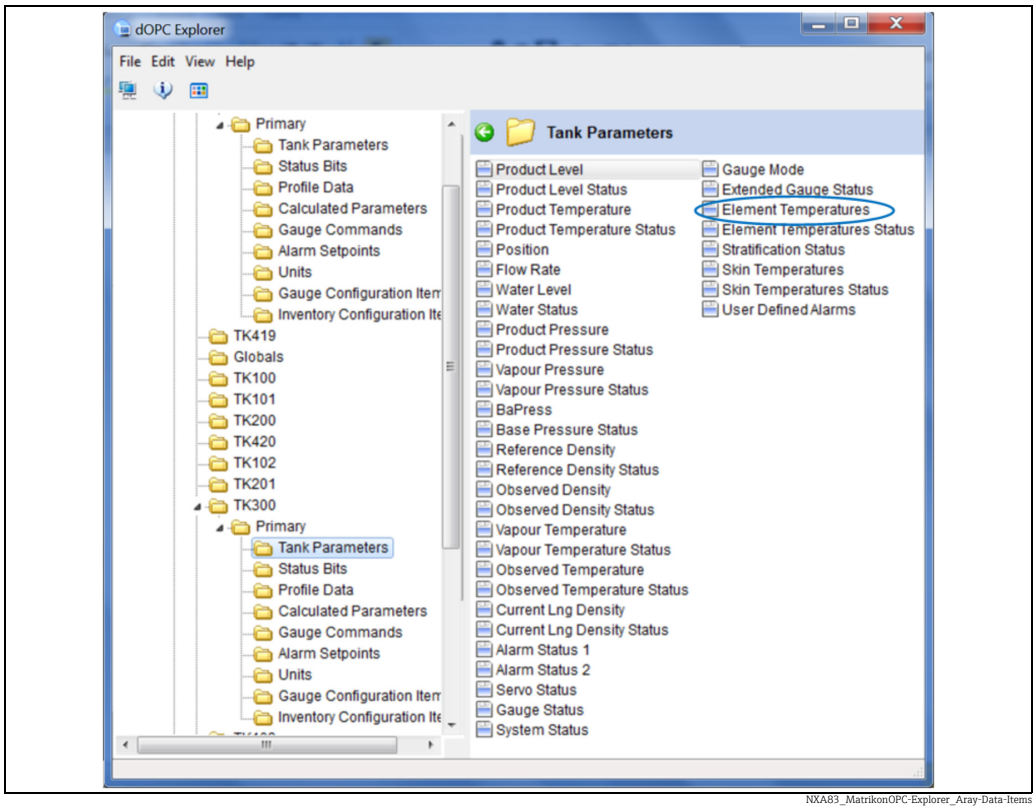
In addition to the standard bit-mapped status data there are a number of status fields that have no fixed mapping, but rather have a "free form" bit allocation dependent on the type of gauge being polled.

These codes include:
- Gauge Mode
- ExtendedGaugeStatus

At present only the Scientific Instruments 6280/6290 and Whessoe ITG60/70 gauges will have a set of bits defined, all others will be blank.

8.5.4 Array Data Items

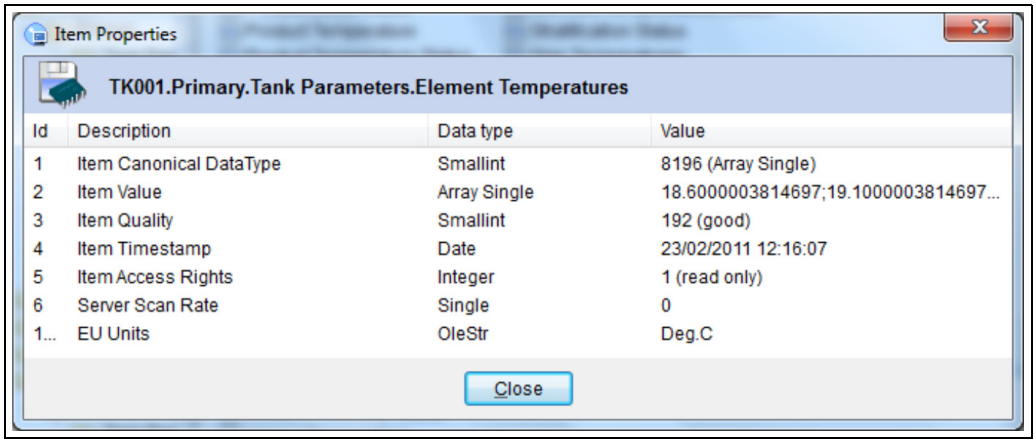
Certain of the data items are available as arrays of integers or floats. These include the **Element Temperatures** (in the **Tank Parameters** block) and all **Profile** items in the **Profiles** block.
Each array item will have 200 points. Array items will be in pairs, one with the actual values and one with the corresponding statuses.



NXA83_MatrikonOPC-Explorer_Aray-Data-Items

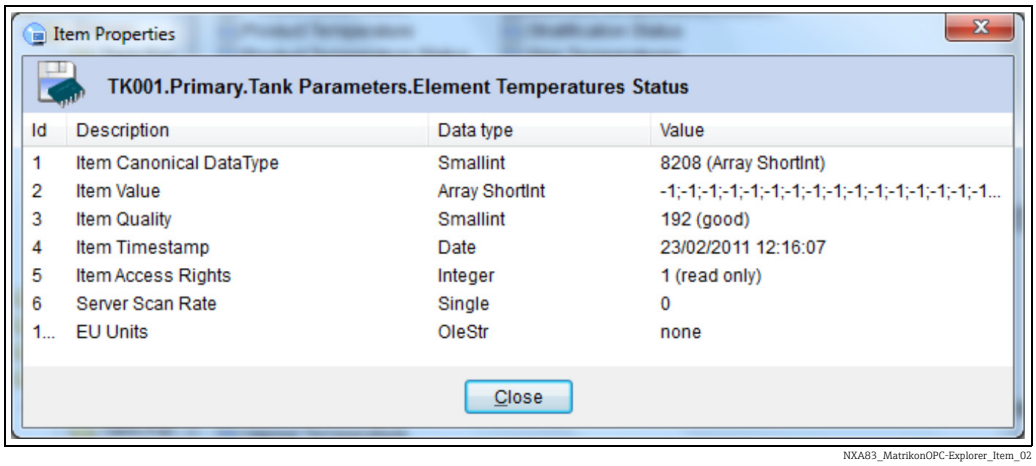
1 Array data item (Element Temperatures in the Tank Parameters block)

Thus the **Element Temperatures** data item contains the array of 200 actual data values whilst the **Element Temperatures Status** data item contains the array of 200 statuses that correspond to the values.



NXA83_MatrikonOPC-Explorer_Item_01

Statuses are mapped as −1 if the corresponding value is valid and zero or above if invalid, i.e. bad.



NXA83_MatrikonOPC-Explorer_Item_02

The profile data items consist of the levels, temperatures and densities of the last profile carried out by the gauge. The Time item is the time that the profile was carried out.

Only certain types of gauges support profiles.

8.5.5 Device Commands

The **Device Commands** section contains data items that may be written to by a client. These 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 shortint).
The other items are a number of arguments that supply further information for the command being activated. They should be written to BEFORE sending the control code to the **Device Command** item.
The **Device Command** data item consists of an ASCII character which may be one of the following:

ASCII	Description
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 gauge command is **Stow (S)** then the following items may be used to set any options:

Stow Command: Type

Value	Description
0	Stow Gauge to Top Limit Cut-out = 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 Inerval

Value	Description
0	Lock Test to Top Limit Cut-out, otherwise use interval in mm

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

Stow Command: Test Distance

Value	Description
0	Use default 300 mm, otherwise use distance in mm

Stow Command: Test Tolerance

Value	Description
0	Use default ±5 mm, otherwise use tolerance ± mm

Stow Command: Test Timeout

Value	Description
0	Use default 90 seconds, otherwise use timeout in seconds

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

Profile Command: Topscan

Value	Description
0	Tank (Full) Profile
1	Interface Profile (Topscan)

Profile Command: Scan Upwards

Value	Description
0	Downwards Scan
1	Upwards Scan

Profile Command: Include Water

Value	Description
0	Exclude Water Level Dip
1	Include Water Level Dip

Profile Command: Include Datum

Value	Description
0	Exclude Datum Level Dip
1	Include Datum Level Dip

Profile Command: Exclude Temperature

Value	Description
0	Include Temperature Profile Scan
1	Exclude Temperature Profile Scan

Profile Command: Exclude Density

Value	Description
0	Include Density Profile Scan
1	Exclude Density Profile Scan

Profile Command: Positions are Relative

Value	Description
0	Profile Scan Limit Levels Use Absolute Positions
1	Profile Scan Limit Levels Use Relative Positions

Profile Command: End Position

Value	Description
0	Use value pre-configured in gauge, otherwise use position in mm

Profile Command: Start Position

Value	Description
0	Use value pre-configured in gauge, otherwise use position in mm

Profile Command: Interval

Value	Description
≥1 and ≤64	Number of Profile Points
≥65	Profile Interval (mm)
0	Use value pre-configured in gauge

9 Data Items Per Gauge

A set of data items will be implemented per gauge, as defined in the table below. Each item will supply the standard Value/Time Stamp/Status format for any reads by the client and will also include a set of properties that may also be read. The properties will define certain configuration data that are usually fixed or change very infrequently.

9.1 Tank Parameters

The following parameters can be accessed in the **Tank Parameters** section, using the path: tankname.gauge duty.**TankParameters**.parameter

e.g. **TK001.Primary.TankParameters.Product Level**

Certain of the parameters are Bit-Mapped. For further information on these → 17.

Certain data items in this section have Write access permissions, in addition to Read permission. They are marked with a "**(w)**" in the Type column. These items can only be written to if their corresponding manual mode setting is set to **TRUE**. For details on manual mode items → 32.

Name	Type	Properties
Product Level	VT_R4 (w)	Units High Range Low range Prog. Deadband Prog. HiHi Limit Prog. Hi Limit Prog. Lo Limit Prog. LoLo Limit Prog. Alarm Enabled Manual Value Manual Mode Enabled
Product Level Status	VT_I1	−1 = Parameter valid 0+ = DN number
Product Temperature	VT_R4 (w)	Units High Range Low range Prog. Deadband Prog. Hi Limit Prog. Lo Limit Prog. Alarm Enabled Manual Value Manual Mode Enabled
Product Temperature Status	VT_I1	−1 = Parameter valid 0+ = DN number
Position	VT_R4	Units
Flow Rate	VT_R4	Units
Water Level	VT_R4 (w)	Units High Range Low range Prog. Deadband Prog. Hi Limit Prog. Lo Limit Prog. Alarm Enabled Manual Value Manual Mode Enabled
Water Status	VT_I1	−1 = Parameter valid 0+ = DN number

Name	Type	Properties
Product Pressure	VT_R4 (w)	Units Manual Value Manual Mode Enabled
Product Pressure Status	VT_I1	−1 = Parameter valid 0+ = DN number
Vapour Pressure	VT_R4 (w)	Units Manual Value Manual Mode Enabled
Vapour Pressure Status	VT_I1	−1 = Parameter valid 0+ = DN number
Base Pressure	VT_R4 (w)	Units Manual Value Manual Mode Enabled
Base Pressure Status	VT_I1	−1 = Parameter valid 0+ = DN number
Reference Desity	VT_R4 (w)	Units Prog. Deadband Prog. Hi Limit Prog. Lo Limit Prog. Alarm Enabled Manual Value Manual Mode Enabled
Reference Density Status	VT_I1	−1 = Parameter valid 0+ = DN number
Observed Density	VT_R4 (w)	Units Prog. Deadband Prog. Hi Limit Prog. Lo Limit Prog. Alarm Enabled Manual Value Manual Mode Enabled
Observed Density Status	VT_I1	−1 = Parameter valid 0+ = DN number
Vapour Temperature	VT_R4 (w)	Units Manual Value Manual Mode Enabled
Vapour Temperature Status	VT_I1	−1 = Parameter valid 0+ = DN number
Observed Temperature	VT_R4 (w)	Units Manual Value Manual Mode Enabled
Observed Temperature Status	VT_I1V	−1 = Parameter valid 0+ = DN number
Current Lng Density	VT_R4	Units
Current Lng Status	VT_I1	−1 = Parameter valid 0+ = DN number

Name	Type	Properties
Alarm Status 1	VT_UI2 (Bit-mapped)	Bit 1 = HiHi Alarm Bit 2 = Hi Alarm Bit 3 = Lo Alarm Bit 4 = LoLo Alarm Bit 5 = Software Roof Alarm Bit 6 = Software Float Alarm Bit 7 = Software Diff Alarm Bit 8 = Move Alarm Bit 9 = Software HiHi Alarm Bit 10 = Software Hi Alarm Bit 11 = Software Lo Alarm Bit 12 = Software LoLo Alarm Bit 13 = Soft Temp Hi Alarm Bit 14 = Soft Temp Lo Alarm Bit 15 = Soft Hi Flow Alarm Bit 16 = Soft Lo Flow Alarm
Alarm Status 2	VT_UI2 (Bit-mapped)	Bit 1 = Lo Density Alarm Bit 2 = Hi Density Alarm Bit 3 = Lo Temp Alarm Bit 4 = Hi Temp Alarm Bit 5 = Soft Lo Density Alarm Bit 6 = Soft Hi Density Alarm Bit 7 = Soft Density Dev Alarm Bit 8 = Soft Temp Dev Alarm Bit 9 = Soft Hi Water Alarm Bit 10 = Soft Lo Water Alarm Bit 11 = Density Dev Alarm Bit 12 = Temp Dev Alarm Bit 13 = Not Used Bit 14 = Not Used Bit 15 = Not Used Bit 16 = Not Used
Servo Status	VT_I1 (Bit-mapped)	Bit 1 = Servo Up Bit 2 = Servo Down Bit 3 = Stowed / Top Stop Bit 4 = Bottom Stop Bit 5 = Off Level Bit 6 = Water mode Bit 7 = Testing Bit 8 = Frozen
Gauge Status	VT_I1 (Bit-mapped)	Bit 1 Config Command Data Ready Bit 2 = Config Command Executing Bit 3 = Gauge Command Data Ready Bit 4 = Gauge Command Executing Bit 5 = Gauge Initialisingl Bit 6 = Fast Scan Bit 7 = Manual Scan Completed Bit 8 = Off Scan
System Status	VT_I1 (Bit-mapped)	Bit 1 = Test/Calibration Passed Bit 2 = Test/Calibration Failed Bit 3 = Config Command Failed Bit 4 = Gauge Command Failed Bit 5 = Gauge Fault Bit 6 = Data Available Bit 7 = Fault Data Available Bit 8 = General Fault
Gauge Mode	VT_I2 (Bit-mapped)	–
Extended Gauge Status	VT_UI2 (Bit-mapped	–
Element Temperatures	Array of VT_R4 (Max 16)	Units
Element Temperature Status	Array of VT_I1 (Max 16)	–

Name	Type	Properties
Stratification Status	VT_I1	Units Manual Value Manual Mode Enabled
User Defined Alarms	VT_I1	Bit 1 = User Def. Alarm 1 Bit 2 = User Def. Alarm 2 Bit 3 = User Def. Alarm 3 Bit 4 = User Def. Alarm 4 Bit 5 = User Def. Alarm 5 Bit 6 = User Def. Alarm 6 Bit 7 = User Def. Alarm 7 Bit 8 = User Def. Alarm 8

9.2 Status Bits

The following parameters can be accessed in the **Status Bits** section, using the path: tankname.gauge duty.**StatusBits**.parameter

e.g. **TK001.Primary.StatusBits.Hardware HiHi Alarm**

They are a repeat of the bit-mapped parameters in the **Tank Parameters** section but as discrete Boolean values. For information on Bit-Mapped data items → 17.

Name	Type	Properties
Hardware HiHi Alarm	VT_BOOL	–
Hardware Hi Alarm	VT_BOOL	–
Hardware Lo Alarm	VT_BOOL	–
Hardware LoLo Alarm	VT_BOOL	–
Software HiHi Alarm	VT_BOOL	–
Software Hi Alarm	VT_BOOL	–
Software Lo Alarm	VT_BOOL	–
Software LoLo Alarm	VT_BOOL	–
Hi Temperature Alarm	VT_BOOL	–
Lo Temperature Alarm	VT_BOOL	–
Software Hi Temperature Alarm	VT_BOOL	–
Software Lo Temperature Alarm	VT_BOOL	–
Hi Density Alarm	VT_BOOL	–
Lo Density Alarm	VT_BOOL	–
Software Hi Density Alarm	VT_BOOL	–
Software Lo Density Alarm	VT_BOOL	–
Software Hi Flow Alarm	VT_BOOL	–
Software Lo Flow Alarm	VT_BOOL	–
Software Roof Alarm	VT_BOOL	–
Software Float Alarm	VT_BOOL	–
Software Difference Alarm	VT_BOOL	–
Unauthorised Movement Alarm	VT_BOOL	–
Density Deviation Alarm	VT_BOOL	–
Temp Deviation Alarm	VT_BOOL	–
Software Density Deviation Alarm	VT_BOOL	–
Software Temp Deviation Alarm	VT_BOOL	–

Name	Type	Properties
Software Hi Water Alarm	VT_BOOL	–
Software Lo Water Alarm	VT_BOOL	–
Servoing Up	VT_BOOL	–
Servoing Down	VT_BOOL	–
Stowed or Top Limit	VT_BOOL	–
Bottom Limit	VT_BOOL	–
Off Level	VT_BOOL	–
Water Interface Mode	VT_BOOL	–
Testing	VT_BOOL	–
Blocked or Frozen	VT_BOOL	–
Config Command Data Ready	VT_BOOL	–
Config Command Executing	VT_BOOL	–
Gauge Command Data Ready	VT_BOOL	–
Gauge Command Executing	VT_BOOL	–
Gauge Initialising	VT_BOOL	–
Fast Scan	VT_BOOL	–
Manual Scan Completed	VT_BOOL	–
Offscan	VT_BOOL	–
Test or Calibration Passed	VT_BOOL	–
Test or Calibration Failed	VT_BOOL	–
Config Command Failed	VT_BOOL	–
Gauge Command Failed	VT_BOOL	–
Gauge Fault	VT_BOOL	–
Data Available	VT_BOOL	–
Fault Data Available	VT_BOOL	–
General Fault	VT_BOOL	–
User Defined Alarms 1 to 8	VT_BOOL	8 tags
Theft Alarm	VT_BOOL	–

9.3 Profile Data

The following parameters can be accessed in the **Profile Data** section, using the path: tankname.gauge duty.**ProfileData**.parameter

e.g. **TK001.Primary.ProfileData.Profile Levels**

Most of the parameters in this section have an array format. For further information on Array Data Items → 18.

Name	Type	Properties
Profile Time	Text	–
Number Profile Points	VT_I2	–
Profile Levels	Array of VT_R4 (max. 256)	Units
Profile Level Status	Array of VT_I1 (max. 256)	–

Name	Type	Properties
Profile Temperature	Array of VT_R4 (max. 256)	Units Deviation Limit Deviation Alarm Enabled
Profile Temperature Status	Array of VT_I1 (max. 256)	–
Profile Densities	Array of VT_R4 (max. 256)	Units Deviation Limit Deviation Alarm Enabled
Profile Densities Status	Array of VT_I1 (max. 256)	–

9.4 Calculated Parameters

The following parameters can be accessed in the **Calculated Parameters** section, using the path:
tankname.gauge duty.**CalculatedParameters**.parameter

e.g. **TK001.Primary. CalculatedParameters.Total Observed Volume**

Name	Type	Properties
Ullage Level	VT_R4	Units
Difference Level	VT_R4	Units
Level Extent	VT_R4	Units
Reference Height	VT_R4	Units
Water Extent	VT_R4	Units
Volume Correction Factor	VT_R4	–
Total Observed Volume	VT_R4	Units
DeadStock	VT_R4	Units
Free Water Volume	VT_R4	Units
Gross Observed Volume	VT_R4	Units
Net Observed Volume	VT_R4	Units
Usable Volume	VT_R4	Units
Ullage Volume	VT_R4	Units
Gross Standard Volume	VT_R4	Units
Net Standard Volume	VT_R4	Units
Standard Usable Volume	VT_R4	Units
Standard Ullage Volume	VT_R4	Units
Total Gross Standard Volume	VT_R4	Units
Total Calculated Volume	VT_R4	Units
Gross Mass	VT_R4	Units
Net Mass	VT_R4	Units
Usable Mass	VT_R4	Units
Ullage Mass	VT_R4	Units
Gross Weight	VT_R4	Units
Net Weight	VT_R4	Units
Usable Weight	VT_R4	Units
Ullage Weight	VT_R4	Units
Shell Capacity	VT_R4	Units

Name	Type	Properties
Min. Operating Volume	VT_R4	Units
Max. Operating Volume	VT_R4	Units
Vapour Standard Volume	VT_R4	Units
Vapour Mass	VT_R4	Units
Volume Flow Rate (m3)	VT_R4	Units
Volume Flow Rate (tonnes)	VT_R4	Units
Vapour Weight	VT_R4	Units
Liquid Mass	VT_R4	Units
Liquid Weight	VT_R4	Units
Stratification Severity	VT_R4	Units
Days to Density Equalisation (DDE)	VT_R4	Units
DDE Confidence	VT_R4	Units
Calorific Value	VT_R4	Units
Leak Test Volume	VT_R4	Units
Time to Stop Gauge	VT_R4	Units
Time To FillEmpty	VT_R4	Units

9.5 Device Commands

The following parameters can be accessed in the **Gauge Commands** section, using the path: tankname.gauge duty.**DeviceCommands**.parameter

e.g. **TK001.Primary.GaugeCommands.GaugeCommand**

All data items in this section have Read/Write access permissions. For further information on Gauge Commands → 21.

Name	Type	Properties
Gauge Command	VT_I1	–
Stow Command: Type	VT_UI4	–
Stow Command: Lock Test Level	VT_UI4	Units
Servo Command: Test Distance	VT_UI4	Units
Servo Command: Test Tolerance	VT_UI4	Units
Servo Command: Test Timeout	VT_UI4	Units
Profile Command: TopScan	VT_BOOL	–
Profile Command: Scan Upwards	VT_BOOL	–
Profile Command: Include Water	VT_BOOL	–
Profile Command: Include Datum	VT_BOOL	–
Profile Command: Exclude Temp.	VT_BOOL	–
Profile Command: Exclude Density	VT_BOOL	–
Profile Command: Positions are relative	VT_BOOL	–
Profile Command: End Position	VT_I4	Units
Profile Command: Start Position	VT_I4	Units
Profile Command: Interval	VT_UI4	Units

9.6 Alarm Setpoints

The following parameters can be accessed in the **Alarm Setpoints** section, using the path: tankname.gauge duty.**AlarmSetpoints**.parameter

e.g. **TK001.Primary.AlarmSetpoints.LevelHiHi**

Certain data items in this section have Write access permissions, in addition to Read permission. They are marked with a "**(w)**" in the Type column.

Name	Type	Properties
Leak Treshold	VT_R8 (w)	Units
Leak Start	VT_R8	Units
Level HiHi	VT_R4 (w)	Units
Level Hi	VT_R4 (w)	Units
Level Lo	VT_R4 (w)	Units
Level LoLo	VT_R4 (w)	Units
Float Level	VT_R4 (w)	Units
Float Hysteresis	VT_R4 (w)	Units
Roof Early Warning	VT_R4 (w)	Units
Roof Hysteresis	VT_R4 (w)	Units

Name	Type	Properties
Temperature Hi	VT_R4 (w)	Units
Temperature Lo	VT_R4 (w)	Units
Temperature Hysteresis	VT_R4 (w)	Units
Flow Hi	VT_R4 (w)	Units
Flow Lo	VT_R4 (w)	Units
Flow Hysteresis	VT_R4 (w)	Units
Flow Holdoff Upwards	VT_R4 (w)	Units
Flow Holdoff Downwards	VT_R4 (w)	Units
Difference Allowable Tolerance	VT_R4 (w)	Units
Difference Hysteresis	VT_R4 (w)	Units
Target Level	VT_R4 (w)	Units
Pre Alarm 1	VT_R4	Units
Pre Alarm 2	VT_R4	Units
Pre Alarm 3	VT_R4	Units
Pre Alarm 4	VT_R4	Units
Flow Sample Time	VT_R4	Units
Density Hi	VT_R4 (w)	Units
Density Lo	VT_R4 (w)	Units
Density Hysteresis	VT_R4 (w)	Units
Temperature Profile Deviation	VT_R4 (w)	Units
Density Profile Deviation	VT_R4 (w)	Units
Free Water Hi	VT_R4 (w)	Units
Free Water Lo	VT_R4 (w)	Units
Free Water Hysteresis	VT_R4 (w)	Units

9.7 Gauge Configuration Items

The following parameters can be accessed in the **Gauge Configuration Items** section, using the path:
tankname.gauge duty.**GaugeConfigurationItems**.parameter

e.g. **TK001.Primary.GaugeConfigurationItems.ProductLevelManualMode**

Certain data items in this section have Write access permissions, in addition to Read permission. They are marked with a "**(w)**" in the Type column.

Name	Type	Properties
Gauge ID	Text	–
Gauge Type	Text	–
Product Name	Text	–
Gauge tag	Text	–
Mode Flags 1	VT_UI4	Bit-Mapped
Mode Flags 2	VT_UI4	Bit-Mapped
Product Level Manual Mode	VT_BOOL (w)	–
Free Water Manual Mode	VT_BOOL (w)	–
Oil Depth Manual Mode	VT_BOOL (w)	–

Name	Type	Properties
Product Pressure Manual Mode	VT_BOOL (w)	–
Vapour Pressure Manual Mode	VT_BOOL (w)	–
Air Pressure Manual Mode	VT_BOOL (w)	–
Product Temperature Manual Mode	VT_BOOL (w)	–
Observed Temperature Manual Mode	VT_BOOL (w)	–
Air Temperature Manual Mode	VT_BOOL (w)	–
Vapour Temperature Manual Mode	VT_BOOL (w)	–
Reference Density Manual Mode	VT_BOOL (w)	–
Observed Density Manual Mode	VT_BOOL (w)	–
Strap Table Entered	VT_BOOL	–
Water Table Entered	VT_BOOL	–
Roof Legs Down	VT_BOOL	–
Temperature Alarm Enabled	VT_BOOL (w)	Read/Write
Multi Gauge Mode	VT_BOOL	–
Flow Alarm Enabled	VT_BOOL (w)	–
Difference Alarm Enabled	VT_BOOL (w)	–
Level Alarm Enabled	VT_BOOL (w)	–
Float Alarm Enabled	VT_BOOL (w)	–
Float Direction	VT_BOOL (w)	–
Roof Alarm Enabled	VT_BOOL (w)	–
Pre Alarm Enabled	VT_BOOL (w)	–
Pre Alarm Direction	VT_BOOL (w)	–
Element Temperatures Enabled	VT_BOOL	–
Leak Alarm Enabled	VT_BOOL (w)	–
Offline Mode	VT_BOOL (w)	–
Density Alarm Enabled	VT_BOOL (w)	–
Profile Deviation Alarm Enabled	VT_BOOL (w)	–
Free Water Alarm Enabled	VT_BOOL (w)	–
Free Water Volume Manual Mode	VT_BOOL (w)	–
Vapour Uses Product Temp	VT_BOOL	–
Stratification Status Manual Mode	VT_BOOL	–
Base Pressure Manual Mode	VT_BOOL	–

Those items in the above list with "manual mode" in their name (i.e. Product Level Manual Mode) are used to configure the source for the corresponding tank parameters (i.e. Product Level).

Manual Mode Value	Tank Parameter Source
1 or TRUE	Tank Parameter uses the manually entered value
0 or FALSE	Tank Parameter uses value returned from gauge

Those items in the list with "alarm enabled" in their name denote a configuration flag, used to enable/disable alarms within the tankgauging system.

Alarm Enabled Value	Alarm Operation
1 or TRUE	Enabled
0 or FALSE	Disabled

9.8 Inventory Configuration Items

The following parameters can be accessed in the **Inventory Configuration Items** section, using the path:
tankname.gauge duty.**Inventory Configuration Items**.parameter

e.g. **TK001.Primary.Inventory Configuration Items.Shell Insulation Factor**

Certain data items in this section have Write access permissions, in addition to Read permission. They are marked with a "**(w)**" in the Type column.

Name	Type	Properties
Inventory Control Bits	VT_UI4	Bit-Mapped
Shell Insulation Factor	VT_R8	–
Shell Temperature Coefficient	VT_R8	–
Shell Reference Temperature	VT_R8	–
Roof Floating Legs Down	VT_R4	–
Roof Support Legs Down	VT_R4	–
Roof Floating Legs Up	VT_R4	–
Roof Support Legs Up	VT_R4	–
Roof Weight	VT_R4	–
Temperature Correction Factor	VT_R8	–
Density Correction Factor	VT_R8	–
Product Reference Temperature	VT_R4	–
Liquid Volume Ratio	VT_R4	–
ThermalExpansionCoefficient	VT_R8 (w)	–
Molecular Mass	VT_R4	–
Manual VCF	VT_R8 (w)	–
SuspendedSediment	VT_R4	–
Suspended Water	VT_R4	–
Air Density	VT_R8	–
Movement Start Level	VT_R4	–
Movement Planned Volume	VT_R4	–

10 Diagnostic Logging

The OPC Server can be configured to log all client connection states to a text file whenever a client connects or disconnects.
To enable this, the registry value called “EnableOPCDumpLog” must be set to 1. This value is located under the following key:
HKEY_LOCAL_MACHINE Software MHT Technology
If the value does not exist then it must be added as a REG_DWORD.
Setting this value to 0 disables diagnostic logging.
With logging enabled, each time a client connection change occurs, a new log file will be created in the standard tankgauging install directory, with the following name:
OPCServerDump_XXXXXX.log
The XXXXXX is the number of seconds since 1st January 1970.

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