

Operating Instructions

Tankvision

Multi Scan NXA83B

Redundancy manual

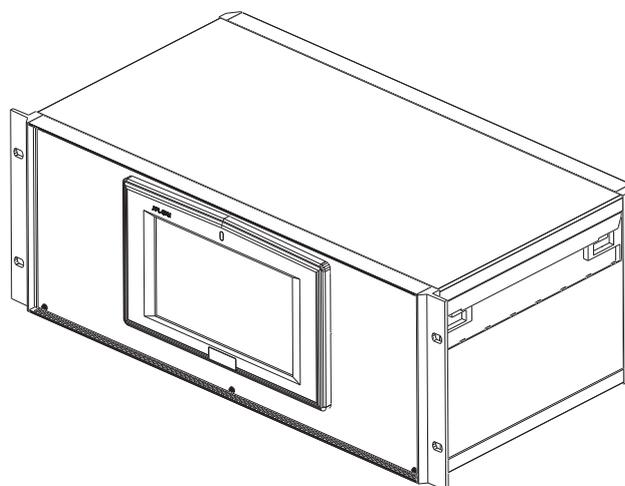
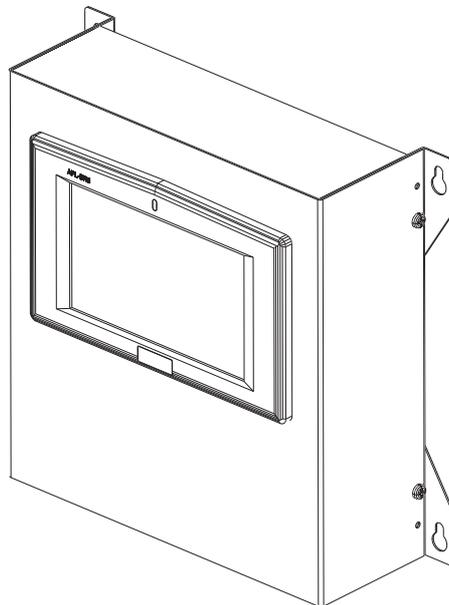


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1 Document information

1.1 Target audience for this manual

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 Version history

Document version	Valid for SW version	Changes to the previous version
BA01296G/00/EN/01.14	3.0.10	Initial version
BA01296G/00/EN/02.15	3.0.12	Change of order code structure
BA01296G/00/EN/03.16	3.1.0 and 4.0.0	Old V1 support and simplified configuration

1.3 Document function

1.3.1 Used symbols

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.

Symbols for certain types of information

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

Symbols in graphics

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

1.4 Documentation

1.4.1 Operating instructions

Document number	Instrument	Type of Document
BA01288G/00	<ul style="list-style-type: none"> Multi Scan NXA83B 	Operation manual
BA01290G/00		Installation and Maintenance manual
BA01291G/00		Configuration manual
BA01292G/00		DCC Configuration manual
BA01289G/00		OPC Tank Data Server manual
BA01297G/00		Web Client System Operation manual
BA01287G/00		Weights and Measures Additions
BA01296G/00		Redundancy manual

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 beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Following instructions and basic conditions

The operating personnel must fulfill the following requirements:

- Being instructed and authorized according to the requirements of the task by the facility's owner operator
- Following the instructions in these Operating Instructions

2.2 IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

Endress+Hauser can be contacted to provide support in performing this task.

2.3 Designated use

2.3.1 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/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 pumpable 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

2.4 Workplace safety

For work on and with the device:

- Wear the required personal protective equipment according to federal/national regulations.
- Switch off the supply voltage before connecting the device.

2.5 Operational safety

Risk of injury!

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

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.

- If, despite this, modifications are required, consult with Endress+Hauser.

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 repair of an electrical device.
- Use original spare parts and accessories from Endress+Hauser only.

2.6 Product safety

The device is designed 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. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EG directives. Endress+Hauser confirms the successful testing of the device by affixing to it the CE mark.

3 Introduction

The Multi Scan NXA83B is a configurable system designed for tank gauging and tank inventory management systems.

Redundant operation with a pair of Multi Scan NXA83B linked together is supported, so that only one NXA83B will poll the gauges. The other Multi Scan NXA83B will automatically update its database with live data from the active Multi Scan NXA83B.

This mode of redundancy is called **Switch By System** and this document outlines the configuration and operation of the two Multi Scan NXA83B.

There are two other modes of redundancy, both of which operate on a single Multi Scan NXA83B (i.e. not a redundant pair):

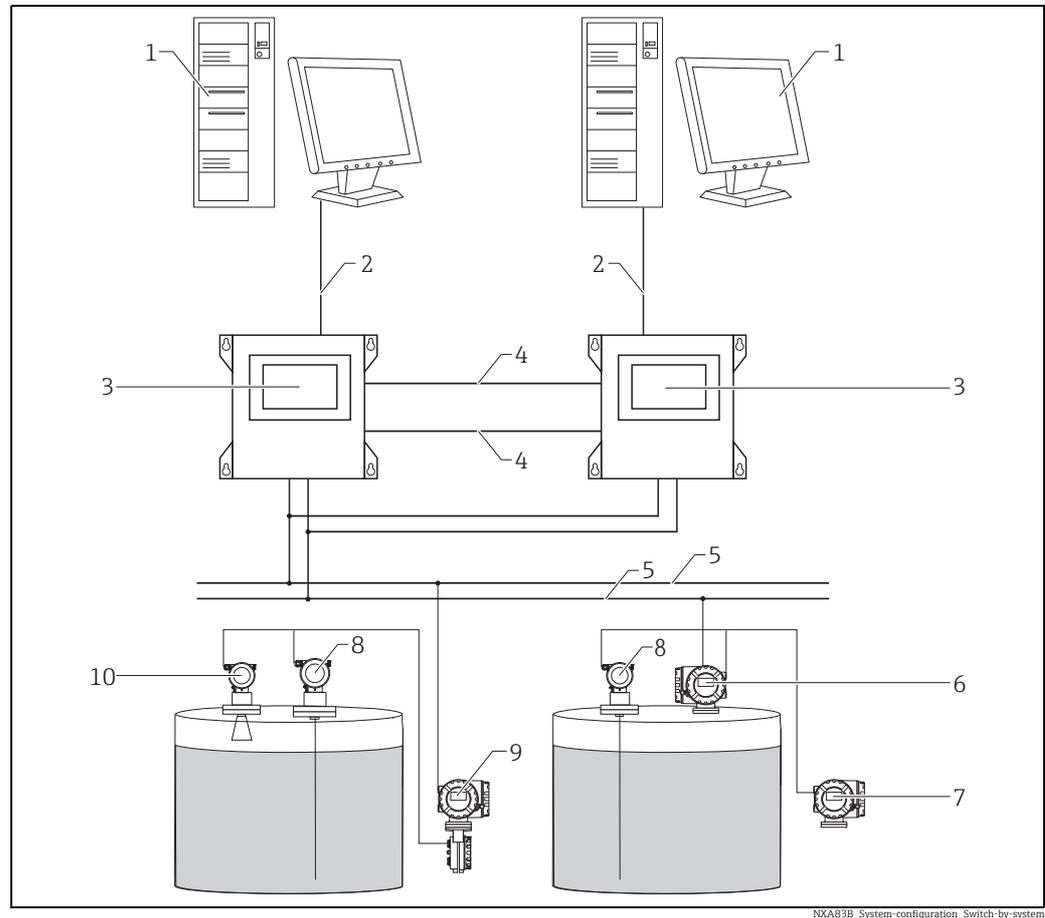
- **Switch By Gauge:** Gauges are configured with two ports (Primary and Backup) on the same Multi Scan NXA83B. If the Multi Scan NXA83B loses connection to a gauge on one port it will switch to poll the gauge from the other port. This is on an individual gauge basis, thus both Primary and Backup ports may be polling at the same time.
- **Switch By Interface:** This is similar the switch by Gauge, except that the Multi Scan NXA83B will poll ALL gauges on only one port (i.e. Primary on startup). Only when communication to all gauges has failed on this port will the Multi Scan NXA83B switch to poll gauges from the other port. Thus the Primary and Backup ports will never poll at the same time.

This manual is solely concerned with the redundancy functionality, it is assumed that the user has read the Multi Scan NXA83B manuals and is familiar with configuring a Multi Scan NXA83B database.

4 Switch By System

4.1 Operation

The diagram below shows an example of a pair of Multi Scan NXA83B used in the Switch By System redundancy mode.



- 1 Tankvision Professional NXA85 Workstation
- 2 Ethernet
- 3 Tankvision Multi Scan NXA83B
- 4 Control link RS232
- 5 Fieldbus protocol
- 6 Proservo
- 7 Promonitor
- 8 Prothermo
- 9 Tank Side Monitor
- 10 Micropilot

The two NXA83B have a number of field loops (2 Enraf BPM in this example) connected to both Multi Scan NXA83B.

There are also 2 Control links connected between the NXA83B, these are used to transfer data between the systems, one for each direction of data transfer.

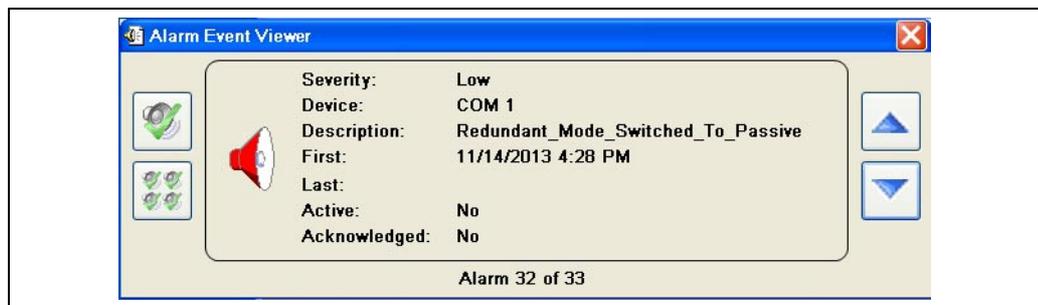
In normal operation one Multi Scan NXA83B will be in Live Polling mode, that is, polling for all field data from the gauges. The other Multi Scan NXA83B will be in Redundant Link mode, and it will be getting data from the live Multi Scan NXA83B via one of the Control Links.

Therefore both Multi Scan NXA83B will have live field data, which will be displayed on screen and be available on any slave (Modbus etc.) port or OPC connection. Slave ports may

be configured to not reply on the passive system, to mimic functionality in older equipment such as the Datacon.

If one of the field ports on the live system does not receive a correctly formatted reply for longer than the timeout period (default 60 seconds), it will be marked as failed and initiate a switch. This will cause the Multi Scan NXA83B to stop polling all field ports and switch to Redundant Link mode.

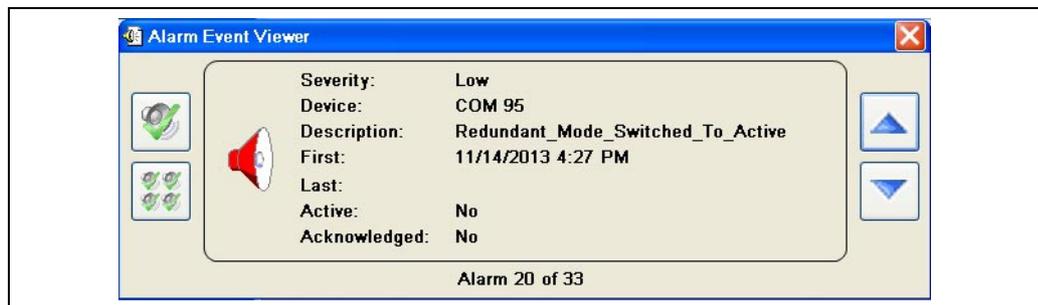
An event will be generated to inform the user that the system is now passive.



NXA83_Alarm-Event-Viewer_Redundant-Mode-Switched-To-Passive

The second Multi Scan NXA83B will detect this change, switch to Live Polling mode and start to poll all the field ports for gauge data.

An event will be generated in the second Multi Scan NXA83B to inform the user that the system is now active and polling for gauge data.



NXA83_Alarm-Event-Viewer_Redundant-Mode-Switched-To-Active

During the switchover, no data will be lost and no gauging alarms will be raised in the Multi Scan NXA83B or in any connected tank gauging software.

If, following the switch, the field port on the second Multi Scan NXA83B also fails to receive correctly formatted data then a No Reply From Gauge alarm will be generated for each gauge on that field port.

If at any time an individual gauge fails on a port (i.e. does not reply), but other gauges are returning valid data, the failed gauge will immediately be set to error and an alarm raised. This will not trigger a switch.

4.2 Port Latching

If a port has failed on both Multi Scan NXA83B the system will "Latch" for that port. A Latched port will not trigger redundancy mode switching. This state will remain until valid communications is restored to the port. If the second Multi Scan NXA83B is not connected or powered up, all ports will latch and no switching will occur.

Latching does not affect other ports, so if an unlatched port fails redundant mode switching will occur as normal.

4.3 Boot Up

Multi Scan NXA83B which are configured as "Switch by System" will initially boot up in Redundant Link mode and check to see if there is a Multi Scan NXA83B in Live Polling Mode.

If a Multi Scan NXA83B in Redundant Link mode does not find a "Live" system within a timeout period it will switch to Live Polling mode. The timeout period contains a random element, so that if two Multi Scan NXA83B boot at exactly the same time, one should always switch to Live Polling before the other.

If there are no Control Link connections between the two systems both will eventually switch to Live Polling mode.

4.4 Slave interfaces

All slave interfaces (Modbus, Datacon etc) by default operate as normal when used on redundant Multi Scan NXA83B. They will reply to requests whether they are running on the Live Polling or Passive system, as both systems have valid live data.

However there may be applications where the master system requires that only slave interfaces running on the Live Polling system reply to requests. For instance if both Multi Scan NXA83B are multi-dropped on the same interface and have the same addresses etc.

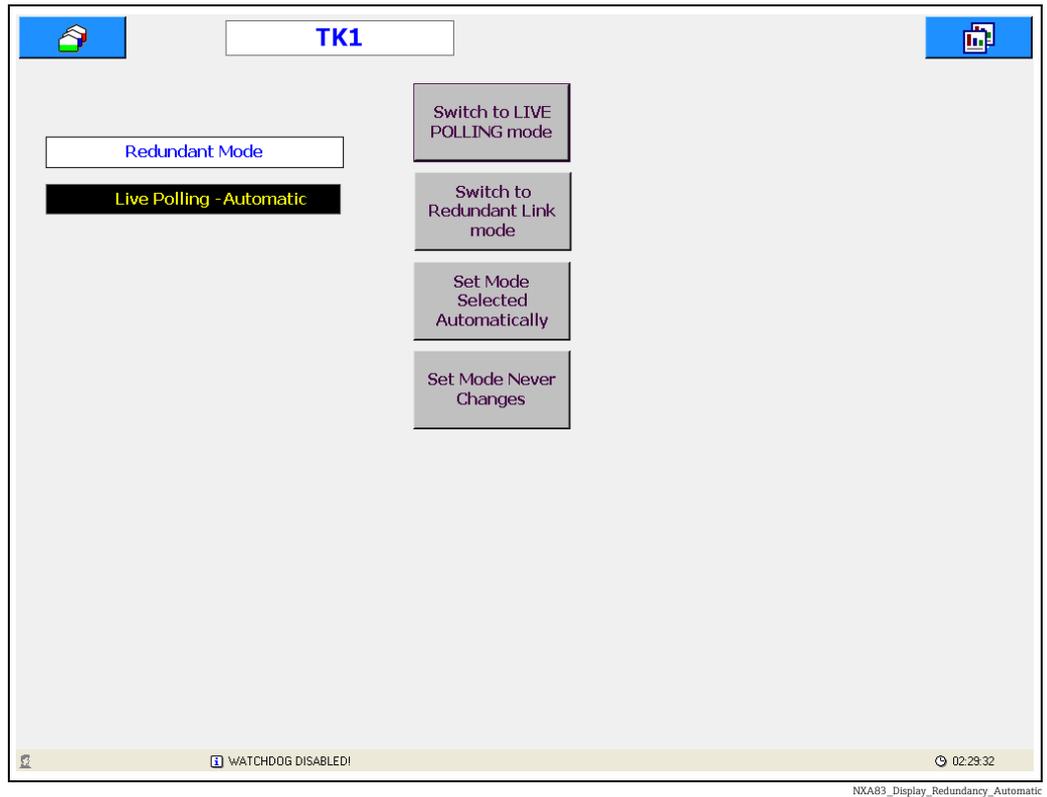
In this case the Slave port should be configured with the **Do Not Reply When Passive** option ticked in the **Port Config** tool. See later section on Slave Port Configuration for details on where this can be found, →  14.

If this option is ticked then the slave interface will not reply to any requests if it is running on the Passive system.

4.5 Mode display and control

The current redundancy mode may be displayed in the NXA83B runtime displays on the local touchscreen.

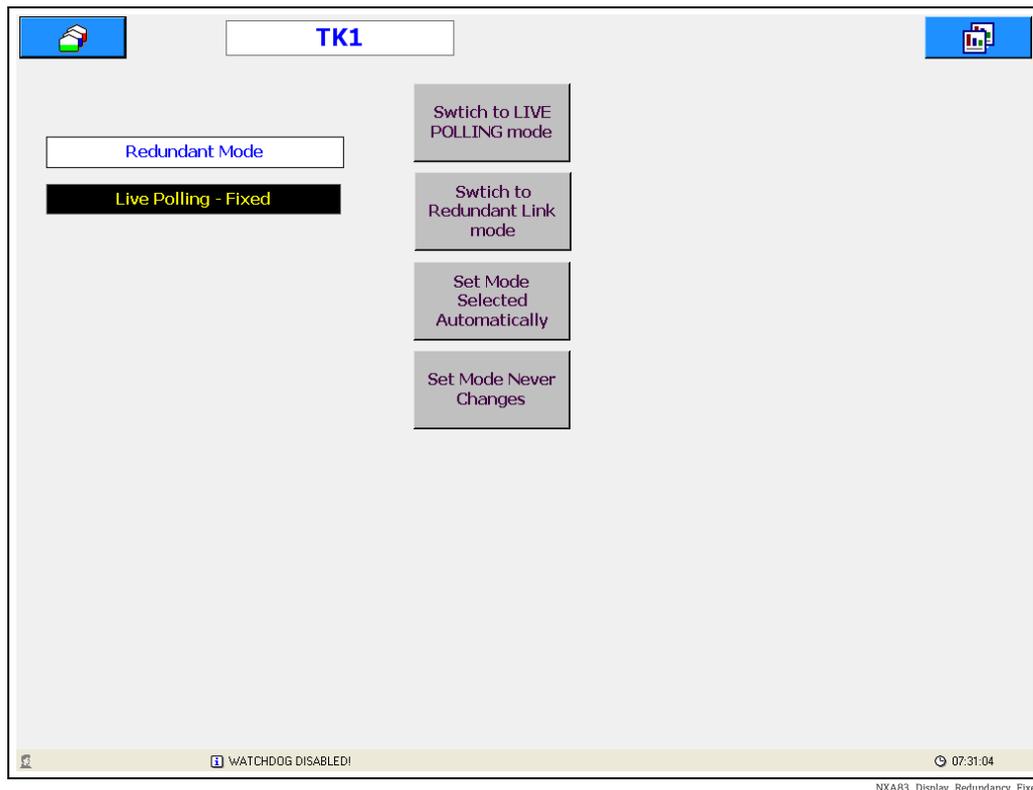
A default screen is available on the configurator, although this may altered as required during the configuration process.



This screen shows the mode that the Multi Scan NXA83B is currently operating. The mode may also be manually controlled using this screen.

The redundant mode is normally selected automatically, i.e. the two systems will determine the best mode for each.

There may be times when the redundancy mode needs to be fixed to prevent switching, e.g. during maintenance periods. This can be achieved by selecting the **Set Mode Never Changes** option. When the mode is set to Fixed, if a port fails NO switch will occur.



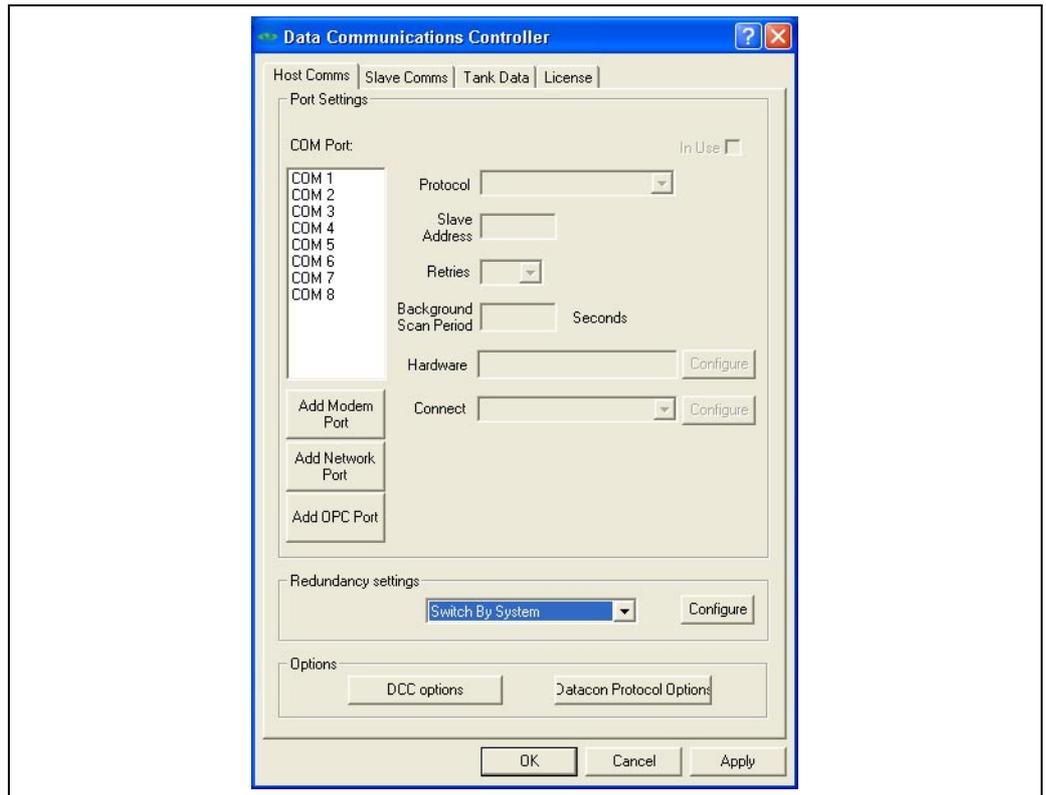
When a NXA83B is rebooted, it always starts in automatic redundant selection.

4.6 Configuration

4.6.1 Redundancy Control Port Configuration

The first step to configuring a redundant database on the Multi Scan NXA83B is to configure the redundancy mode. This is set using the Port Configuration module in the Communications menu.

Click on the Host Comms tab, and set the **Redundancy Settings** to **Switch By System**.



NXA83_Port-Configuration_Host-Comms_Switch-By-System

The **Configure** button will now be enabled. Click this button to determine the method of connecting the control links between the two Multi Scan NXA83B.



NXA83_Port-Configuration_Host-Comms_Redundancy-Settings

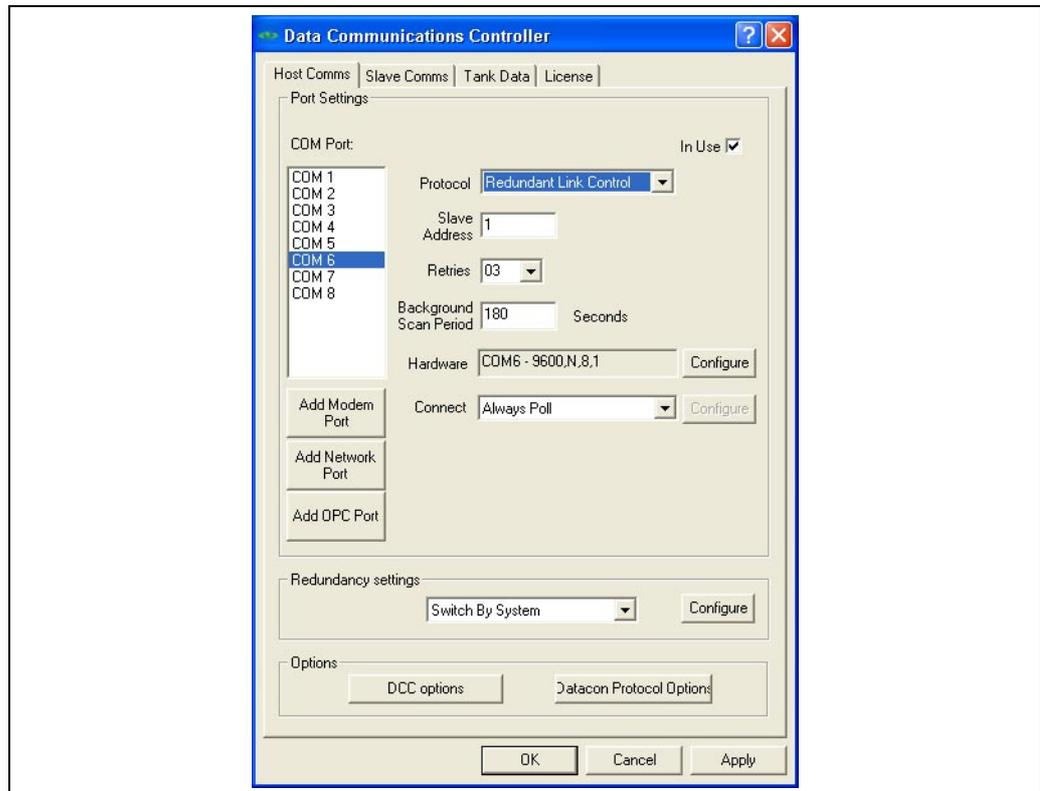
There are five options to select from:

- **COM ports 1 and 2 used for Control Ports:** The Multi Scan NXA83B automatically configures the communications ports for redundancy. Ensure that COM 1 and COM 2 are NOT selected as "In Use" as either Host or Slave ports. Connect a Serial Cross-over lead from COM 1 on one Multi Scan NXA83B to COM 2 on the other for both Multi Scan NXA83B. This is the recommended method of connecting the control links.
- **COM ports 7 and 8 used for Control Ports:** The Multi Scan NXA83B automatically configures the communications ports for redundancy. Ensure that COM 7 and COM 8 are NOT selected as "In Use" as either Host or Slave ports. Connect a Serial Cross-over lead from COM 7 on one Multi Scan NXA83B to COM 8 on the other for both Multi Scan NXA83B.
- **Manual Selection of Control Ports:** This option must be selected when the control ports have been manually configured. There must be two control ports configured:

 - 1 DCC Host port configured as a Redundant Link Control protocol.
 - 1 DCC Slave port configured as a Redundant Link Control protocol.

These can be either standard RS232 COM ports (recommended for manual configuration) or Network ports. The communication parameters should be set identically for both Multi Scan NXA83B.

In operation the Host Redundant Link Control is connected to the Slave Redundant Link Control of the other system, and vice-versa.

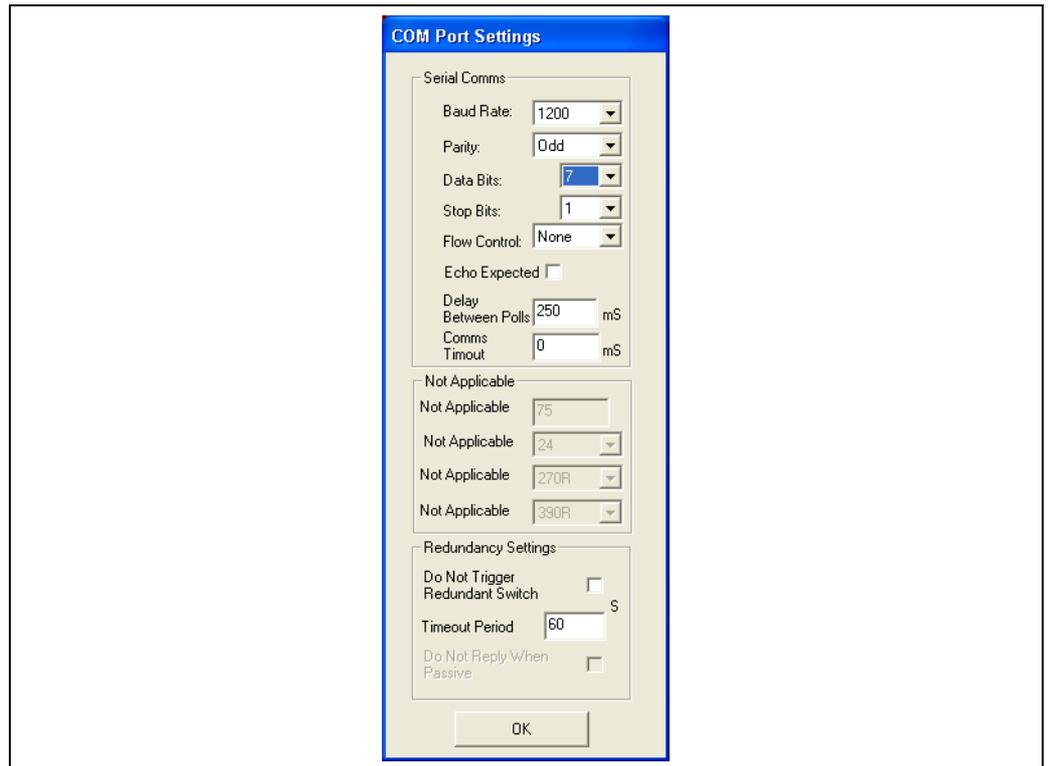


NXA83_Port-Configuration_Host-Comms

- Network used for Control Ports:** The Multi Scan NXA83B automatically configures network ports for redundancy. The Network address of the second Multi Scan NXA83B must be supplied in the Network Address field. Both Multi Scan NXA83B must be connected to the same network, or have a Network Cross-over lead connected between the Ethernet ports of the two Multi Scan NXA83B. Connection using a Network Cross-over lead is not a recommended method for Redundant Link since it prevents access to the Multi Scan NXA83B operating system using a remote desktop connection.
- No Control Ports Used:** If this option is selected both Multi Scan NXA83B will default to Live polling mode. This option should **NOT** be used for **Switch By System** redundancy.

4.6.2 Field Port and Slave Port Configuration

Next configure all field ports in the Host Comms page as normal, except that the redundancy operation may be modified for individual ports by editing the **Redundancy Settings** section of the COM port Settings dialog.



NXA83_COM-Port-Settings

For Host ports the following settings may be adjusted:

- **Do Not Trigger Redundant Switch:** If ticked the port will not trigger a switchover if it fails
- **Timeout Period:** The time period for determining if the port has failed. If no replies are received from devices on the port for longer than this period a switchover will be triggered. Defaults to 60 seconds.

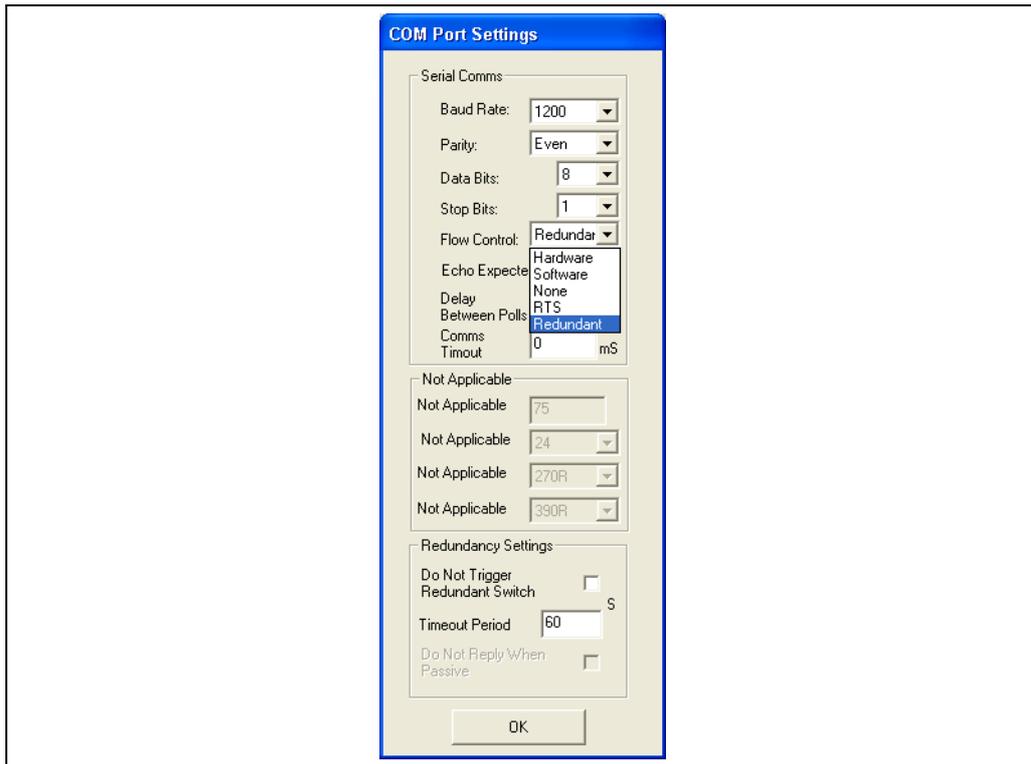
For Slave ports the following setting may be adjusted:

- **Do Not Reply When Passive:** The port will not reply to any requests if it is running on the passive system.

4.6.3 Current Loop Board Configuration

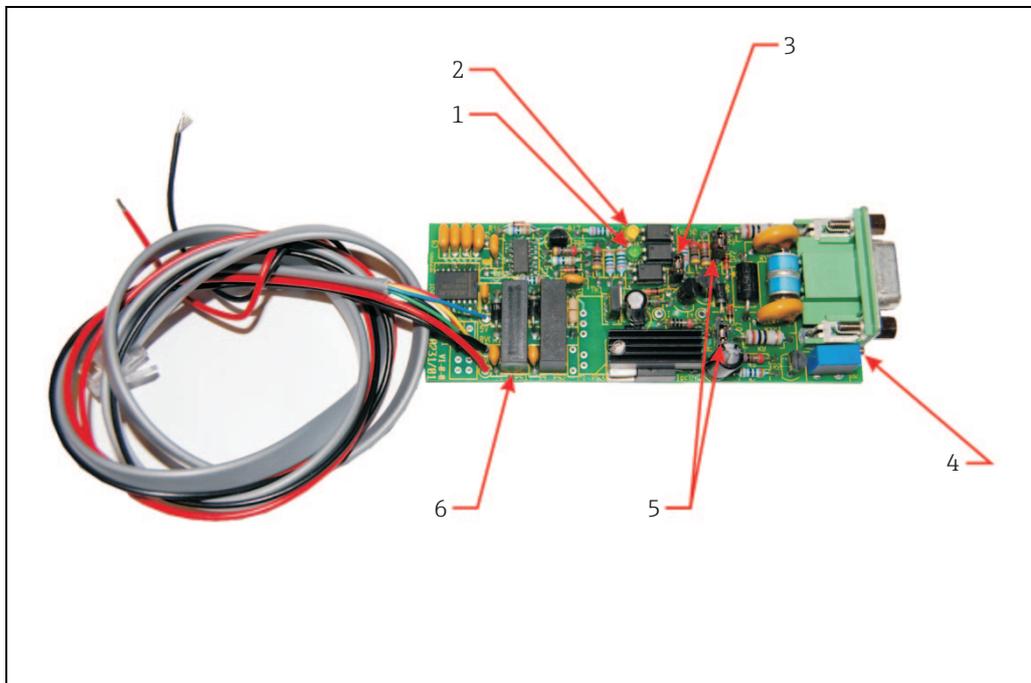
When using Current Loop interface boards with redundant systems (such as when interfacing to Whessoe WM500/550 devices) the following should be implemented:

1. Set the **Flow Control** Field to **Redundant**.



NXA83_COM-Port-Settings_Flow-Control_Redundant

2. Remove the **Redundant Mode Control** jumper from each board.



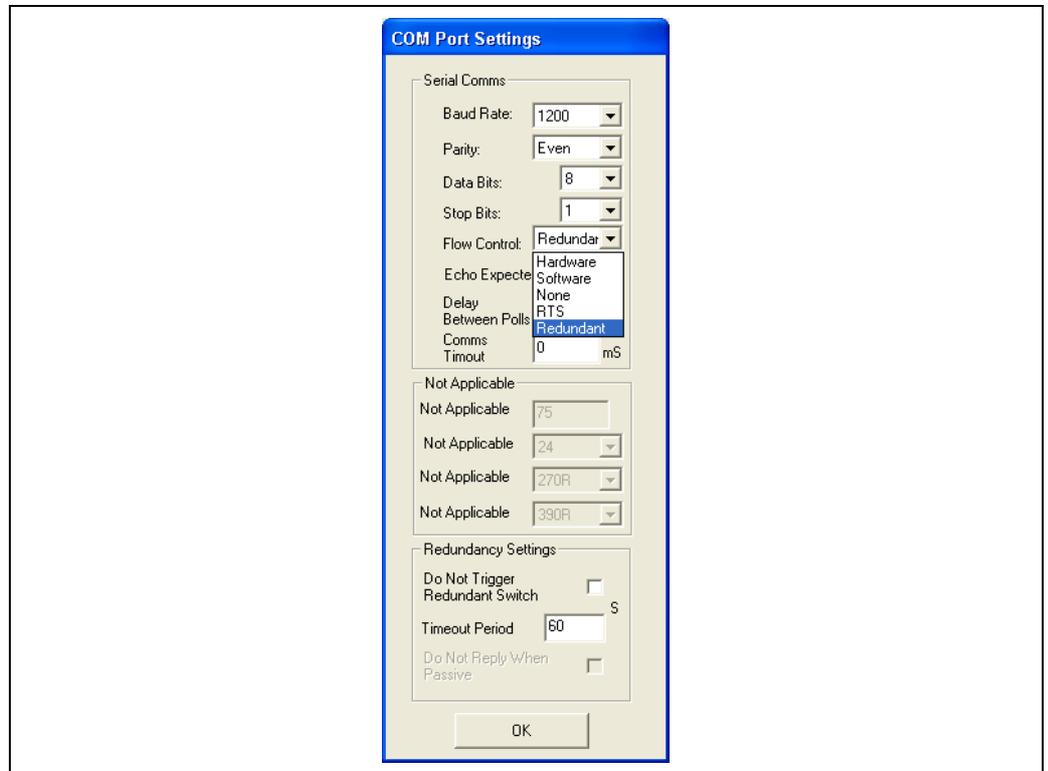
NXA83_Current-Loop-Board_Redundant-Mode-Control-jumper

- 1 Tx LED
- 2 Rx LED
- 3 Redundant Mode Control jumper (Fitted = Loop always powered; Not Fitted = Redundant Mode)
- 4 Loop Current Adjust
- 5 Master/Slave Select
- 6 Power Converters

4.6.4 L&J Tankway Board Configuration

When using L&J interface boards with redundant systems the following should be implemented:

1. Set the **Flow Control** field to **Redundant**.



NXA83_COM-Port-Settings_Flow-Control_Redundant

2. Make sure LK1 is in the UP position (i.e. towards the Tx/Rx LEDs) on each board.

4.6.5 Gauge Configuration

After the interfaces have been configured, the gauges must be configured for redundant operation.

To do this, select the gauge in the **Gauge Configuration** screen in the Configurator tools.

NXA83_Device-Configuration

Set the **Comm Port** field to be the field port (i.e. the port that the gauges are connected to). There is no need to enter port a **Backup COM Port** field, so leave blank.

 Firmware Versions before 3.0.6 do require the **Backup COM Port** field to be the Host Redundant Link Control port. To display this field click on the **Advanced** button.

4.7 Configuring Tankvision Professional NXA85 to talk to a pair of redundant Multi Scan NXA83B

A PC running the Tankvision Professional NXA85 tank gauging software may be used on conjunction with a pair of redundant pair of Multi Scan NXA83B.

It must be connected to the Multi Scan NXA83B by one of the following:

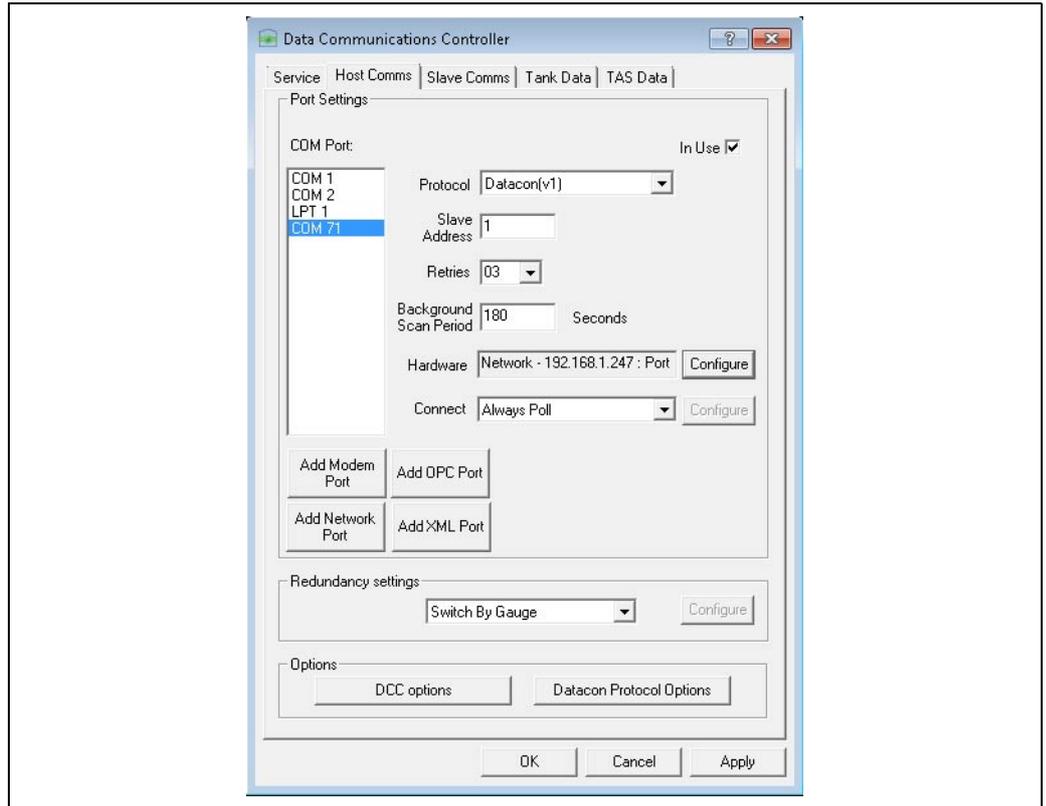
- RS232, RS485 or RS422, using a pair of serial communication ports on the PC (one for each Multi Scan NXA83B).
- Ethernet, with the PC and both Multi Scan NXA83B connected via a switch or similar.

This section will give some notes on what to configure, but refer to the DCC Configuration manual (BA01292G) for more details on configuring Tankvision Professional NXA85.

4.7.1 Port Configuration

In the Tankvision Professional NXA85 system configure a pair of Host COM ports using the **Datacon** protocol. These may be either physical serial COM ports (COM 1 +) or network ports (COM 71 +).

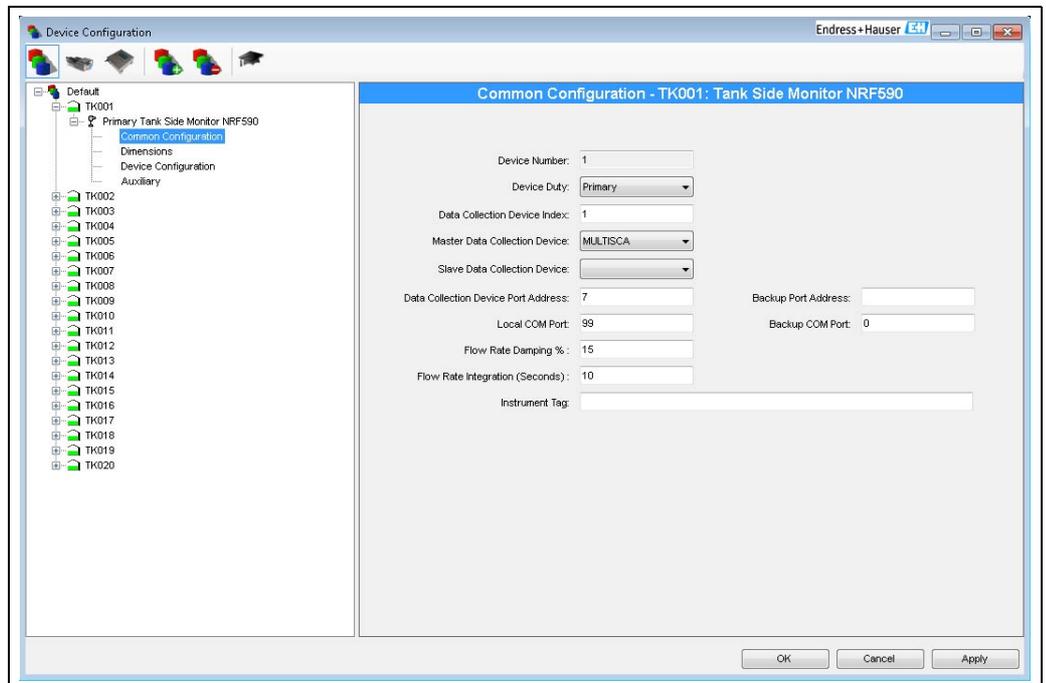
Set the **Redundancy settings** mode to **Switch By Gauge**.



NXA83_DCC_Host-Comms_Switch-By-Gauge

4.7.2 Gauge Configuration

Gauges should be configured as normal in Tankvision Professional NXA85.



NXA83_Device-Configuration_Common-Configuration

Set the **Local COM Port** and the **Backup COM Port** to the two interfaces configured for the datacon protocol

4.7.3 Tankvision Professional NXA85 Redundant Operation

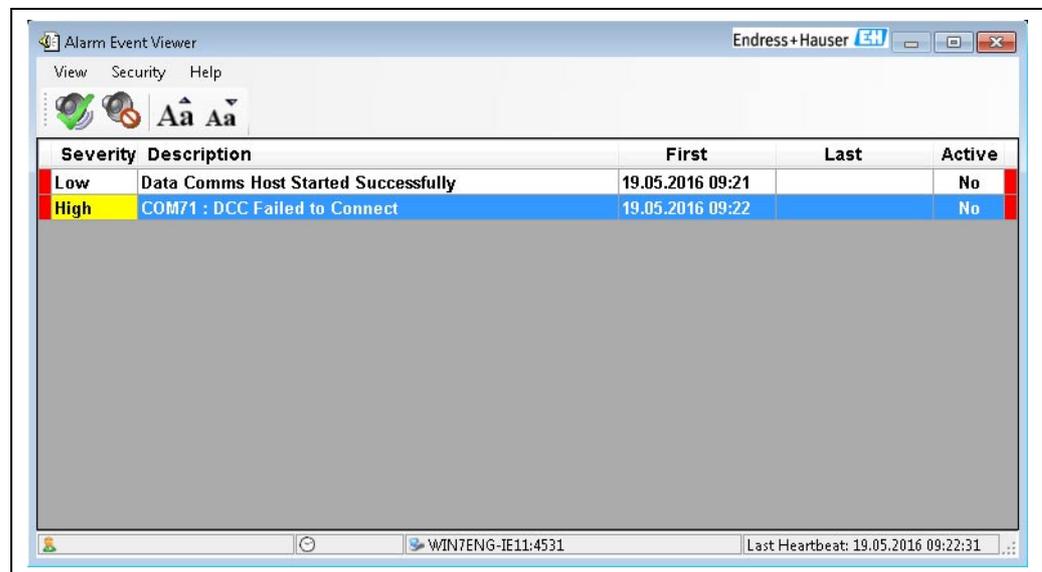
Tankvision Professional NXA85 will attempt to poll for gauge data on the Local COM Port initially. If the data for the gauge is all invalid then it will switch individual gauges to poll on the backup COM Port. During the switch there will be no loss of data.

If the Multi Scan NXA83B initiate a redundant switchover then there should be no loss of data in Tankvision Professional NXA85 and assuming both Multi Scan NXA83B are still operational then Tankvision Professional NXA85 will not switch its ports.

If an interface port fails completely, for instance if the link between the PC and a Multi Scan NXA83B is broken or the Multi Scan NXA83B loses power, then Tankvision Professional NXA85 will switch all gauges to its other port. During the switch there will be no loss of data, but alarms will be generated.

If the interface port is via Ethernet (COM 71+) then the following alarms will be generated:

- **DCC Comms Failure**
- **Device Disconnected** (20 to 30 seconds after failure)
- **Failed To Connect** (5 to 10 seconds later)



Severity	Description	First	Last	Active
Low	Data Comms Host Started Successfully	19.05.2016 09:21		No
High	COM71 : DCC Failed to Connect	19.05.2016 09:22		No

NXA83_Alarm-Event-Viewer_DCC-Comms-Failure

If the interface port is via a physical serial port then only the **DCC Comms Failure** will be generated.

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