Tank Side Monitor
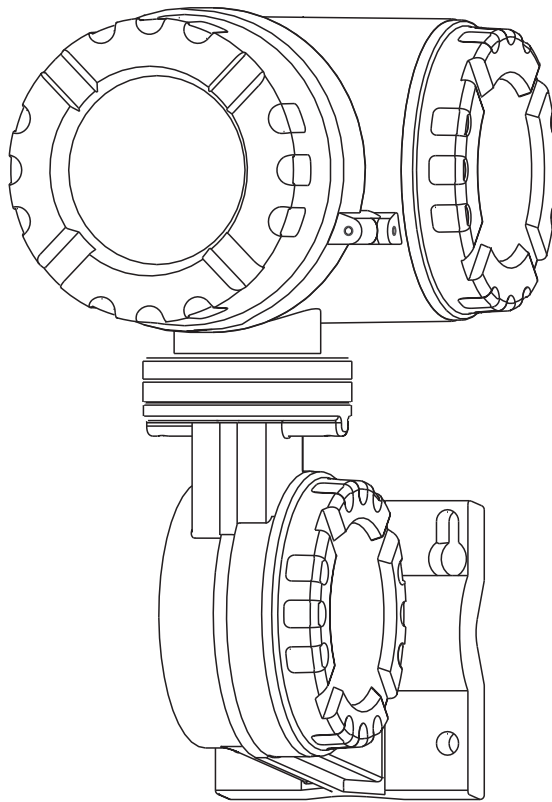# NRF 590

L&J Tankway communication protocol

Endress+Hauser

The Power of Know How

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1 Introduction

This protocol guide explains the operation of the L&J Tankway protocol implemented in the Endress+Hauser Tank Side Monitor NRF590.

2 Implementation

The implementation of the L&J Tankway protocol for the Tank Side Monitor provides a standard form of digital communication via a voltage mode bus. An effort has been made to parallel current implementations to the greatest extent possible, so that the Tank Side Monitor communicates with existing L&J Tankway masters.
Check compatibility carefully to ensure that the Tank Side Monitor is properly configured for the data format expected by the host system or computer. Exceptions made because of the unique requirements of the Tank Side Monitor application have been noted.

✎ Note!
This is no guarantee, however, that the interpretation made here will be the same as that followed by the L&J Tankway master.

The L&J Tankway interface supports two commands and four types of communication level encoding which are based on the emulation of older devices.

L&J Tankway Commands

Command	Description
1	Report Level
2	Report Temperature 1[1]

1) The command 4 (report temperature 2) is not supported by the Tank Side Monitor L&J Tankway interface.

L&J Tankway Encoding Types

Device Type	Decription
1	Uses gray code table for CCW VAREC TAnk Gauge
2	Uses gray code table for CCW Shand & Jurs Tank Gauge
3	Whole number of Feet and 8ths of an inch
4	Number of 32nds of an inch

3   Configuration

The L&J Tankway interface on the Tank Side Monitor must be configured to establish communications. The local display or ToF tool allows the user to set the Tank Side Monitor L&J Tankway interface to match the L&J Tankway master settings.

3.1   Address

Tank Side Monitor addresses provide unique identification for the host. The Tank Side Monitor address is configurable through the local display or ToF tool. This address may range from 0 to 127 and must be unique for each L&J Tankway device on a bus. Each Tank Side Monitor only responds when a query has been sent to its unique address by the host.

3.2   Configuration settings

In order for successful communication on a L&J Tankway bus a number of configuration settings must be made to match the configuration of the bus.

3.2.1   Summary of Configuration Parameters

A summary of the configuration information required by the Tank Side Monitor is shown in the following table.

Configuration parameter	Valid Entries	Default
ID	0 ... 127	1
Device Type	• 1 • 2 • 3 • 4	2

3.2.2   Description of Configuration Parameters

ID (22109)

This is a unique number for this device on the L&J Tankway bus, only when the Tank Side Monitor receives a request message with this number is a response generated.

Device Type (22110)

Specifies the format of the response generated by the Tank Side Monitor

4   Measured values

4.1   Measured Value Ranges

The L&J Tankway response will contain one of 2 measurement values; level and temperature as well as 2 alarm bits indicating the status of the two Tank Side Monitor discrete IOs. Depending on the setting of the L&J Tankway parameters these values are subject to the following limits.

Measured Value	Type (22110)	Value Range	Granularity	Units
Level[1]	1	0.0 ... 95.5	1/16 inch	ft
	2	0.0 ... 95.5	1/16 inch	ft
	3	0.0 ... 255.9	1/8 inch	ft
	4	0.0 ... 170.66	1/8 inch	ft
Temperature[2]		-819.0 ... +819.0	0.2 °F	°F
Alarm 0	State of discrete IO 0			
Alarm 1	State of discrete IO 1			

1)   The level is obtained from the TANK Corrected Level value.

2)   The temperature is obtained from the TANK Temperature value.

4.2   Measured Value Error Handling

The following error handling rules are applied to all values returned in the L&J Tankway message.

4.2.1   Error in Level

If the Tank Corrected Level is invalid or outside of the limits the following will happen:

Condition	Reaction for Types 1 and 2	Reaction for Types 3 and 4
Level Invalid	Invalid Gray Code	Maximum Value
Below Minimum Value	Invalid Gray Code	Minimum Value
Above Maximum Value	Invalid Gray Code	Maximum Value

4.2.2   Error in Temperature

If the Tank Temperature is invalid or outside of the limits the following will happen:

Condition	Reaction for Types 1 and 2	Reaction for Types 3 and 4
Temperature Invalid	Temperature Invalid Bit set	Maximum Value
Below Minimum Value	Minimum Value	Minimum Value
Above Maximum Value	Maximum Value	Maximum Value

5　　　L&J Tankway Message Formats

5.1　　Physical Layer

The L&J Tankway communication takes place on a pair of voltage mode cables normally at 30VDC (one for transmission and one for reception). Bits are represented by digital voltage levels on these cables.
These bits are then assembled in to bytes, two bytes per message block.

5.2　　Request Message

The request is a message block sent from the control room, these bits encode the device whose data is requested as well as the command to be performed.

Byte	Description
1st	Bit 7 is always 1 Bit 0 ... 6 hold the Device ID
2nd	Bits 3 ... 7 are always 0 Bit 2 is set if Temperature 2 is requested[1] (not supported by the Tank Side Monitor) Bit 1 is set if Temperature 1 is requested[1] Bit 0 is set if Level is requested[1]

[1]Only one of these three bits can be set at a time.

5.3　　Reply Message

The reply from the Tank Side Monitor depends on the L&J Tankway interface settings of the Tank Side Monitor. However it always consists of a single message.

5.3.1　　Level Request Reply

This reply from the Tank Side Monitor consists of a message where all 16 bits of the data are used to encode the level value. Depending on the Device Type setting the level will be encoded as follows.

Device Type (22110)	Description
1[1]	1st Byte = Gray code value of the number of 1/2 foots in the level 2nd Byte = Gray code value of the number of 1/16 inch in the level
2[2]	1st Byte = Gray code value of the number of 1/2 foots in the level 2nd Byte = Gray code value of the number of 1/16 inch in the level
3	1st Byte = Binary coded number of whole feet in the level 2nd Byte = Binary coded number of 1/8 inch in the level
4	The full 16 bits of the reply contain the binary coded value representing a number of 32nds of an inch in the level.

1)　　　Uses gray code table for CCW VAREC Tank Gauge.

2)　　　Uses gray code table for CCW Shand & Jurs Tank Gauge.

5.3.2   Temperature Request Reply

This reply from the Tank Side Monitor consists of a message containing the following information.

Device Types 1 and 2

Byte	Description
1st	All bits hold the temperature data bits 0 ... 7[1]
2nd	Bit 7 indicates the status of discrete IO 2 Bit 6 indicates the status of discrete IO 1 Bit 5 if set indicates the temperature is +ve Bit 4 if set indicates the value if over range (or invalid[2]) Bits 0-3 hold the temperature data bits 8-11[1]

1)   The temperature is stored as a binary number representing the number of 0.2ºF in the value.

2)   This is a specific Tank Side Monitor extension to the meaning of this bit.

Device Types 3 and 4

Byte	Description
1st	All bits hold the temperature data bits 0 ... 7[1]
2nd	Bit 7 is set to 1 Bit 6 is set to 0 Bit 5 if set indicates the temperature is +ve Bit 4 is set to 0 Bits 0-3 hold the temperature data bits 8-11[1]

1)   The temperature is stored as a binary number representing the number of 0.2ºF in the value.

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