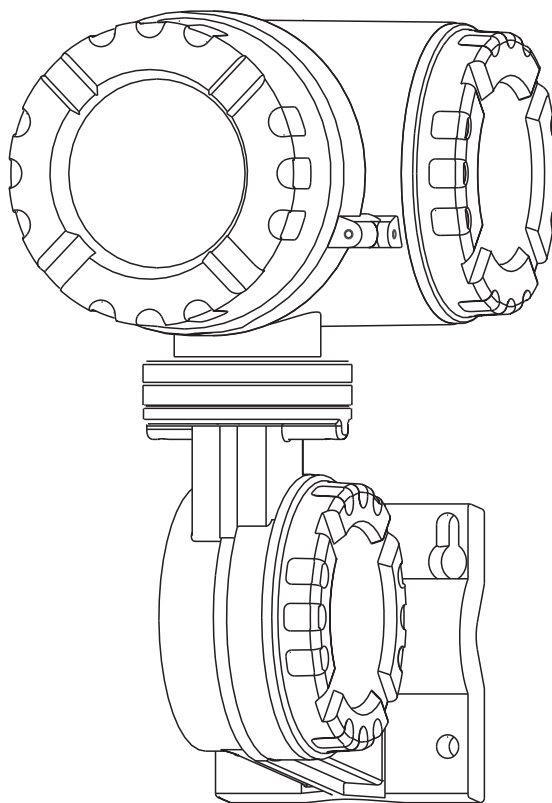


Tank Side Monitor NRF 590



WM550 communication protocol



Endress + Hauser

The Power of Know How



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1 Introduction

This protocol guide explains the operation of the WM550 protocol implemented in the Endress+Hauser Tank Side Monitor NRF 590.

2 Implementation

The implementation of the WM550 protocol for the Tank Side Monitor provides a standard form of digital communication via dual current loops. An effort has been made to parallel current implementations to the greatest extent possible, so that the Tank Side Monitor communicates with existing WM550 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 WM550 master.

The Tank Side Monitor implementation of the WM550 protocol supports the following WM550 tasks

WM550 supported tasks

Task	Sub Task	Task Name
1		Status Report
4		Alarms, Level, Temperature
6		Percentage Level
9		Stow Command
11		Unstow Command
12		Programmed Tank Height
13		Averaging Temperature Data
17	3	BSW value
	10	Datum, Position, Value
	11	Average Density
27		Alarms, Level, Temperature, Percentage Level
28		Alarms, Level, Temperature, Percentage Level
30		Alarms, Level, Temperature, Percentage Level, Pressure
31		Alarms, Level, Temperature, Percentage Level, Pressure
32		Software Identification and Date
36		Alarms, Level, Temperature, Percentage Level, Pressure, Head Status, Position
38		Intelligent Sensing Head Command

3 Configuration

The WM550 ports on the Tank Side Monitor must each be configured to establish communications. The local display or ToF tool allows the user to set the Tank Side Monitor WM550 ports to match the WM550 master.

3.1 Address

Tank Side Monitor addresses provide unique identification for the host. The Tank Side Monitor address (ID) is configurable through the local display or ToF tool. This address may range from 0 to 63 and must be unique for each WM550 device on a loop. 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 WM550 loop a number of configuration settings must be made to match the configuration of the loop.

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.

WM550 configuration information

Configuration parameter	Valid Entries	Default
ID	0 ... 63	1
Baudrate	<ul style="list-style-type: none"> • 150 • 300 • 600 • 1200 • 1800 • 2400 • 4800 	2400
Comm Params	<ul style="list-style-type: none"> • 8N • 8O • 8E • 7O • 7E 	8E
Alarm 1	<ul style="list-style-type: none"> • DIO#1 • DIO#2 • AAL#1 High-High • AAL#1 High¹ • AAL#1 Low² • AAL#1 Low-Low 	AAL#1 High-High
Alarm 2		AAL#1 High
Alarm 3		AAL#1 Low
Alarm 4		AAL#1 Low-Low
Software ID	0 ... 9999	2000

- 1) If an alarm bit is set to AAL#1 High, it will be set for both AAL#1 High and AAL#1 High-High alarm conditions.
- 2) If an alarm bit is set to AAL#1 Low, it will be activated for both AAL#1 Low and AAL#1 Low-Low alarm conditions.

3.2.2 Description of Configuration Parameters

Both WM550 loops have a set of the following settings, the menu numbers will have n=1 for loop #1 and n=2 for loop#2.

ID (20n09)

This is a unique number for this device on the WM550 loop, only when the Tank Side Monitor receives a message with this number is a response generated.

Baudrate (20n10)

Specifies the communication speed used on the WM550 loop.

Comm Params (20n11)

Specifies the byte format (7 or 8 bits) and the parity (None, Odd or Even) to be used during communication on the WM550 loop.

Alarm1 (20n12)

Specifies which internal discrete IO or alarm from AAL#1 is mapped to the WM550 alarm bit #1.

Alarm2 (20n13)

Specifies which internal discrete IO or alarm from AAL#1 is mapped to the WM550 alarm bit #2.

Alarm3 (20n14)

Specifies which internal discrete IO or alarm from AAL#1 is mapped to the WM550 alarm bit #3.

Alarm4 (20n15)

Specifies which internal discrete IO or alarm from AAL#1 is mapped to the WM550 alarm bit #4.

Software ID (20n16)

Specifies the value returned by Task 32.

4 Measured values

4.1 Measured Value Ranges

The WM550 response will contain a number of measurement values, level, temperature, percentage, density and pressure. These values are subject to the following limits.

Measured Value	Minimum	Maximum	Granularity	Units	Tank Parameter ¹
Level	0	65000	1	mm	Corr. Level
Temperature	-400.0	+400.0	0.1	°C	Temp.
Percentage	0.00	100.00	0.01	%	Percentage Range ²
Pressure	0.0	25.0	0.1	bar	P3 (Top) Pressure
Density	0.0	9999.9	0.1	kg/m ³	Obs. Density
Tank Height	0	65000	1	mm	Tank Ref Hght
BSW	0	9999	1	mm	Water Level
Element Temps	-200.0	+200.0	0.1	°C	NMT Element Temps ³

- 1) This column indicates the source of the value return by the WM550 communication.
- 2) The percentage is calculated from the TANK Corrected Level and TANK reference height values.
- 3) Element temperatures can only be provided if a NMT multi-element temperature device is connected to the Tank Side Monitor. In this case the first value returned is the NMT Element #1 temperature value, the second is NMT Element #2, etc.

4.2 Measured Value Error Handling

The following error handling rules are applied to all values returned in the WM550 message:

1. If a value (level, temperature or any other) is below the minimum value then the minimum value is returned.
2. If a value (level, temperature or any other) is above the maximum value then the maximum value is returned.
3. If a value (level, temperature or any other) is undefined, invalid or offline the appropriate WM550 invalid bit or code is returned for that value along with the diagnostic code 0.



Note!

If an Endress + Hauser FMR radar is connected to the Tank Side Monitor and used for level values, a "in safety distance" or "echo lost" error condition will cause a maximum level value to be returned on the WM550 bus and not a data invalid. The FMR and Tank Side Monitor must be properly configured for alarm handling, refer to Tank Side Monitor documentation for details.

5 WM550 Message Formats

5.1 Physical Layer

The WM550 communication takes place on a 20mA current loop. Bits are represented by current flowing or not in the loop. These bits are generated and interpreted by a standard serial communication controller (UART) running at the selected baudrate and communication settings.

Each group of 7 or 8 bits together with their start, stop and parity if required represents an ASCII character forming the elements of the messages.

5.2 Protocol Layer

The request messages on the bus (called Tasks) instruct the device what data or action is required, the device will then reply with the appropriate response.

Below you will find information for the supported tasks which shows the value returned by the Tank Side Monitor to the given request. It is not intended to fully describe the WM550 protocol which can be found in the "Whessoe Varec Fieldbus Protocol Definition" document (1st January 1997).

5.2.1 Task 1 (Status Report)

Value	Type	Value Returned	Notes
Gauge Servoing	bit	0	
Gauge Stowed	bit	0	
Stow Received on Port 1	bit	0	
Stow Received on Port 2	bit	0	
NOVRAM corrupted	bit	0	
Multi-element Thermometer fitted	bit	<ul style="list-style-type: none"> • 0 if no NMT53x connected • 1 if NMT53x connected 	
Selected Element of Thermometer	number	<ul style="list-style-type: none"> • 0 if no NMT53x connected • 1 if NMT53x connected 	
Ref. Voltage	number	0	
Ref. Voltage is DN	bit	0	
Calibration	2 bits	0	

5.2.2 Tasks 4 (Alarms, Level, Temp), 9 (Stow), 11 (Unstow)

Value	Type	Value Returned	Notes
Alarm No 1	bit	1 if linked discrete IO or alarm is on.	
Alarm No 2	bit	1 if linked discrete IO or alarm is on.	
Alarm No 3	bit	1 if linked discrete IO or alarm is on.	
Alarm No 4	bit	1 if linked discrete IO or alarm is on.	
Servo Check	bit	1 if a die freeze is in progress	
Level	number	from Tank Corr. Level	in mm
Temperature	number	from Tank Temp.	in 0.1 °C

5.2.3 Task 6 (Percentage Level)

Value	Type	Value Returned	Notes
Percentage Level	number	from Tank Percent Range	in 0.01%

5.2.4 Task 12 (Programmed Tank Height)

Value	Type	Value Returned	Notes
Alarm No 1	bit	1 if linked discrete IO or alarm is on.	
Alarm No 2	bit	1 if linked discrete IO or alarm is on.	
Alarm No 3	bit	1 if linked discrete IO or alarm is on.	
Alarm No 4	bit	1 if linked discrete IO or alarm is on.	
Servo Check	bit	1 if a die freeze is in progress	
Tank Height Level	number	from Tank Ref Hght.	in mm

5.2.5 Task 13 (Averaging Thermometer Data)

If an NMT53x is connected to the Tank Side Monitor this task returns the element numbers and temperature for each element in the device.

Value	Type	Value Returned	Notes
Element Number	number	1 ... 15	
Element Temperature	number	from NMT Element #1 ... #15	in 0.1 °C

5.2.6 Task 17 (Density and BSW Probe Data)

Sub-Task 3 (BSW Value)

Value	Type	Value Returned	Notes
BSW	number	from Tank Water Level	in mm

Sub-Task 10 (Datum Position Value)

Value	Type	Value Returned	Notes
Datum	number	0	in mm

Sub-Task 11 (Density Value)

Value	Type	Value Returned	Notes
Density	number	from Tank Obs. Density	in 0.1 kg/m ³
Temperature	number	from Tank Temp.	in 0.1 °C

5.2.7 Tasks 27 and 28 (Alarms, Level, Temperature, Percent Level)

Value	Type	Value Returned	Notes
Alarm No 1	bit	1 if linked discrete IO or alarm is on.	
Alarm No 2	bit	1 if linked discrete IO or alarm is on.	
Alarm No 3	bit	1 if linked discrete IO or alarm is on.	
Alarm No 4	bit	1 if linked discrete IO or alarm is on.	
Servo Check	bit	1 if a die freeze is in progress	
Level	number	from Tank Corr. Level	in mm
Temperature	number	from Tank Temp.	in 0.1 °C
Percentage Level	number	from Tank Percent Range	in 0.01%

5.2.8 Tasks 30 and 31 (Alarms, Level, Temperature, Percent Level, Pressure)

Value	Type	Value Returned	Notes
Alarm No 1	bit	1 if linked discrete IO or alarm is on.	
Alarm No 2	bit	1 if linked discrete IO or alarm is on.	
Alarm No 3	bit	1 if linked discrete IO or alarm is on.	
Alarm No 4	bit	1 if linked discrete IO or alarm is on.	
Servo Check	bit	1 if a die freeze is in progress	
Level	number	from Tank Corr. Level	in mm
Temperature	number	from Tank Temp.	in 0.1 °C
Percentage Level	number	from Tank Percent Range	in 0.01%
Pressure	number	from Tank P3 (Top) Pressure	in 0.1 bar

5.2.9 Task 32 (Software Identification and Date)

Value	Type	Value Returned	Notes
Software ID	number	from "Software ID" (20n16)	
Software Date	number	day, month, year	

5.2.10 Task 36 (Alarms, Level, Temperature, Percent level, Pressure, Head Status, Positions)

Value	Type	Value Returned	Notes
Alarm No 1	bit	1 if linked discrete IO or alarm is on.	
Alarm No 2	bit	1 if linked discrete IO or alarm is on.	
Alarm No 3	bit	1 if linked discrete IO or alarm is on.	
Alarm No 4	bit	1 if linked discrete IO or alarm is on.	
Servo Check	bit	1 if a die freeze is in progress	
Level	number	from Tank Corr. Level	in mm
Temperature	number	from Tank Temp.	in 0.1 °C
Percentage Level	number	from Tank Percent Range	in 0.01%

Value	Type	Value Returned	Notes
Pressure	number	from Tank P3 (Top) Pressure	in 0.1 bar
Seeking Level	bit	0	
Doing Profile	bit	0	
Doing Dip	bit	0	
Finding BSW	bit	0	
Following BSW	bit	0	
Finding Datum	bit	0	
Following Level	bit	0	
Density Sensor	bit	0	
Temperature Sensor	bit	0	
BSW Sensor	bit	0	
Datum Sensor	bit	0	
1 Minute Warning	bit	0	
Configuration Warning	bit	0	
Liquid State (1=homogenous)	bit	0	
Liquid State Unknown	bit	0	
ISH fitted	bit	0	
Sensor Positions	number	invalid value	

5.2.11 Task 38 (Intelligent Sensing Head Command)

Same data is returned as in Task 36. The command and control information in the request is ignored.

5.2.12 Un-supported Tasks

If a request is received by the Tank Side Monitor for a task which it does not support, a "Task 0: Error Return" message is sent as the reply with the error number "1".

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