Proservo
NMS 53x

WM550 communication protocol
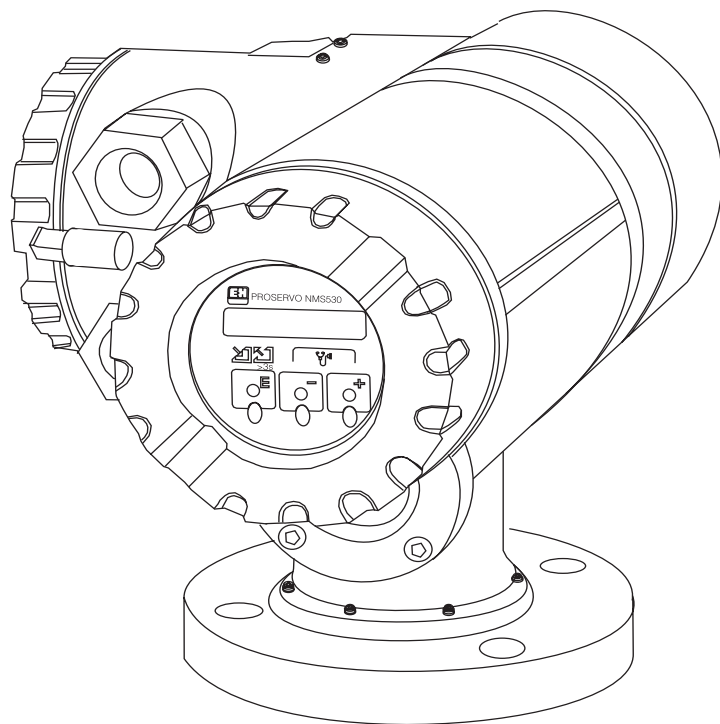
Endress + Hauser

The Power of Know How

Table of contents

1   Introduction

This protocol guide explains the operation of the WM550 protocol implemented in the Endress + Hauser Proservo NMS 53x.
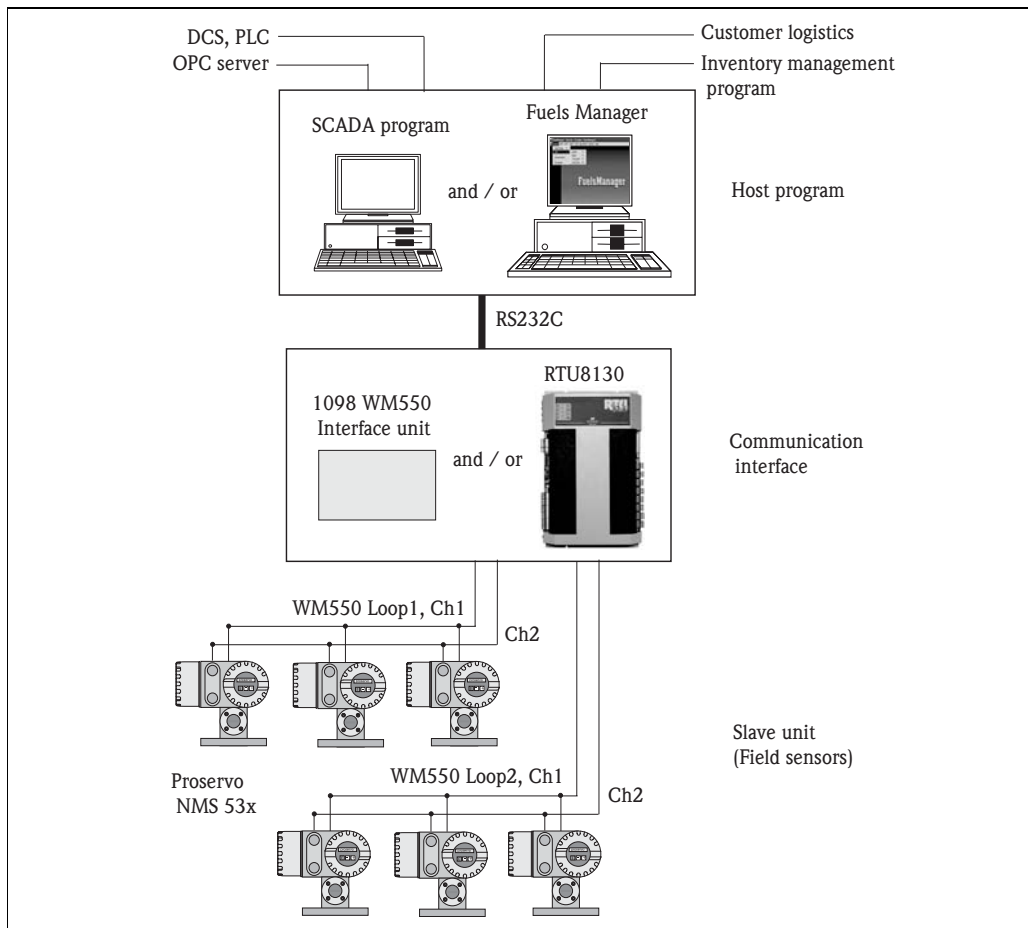

Diagram1. Typical WM550 implementation for the Proservo NMS 53x

2   Implementation

The implementation of the WM550 protocol for the Proservo provides a standard form of digital communication via dual current loops. Am effort has been made to parallel current lmplementations to the greatest extent possible, so that the Proservo communicates with existing WM550 masters.

Check compatibility carefully to ensure that the Proservo is properly configures for the data format expected by the host system or computer. Exceptions made because of the unique requirements of the Proservo 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 Proservo implementation of the WM550 protocol supports the following WM550 tasks.

WM550 supported tasks

Task	Sub Task	Task Name	Note
0	1	Error return	
1		Status report	with servo check
2		Alarms and Level	(& cancel servo check)
3		Alarms and Level	with servo check
4		Alarms, Level and Temperature	(& cancel servo check)
5		Alarms, Level and Temperature	
6		Percentage level	
9		Stow command	(& cancel servo check)
10		Unstow cmd by port	
11		Unstow gauge	(unstow regardless of port)
13		Average thermometer data	
17	3	BSW value	Upper I/F level or Water Bottom
	9	Density value	Upper density
	10	Datum position value	Tank height
	11	Average density	Average density
27		Alarm, Level, Temp & Percent level	with servo check
30		Alarm, Level, Temp, Percent level & Pressure	(& cancel servo check)
31		Alarm, Level, Temp, Percent level & Pressure	with servo check
32		Software ID & date	
36		Alarm, Level, Temp, Percent level Pressure, Head status & Head pos	(& cancel servo check)
37		Alarm, Level, Temp, Percent level Pressure, Head status & Head pos	with servo check
38		Command ISH	

3   Configuration

The WM550 ports on the Proservo must each be configured to establish communications. The local display and mechanical dip switch on the Proservo allows the user to set the Proservo ports to match the WM550 master.

3.1   Address

Proservo addresses provide unique identification for the host. The Proservo address (ID is configurable through the mechanical dip switch on the WM550 COM board on the Proservo. This address nay range from 0 to 31 and must be unique to each WM550 device on a loop. Each Proservo 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 Proservo is shown in the following table.

WM550 configuration information

Configuration parameter	Valid entries	Default
ID	0... 31	Dip switch value
Baudrate	150 300 600 1200 1800 2400 4800	Auto select
COMM parameters	8 bit, EVEN parity	fixed
Alarm 1		High alarm
Alarm 2		High alarm
Alarm 3		Low alarm
Alarm 4		Low alarm

3.2.2   Description of Configuration Parameters

Both WM550 loops have a set of the following settings.

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

Baud rate
Specifies the communication speed used on the WM550 loop.

Comm Parameters
Specifies the byte format(8 bits) and the parity (EVEN) to be used during communication on the WM550 loop.

Alarm 1
Specifies which internal (I/O-3 configuration) alarm setting is mapped to the WM550 alarm bit #1.

Alarm 2
Specifies which internal (I/O-3 configuration) alarm setting is mapped to the WM550 alarm bit #2.

Alarm 3
Specifies which internal (I/O-3 configuration) alarm setting is mapped to the WM550 alarm bit #3.

Alarm 4
Specifies which internal (I/O-3 configuration) alarm setting is mapped to the WM550 alarm bit #4.

3.3   External configuration settimgs

3.3.1   GVH292 "WM550 ALARM SEL"

Configuration variable: 1-4
Default: 1
Access code: 51
This newly added matrix field has an alarm output configuration function. It is designated to WM550 communication when the Proservo's I/O-3 (BIT3) is ON, WM550 will reply corresponding bit ON. The switching orientation (N/O or N/C) shall be selected at GVH291 "SELECT CONTACT" as well.

1: Alarm No.1 (High-High alarm) = ON
2: Alarm No.2 (High alarm) = ON
3: Alarm No.3 (Low alarm) = ON
4: Alarm No.4 (Low-Low alarm) = ON

Note!
Since the Proservo NMS employs the modular design structure, an independent alarm output module "I/O-3" has to be installed & recognized by the main CPU module prior to initiate alarm settings.

3.3.2   GVH293 "WM550 BSW SEL"

Configuration variable: 0 or 1
Default: 0
Access code: 51
The operator must select the method of BSW measurement function to output on the WM550 communication.

0: Upper I/F Level
  – A measured value via the displacer of Proservo.
  – BSW value from GVH002 "UPPER I/F LEVEL"

1: WATER BOTTOM
  – A measured value via the capacitance probe on the Prothermo NMT 539.
  – BSW value from GVH014 "WATER BOTTOM"

3.3.3   GVH294 "WM550 DENS SEL"

Configuration variable: 0 - 2
Default: 0
Access code: 51
The operator shall select the WM550 output density measurement value, along with designated temperature value, from one of following three options based on the requirement.

0: Upper Density
A measured value from single spot density within the highest layer of the liquid phases (if multiple layer exist in the tank). Data will be acquired from following matrix fields.
• Density value: GVH005 "UPPER DENSITY"
• Temperature value: GVH010 "LIQUID TEMP"

1: Tank Profile Average Density
A measured value of the true average density based on the multiple points density profiling throughout the tank. Data will be acquired from following matrix fields.
Note!
The Tank Profile density measurement may take several minutes to 1hour depending on the number of profiling point selected and the level height

• Density value: GVH854 "AVERAGE DENSITY"
• Temperature value: GVH855 "AVERAGE TEMP"

2: I/F Profile Average Density
A measured value of the true average density based on the multiple points density profiling within the upper layer liquid in the tank. The measurement will begin to detect the oil / water interface first (manual input function available), then density profile to follow. Data will be acquired from following matrix fields.
Note!
The I/F Profile density measurement may take several minutes to 1hour depending on the number of profiling point selected and the level height

• Density value: GVH954 "AVERAGE DENSITY"
• Temperature value: GVH955 "AVERAGE TEMP"

3.3.4   GVH368 "IF_LEVEL_SELECT"

Configuration variable: 0 - 2
Default: 0
Access code: 51
Selection of the assigned upper interface value on WM550 communication, via the measurement
by NMS's own displacer or the WB measurement by NMT539.
0: UP_IF_LEVEL
The upper IF value is only available with NMS's displacer measurement. No WB value is
available at all.

1: WATER BOTTOM
The WB measured value is collected by free scan on the HART loop when NMT 539 is connected.
Note!
The measured value, on the other hand; is assigned and replied when the WM550 master requests
and issues the upper IF command to the NMS.

2: WATER BOTTOM 2
The WB measured value is collected by free scan on the HART loop when NMT 539 is connected.
Note!
The measured value by the NMT 539 WB is continuously scanned and replied to the WM550
master regardless of the specific SERVO command is given.

3.3.5   GVH295 "WM550_SW_ID_20xx"

Configuration variable: 0 - 99
Default: 37
Access code: 51
The software ID number setting for WM550 communication on the NMS. The configuration
variables from 2000 - 2099 is available for the NMS to perform designated function.

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	Min.	Max.	Granular-ity	Units	Matrix description (GVH) *1
Level	0	65000	1	mm	MEASURED LEVEL (000)
Temperature	-400.0	+400.0	0.1	°C	LIQUID TEMP. (010)
Percentage	0.0	100.0	0.1	%	*2
Pressure	0.0	25.0	0.1	bar	PV DATA (540)
Density	0.0	9999.9	0.1	kg/cm^3	UPPER DENSITY (005)
Tank height	0	65000	1	mm	TANK HEIGHT (140)
BSW	0	9999	1	mm	UPPER INTERF. LEV. (002) or WATER BOTTOM (014)*3 or WATER BOTTOM 2 (444)*4
Element temp.	-200.0	+200.0	0.1	°C	TEMP. NO.x (450 ~ 459)*5

- *1: This column indicates the source of the value originally locate and return by the WM550 communication.
- *2: The percentage is calculated from the MEASURED LEVEL (000) and TANK HEIGHT (140) value.
- *3: The WB measured value when the "Upper IF Level" gauge command is issued from WM550 master. It is available unless UP_IF_LEVEL is selected at GVH368.
- *4: The continuous WB measured value regardless of the gauge command from the WM550 master. It is also available unless UP_IF_LEVEL is selected at GVH368.
- *5: Element value only can be provided if the Prothermo NMT 53x multi-element temperature device is connected to the Proservo. In this case the first value returned is the NMT Element #1 (450), the second is NMT Element #2 (451), and so on...

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 ant other) is below the minimum value then the minimum value is returned.
2. If a value (level, temperature or ant 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.

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 there start, stop and parity if required represents an ACSII character forming the elements of the messages.

5.2 Protocol layer

The request message 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 Proservo 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	
Srow Received on Port 2	bit	0	
NOVRAM corrupted	bit	0	
Multi-element Thermometer fitted	bit	0 - 1, GVH662 "CONNECT NMT"	
Selected Element of Thermometer	number	0 - 1, GVH662 "CONNECT NMT"	
Ref, Voltage	number	0	
Ref. Voltage is DN	bit	0	
Calibration	2 bits	0	

5.2.2   Task 2 & Task 3 (Alarms and Level),
Task 4 & 5 (Alarms, Level and Temperature),
Task 9 (Stow command), Task 10 (unstow) and Task 11 (unstow)

Value	Type	Value returned	Notes
Alarm No. 1	bit	1 if configured I/O 3 activated	
Alarm No. 2	bit	1 if configured I/O 3 activated	
Alarm No. 3	bit	1 if configured I/O 3 activated	
Alarm No. 4	bit	1 if configured I/O 3 activated	
Servo Check	bit	1 if a die freeze is in progress	
Level	number	from GVH000 "MEASURED LEVEL"	in 0.1 mm
Temperature	number	from GVH010 "LIQUID TEMP"	in 0.1°C

5.2.3   Task 6 (Percentage level)

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

5.2.4   Task 13 (Average Thermometer Data)

Value	Type	Value returned	Notes
Element Number	number	1... 15, from GVH482 "TOTAL NO. ELEMENT"	
Element Temperature	number	from GVH450 ~ GVH459 "NMT Element #1 ~ #15" and GVH473 "ELEMENT TEMP"	Temperature above 11th element is displayed on GVH473 only

5.2.5   Task 17 (Density and BSW Probe Data)

Sub-Task 3 (BSW value)

Value	Type	Value returned	Notes
BSW	number	from GVH002 "UPPER I/F LEVEL"	in mm

Sub-Task 10 (Datum Position Value)

Value	Type	Value returned	Notes
Datum	number	from GVH000 "MEASURED LEVEL"	in mm

Sub-Task 9 (Density value)

Value	Type	Value returned	Notes
Density	number	from GVH005 "UPPER DENSITY"	in 0.1kg/cm^3

Sub-Task 11 (Density Value)

Value	Type	Value returned	Notes
Density	number	from GVH005 "UPPER DENSITY"	in 0.1kg/cm^3
Temperature	number	from GVH010 "LIQUID TEMP"	in 0.1°C

5.2.6   Task 27 & 28 (Alarms, Level, Temp and Percent Level)

Value	Type	Value returned	Notes
Alarm No. 1	bit	1 if configured I/O 3 activated	
Alarm No. 2	bit	1 if configured I/O 3 activated	
Alarm No. 3	bit	1 if configured I/O 3 activated	
Alarm No. 4	bit	1 if configured I/O 3 activated	
Servo Check	bit	1if a die freeze is in progress	
Level	number	from GVH000 "MEASURED LEVEL"	in 0.1 mm
Temperature	number	from GVH010 "LIQUID TEMP"	in 0.1°C
Percentage Level	number	from Tank Percentage Range	in 0.01%

5.2.7   Task 30 & 31 (Alarms, Level, Temp, Percent Level and Pressure)

Value	Type	Value returned	Notes
Alarm No. 1	bit	1 if configured I/O 3 activated	
Alarm No. 2	bit	1 if configured I/O 3 activated	
Alarm No. 3	bit	1 if configured I/O 3 activated	
Alarm No. 4	bit	1 if configured I/O 3 activated	
Servo Check	bit	1if a die freeze is in progress	
Level	number	from GVH000 "MEASURED LEVEL"	in 0.1 mm
Temperature	number	from GVH010 "LIQUID TEMP"	in 0.1°C
Percentage Level	number	from Tank Percentage Range	in 0.01%
Pressure	number	from GVH540 "PV DATA)"	in 0.1 bar

5.2.8   Task 32 (Software identification and Date)

Value	Type	Value returned	Notes
Software ID	number	2000 or 2037	
Software Date	number	day, month, year	DD/MM/YY

5.2.9 Task 36 & 37 (Alarms, Level, Temp, Percent Level, Pressure, Head Status and Position), Task 38 (Intelligent Sensing Head Command)

Value	Type	Value returned	Notes
Alarm No. 1	bit	1 if configured I/O 3 activated	
Alarm No. 2	bit	1 if configured I/O 3 activated	
Alarm No. 3	bit	1 if configured I/O 3 activated	
Alarm No. 4	bit	1 if configured I/O 3 activated	
Servo Check	bit	1if a die freeze is in progress	
Level	number	from GVH000 "MEASURED LEVEL"	in 0.1 mm
Temperature	number	from GVH010 "LIQUID TEMP"	in 0.1°C
Percentage Level	number	from Tank Percentage Range	in 0.01%
Pressure	number	from GVH540 "PV DATA)"	in 0.1 bar
Seeking Level	bit	from GVH021 "OPERATING STATUS"	
Doing Profile	bit	0	
Doing Dip	bit	0	
FInding BSW	bit	from GVH021 "OPERATING STATUS"	
Following BSW	bit	from GVH021 "OPERATING STATUS"	
Finding Datum	bit	0	
Following Level	bit	from GVH021 "OPERATING STATUS"	
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	from GVH000 "MEASURED LEVEL"	in mm

5.2.10 Un-supported Tasks

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

Endress+Hauser

The Power of Know How