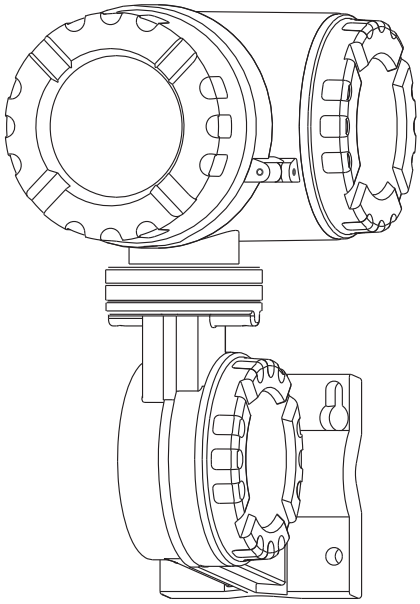
4590 Tank Side Monitor

WM550 Communication Protocol

Service Manual

Software Versionv2.03



Varec, Inc.
5834 Peachtree Corners East, Norcross (Atlanta), GA 30092 USA
Tel: +1 (770) 447-9202 Fax: +1 (770) 662-8939

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5834 Peachtree Corners East
Norcross (Atlanta), GA 30092
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Contents

1 Introduction

This protocol guide explains the operation of the WM550 protocol ????per Modicon document PI-MBUS-300 Rev C (1991) implemented in the Varec 4590 Tank Side Monitor (TSM).

2 Implementation

The implementation of the WM550 protocol for the 4590 TSM provides a standard form of digital communication via dual current loops. An effort has been made to provide the most complete and functional WM550 implementation in the 4590 TSM in order to communicate with existing WM550 masters.

Check compatibility carefully to ensure that the 4590 TSM is properly configured for the data format expected by the host system or computer. Due to the unique application requirements of the 4590 TSM application, exceptions have been made and noted.

Note! There is no guarantee that the interpretation made here is the same as that followed by the WM550 master.

The 4590 TSM implementation of the WM550 protocol supports a variety of tasks. For a detailed description, see Section 6-2 Protocol Layer.

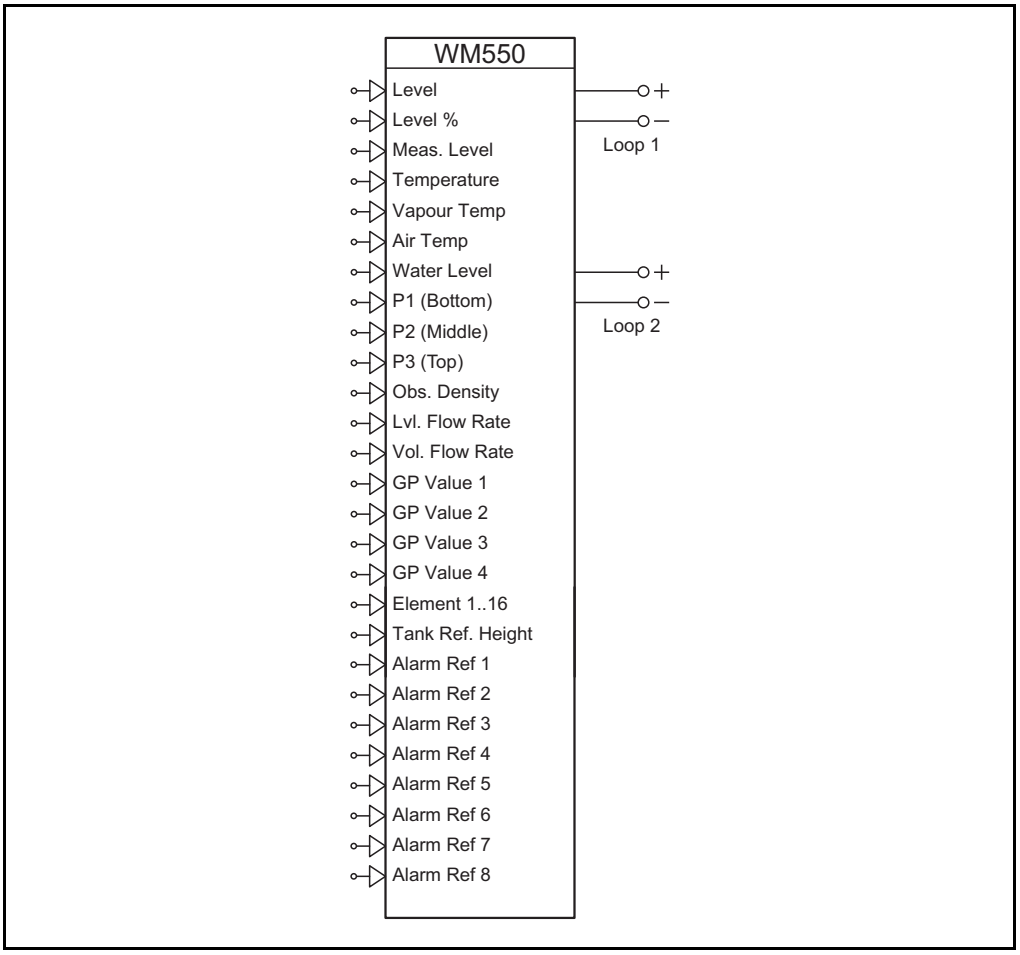

Figure 2-1: Function Block "WM550 Output"

3 Installation Recommendations

3.1 Cable Specifications for the WM550 Protocol

Follow these recommendations for field installation of the 4590 TSM with the WM550 protocol variant:

- Use cable with twisted and non-shielded pairs
- Use cable with at least 0.5 mm^2 section
- Maximum total cable resistance: 250 Ω
- Cable with low capacitance
- The maximum number of field devices for the WM550 protocol is 16 (excluding the master unit)

The use of a cable with a large cross-section is advised for long cable length, but may require the use of a slower baud rate because of the higher capacitance.

Table 3-1 summarizes the physical characteristics of three typical cables.

Table 3-1: Typical Cable Specifications

	Cross Section [mm^2]	Resistance [Ω /km]	Capacitance [nF/km]
Cable 1	0.5	39.2	60
Cable 2	0.75	24.6	65
Cable 3	1.3	14.2	75

3.2 Example Topology

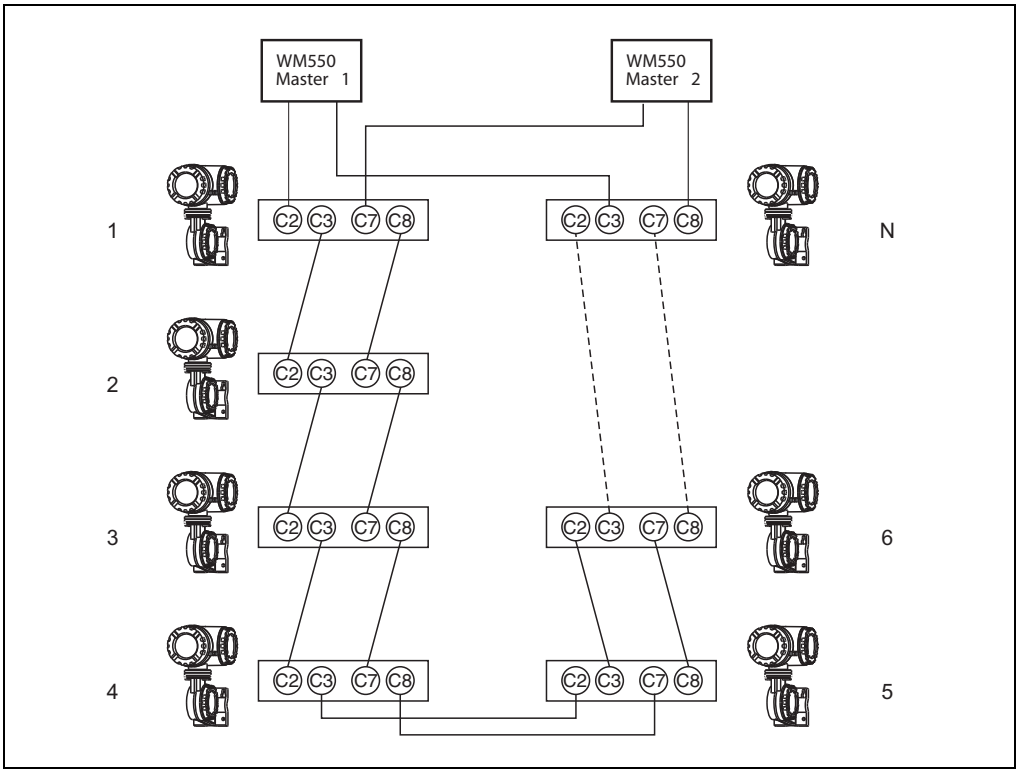

Figure 3-1: Example Topology

4 Configuration

The WM550 ports (loop 1 and loop 2) on the 4590 TSM must each be configured to establish communication. The local display or ToF tool allows the user to set the 4590 TSM WM550 ports to match the WM550 master settings.

4.1 Address

The 4590 TSM addresses provide unique identification for the host. The 4590 TSM address is configured 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 4590 TSM only responds when a query has been sent to its unique address by the host.

4.2 Configuration Settings

To achieve successful communication on a WM550 loop, a number of configuration settings must be entered to match the configuration of the loop. Refer to Chapter 2, Implementation for a summary of the configuration information required by the 4590 TSM.

4.2.1 Summary of Configuration Parameters

Table 4-1 summarizes the configuration parameters required by the 4590 TSM.

Table 4-1: WM550 Configuration Information

Configuration Item	Valid Entries	Default
ID	0 – 63	1
Baudrate	• 150 • 300 • 600 • 1200 • 1800 • 2400 • 4800	2400
Loop 2	As loop 1, Different	As loop 1
Baudrate 2	• 150 • 300 • 600 • 1200 • 1800 • 2400 • 4800	2400
Software ID	0 – 9999	2000
Alarm 1	Reference to any discrete or alarm value inside the 4590 TSM	Level Alarm HH
Alarm 2		Level Alarm H[1)]

Configuration Item	Valid Entries	Default
Alarm 3	Reference to any discrete or alarm value inside the 4590 TSM	Level Alarm L[2)]
Alarm 4		Level Alarm LL
Alarm 5		Undefined[3)]
Alarm 6		Undefined[3)]
Alarm 7		Undefined[3)]
Alarm 8		Undefined[3)]

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

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

3) These parameters are not currently in use and are present for future expansion only.

4.2.2 Description of Configuration Parameters

Table 4-2 summarizes the configuration parameters that make up the Basic Setup. The numbers in parentheses indicate the menu position.

Table 4-2: Submenu "Basic Setup" (921X)

Field	Description	Default	Protected
ID(9211)	This is the identifier value. The 4590 TSM responds to requests which contain this identifier value.	1	W&M Switch
Baud Rate(9212)	Selects which of the possible baud rates communication should work at.	2400	W&M Switch
Software Id(9213) (Software Identification Value)	Describes which parity type is used for the communication.	2000	W&M Switch

Table 4-3 summarizes the configuration parameters that make up the Extended Setup. The numbers in parentheses indicate the menu position.

Table 4-3: Submenu "Extended Setup" (922X)

Field	Description	Default
Alarm Ref 1 (9221) (Alarm No 1 Reference)	Indicates which discrete value is transmitted as Alarm Bit 1.	Level Alarm, Alarm HH Active
Alarm Ref 2 (9222) (Alarm No 2 Reference)	Indicates which discrete value is transmitted as Alarm Bit 2.	Level Alarm, Alarm H Active
Alarm Ref 3 (9223) (Alarm No 3 Reference)	Indicates which discrete value is transmitted as Alarm Bit 3.	Level Alarm, Alarm L Active
Alarm Ref 4 (9224) (Alarm No 4 Reference)	Indicates which discrete value is transmitted as Alarm Bit 4.	Level Alarm, Alarm LL Active
Alarm Ref 5 (9225) (Alarm No 5 Reference)	Indicates which discrete value is transmitted as Alarm Bit 5.	Undefined
Alarm Ref 6 (9226) (Alarm No 6 Reference)	Indicates which discrete value is transmitted as Alarm Bit 6.	Undefined
Alarm Ref 7 (9227) (Alarm No 7 Reference)	Indicates which discrete value is transmitted as Alarm Bit 7.	Undefined
Alarm Ref 8 (9228) (Alarm No 8 Reference)	Indicates which discrete value is transmitted as Alarm Bit 8.	Undefined

Table 4-4 summarizes the configuration parameters that make up the Loop 2 Setup. The numbers in parentheses indicate the menu position.

Table 4-4: Submenu "Loop 2" (923X)

Field	Description	Default	Protected
Loop 2 (9231) (Loop 2 Operation Mode)	Specifies if both loops use the same baud rate or not.	As Loop 1	W&M Switch
Baud Rate (2) (9232) Baud Rate (Loop 2)	Selects which of the possible baud rates the second loop will communicate with if the loop mode is set to different; otherwise, both loops will use the normal baud rate.	2400	W&M Switch

Table 4-5 summarizes the configuration parameters that make up the Diagnotics Submenu. The numbers in parentheses indicate the menu position.

Table 4-5: Submenu "Diagnostics"(924X)

Field	Description	Height of Bar
Output Status(9241)	The Communication Status Graph (CSG) provides a simple graphical overview of communication between the gauges and the control room.	The height of the bar represents the activity during the last second: • Replied to Host (largest bar) • Received request for this 4590 TSM • Request for another gauge on the same bus • Bytes were detected on the bus • Bits were detected on the bus (smallest bar) • Nothing detected (no bar, gap in graph)

Under normal operating conditions, only the first three items should be seen (with or without gaps).

Table 4-6 summarizes the configuration parameters that make up the Diagnotics 2 Submenu. The numbers in parentheses indicate the menu position.

Table 4-6: Submenu "Diagnostics 2"(925X)

Field	Description	Height of Bar
Output Status(9251)	The Communication Status Graph (CSG) provides a simple graphical overview of communication between the gauges and the control room.	The height of the bar represents the activity during the last second: • Replied to Host (largest bar) • Received request for this 4590 TSM Request for another gauge on the same bus • Bytes were detected on the bus • Bits were detected on the bus (smallest bar) • Nothing detected (no bar, gap in graph)

Under normal operating conditions, only the first three items should be seen (with or without gaps).

5 Measured Values

5.1 Measured Value Ranges

The WM550 response contains a number of measurement values, level, temperature, percentage, density, and pressure.

Table 5-1 summarizes the measurement values and the limits they are subject to.

Table 5-1: Measured Value Ranges

Measured Value	Minimum	Maximum	Granularity	Units	Tank Parameter [1]
Level	0	65000	1	mm	Level
Temperature	-400.0	+400.0	0.1	°C	Temperature
Percentage [2]	0.00	100.00	0.01	%	Percentage Level[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	453x ATC Element Temps [3]

1) This column indicates the source of the value returned by the WM550 communication.

2) The percentage is calculated from the Level and Reference Height values.

3) Element temperatures can only be provided if a NMT??? multi-element temperature device is connected to the 4590 TSM. In this case, the first value returned is the NMT Element #1 temperature value, the second is NMT??? Element #2, and so on.

5.2 Measured Value Error Handling

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

Refer to Table 5-1 for the related minimum and maximum values.

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

Note! If a Varec FMR radar ??? is connected to the 4590 TSM and is used for level values, an “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” error condition. The FMR and 4590 TSM must be properly configured for alarm handling. ?????Refer to the 4590 TSM documentation????? for details.

6 WM550 Message Formats

6.1 Physical Layer

The WM550 communication takes place on a 20 mA current loop. Bits are represented by current flowing (not in the loop). These bits are generated and interpreted by a standard serial communication controller (UART) running at the selected baud rate and communication settings. Refer to Section 4.2.2 Description of Configuration Parameters for details.

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

6.2 Protocol Layer

The request message on the bus (called Tasks) instruct the device as to what data or action is required. The device will reply with the appropriate response.

Below you will find information for the supported tasks which shows the value returned by the 4590 TSM 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 (January 1, 1997).

Tables 6-1 thru 6-15 give an overview of the different tasks and subtasks supported by the 4590 TSM.

Table 6-1: 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 -------- 10 -------- 11	BSW Value ---------- Datum, Position, Value ---------- Average Density
18	3 -------- 4	BSW Value ---------- 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

Task	Sub Task	Task Name
36		Alarms, Level, Temperature, Percentage Level, Pressure, Head Status, Position
38		Intelligent Sensing Head Command

Task 1 (Status Report)

Table 6-2: 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	• 0 = No 453x ATC connected • 1 = 453x ATC connected	
Selected Element of Thermometer	number	• 0 = No 453x ATC connected • 1 = 453x ATC connected	
Ref. Voltage	number	0	
Ref. Voltage is DN	bit	0	
Calibration	2 bits	0	

Task 4 (Alarms, Level, Temp), 9 (Stow), 11 (Unstow)

Table 6-3: Task 4 (Alarms, Level, Temp), 9(Stow), 11 (Unstow)

Value	Type	Value Returned	Notes
Alarm No 1	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 2	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 3	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 4	bit	1 = Linked Discrete IO or Alarm is On	
Servo Check	bit	1 = A Dip Freeze is In-Progress	
Level	number	From Tank Corr. Level	in mm
Temperature	number	From Tank Temp.	in 0.1ºC

Task 6 (Percentage Level)

Table 6-4: Task 6 (Percentage Level)

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

Task 12 (Programmed Tank Height)

Table 6-5: Task 12 (Programmed Tank Height)

Value	Type	Value Returned	Notes
Alarm No 1	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 2	bit	1 = Linked Discrete IO or Alarm is On	

Value	Type	Value Returned	Notes
Alarm No 3	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 4	bit	1 = Linked Discrete IO or Alarm is On	
Servo Check	bit	1 = A Dip Freeze is In-Progress	
Tank Height Level	number	From Tank Ref Hght	in mm

Tank 13 (Averaging Thermometer Data)

Note! If an 453x ATC is connected to the 4590 TSM, this task returns the element numbers and temperature for each element in the device.

Table 6-6: Tank 13 (Averaging Thermometer Data)

Value	Type	Value Returned	Notes
Element Number	number	1–15	
Element Temperature	number	From 453x ATC Element #1–#15	in 0.1ºC

Task 17 (Density and BSW Probe Data)

Table 6-7: Sub-Task 3 (BSW Value)

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

Table 6-8: Sub-Task 10 (Datum Position Value)

Value	Type	Value Returned	Notes
Datum	number	0	

Table 6-9: Sub-Task 11 (Density Value)

Value	Type	Value Returned	Notes
Density	number	From Tank Obs. Density	0.1 kg/m^3
Temperature	number	From Tank Temp.	in 0.1ºC

Task 18 (Density and BSW Probe Data)

*Table 6-10: **Sub-Task 3 (BSW Value)***

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

Note! The 4590 TSM does not allow this task to modify the Water Level. If the host tries to set the value of the parameter (eight frames request), the 4590 TSM simply ignores the command and echoes back the received value.

Table 6-11: Sub-Task 4 (Density Value)

Value	Type	Value Returned	Notes
Density	number	From Tank Obs. Density	in 0.1 kg/m^3

Note! The 4590 TSM does not allow this task to modify the Density Level. If the host tries to set the value of the parameter (eight frames request), the 4590 TSM simply ignores the command and echoes back the received value.

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

Table 6-12: Tasks 27 and 28 (Alarms, Level, Temperature, Percent Level)

Value	Type	Value Returned	Notes
Alarm No 1	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 2	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 3	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 4	bit	1 = Linked Discrete IO or Alarm is On	
Servo Check	bit	1 = A Dip Freeze is In-Progress	
Level	number	From Tank Corr. Level	in mm
Temperature	number	From Tank Temp.	in 0.1ºC
Percentage Level	number	From Tank Percent Range	in 0.01%

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

Table 6-13: Tasks 30 and 31 (Alarms, Level, Temperature, Percent Level, Pressure)

Value	Type	Value Returned	Notes
Alarm No 1	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 2	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 3	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 4	bit	1 = Linked Discrete IO or Alarm is On	
Servo Check	bit	1 = A Dip Freeze is In-Progress	
Level	number	From Tank Corr. Level	in mm
Temperature	number	From Tank Temp.	in 0.1ºC
Percentage Level	number	From Tank Percent Range	in 0.01%
Pressure	number	From Tank P3 (Top) Pressure	in 0.1 bar

Task 32 (Software Identification and Date)

Table 6-14: Task 32 (Software Identification and Date)

Value	Type	Value Returned	Notes
Software ID	number	From WM550 Software ID	
Software Date	number	Day, Month, Year	

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

Table 6-15: Task 36(Alarms, Level, Temperature, Percent Level, Pressure, Head Status, Positions)

Value	Type	Value Returned	Notes
Alarm No 1	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 2	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 3	bit	1 = Linked Discrete IO or Alarm is On	
Alarm No 4	bit	1 = Linked Discrete IO or Alarm is On	
Servo Check	bit	1 = A Dip Freeze is In-Progress	
Level	number	From Tank Corr. Level	in mm
Temperature	number	From Tank Temp.	in 0.1ºC

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

Task 38 (Intelligent Sensing Head Command)

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

Un-supported Tasks

If a request is received by the 4590 TSM for a task which it does not support, a “Task 0: Error Return” message is sent as a reply with the error number “1”.

NOTES

Your official representative

Varec®

Varec, Inc.
5834 Peachtree Corners East, Norcross (Atlanta), GA 30092 USA
Tel: +1 (770) 447-9202 Fax: +1 (770) 662-8939