

Varec, Inc. 5834 Peachtree Corners East, Norcross (Atlanta), GA 30092 USA Tel: +1 (770) 416-6629 Fax: +1 (770) 662-8939

# Varec®

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# 1 Notes on use

You have various options for accessing the descriptions of instrument functions or how to enter parameters.

# 1.1 Using the table of contents to locate a function description

All the functions are listed in the table of contents sorted by function group. You can access a more detailed description of a function by using a page reference / link.

# 1.2 Using the graphic of the function menu to locate a function description

This guides you step by step from the highest level, the function groups, to the exact function description you require.

All the available function groups and instrument functions are listed in the table (see page 13). Select your required function group or function. You can access an exact description of the function group or function by using a page reference / link.

# 1.3 Using the index of the function menu to locate a function description

To simply navigation within the function menu, each function has a position which is shown in the display. You can access each function via a page reference/link in the function menu index (see page 83) which lists all the function names alphabetically and numerically.

### Note!

The default values of the parameters are typed in **boldface**.

## 1.4 General structure of the operating menu

The operating menu is made up of two levels:

- Function groups (00, 01, 03, ..., 0C, 0D): The individual operating Selection of the instrument are split up roughly into different function groups. The function groups that are available include, e.g.: "basic setup", "safety settings", "output", "display", etc.
- Functions (001, 002, 003, ..., 0D8, 0D9): Each function group consists of one or more functions. The functions perform the actual operation or parameterisation of the instrument. Numerical values can be entered here and parameters can be selected and saved. The available functions of the "basic setup (00)" function group include, e.g.: "tank shape (002)", "medium property (003)", "process cond. (004)", "empty calibr. (005)", etc.

If, for example, the application of the instrument is to be changed, carry out the following procedure:

1.Select the "basic setup (00)" function group.

2.Select the "tank shape (002)" function (where the existing tank shape is selected).

### 1.4.1 Identifying the functions

For simple orientation within the function menus (see Page 13 ff.), for each function a position is shown on the display.



The first two digits identify the function group:

<ul> <li>basic setup</li> </ul>	00
<ul> <li>safety settings</li> </ul>	01
<ul> <li>linearisation</li> </ul>	04

The third digit numbers the individual functions within the function group:

basic setup	00	$\rightarrow$	<ul> <li>tank shape</li> </ul>	002
			<ul> <li>medium property</li> </ul>	003
			<ul> <li>process cond.</li> </ul>	004

Hereafter the position is always given in brackets (e.g. "tank shape" (002)) after the described function.



# 1.5 Display and operating elements



Abb. 1Layout of the display and operating elements

### 1.5.1 Display

### Liquid crystal display (LCD):

Four lines with 20 characters each. Display contrast adjustable through key combination.



Abb. 2Display

### 1.5.2 Display symbols

The following table describes the symbols that appear on the liquid crystal display:

Symbols	Meaning
Ч	<b>ALARM_SYMBOL</b> This alarm symbol appears when the instrument is in an alarm state. If the symbol flashes, this indicates a warning.
£	<b>LOCK_SYMBOL</b> This lock symbol appears when the instrument is locked,i.e. if no input is possible.
۵	<b>COM_SYMBOL</b> This communication symbol appears when a data transmission via e.g. HART, PFOFIBUS-PA or Foundation Fieldbus is in progress.
*	<b>SIMULATION_SWITCH_ENABLE</b> This communication symbol appears when simulation in FF is enabled via the DIP switch.

Tab. 1 Meaning of Symbols

### 1.5.3 Key assignment

The operating elements are located inside the housing and are accessible for operation by opening the lid of the housing.

### Function of the keys

Key(s)	Meaning
+ or +	Navigate upwards in the selection list Edit numeric value within a function
- or +	Navigate downwards in the selection list Edit numeric value within a function
	Navigate to the left within a function group
	Navigate to the right within a function group, confirmation.
+ and E or and E	Contrast settings of the LCD
+ and - and E	Hardware lock / unlock After a hardware lock, an operation of the instrument via display or communication is not possible! The hardware can only be unlocked via the display. An unlock parameter must be entered to do so.

Tab. 2Function of the keys



### 1.5.4 Operation with the VU 331



Abb. 3Selection and configuration in operation menu

### 1.6 Commissioning

### 1.6.1 Switching on the measuring device

When the instrument is switched on for the first time, the following messages appear on the display:





# 2 Function menu 7200 Radar Tank Gauge

Function group			Function			Description
basic setup	00	$\Rightarrow$	measured value	000	$\rightarrow$	Page 16
(Page 16)			tank shape	002	$\rightarrow$	Page 16
↓		-	medium property	003	$\rightarrow$	Page 17
			process cond.	004	$\rightarrow$	Page 17
			empty calibr.	005	$\rightarrow$	Page 20
			full calibr.	006	$\rightarrow$	Page 21
			pipe diameter	007	$\rightarrow$	Page 22
			check distance	051	$\rightarrow$	Page 24
			range of mapping	052	$\rightarrow$	Page 25
			start mapping	053	$\rightarrow$	Page 25
		-				
safety settings	01	$\Rightarrow$	output on alarm	010	$\rightarrow$	Page 27
(Page 27)			output on alarm (HART only)	011	$\rightarrow$	Page 29
$\Downarrow$			outp. echo loss	012	$\rightarrow$	Page 29
			ramp %span/min	013	$\rightarrow$	Page 30
			delay time	014	$\rightarrow$	Page 31
			safety distance	015	$\rightarrow$	Page 31
			in safety dist.	016	$\rightarrow$	Page 31
			ackn. alarm	017	$\rightarrow$	Page 33
			overspill prot.	018	$\rightarrow$	Page 33
	0.4	1		0.40	I	Da
linearisation	04	⇒		040	$\rightarrow$	Page 34
(Page 34)				041	$\rightarrow$	Page 35
Ų			customer unit	042	$\rightarrow$	Page 39
			table no.	043	$\rightarrow$	Page 40
			input level	044	$\rightarrow$	Page 40
			input volume	045	$\rightarrow$	Page 41
			max. scale	046	$\rightarrow$	Page 41
			diameter vessel	047	$\rightarrow$	Page 41
extended calibr	05	] _	selection	050		Page 42
(Page 42)	05	-	check distance	051	) →	Page 42
(i uge i2) ↓			range of mapping	052	$\rightarrow$	Page 43
·			start mapping	053	$\rightarrow$	Page 43
			pres map dist	054	) →	Page 44
			cust tank map	055	) →	Page 44
			echo quality	056	) →	Page 45
			offset	057	) →	Page 46
			antenna extens	000	) →	Page 46
				009		Page 47
			blocking dist	050		Page 17
				039	$\rightarrow$	i aye 47

Function group			Function			Description		
output 06 $\Rightarrow$			commun. address (HART only)	060	$\rightarrow$	Seite 48		
profibus param.	profibus param. 06		instrument addr. (PROFIBUS PA only)	060	$\rightarrow$	Page 48		
PROFIBUS PA only	PROFIBUS PA only		no. of preambels (HART only)	061	$\rightarrow$	Page 49		
(Page 48)			ident number (PROFIBUS PA only)	061	$\rightarrow$	Page 49		
$\downarrow$		_	low output limit (HART only)	062	$\rightarrow$	Page 50		
			set unit to bus (PROFIBUS PA only)	062	$\rightarrow$	Page 50		
			curr.output mode (HART only)	063	$\rightarrow$	Page 51		
			out value (PROFIBUS PA only)	063	$\rightarrow$	Page 51		
			fixed cur. value (HART only)	064	$\rightarrow$	Page 52		
			out status (PROFIBUS PA only)	064	$\rightarrow$	Page 52		
			simulation	065	$\rightarrow$	Page 53		
			simulation value	066	$\rightarrow$	Page 53		
			output current (HART only)	067	$\rightarrow$	Page 53		
			2nd cyclic value (PROFIBUS PA only)	067	$\rightarrow$	Page 55		
			4mA value	068	$\rightarrow$	Page 56		
			select v0h0 (PROFIBUS PA only)	068	$\rightarrow$	Page 57		
			20mA value	069	$\rightarrow$	Page 57		
			display value (PROFIBUS PA only)	069	$\rightarrow$	Page 57		
envelope curve	0E	⇒	plot settings	0E1	$\rightarrow$	Page 58		
(Page 58)			recording curve	0E2	$\rightarrow$	Page 58		
Ų		-	envelope curve display	0E3	$\rightarrow$	Page 59		
display	09	]⇒	language	092	$\rightarrow$	Page 61		
(Page 61)			back to home	093	$\rightarrow$	Page 61		
↓		1	format display	094	$\rightarrow$	Page 62		
			no.of decimals	095	$\rightarrow$	Page 62		
			sep. character	096	$\rightarrow$	Page 62		
			display test	097	$\rightarrow$	Page 63		
diagnostics	0A	⇒	present error	0A0	$\rightarrow$	Page 65		
(Page 64)			previous error	0A1	$\rightarrow$	Page 65		
↓		1	clear last error	0A2	$\rightarrow$	Page 65		
			reset	0A3	$\rightarrow$	Page 66		
			unlock parameter	0A4	$\rightarrow$	Page 67		
			measured dist.	0A5	$\rightarrow$	Page 68		
			measured level	0A6	$\rightarrow$	Page 69		
			application par.	0A8	$\rightarrow$	Page 69		
system parameters	0C	∣⇒	tag no.	0C0	$\rightarrow$	Page 70		
(Page 70)			device tag (Foundation Fieldbus onlv)	0C0	$\rightarrow$	Page 70		
↓ ↓		L	Profile Version (PROFIBUS PA onlv)	0C1	$\rightarrow$	Page 70		
			protocol+sw-no.	0C2	$\rightarrow$	Page 70		
			serial no.	0C4	$\rightarrow$	Page 72		
			device id (Foundation Fieldbus only)	0C4	$\rightarrow$	Page 72		
			distance unit	0C5	$\rightarrow$	Page 72		
				-	I	2		



	-		download mode antenna extens.	0C8 0C9	$\rightarrow$ $\rightarrow$	Page 73 Page 73
service	D0 0	⇒	service level	D00		Page 74

# 3 Function group "basic setup" (00)



# 3.1 Function "measured value" (000)





This function displays the current measured value in the selected unit (see "customer unit" (042) function). The number of digits after decimal point can be selected in the "no.of decimals" (095) function.

### Caution!

When using an FAR 10 antenna extension, carry out an correction before the basic setup. The length of the FAR 10 is to be entered in the function "antenna extens" (0C9) (see Page 46 or page 73).

# 3.2 Function "tank shape" (002)



tank shape	002
√dome ceilin9	
horizontal cyl	
hypass	

This function is used to select the tank shape.

### Selection:

- · dome ceiling
- horizontal cyl
- bypass
- stilling well
- ·flat ceiling
- sphere





# 3.3 Function "medium property" (003)



medi	<u>um property</u>	00.
zuna	uómu –	
DC:	5 <b>1.</b> 9	
DU:	<u> </u>	

This function is used to select the dielectric constant.

### Selection:

• unknown • < 1.9 • 1.9 ... 4 • 4 ... 10

·> 10

Product class	DK (Er)	Examples
Α	1,4 1,9	non-conducting liquids, e.g. liquefied gas <sup>1)</sup>
В	1,9 4	non-conducting liquids, e.g. benzene, oil, toluene,
С	4 10	e.g. concentrated acids, organic solvents, esters, aniline, alcohol, acetone,
D	> 10	conducting liquids, e.g. aqueous solutions, dilute acids and alkalis

1)Treat Ammonia NH3 as a medium of group A, i.e. use 7230 RTG in a stilling well.

# 3.4 Function "process cond." (004)

		<u>process cond.</u>	- 004
SURED VALUE 000	~	vstandard	
03.0%	?	colm cumfoco	
		turh. surface	

This function is used to select the process conditions.

Selection:

- standard
- calm surface
- turb. surfaceadd. agitator
- $\cdot$ fast change • test:no filter



	1	
standard	calm surface	turb. surface
For all applications that do not fit into any of the following groups.	Storage tanks with immersion tube or bottom filling	Storage / buffer tanks with rough surface due to free filling or mixer nozzles
The filter and output damping are set to average values.	The averaging filters and output damping are set to high values. -> steady meas. value -> precise measurement -> slower reaction time	Special filters to smooth the input signals are emphasised. -> smoothed meas. value -> medium fast reaction time

add. agitator	fast change	test:no filter
Agitated surfaces (with possible vortex) due to agitators	Fast change of level, particularly in small tanks	All filters can be switched off for service / diagnostic purposes.
Special filters to smooth the input signals are set to high values. ->smoothed meas. value ->medium fast reaction time ->minimization of effects by agitator blades	The averaging filters are set to low values. The output damping is set to 0. -> rapid reaction time -> possibly unsteady meas. value	All filters off.

# 3.5 Function "empty calibr." (005)



em<u>pty calib</u>r. 005 **5.00** m distance process conn. to min. level

This function is used to enter the distance from the flange (reference point of the measurement) to the minimum level (=zero).



### Caution!

For dish bottoms or conical outlets, the zero point should be no lower than the point at which the radar beam hits the bottom of the tank.



# 3.6 Function "full calibr." (006)



full <u>calibr</u>. 006 **4.000** m span

This function is used to enter the distance from the minimum level to the maximum level (=span).



In principle, it is possible to measure up to the tip of the antenna. However, due to considerations regarding corrosion and build-up, the end of the measuring range should not be chosen any closer than 50 mm (2") to the tip of the antenna (7244: 150 mm / 6", 7245: 200 mm / 8").

### Note!

If **bypass** or **stilling well** was selected in the "**tank shape**" **(002)** function, the pipe diameter is requested in the following step.

# 3.7 Function "pipe diameter" (007)





This function is used to enter the pipe diameter of the stilling well or bypass pipe.



Microwaves propagate more slowly in pipes than in free space. This effect depends on the inside diameter of the pipe and is automatically taken into account by the RTG. It is only necessary to enter the pipe diameter for applications in a bypass or stilling well.

# 3.8 Display (008)



dist./meas.value 008 dist. 2.463 m meas.v. 63.422 %

The **distance** measured from the reference point to the product surface and the **level** calculated with the aid of the empty adjustment are displayed. Check whether the values correspond to the actual level or the actual distance. The following cases can occur:

- Distance correct level correct -> continue with the next function, "check distance" (051)
- Distance correct level incorrect -> Check "empty calibr." (005)
- Distance incorrect level incorrect -> continue with the next function, "check distance" (051)

# 3.9 Function "check distance" (051)



<u>check distance</u> 051 Zdist. unknown manual distance = ok

This function triggers the mapping of interference echoes. To do so, the measured distance must be compared with the actual distance to the product surface. The following options are available for selection:

Selection:

- $\cdot$  distance = ok
- dist. too small
- •dist. too big
- dist. unknown

• manual



### distance = ok

• Mapping is carried out up to the currently measured echo.

•The range to be suppressed is suggested in the "range of mapping (052)" function Anyway, it is suggested to carry out a mapping in this case as well.

### dist. too small

- •At the moment, an interference is being evaluated.
- •Therefore, a mapping is carried out including the presently measured interference echoe.
- The range to be suppressed is suggested in the "range of mapping (052)" function.

### dist. too big

- •This error cannot be remedied by interference echo mapping
- Check the application parameters (002), (003), (004) and "empty calibr." (005)

### dist. unknown

If the actual distance is not known, no mapping can be carried out.

### manual

A mapping is also possible by manual entry of the range to be suppressed. This entry is made in the "range of mapping (052)" function.

### 11 Caution!

The range of mapping must end 0.5 m (20") before the echo of the actual level. For an empty tank, do not enter E, but E – 0.5 m (20").

If a mapping already exists, it is overwriten up to the distance specified in "range of mapping" (052). Beyond this value the existing mapping remains unchanged.



# 3.10 Function "range of mapping" (052)



^a <u>n9e</u>	of	mai	pping	-052
		<u>s[s[s]</u>	m	
input	of		-	
nappir	n9 I	han:	9e	

This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (see Page 2 ff.). This value can be edited by the operator.

For manual mapping, the default value is 0 m.

# 3.11 Function "start mapping" (053)



start	mappin9	053
on		

This function is used to start the interference echo mapping up to the distance given in "range of mapping" (052).

### Selection:

• off: no mapping is carried out

•on: mapping is started

During the mapping process the message "record mapping" is displayed.

### Caution!

A mapping will be recorded only, if the device is not in error state.

# 3.12 Display (008)





The distance measured from the reference point to the product surface and the level calculated with the aid of the empty alignment are displayed again. Check whether the values correspond to the actual level or the actual distance. The following cases can occur:

- ·Distance correct level correct -> basic setup completed
- Distance incorrect level incorrect –> a further interference echo mapping must be carried out "check distance" (051).
- Distance correct level incorrect -> check "empty calibr." (005)





After 3 s, the following message appears

### Note!

After the basic setup, an evaluation of the measurement with the aid of the envelope curve ("**display**" (09) function group) is recommended.



# 4 Function group "safety settings" (01)





# 4.1 Function "output on alarm" (010)



output on alarm	— Q10
<u>outrut on alarn</u>	010
1.7四日父 (1717四日)	
PINKS SZZENIZ	
F 11 I I I I I	

This function is used to select the reaction of the output on an alarm.

### Selection:

- •MIN (<= 3.6mA) •MAX (22mA)
- MAX (22
  hold
- user specific

### MIN (<= 3.6mA)



If the instrument is in alarm state, the output changes as follows:

- •HART:MIN-Alarm 3.6 mA
- PROFIBUS PA:MIN-Alarm -99999
- Foundation Fieldbus:MIN-Alarm -99999

### MAX (22mA)



If the instrument is in alarm state, the output changes as follows:

- •HART:MAX-Alarm 22 mA
- PROFIBUS PA:MAX-Alarm +99999
- Foundation Fieldbus:MAX-Alarm +99999

### hold



If the instrument is in alarm state, the last measured value is held.

#### user specific



If the instrument is in alarm state, the output is set to the value configured in "output on alarm" (011) (x mA).

#### Caution!

This selection is available for HART devices only!



# 4.2 Function "output on alarm" (011), HART only



On alarm, the output current is set to the entered value in mA. This function is active when you selected "**user specific**" in the "**output on alarm**" (010) function.

### Caution!

?

This function is available for HART devices only!

# 4.3 Function "outp. echo loss" (012)



outp.	echo loss	012
ramp aları	%∕min m	

Use this function to set the output response on echo loss.

### Selection:

- ∙alarm
- hold
- ramp %/min

### alarm



On echo loss, the instrument switches to alarm state after an adjustable "delay time" (014). The output response depends on the configuration set in "output on alarm" (010).

### hold



On echo loss, a warning is generated after a definable "delay time" (014). Output is held.





On echo loss, a warning is generated after a definable "**delay time**" (014). The output is changed towards 0% or 100% depending on the slope defined in "**ramp %span/min**" (013).

### 4.4 Function "ramp %span/min" (013)



Ramp slope which defines the output value on echo loss. This value is used if "ramp %span/min" is selected in "outp. echo loss" (012). The slope is given in % of the measuring range per minute.



## 4.5 Function "delay time" (014)





Use this function to enter the delay time (Default = 30 s) after which a warning is generated on echo loss, or after which the instrument switches to alarm state.

# 4.6 Function "safety distance" (015)

A configurable safety distance is placed before the "**blocking dist**." **(059)** (see page 47). This distance warns you that any further level increase would make the measurement invalid, for example, when touching the antenna area.





sa <u>fety dist</u> ance	-015
<b>9. 19</b> 19 m	
from antenna tip	/
lower ed9e of ho	rn

Enter the size of the safety distance here. The default value is 0.1 m.

# 4.7 Function "in safety dist." (016)



<u>in sa</u>	<u>fety dist.</u>	016
<u>Muria</u> na	ning	
self	ˈholdin9	
alar	٠M	

This function defines the response when the level enters the safety distance .

Selection:

- ∙alarm
- warning
- self holding

### alarm



Instrument enters the defined alarm state ("output on alarm" (011)). The alarm message E651 – "level in safety distance – risk of overspill" is displayed.

If the level drops out of the safety distance, the alarm warning disappears and the instrument starts to measure again.

### warning



Instrument displays a warning **E651** – "level in safety distance – risk of overspill", but continues to measure. If the level leaves the safety distance, the warning disappears.

#### self holding



Instrument switches to defined alarm state ("output on alarm" (011)). The alarm message E651 – "level in safety distance – risk of overspill" is displayed.

If the level leaves the safety distance, the measurement continues only after a reset of the self holding (function: "ackn. alarm" (017)).



# 4.8 Function "ackn. alarm" (017)



ackn.	alarm	017
2no —		
9es		

This function acknowledges an alarm in case of "self holding".

### Selection:

۰no

•yes

### no

The alarm is not acknowledged.

### yes

Acknowledgement takes place.

# 4.9 Function "overspill prot." (018)



overspill	. prot.	018
zstandaro		
9erman l	JHG	

When "german WHG" is selected, various parameters relating to WHG overspill protection/SIL are modified and the instrument is locked against further operation. Select "Standard" to unlock. Thereby the WHG parameter adjustment is preserved. In order to reset the WHG-specific parameters it is recommended to carry out a reset of the instrument (see Page 66). For further information see ZE 244F/00/de (for german WHG) or SD 150F/00/en (for SIL).





After 3 s, the following message appears

# 5 Function group "linearisation" (04)





# 5.1 Function "level/ullage" (040)



level/ulla9e	040
∕level CU	
level DU	
ulla9e CU	

### Selection:

- ·level CU
- level DU
- ∙ullage CU
- ∙ullage DU

### level CU

Level in customer units. The measured value can be linearised. The "linearisation" (041) default value is set to a linear 0...100%.

### level DU

Level in the selected "distance unit" (0C5).

### ullage CU

Ullage in customer units. The value can be linearised. The "linearisation" (041) default value is set to a linear 0...100%.

### ullage DU

Ullage in the selected "distance unit" (0C5).

### Note!

Reference point for the ullage is "full calibr." (=span).





# 5.2 Function "linearisation" (041)

Linearisation defines the ratio of level to container volume or product weight and allows a measurement in customer units, e.g. metres, hectolitres etc. The measured value in (000) is then displayed in the selected unit.

ľ	[ 65.0×	1
l		

linearisation	041
<u>zlinear                                     </u>	
horizontal cyl	
<u>manual</u>	

This function is used to select the linearisation modes.

### Selection:

- linear
- $\cdot$  horizontal cyl
- manual
- $\cdot$  semi-automatic
- ∙table on
- $\cdot$  clear table

### linear

The tank is linear e.g. a cylindrical vertical tank. You can measure in customer units by entering a maximum volume/weight.

You can select the "customer unit" (042). Define the volume value corresponding to the calibration in "max. scale" (046). This value corresponds to an output of 100% (= 20 mA for HART).



### horizontal cyl

The volume, mass etc. are calculated automatically in cylindrical horizontal tanks by entering the "diameter vessel" (047), the "customer unit" (042) and the "max. scale" (046). The "max. scale" (046) corresponds to an output of 100% (= 20 mA for HART).



### manual

If the level is not proportional to the volume or weight within the set measuring range, you can enter a linearisation table in order to measure in customer units. The requirements are as follows:

- •The 32 (max.) value pairs for the linearisation curve points are known.
- •The level values must be given in ascending order. The curve is monotonously increasing.
- •The level heights for the first and last points on the linearisation curve correspond to empty and full calibration respectively.
- The linearisation takes place in the basic setup unit ("distance unit" (0C5)).



Each point (2) in the table is described by a value pair: level (3) and, for example, volume (4). The last value pair defines the 100% output (= 20 mA for HART).


#### Note!

After making entries into the table, activate it with "table on". The 100% value (=20 mA for HART) is defined by the last point in the table.

#### Note!

Before confirming 0.00 m as the level or 0.00% as the volume, activate the Edit mode with  $^+$  or  $^-$ .

Entries can be made into the linearisation table in ToF Tool using the table editor. You can also display the contents graphically. Linearization curves for any tank forms can be calculated additionally.

#### semi-automatic

The tank is filled in stages when the linearisation curve is entered semi-automatically. The RTG automatically detects the level and the corresponding volume/weight has to be entered.

The procedure is similar to manual table entry, where the level value for each table point is given automatically by the instrument.

#### Note!

If the tank is emptied, pay attention to the following points:

•The number of points must be known in advance.

- The first table number = (32 number of points).
- Entries in "Tab. no." (043) are made in reverse order (last entry = 1).

#### table on

An entered linearisation table only becomes effective when activated.

#### clear table

Before making entries into the linearisation table, any existing tables must be deleted. The linearisation mode automatically switches to linear.

#### Note!

A linearisation table can be deactivated by selecting "linear" or "horizontal cyl" (or the "level/ullage" (040) function = "level DU", "ullage DU"). It is not deleted and can be reactivated at any time by selecting "table on".



# 5.3 Function "customer unit" (042)

042



You can select the customer unit with this function.

#### Selection:

- ∙% ∙I ∙hl
- •m3
- ∙dm3 ∙cm3
- •ft3
- ∙usgal
- •i gal
- ۰kg
- ∙t ∙lb
- •ton
- •m
- ۰ft
- •mm
- inch

#### Dependence

The units of the following parameters are changed:

- measured value (000)
- input volume (045)
- •max. scale (046)
- simulation value (066)



### 5.4 Function "table no." (043)

Position of the value pair in the linearisation table.

#### Dependence

Updates "input level" (044), "input volume" (045).

### 5.5 Function "input level" (044)





You can enter the level for each point of the linearisation curve with this function. When the linearisation curve is entered semi-automatically, RTG detects the level automatically.

#### User input:

Level in "distance unit" (0C5).



5.6 Function "input volume" (045)





Specify the volume for each point of the linearisation curve with this function.

#### User input:

Volume in "customer unit" (042).

### 5.7 Function "max. scale" (046)



?



You can enter the end value of the measuring range with this function. This input is necessary if you selected "linear" or "horizontal cyl" in the "linearisation" (041) function.

### 5.8 Function "diameter vessel" (047)



Enter the tank diameter with this function. This entry is necessary if you selected "horizontal cyl" in the "linearisation" (041) function.

# 6 Function group "extended calibr." (05)



# 6.1 Function "selection" (050)



selection		050
vcommon		
mannind		
naterija i		
extended	Map.	

Select the function of the extended calibration.

Selection:

- common (e.g. "Level correction", "Output damping", "Antenna extension", ...)
- mapping
- $\boldsymbol{\cdot} extended map.$

# 6.2 Function "check distance" (051)



check	distance	051
~dist	. unknown	
manu	al	
dist	ance = ok	

This function triggers the mapping of interference echoes. To do so, the measured distance must be compared with the actual distance to the product surface. The following options are available for selection:

#### Selection:

- $\cdot$  distance = ok
- •dist. too small
- •dist. too big
- ∙ dist. unknown
- manual





#### distance = ok

mapping is carried out up to the currently measured echo
The range to be suppressed is suggested in the "range of mapping (052)" function Anyway, it is wise to carry out a mapping even in this case.

#### dist. too small

- •At the moment, an interference is being evaluated
- $\cdot$ Therefore, a mapping is carried out including the presently measured echoes
- •The range to be suppressed is suggested in the "range of mapping (052)" function

#### dist. too big

- This error cannot be remedied by interference echo mapping
- · Check the application parameters (002), (003), (004) and "empty calibr." (005)

#### dist. unknown

If the actual distance is not known, no mapping can be carried out.

#### manual

A mapping is also possible by manual entry of the range to be suppressed. This entry is made in the **"range of mapping (052)"** function.

#### Caution!

The range of mapping must end 0.5 m (20") before the echo of the actual level. For an empty tank, do not enter E, but E - 0.5 m (20").

If a mapping already exists, it is overwriten up to the distance specified in "range of mapping" (052). Beyond this value the existing mapping remains unchanged.

### 6.3 Function "range of mapping" (052)



ra <u>n9e</u>	<u>ot</u> .	Mar	PP1n9	-052
		SISISI	m	
input	of			
mappir	ng i	rang	Je	

This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (see Page 2 ff.). This value can be edited by the operator.

For manual mapping, the default value is 0 m.

### 6.4 Function "start mapping" (053)



start	mappin9	053
on		

This function is used to start the interference echo mapping up to the distance given in "range of mapping" (052).

#### Selection:

- off: no mapping is carried out
- on: mapping is started

During the mapping process the message "record mapping" is displayed.

#### Caution!

A mapping will be recorded only, if the device is not in error state.

6.5 Function "pres. map dist." (054)



pres. map dist. 054 0.000 m

Displays the distance up to which a mapping has been recorded. A value of 0 indicates that no mapping was recorded so far.



### 6.6 Function "cust. tank map" (055)



cust.	tank	Map	055
vinact	tive		
activ	ve 🛛		
reset	t		

This function displays the evaluation mode using the customer tank map.

#### Selection:

- inactive
- active
- reset

#### inactive

No tank mapping has been recorded, or map is switched off. Evaluation is only using FAC (see page 78).

#### active

Evaluation is using the customer tank map (see page 77).

#### reset

Deletes the complete tank map.



### 6.7 Function "echo quality" (056)





The echo quality is the benchmark for measurement reliability. It describes the amount of reflected energy and depends primarily on the following conditions:

- $\boldsymbol{\cdot}$  Dielectric constant of the medium
- $\cdot$  Surface characteristics (waves, foam etc.)

• Distance between sensor and product

Low values increase the probability that the echo is lost through a change in measurement conditions, e.g. turbulent surface, foam, large measuring distance.

#### Caution!

Echo quality can be improved by orientation of the RTG (see page 86).

# 6.8 Function "offset" (057)



### of<u>fset</u>057 will be added to the measured level

This function corrects the measured level by a constant value. The entered value is added to the measured level.

## 6.9 Function "antenna extens." (0C9)





With this function, the length of the antenna extension FAR 10 can be entered (7230 only).

The influence of slower speed of propagation of the microwaves within the FAR 10 is corrected automatically.



### 6.10 Function "output damping" (058)



ou<u>teut dame</u>ing 058 **5.**0 s

Influences the time an output requires to react to a sudden level jump (63% of steady state). A high value attenuates, for example, the influences of rapid changes on the measured variable.

User input: 0...255 s

The default value depends on the selected application parameters "tank shape" (002), "medium property" (003) and "process cond." (004).

# 6.11 Function "blocking dist." (059)





A window below the antenna tip can be suppressed when there are strong reflections of structures, welding joints or struts near the antenna.

- •The blocking distance is measured from the bottom edge of the process connection. Usually, the suppression reaches up to the tip of the antenna (see diagram on page 31).
- For 7 244 and 7 245, the blocking distance is 20 cm by default.
- •All echos are suppressed within this blocking distance.
- As the level echo could possibly be suppressed (and there is no guarantee that no other significant echo is available), a 10 cm long safety distance is placed in front of the suppression (see "safety distance" (015) function on page 31).
- The customer can set the RTG to respond to circumstances when the product is within this zone (safety distance) (see page 31).



Return to Group Selection Group selection 057 Mextanel Calibration output display

After 3 s, the following message appears

# Function group "output" (06), - "profibus param." (06), PROFIBUS PA only

06÷



MEASURED VALUE 000 # 65.0%	2

disp dia9	lay <u>nostics  </u>	
Group	selectio	on 06⊰
disp	<b>1908 - Sera</b> s Lay Loctine	-101-

Group selection

√output

Display at HART and Foundation Fieldbus instrument

Display at PROFIBUS PA instrument

# 7.1 Function "commun. address" (060), HART only



co <u>mmun.</u>	address	060
	<u>9</u> ]	

Enter the communication address for the instrument with this function.

Standard: 0

```
•Multidrop: 1-15
```

In multidrop mode the default value of the output current is 4 mA. It can be modified in the function **"fixed cur. value" (064)**.

#### Caution!

This function is available for HART devices only!

### 7.2 Function "instrument addr." (060), PROFIBUS PA only





The PA bus address is displayed in this field. The address is set either directly on the instrument using DIP switches (see instrument operating instructions) or using a special SetSlaveAddress command via the bus, e.g. by the ToF Tool.

#### Caution!



## 7.3 Function "no. of preambels" (061), HART only





Enter the number of preambles for the HART protocol with this function. An increase in the value is advisable for "bad" lines with communications problems.

#### Caution!

This user input is available for HART devices only!

# 7.4 Function "ident number" (061), PROFIBUS PA only



ic Bu	en 89	t. Vije	unk	)er Diski	961
P	ro	fil	e		

manufacturer

profile

#### manufacturer

Set to1522 hex according to manufacturer (PNO registered).

#### profile

Setting defined as in PA Profile 3.0: 9700 hex - instrument with one AI block.

#### Caution!

### 7.5 Function "low output limit" (062), HART only



low	output	limit	062
2017			
off	•		

The output of negative level values can be suppressed with this function.

#### Selection:

- •offminimum output -10% (3.8 mA for HART)
- •onminimum output 0% (4 mA for HART)



#### Caution!

This user input is available for HART devices only!

# 7.6 Function "set unit to bus" (062), PROFIBUS PA only



<u>set un</u>	t to	ous	962

• confirm

After confirming this function, the unit of the measured variable is taken over in the AI block (PV scale -> Out scale).

This function must always be executed after changing the unit.

#### Caution!



## 7.7 Funktion "curr.output mode" (063), HART only



<u>curr.outeut mode</u>	063
<u>/standard</u>	
çurr.turn down	
fixed current	

With this function you specify the mode of the current output with HART devices.

#### Selection:

standard

curr.turn down

fixed current

#### standard

The total measuring range (0  $\dots$  100%) will be mapped to the current intervall (4  $\dots$  20 mA).

#### curr.turn down

Only a part of the measuring range will be mapped to the current intervall (4 ... 20 mA). Use the functions **"4mA value" (068)** and **"20mA value" (069)** to define the concerning range.

#### fixed current

The current is fixed. The actual measured value is transmitted by the HART signal only. The value of the current is defined in the **"fixed current" (064)** function.

#### Caution!

This function is available for HART devices only!





# 7.8 Function "out value" (063), PROFIBUS PA only



out	value		063
£	Ū.	000	

This displays the AI block output.

#### Caution!



# 7.9 Function "fixed cur. value" (064), HART only

Set the fixed current value with this function. This entry is necessary when you have switched on the "**fixed current**" (063) function.

#### User input:

3,8...20,5 mA

#### Caution!

This user input is available for HART devices only!

### 7.10 Function "out status" (064), PROFIBUS PA only





Displays the current output status (for value, see operating instructions of relevant instrument).

#### Caution!



### 7.11 Function "simulation" (065)



simulation 065 vsim. off sim. level sim. volume

If necessary, linearisation, the output signal and the current output can be tested with the simulation function. You have the following simulation options:

#### Selection:

- sim. off
- •sim. level
- sim. volume
- sim. current (HART only)



#### sim. off

Simulation is switched off.

#### sim. level

Enter the level value in "**simulation value**" (066). The functions • measured value (000) • measured level (0A6) • output current" (067) – only with HART instruments! follow the entered values.

#### sim. volume

Enter the volume value in "**simulation value**" (066). The functions • measured value (000) • output current" (067) – only with HART instruments! follow the entered values.

#### sim. current (HART only)

Enter the current value in "**simulation value**" (066). The function • output current" (067) – only with HART instruments! follows the entered values.

### 7.12 Function "simulation value" (066)

After selecting the "**sim. level**" option in the "**simulation**" **(065)** function, the following message appears in the display:



The level can be entered.

After selecting the "**sim. volume**" option in the "**simulation**" (065) function, the following message appears in the display:



?



The volume can be entered.

After selecting the "**sim. current**" option in the "**simulation**" (065) function, the following message appears in the display:



	-						
si	mul	ati B	on Nsis	val I mi	.ue A	066	

Enter the output current (only for HART instruments).



# 7.13 Function "output current" (067), HART only



output current 067 4.00 mA

Displays the output current in mA.

#### Caution!

This function is available for HART devices only!

# 7.14 Function "2nd cyclic value" (067), PROFIBUS PA only



Owner	and a l	·	1511.05	- az 7
			calada.	
		JJE WIE		
kalla kont		▖▀▖▛▁▜▀▁▋▖▘		

Selects the second cyclical value.

• height/dist.

RTG always transmits the distance as the second cyclical value.

#### Caution!







In this function specify the level (or volume, weight, flow resp.), at which the output current should be 4 mA. This value will be used if you choose the option "curr. turn down" in the **"current output mode" (063)** function.

# 7.16 Function "select v0h0" (068), PROFIBUS PA only



select	t v0h0	968
	rzez nojej	
n i c c	tsu usti	362.623000000000000000000000000000000000
urse.	raa varu	400

Selects the value displayed in "measured value" (000).

#### Selection:

measured value

display value

#### measured value

The configured measured value is displayed in the "measured value" (000) function.

#### display value

The value in "display value" (069) is displayed in the "measured value" (000) function.

#### Caution!



# 7.17 Function "20mA value" (069), HART only





In this function specify the level (or volume, weight, flow resp.), at which the output current should be 20 mA. This value will be used if you choose the option "curr. turn down" in the **"current output mode" (063)** function.

# 7.18 Function "display value" (069), PROFIBUS PA only



display value 069 3 NOT AVAILABLE

This field can be set externally, e.g. from a PLC. The value is then displayed as the main measured variable in the display by selecting the "**select v0h0**" (068) = "display value" function.

#### Caution!

# 8 Function group "envelope curve" (0E)



iroue.		ec.1	210	n k	1. –
aenwei				-	
displ	lay				
dia9r	nost	cics	5		

#### Caution!

This function can be performed on the display only!

# 8.1 Function "plot settings" (0E1)



p)	<u>. c</u> 1		ett	<u>ings</u>	. <u>9</u> E1
	372				
e	env	/. C	urv	∙e+FA	IC
ē	env	2. C	unv	ve+cu	<u>ist.map</u>

Select which information will be displayed in the LCD:

- envelope curve
- •env.curve+FAC (on FAC see page 78)
- •env.curve+cust.map (i.e. customer tank map is also displayed)

# 8.2 Function "recording curve" (0E2)

This function defines whether the envelope curve is read as a  $\boldsymbol{\cdot}$  single curve

- or
- cyclic.



recor(	<u>Ying</u>	curve	ME.
sejiye)		i suue ee	
Cycl:	LC.		

#### Note!

If the cyclical envelope curve is active in the display, the measured variable is refreshed in a slower cycle time. It is therefore recommended to exit the envelope curve display after optimising the measuring point.

#### Note!

An **orientation** of the RTG can help to optimise measurement in applications with very weak level echos or strong interference echos by increasing the useful echo/reducing the interference echo (see»Orientation of the RTG« on page 86).



### 8.3 Function "envelope curve display" (0E3)

The envelope curve is displayed in this function. You can use it to obtain the following information:



#### Navigating in the envelope curve display

Using navigation, the envelope curve can be scaled horizontally and vertically and shifted to the left or the right. The active navigation mode is indicated by a symbol in the top left hand corner of the display.



#### **Horizontal Zoom mode**

Firstly, go into the envelope curve display. Then press  $\stackrel{+}{-}$  or  $\stackrel{-}{-}$  to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either  $\stackrel{+}{\bullet}$  or  $\stackrel{+}{\bullet}$  is displayed. You now have the following options:

- $\cdot$  increases the horizontal scale.
- $\cdot$  reduces the horizontal scale.



#### Move mode

Then press 🗉 to switch to Move mode. Either 🕨 🕨 or 📲 🖷 is displayed.

- You now have the following options:
- $\cdot \pm$  shifts the curve to the right.
- $\cdot$   $\Box$  shifts the curve to the left.



#### Vertical Zoom mode

Press  $\mathbf{E}$  once more to switch to Vertical Zoom mode.  $\mathbf{D}$  is displayed. You now have the following options.

+ increases the vertical scale.

- reduces the vertical scale.

The display icon shows the current zoom factor ( $\bigcirc$  to  $\bigcirc$ .).



#### Exiting the navigation

- Press 🖻 again to run through the different modes of the envelope curve navigation.
- Press  $\pm$  and  $\equiv$  to exit the navigation. The set increases and shifts are retained. Only when you reactivate the **"recording curve" (0E2)** function does the RTG use the standard display again.





After 3 s, the following message appears



# 9 Function group "display" (09)



Group selection 097 display dia9nostics system parameters

# 9.1 Function "language" (092)



lan9ua9e	092
Deutsch	
Français	

Selects the display language.

#### Selection:

- English
- Deutsch
- Français
- Español
- Italiano
- Nederlands
- ・二十ウコ<sup>、</sup>(Katakana, Japanese)

#### Note!

When using tools on operating systems without Japanese language support "????." will be displayed only.

#### Dependence

All texts will be changed.

#### Caution!

This function is not visualised in Commuwin II!

### 9.2 Function "back to home" (093)



back	to	home Elsisi	s	093

If no entry is made using the display during the specified time period, the display returns to the measured value display.

9999 s means that there is no return.

User input: 3...9999 s

#### Caution!

This function is not visualised in Commuwin II!

### 9.3 Function "format display" (094)





Selects the display format.

#### Selection:

decimal

•ft-in-1/16"

#### decimal

The measured value is given in decimal form in the display (e.g. 10.70%).

#### ft-in-1/16"

The measured value is displayed in the following format (e.g 5'05-14/16''). This option is only possible for "distance unit" (0C5) – "ft" and "in"!

#### Caution!

This function is not visualised in Commuwin II!

### 9.4 Function "no.of decimals" (095)



no.of decimals 095 VX.XX X.XXX X

Selection:

- X
- •x.x •**x.xx**
- **x.xx** • x.xxx

x.xxx

### 9.5 Function "sep. character" (096)



SEP.	character	096
7		

#### Selection:

•.

•,

The decimal place is separated by a point.

The decimal place is separated by a comma.



# 9.6 Function "display test" (097)



display test 097 Zoff on

All display pixels are switched on. If the whole LCD is dark, it is working correctly.

#### Caution!

This function can be performed on the display only!





After 3 s, the following message appears

# 10 Function group "diagnostics" (0A)





In the "diagnostics" function group, you can display and confirm error messages.

#### Type of error

Errors that occur during commissioning or measuring are displayed immediately on the local display. If two or more system or process errors occur, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:

- · A (Alarm):
  - Instrument goes into a defined state (e.g. MAX)
  - Indicated by a constant **4** symbol.
  - (For a description of the codes, see Table 14.2 on Page 81)
- •W (Warning):

Instrument continue measuring, error message is displayed. Indicated by a flashing **4** symbol.

(For a description of the codes, see Table 14.2 on Page 81)

- E (Alarm / Warning):
- Configurable (e.g. loss of echo, level within the safety distance) Indicated by a constant/flashing **4** symbol. (For a description of the codes, see Table 14.2 on Page 81)

#### Error messages

Error messages appear as four lines of plain text on the display. In addition, a unique error code is also output. A description of the error codes is given on page 81.

- The "diagnostics (0A)" function group can display current errors as well as the last errors that occurred.
- ·If several current errors occur, use  $\pm$  or  $\equiv$  to page through the error messages.
- The last occurring error can be deleted in the "diagnostics (0A)" function group with the funktion "clear last error" (0A2).



# 10.1 Function "present error" (0A0)



<u>present error</u>	<u>0A0</u>
linearisation ch	
not complete,	
not usable	

The present error is shown using this function. If several current errors occur, use  $\stackrel{+}{=}$  or  $\stackrel{-}{=}$  to page through the error messages.

# 10.2 Function "previous error" (0A1)



<u>previous error</u>	0A1
simulation ch.	
on	

The last error presented is shown with this function.

# 10.3 Function "clear last error" (0A2)



_ 1	1 1		000
<u>riear.</u>	1920	<u>errur</u>	<u> </u>
/keep			
erase	I		

- keep
- erase

### 10.4 Function "reset" (0A3)

#### Caution!

A reset sets the instrument back to the factory settings. This can lead to an impairment of the measurement. Generally, you should perform a basic setup again following a reset.

A reset is only necessary:

- · if the instrument no longer functions
- $\boldsymbol{\cdot}$  if the instrument must be moved from one measuring point to another
- if the instrument is being de-installed /put into storage/installed





#### Entry ("reset" (0A3)):

- •333 = customer parameters (HART)
- 33333 = customer parameters (PROFIBUS PA and Foundation Fieldbus)

#### 333 = reset customer parameters for HART

#### 33333 = reset customer parameters for PROFIBUS PA and Foundation Fieldbus

This reset is recommended whenever an instrument with an unknown 'history' is to be used in an application:

- •The RTG is reset to the default values.
- $\boldsymbol{\cdot}$  The customer specific tank map is not deleted.
- A linearisation is switched to "linear" although the table values are retained. The table can be reactivated in the "linearisation" (04) function group.

List of functions that are affected by a reset:

•diameter vessel (047)
<ul> <li>range of mapping (052)</li> </ul>
•pres. Map dist (054)
•offset (057)
<ul> <li>low output limit (062)</li> </ul>
<ul> <li>fixed current (063)</li> </ul>
<ul> <li>fixed cur. value (064)</li> </ul>
<ul> <li>simulation (065)</li> </ul>
<ul> <li>simulation value (066)</li> </ul>
•4mA value (068)
•20mA value (069)
•format display (094)
<ul> <li>distance unit (0C5)</li> </ul>
<ul> <li>download mode (0C8)</li> </ul>

The tank map can also be reset in the "cust. tank map" (055) function of the "extended calibr." (05) function group.

This reset is recommended whenever an instrument with an unknown 'history' is to be used in an application or if a faulty mapping was started:

•The tank map is deleted. The mapping must be recommenced.



### 10.5 Function "unlock parameter" (0A4)



unlock parameter 0A4 5 Hardware locked

Set-up can be locked and unlocked with this function.

### 10.5.1 Locking of the configuration mode

The RTG can be protected in two ways against unauthorised changing of instrument data, numerical values or factory settings:

#### "unlock parameter" (0A4):

#### Hardware lock:

The instrument is locked by pressing the  $\stackrel{+}{=}$  and  $\stackrel{-}{=}$  and  $\stackrel{E}{=}$  keys at the same time. The lock is shown on the display by the  $\stackrel{+}{=}$  symbol and can **only** be unlocked again via the display by pressing the  $\stackrel{+}{=}$  and  $\stackrel{-}{=}$  and  $\stackrel{E}{=}$  keys at the same time again. It is **not** possible to unlock the hardware by communication.

All parameters can de displayed even if the instrument is locked.



### 10.5.2 Unlocking of configuration mode

If an attempt is made to change parameters when the instrument is locked, the user is automatically requested to unlock the instrument:

#### "unlock parameter" (0A4):

By entering the unlock parameter (on the display or via communication)

**100** = for HART devices

2457 = for PROFIBUS PA and Foundation Fieldbus devices

the RTG is released for operation.

#### Hardware-Verriegelung:

After pressing the + and - and - and - keys at the same time, the user is asked to enter the unlock parameter

**100** = for HART devices

**2457** = for PROFIBUS PA and Foundation Fieldbus devices.



#### Caution!

Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy. There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Varec service organization. Please contact Varec if you have any questions.

### 10.6 Function "measured dist." (0A5)



measured dist. 2.463 m	085
---------------------------	-----

Display of measured distance in the selected "distance unit" (0C5).



### 10.7 Function "measured level" (0A6)



measured level 0A6 2.541 m

Display of measured level in the selected "distance unit" (0C5).



### 10.8 Function "application par." (0A8)



application par. 0A8 vnot modified modified

Displays whether or not one of the settings dependent on the "tank shape" (002), "medium property" (003) and "process cond." (004) application parameters has been changed.

If, for example, the "output damping" (058) is changed, the "application par." shows "modified".

Selection: • not modified

modified



After 3 s, the following message appears

# 11 Function group "system parameters" (0C)



# 11.1 Function "tag no." (0C0)



tą	9		r	ìC	).											0	<u>i</u> Ce	3
	-	-	•	•	-	•	•	-	•	-	÷	-	•	•	-	•		
																	-	

You can define the tag number with this function.

#### User input:

- •16 alphanumeric characters for HART instruments (8 using the HART universal command)
- ·32 alphanumeric characteristics for PROFIBUS PA instruments

# 11.2 Function "device tag" (0C0), Foundation Fieldbus only

This function displays the tag number.

### 11.3 Function "Profile Version" (0C1), PROFIBUS PA only





The PA Profile version is shown using this function (Profile 3.0).

#### Caution!

This function is available for PROFIBUS PA devices only!

# 11.4 Function "protocol+sw-no." (0C2)



Protocol+sw-no. 0C2 V01.01.00 HART

This function shows the protocol and the hardware and software version: Vxx.yy.zz.prot.

#### **Display:** xx: hw-version yy: sw-version



zz: sw-revision prot: protocoll type (e.g. HART)

## 11.5 Function "serial no." (0C4)





This function displays the instrument serial number.

# 11.6 Function "device id" (0C4), Foundation Fieldbus only

This function displays the instrument serial number.

# 11.7 Function "distance unit" (0C5)



distance	unit	005
<b>Ζ</b> Μ		
ft		
MM		

You can select the basic distance unit with this function.

#### Selection:

- ۰m
- ۰ft
- •mm • inch

#### Dependence

m, mm: "format display" (094) can only be "decimal".

The units are changed for the following parameters:

- empty calibr. (005)
- full calibr. (006)
- pipe diameter (007)
- safety distance (015)
- input level (044)
- ·diameter vessel (047)
- range of mapping (052)
- •cust. tank map (055)
- •offset (057)
- simulation value (066)
- •measured dist. (0A5)
- measured level (0A6)
- •antenna extens. (0C9)


## 11.8 Function "download mode" (0C8)



<u>download mode</u>	908
<u> vparameter only</u>	
param+cust.map	
mapping only	

This parameter defines which values are written to the instrument during a ToF Tool or Commuwinn II configuration download.

### Selection:

· parameter only

- •param+cust.map
- mapping only

### Note!

This parameter must not be set explicitly in ToF Tool. The various possibilities can be selected from the download dialog.

## 11.9 Function "antenna extens." (0C9)



an <u>tenna ext</u> ens.	0C9
0.000 m	
len9th FAR10 -	
for 72XX only	

With this function, the length of the antenna extension FAR 10 can be entered (7 230 only). The influence of slower speed of propagation of the microwaves within the FAR 10 is corrected automatically.

### Note!

This function can only be edited in the "**extended calibr**." **(05)** function group (see Chap. 6.9 on page 46).





After 3 s, the following message appears

# 12 Function group "service" (0D)

You can find a detailed description of the "Service" function group as well as a detailed overview of the function menu in the Service Manual.

## 12.1 Software history

Software version / Date	Software changes	Documentation changes
V 01.01.00 / 12.2000	Original software. Operated via: - ToF Tool from version 1.5 - Commuwin II (from version 2.07-3) - HART communicator DXR 275 (from OS 4.6) with Rev. 1, DD 1.	
V 01.02.00 / 05.2002 V 01.02.02 / 03.2003	<ul> <li>Function group: envelope curve display</li> <li>Katakana (japanese)</li> <li>current turn down</li> <li>the customer tank map can be edited</li> <li>length of antenna extension FAR 10 can be entered directly</li> <li>Operated via: <ul> <li>ToF Tool from version 3.1</li> <li>Commuwin II (from version 2.07-4)</li> <li>HART communicator DXR 275 (from OS 4.6) with Rev. 2, DD 1.</li> </ul> </li> </ul>	Description of new functions.



# 13 Envelope curve

## 13.0.1 Envelope curve with the ToF Tool

## Signal analysis via envelope curve



See page 58 ff. for the envelope curve in the local display.

## 13.0.2 Tank mapping

## Generation of an envelope curve

Depending on the distance, the electromagnetic wave with a frequency of approx. 6 GHz requires a time-of-flight between 1 ns and 270 ns. The reflected signal is expanded by means of a sampling process to approximately 0.3 ms to 20 ms.

The sampling factor for 6 GHz is 81920; it is 163 840 for 26 GHz. The resulting carrier frequency is approx. 70 kHz, and 140 kHz at 26 GHz, respectively.

The envelope curve generated such is then demodulated, processed to a logarithmic scale, amplified and finally digitalized and evaluated by a microprocessor.

In chronological order, an envelope curve consistes of the sending pulse, the electrical reverberation and one or more echoes.

The maximum measuring time depends on the maximum measuring distance.

Afterwards, the next cycle starts with the sending pulse.

The envelope curve can be viewed on the local display. In order to do that, the function 09C must be selected in the operation menu. The display can be configured in function 09A and 09B. In addition, a laptop computer or PC in combination

with the Varec software "ToF Tool" and an interface adapter can be used for display and evaluation of an evelope curve. (see BA 224F – Operating Instructions for ToF Tool).



Abb. 4Example of a tank with a schematic envelope curve



### **Tank mapping**

It may be required to map interference reflections inside the tank. This map is preferrably done with an empty tank. This way, all eventual interference reflections caused by installations in the tank are detected and stored in memory.

Only significant echoes will then exceed the tank map and be evaluated.

The mapping can also be performed up to the level or a defined distance, even if the tank is not empty. However, if the level drops below the mapping distance, additional reflections can interfere with the measurement.



## The FAC (Floating Average Curve)

The FAC is similar to the tank map, but automatically adapts itself to changing interference echoes in the tank, i.e. caused by buildup and turbulences. The FAC only covers small interference reflections, all signals below this curve are ignored. The echo signal with the greatest distance to the FAC will be evaluated. The FAC is not only recorded once, but newly calculated with every envelope curve. Thus, it continuously adapts itself to the conditions in the tank.





## 14 Trouble-shooting

If you have followed the instructions in this operating manual, the 7500 Radar Tank Gaugehould work correctly. If this is not the case, RTG has facilities for analysing and correcting errors.

You can find a structured approach for locating errors on page 80 ff. or in the appropriate instrument operating manual.







# 14.2 System error messages

Code	Description	Possible cause	Remedy
A102	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E <sup>2</sup> PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
W103	initialising – please wait	E <sup>2</sup> PROM storage not yet finished	wait some seconds; if warning prevails, exchange electronics
A106	downloading please wait	processing data download	wait until warning disappears
A110	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E <sup>2</sup> PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
A111	electronics defect	RAM defective	reset; if alarm prevails after reset, exchange electronics
A113	electronics defect	ROM defective	reset; if alarm prevails after reset, exchange electronics
A114	electronics defect	E2PROM defective	reset; if alarm prevails after reset, exchange electronics
A115	electronics defect	general hardware problem	reset; if alarm prevails after reset, exchange electronics
A116	download error repeat download	checksum of stored data not correct	restart download of data
A121	electronics defect	no factory calibration existant; E²PROM defective	contact service
W153	initialising – please wait	initialisation of electronics	wait some seconds; if warning prevails, power off device and power on again
A155	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A160	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E <sup>2</sup> PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
A164	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A171	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A231	sensor 1 defect check connection	HF module or electronics defective	exchange HF module or electronics
W511	no factory calibration ch1	factory calibration has been deleted	record new factory calibration

Tab. 3System error messages

Code	Description	Possible cause	Remedy
A512	recording of mapping please wait	mapping active	wait some seconds until alarm disappears
W601	linearisation ch1 curve not monotone	linearization not monotonously increasing	correct linearisation table
W611	less than 2 linearisation points for channel 1	number of entered linearization points < 2	correct linearisation table
W621	simulation ch. 1 on	simulation mode is active	switch off simulation mode
E641	no usable echo channel 1 check calibr.	echo lost due to application conditions of built up on antenna	check installation; optimize orientation of antenna; clean antenna (cf. Operating Instructions)
E651	level in safety distance – risk of overspill	level in safety distance	alarm will disappear as soon as level leaves safety distance;
A671	linearisation ch1 not complete, not usable	linearisation table is in edit mode	activate linearisation table
W681	current ch1 out of range	current out of range (3,8 mA 21,5 mA)	check calibration and linearisation

Tab. 3System error messages



# 14.3 Application errors

Error	Output	Possible cause	Remedy
A warning or alarm has occurred.	Depending on the configuration	See table of error messages (see page 81)	1. See table of error messages (see page 81)
Measured value (00) is incorrect	F m/ft         20 mA/100%           (%)         F m/ft           (%)         expected           (%)	Measured distance (008) OK?	<ul> <li>2s →</li> <li>1. Check empty calibr. (005) and full calibr. (006).</li> <li>2. Check linearisation: <ul> <li>→ level/ullage (040)</li> <li>→ max. scale (046)</li> <li>→ diameter vessel (047)</li> <li>→ Check table</li> </ul> </li> </ul>
	actual	no ↓	
	E m/ft 4 mA/0% t →	Measurement in ye bypass or stilling well?	<ul> <li>2s → 1. Is bypass or stilling well selected in tank shape (002)?</li> <li>2. Is the pipe diameter (007) correct?</li> </ul>
		no	
		Is an ye FAR 10 antenna extension being used?	es → 1. offset (057) correctly set? (see page 46)
		no ↓	
		An interference ye echo may have been evaluated.	es $\rightarrow$ 1. Carry out tank mapping $\rightarrow$ basic setup
L			
No change off measured value on filling/empty- ing	20 mA/100% actual expected 4 mA/0% t→	Interference echo from installations, nozzle or extension on the antenna	<ol> <li>Carry out tank mapping → basic setup</li> <li>If necessary, clean antenna</li> <li>If necessary, select better mounting position</li> </ol>









## 14.4 Orientation of the RTG





For orientation a marker is found on the flange or threaded boss of the RTG. During installation this must be oriented as follows (see page 86):

- In tanks: to the vessel wall
- In stilling wells: to the slots
- In bypass pipes: vertical to the tank connectors

After commissioning the RTG, the echo quality indicates whether a sufficiently large measuring signal is obtained. If necessary, the quality can be optimised later. Vice versa, the presence of an interference echo can be used to minimise this by optimum orientation. The advantage of this is that the subsequent tank mapping uses a somewhat lower level that causes an increase in the strength of the measuring signal.

Proceed as follows:

### Warning!

Subsequent alignment can lead to personal injury. Before you unscrew or loosen the process connection, make sure that the vessel is not under pressure and does not contain any injurious substances.

- 1.It is best to empty the container so that the bottom is just covered. However, alignment can be carried out even if the vessel is empty.
- 2.Optimisation is best carried out with the aid of the envelope graph in the display or the ToF Tool.
- 3. Unscrew the flange or loosen the threaded boss by a half a turn.
- 4.Turn the flange by one hole or screw the threaded boss by one eighth of a turn. Note the echo quality.
- 5.Continue to turn until 360° is reached.
- 6.Optimum alignment:
  - a) Vessel partly full, no interference echo obtained:



### b) Vessel partly full, interference echo obtained:





d) Vessel empty, interference echo obtained:



7.Fix the flange or threaded boss in this position. If necessary, replace the seal.8.Carry out tank mapping, see page 23 ff.







Varec, Inc. 5834 Peachtree Corners East, Norcross (Atlanta), GA 30092 USA Tel: +1 (770) 416-6629 Fax: +1 (770) 662-8939