

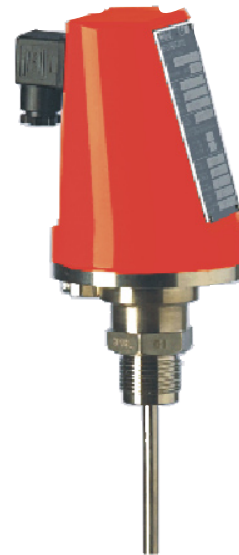


# Reflex VF03 Series Two Wire TDR Level meter

The Reflex VF Series range of TDR products is ideal for the measurement of liquids, powders and granules to a range of 24m. Unaffected by pressure, temperature, viscosity, vacuum, foam, dust, changes in dielectric constant or coating of the probe, the VF Series can measure virtually any product in either Direct or TBF mode utilising any one of its five probe types. (See page 2 for full option details)

## REFLEX VF03 TWO WIRE TDR

- ◆ 24m Measuring Range
- ◆ 24 VDC Loop Powered
- ◆ 4/20mA Output
- ◆ Pressure up to 40 Bar
- ◆ Flange Temperature to 200°C
- ◆ HART Protocol standard
- ◆ ATEX EExia Intrinsically Safe
- ◆ Multiple probe options
- ◆ 316 Stainless Steel Probe
- ◆ FEP Coating option
- ◆ Liquids and Solids



## OPERATING PRINCIPLE

Pulses of low power microwaves are sent along conductors. At the point where the waves meet the product surface, they are reflected by the product. The intensity of the reflection depends on the dielectric constant of the product. The higher the dielectric constant, the stronger the reflection will be, e.g. up to 80% reflection for water. The instrument measures the time between emission and reception which is proportional to the distance.

For TDR guided radar there are two different categories of product:

### 1 - Products with a dielectric constant $\epsilon_r \geq 1.8$

These applications work in "Direct Mode", which means that the reflection from the product surface is used directly for the measurement of the level. Two different applications are possible:

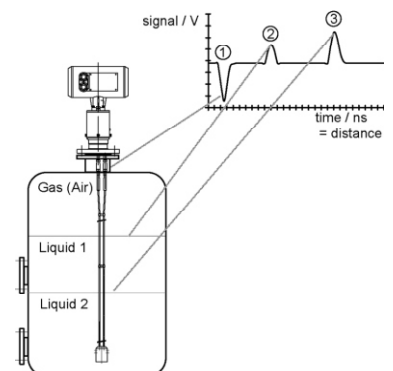
#### a) Level Measurement

The wave is reflected from the first product surface and is received by the receiver on the top of the tank. The wave travels along the conductor above the product at the speed of light and the return time of the wave pulse is directly proportional to the distance between the top of the tank and the surface of the product (level).

#### b) Interface measurement

Interface measurement can only be made if the first layer has a lower dielectric constant than the second and if the difference between the two dielectric constants is greater than 10.

For measuring interface level we use the residual wave after the first reflection. This part of the wave moves further down the conductors through the first product layer until reflected on the interface level. The speed of this wave depends on the dielectric constant of the first product. This means that we have to know the dielectric ( $\epsilon_r$ ) of this first layer to determine the interface level.



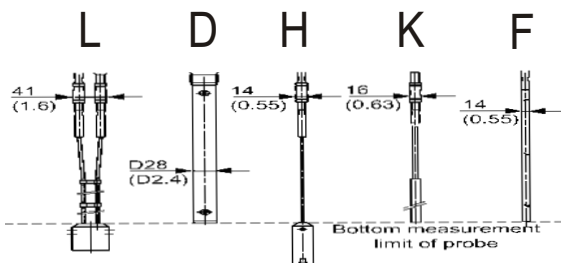
### 2 - Products with a dielectric constant $\epsilon_r < 1.8$

To measure the level of low dielectric products we use the Tank Bottom Following principle (TBF). The downward wave will first pass through the air at a known speed and then through the product at a speed depending on the dielectric constant of the product.

Since the return in air is calibrated; the difference in the two times is directly proportional to the product level in the tank. As we are largely dependent on the dielectric constant, this method is less accurate than the direct mode method.

## TDR Product Selector

Model	VF0301	VF0302	VF0303	VF0304	VF0306
Probe type	F	H	D	L	K
Principle	TDR	TDR	TDR	TDR	TDR
Process	Liquids	Liquids	Liquids	Liquids	Liquids
Medium	Solids	Solids*		Solids	Solids
Range	3m	12m	6m	24m	24m
Application	Level	Level	Level	Level	Level
	Distance	Distance	Distance	Distance	Distance
	Volume	Volume	Volume	Volume	Volume
Mode	Direct	Direct	Direct	Direct	Direct
Accuracy					
Liquids	+/- 15mm	+/- 15mm	+/- 15mm	+/- 15mm	+/- 15mm
Solids	+/- 20mm	+/- 20mm		+/- 20mm	+/- 20mm
Min Dielectric	2.3	2.3	1.5	1.8	2.3
Repeatability	+/- 2mm	+/- 2mm	+/- 2mm	+/- 2mm	+/- 2mm
P Max Bar	40	40	40	40	40
T Max C	200	200	200	200	200
Power Supply					
24 VDC	Yes	Yes	Yes	Yes	Yes
24 VAC/DC	No	No	No	No	No
110/230V AC	No	No	No	No	No
Two Wire	Yes	Yes	Yes	Yes	Yes
Four Wire	No	No	No	No	No
4/20 HART	Yes	Yes	Yes	Yes	Yes
RS485	No	No	No	No	No
Profibus PA	No	No	No	No	No
Fieldbus	No	No	No	No	No
ATEC Approval	EExia	EExia	EExia	EExia	EExia
Integral LCD	No	No	No	No	No
Min Process Con	1" BSP	1" BSP	1" BSP	2" ANSI	1,5" BSP



\* Note: Hycontrol advise the use of 8mm cable for Solids applications due to the high loads and abrasive wear usually associated with these applicators. However, for short cable length and light powders such as flour 4mm may be acceptable

### PROBE TYPES

## Reflex Radar VF Series Tehnical Data Sheet

<b>Function</b>	Level, distance and volume measurement of liquids and solids
<b>Measuring range</b>	
<b>Flexible probe</b>	24 m
<b>Coax probe</b>	6 m
<b>Rod probe</b>	3 m
<b>Accuracy</b>	L < 15 m : +/- 15 mm L < 15 m : +/- 0.1% of measured distance value Powders +/- 20 mm
<b>Repeatability</b>	1 mm
<b>Dielectric constant</b>	
<b>Mono probe</b>	> 2.3
<b>Twin probe</b>	> 1.8
<b>Coac probe</b>	> 1.5
<b>Probe Materials</b>	
<b>F = 1 Rod</b>	AISI 316L
<b>B/E = 2 or 1 flexable cable</b>	AISI 316L, FEP coated AISI 316
<b>C = Coaxial</b>	AISI 316L
<b>Operating pressure</b>	Atmospheric, optional 16 bar or 40 bar
<b>Operating temperature</b>	
<b>Flange temperature</b>	-30 to + 90°C Std 200°C Optional
<b>Product temperature</b>	-50 to + 600°C
<b>Temperature drift</b>	0.01%°C
<b>Ambient temperature</b>	
<b>Standard</b>	- 30 to + 55°C
<b>Ex version</b>	- 20 to + 55°C
<b>Connection</b>	G1" standard. For other see ordering code
<b>Protection category</b>	IP66
<b>Power supply</b>	24VDC (18 to 35VDC);(<28V for Ex version)
<b>Output</b>	4/20mA current loop into maximum of 750 Ohms
<b>Communication</b>	HART protocol for PC-STAR or handheld communicator
<b>Approvals</b>	ATEX II 1 G or II 1/2 D T100C. EExia IICT6...T3 or EExia IIB T6...T3
<b>EMC</b>	EN 50082-2, EN 50081-1
<b>Weight</b>	Without probe 2 kgs
<b>Materials of construction</b>	
<b>Housing</b>	Aluminium with Orange epoxy coating
<b>Wetted parts</b>	Stainless Steel 316L / 316, PTFE
<b>Gaskets</b>	Viton, optional Kalrez 4079

## Electrical Connection

There are two types of electrical connection available:

### DIN CONNECTOR

#### Terminals

#### Ex equipotential bonding

Wire cross section max 1.5 mm (AWG 16)

U-clamp terminal (max 4 mm conductor cross section) at neck of signal converter

#### Cable entries

1 x PG11 (with standard cable gland: cable clamping area = 8 - 10 mm)

#### Signal cable

No shielding needed

### M16 CONNECTOR

#### Terminals

#### Ex equipotential bonding

Wire cross section max 1.5 mm (AWG 16)

U-clamp terminal (max 4 mm conductor cross section) at neck of signal converter

#### Cable entries

1 x M16 x 1.5 (with standard cable gland: cable clamping area = 3.5 - 8 mm)

#### Signal cable

No shielding needed.

### ELECTRICAL SIGNAL OUTPUT

#### Electrical connection

Two wire

#### Power supply

#### Standard

#### Ex version

18 to 35 VDC

> 28 V

#### Current output

4/20 mA / 22mA

#### Power influence

Negligible

#### Temperature drift

~0.5 uA / K

#### Ambient temperature

#### Standard

#### Ex version

- 30 to + 55°C

- 20 to + 55°C

#### Protection category to

#### EN 60529 / IEC 529

IP66

#### Spark protection

EEx ia IIC T6

# Probe Selection Guide

COAXIAL  
TYPE C

TWIN CABLES  
TYPE B

MONO CABLE TYPE E  
MONO ROD TYPE F

## MAIN APPLICATION AREAS

Tank heights to 6 m  
LPG, LNG, Solvents, MH3, Foam  
Alcohol, Oil / Water separators

Tank farms  
Plastic Granule Silos  
Light powders with low dielectric  
LPG, LNG, NH3, Spheres,  
Alcohol, Water storage level

Cement, Limestone, Flyash,  
Alumina  
Highly viscous liquids  
Plastic Powders e.g. PVC  
Plastic Granule Silos

## RECOMMENDED IN THE FOLLOWING CASES

### For clean liquids only

Liquid agitation or flow - the coax acts as a stilling well.  
Liquid or vapour spray near the probe. Can be treated.  
Contact possible with metal object or tank wall.  
Very low dielectric liquids.

### For high tanks and silos with liquids and granules

Up to 24 m  
For tanks with no head clearance.  
For tanks with small upstand or nozzle.  
Can be mounted close to tank wall.

### For clean or waste liquids and fin powders

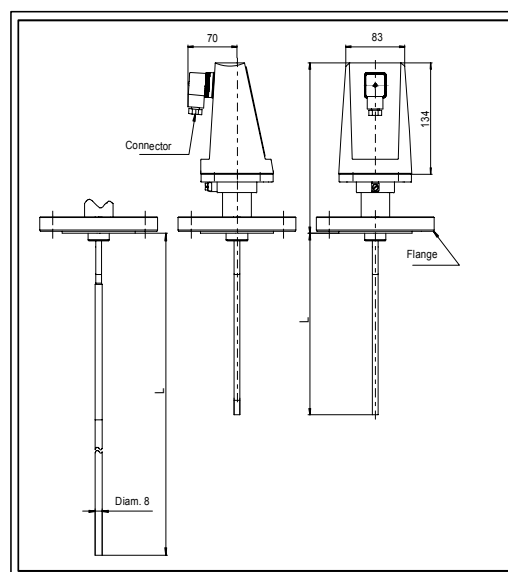
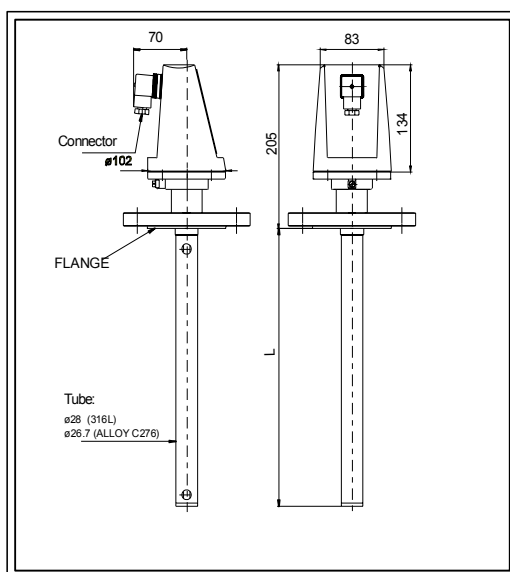
For all viscous liquids.  
To create a coax version using existing stilling well. (Consult Hycontrol)  
Crystalizing products with FEP coating.  
To see through highly conductive foams.  
High temperature applications without spacers.

## AVOID THE FOLLOWING

Crystalizing liquids.  
Liquids with solids in suspension.  
Scaling or coating products.  
Powders.  
Viscous fluids such as Crude Oil.

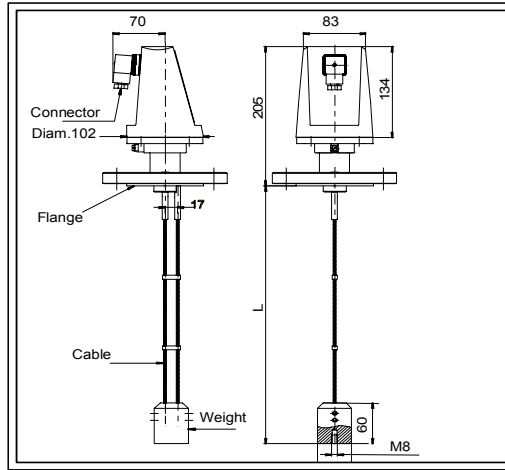
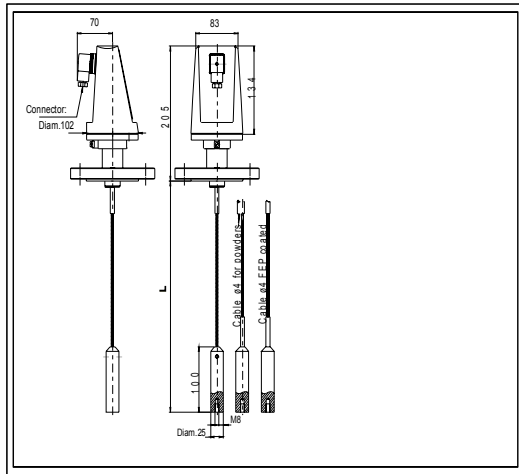
Agitated tanks without anchoring.  
Product temperatures > 200°C  
(Max limit with optional PTFE spacers.)

Upstands with small nozzle diameters (< DIN 100)  
Upstands with large nozzle heights.

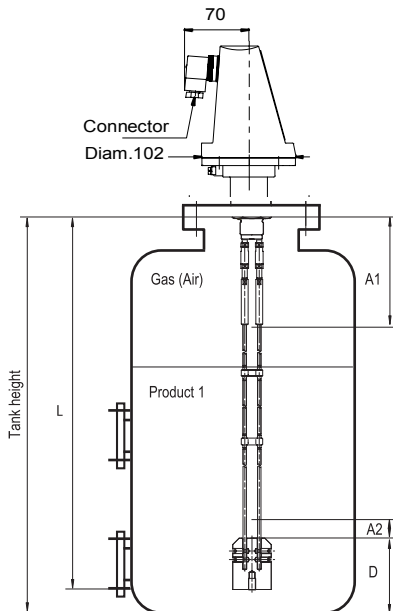


MONO CABLE 4mm MAX 12m. 8mm MAX 24m.

TWIN CABLE MAX 24m.



Probes	Top dead zone (mm)	Bottom dead zone (mm)
Rod	400	100
Twin cable	300	100
Mono cable diam 8mm/diam 0.3mm	400	100
Coaxial	0	100



**A1, Top dead zone**

Min. distance from flange to top limit of measuring range.

**A2, Bottom dead zone**

Length at end of probe, where measurement is not possible.

**D, non measurement zone**

Zone where measurement cannot be taken.

**L, Probe length**

Length specified by customer in the order.