



Reflex VF7 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 35m. 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 six probe types. (See page 4 for full option details).

ADVANTAGES OF TDR

- ◆ 35m Measuring Range
- ◆ 24 VDC 2 wire Loop Powered
- ◆ 4/20mA Output
- ◆ Pressure up to 40 Bar
- ◆ Flange temperature up to 200°C
- ◆ HART Protocol options
- ◆ ATEX EExia and EExd options
- ◆ Wide range of Process connections
- ◆ Liquids and Solids measurement
- ◆ Interface measurement to less than 50mm
- ◆ Simple programming with set-up wizard
- ◆ Capable of measuring low dielectric product (1.4)
- ◆ Clear Alpha-numeric display with tank illustrations
- ◆ Minimal Blanking Zone
- ◆ High accuracy of +3mm
- ◆ Corrosion resistant construction



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 $\epsilon_r \geq 1.4$

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 (ϵ_r) of this first layer to determine the interface level.

2 - Products with a dielectric constant $\epsilon_r < 1.4$

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.

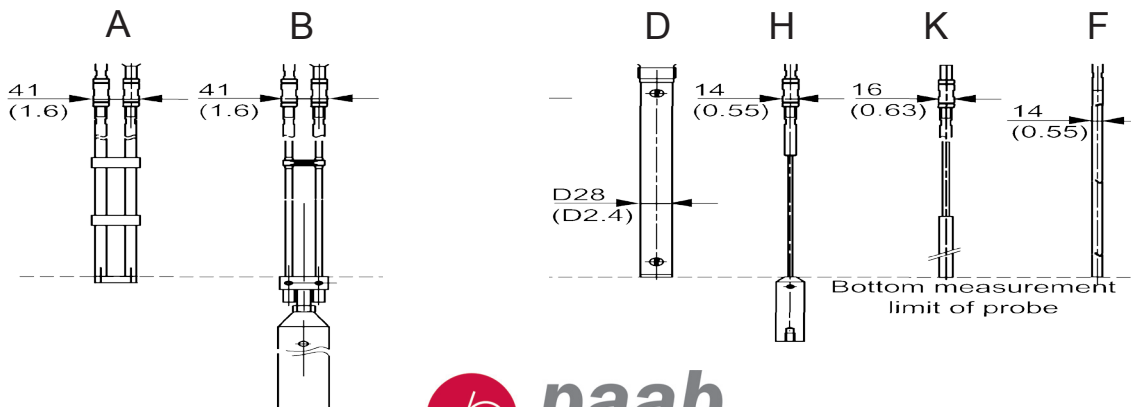
As we are largely dependent on the dielectric constant, this method is less accurate than the direct mode method.

TDR PRODUCT SELECTOR

MODEL	VF7000	VF7001	VF7002	VF7003	VF7004	VF7005
Probe Type	F	A	D	H	K	B
Principle	TDR	TDR	TDR	TDR	TDR	TDR
Process	Liquids	Liquids	Liquids	Liquids	Liquids	Liquids
Medium	Solids	Solids		Solids*	Solids	Solids
Range	3m	3m	6m	35m	35m	35m
Application	Level	Level	Level	Level	Level	Level
	Distance	Distance	Distance	Distance	Distance	Distance
	Volume	Volume	Volume	Volume	Volume	Volume
	Interface	Interface	Interface	Interface	Interface	Interface
Mode	Direct TBF	Direct TBF	Direct TBF	Direct TBF	Direct TBF	Direct TBF
Accuracy						
Liquids	+/- 3mm	+/- 3mm	+/- 3mm	+/- 3mm	+/- 3mm	+/- 3mm
Solids	+/-20mm	+/-20mm		+/-20mm	+/-20mm	+/-20mm
Min Dielectric	1,8	1,6	1,4	1,8	1,8	1,6
Repeatability	+/- 1mm	+/- 1mm	+/- 1mm	+/- 1mm	+/- 1mm	+/- 1mm
Max Press Bar	40	40	40	40	40	40
Max Temp °C	200	200	200	200	200	200
Power Supply						
24 VDC	Yes	Yes	Yes	Yes	Yes	Yes
Two Wire	Yes	Yes	Yes	Yes	Yes	Yes
Four Wire	No	No	No	No	No	No
4/20 HART	Yes	Yes	Yes	Yes	Yes	Yes
RS485	No	Yes	No	No	No	Yes
Profibus PA		Yes	No	No	No	Yes
Fieldbus		Yes	No	No	No	Yes
Approvals						
ATEX EExia	Yes	Yes	Yes	Yes	Yes	Yes
ATEX EExd	Yes	Yes	Yes	Yes	Yes	Yes
Integral LCD	Optinal	Optinal	Optinal	Optinal	Optinal	Optinal
Min Process Con	3/4" BSP	2"ANSI	3/4"BSP	3/4"BSP	1,5"BSP	2"ANSI

*Note:

Hycontrol advise the use of 8mm cable for Solids applications due to the high loads and abrasive wear usually associated with these applications. However, for short cable length and light powders such as flour, 4 mm may be acceptable, up to 10m.

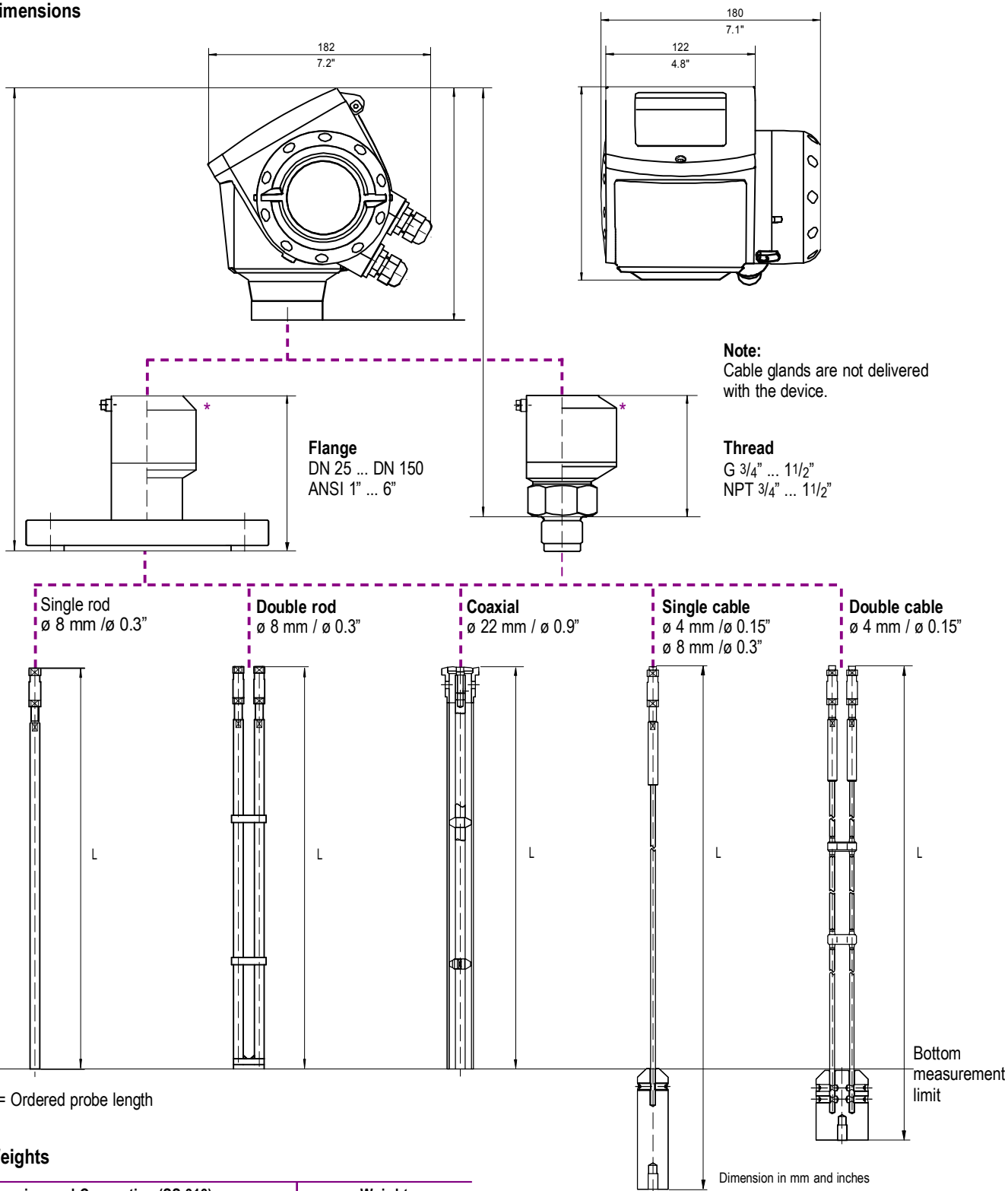


REFLEX VF SERIES EXTENDED RANGE TDR

Technical Data Sheet - Type VF7

Input		
Function		Time Domain Reflectometry (TDR)
Parameter		Level, distance, volume and/or interface
Max measuring range	Double rod diam 8 mm / 0.3" Single rod diam 8 mm / 0.3" Coaxial diam 22 mm / 0.9" Double cable diam 4 mm / 0.15" Single cable diam 4 mm / 0.15" Single cable diam 8 mm / 0.3"	4 m / 13 ft 4 m / 13 ft 6 m / 20 ft 35 m / 115 ft 35 m / 115 ft 35 m / 115 ft
Output		
Output signal	Output 1 Output 2 (option)	4 ... 20 mA HART ® or 3.8 ... 20.5 mA acc to NAMUR NE 43 4 ... 20 mA (no HART ® signal) or 3.8 ... 20.5 mA acc to NAMUR NE 43
Accuracy		0.05% (rel. 20 mA; 20°C / 70°C)
Resolution		±2 µA
Temperature drift		Typically 50 ppm/K
Error signal		High: 22mA; Low: 3.6 mA acc to NAMUR NE 43
Max Load		350 ohm
Measuring accuracy		
Reference conditions acc to IEC770	Temperature Pressure Relative air humidity	+20°C ±5°C / +68°F ± 9°F 1013 mbar abs. ±20 mbar / 14.69 psig ±0.29 psig 60% ±15%
Resolution		±1 mm / ±0.04"
Accuracy (in direct mode)	Liquids Powders Interface	±3 mm / 0.12", when L > 10 m / 33 ft ±20 mm / ±0.8" ±10 mm (Σr constant)
Application conditions		
Temperature	Ambient temperature Storage temperature Flange temperature	-40...+80°C / -40...+175°F; EExi: -40...+60°C / -40...+140°F -40...+85°C / -40...+185°F -40...+200°C / -40...+300°F (Ex: refer to relev ant device's approval and temperature class)
Terminal shock resistance		100°C / min
Process conditions	Operation pressure Dielectric constant	-1...40 bar / -14.5...580 psig; subjeti to process connections used and flange temperature ≥1.4 for coaxial probe, ≥1.6 for single and double probes
Vibration resistance		IEC 68-2-6 and prEN 50178 (10...Hz: 0.075 mm / 57...150 Hz: 1g)
Protection category		IP 66/67 equiv to NEMA 6-6X
Mecanical data		
Material	Housing Single rod Double rod Coaxial Single cable Double cable Process fitting	Aluminium Stainless steel (1.4404 / 316 L); Hastelloy C-22 (2.4602) Stainless steel (1.4404 / 316 L); Hastelloy C-22 (2.4602) Stainless steel (1.4404 / 316 L); Hastelloy C-22 (2.4602) Stainless steel (1.4401 / 316); Hastelloy C-22 (2.4602) (only cable diam 4 mm / 0.15") Stainless steel (1.4404 / 316) Stainless steel (1.4404 / 316 L); Hastelloy C-22 (2.4602)
Process connections	Gaskets Thread Flange	Viton (-40...+150°C / -40...+300°F); Kalrez 6375 (-20...+150°C / -5...+300°F) G 3/4"...1 1/2"; NPT 3/4"...1 1/2" DN 25...DN 150 (PN 40 / PN 16); 1"...8" (150 lb / 300 lb); 10 K (40...100A)
Electrical connection		
2-wire power supply	Terminals output 1 Non-Ex / EEx i EEx d Terminals output 2 Non-Ex / EEx i/ EEX d	24 V DC (14...30 V DC) 24 V DC (20...36 V DC) 24 V DC (10...30 V DC)
Cable entry		M20x1.5; NPT 1/2"; G1/2
Terminals		0.5...1.5 mm ²
Human machine interface		
Display		9 lines, 160x160 pixels in 8-step grey scale with 4-button keypad
Operating languages		English (UK), German, French, Italian, Spanish, Portugese, Japanese, Chinese (Mandarin), Russian
Approvals		
Overfill protecion		WHG
ATEX		ATEX II G/D 1, 1/2, 2 EEx ia IIC T6; ATEX II G/D 1/2, 2 EEx d ia IIC T6
FM		IS class I Div. 1 Gr A...G; XP class I Div. 1 Gr A...G
CSA		IS class I Div. 1 Gr A...G; XP class I Div. 1 Gr A...G

Dimensions



L = Ordered probe length

Weights

Housing and Connection (SS 316)	Weight	
	[kg]	[lb]
Housing	3.3	7.3
Flange connection DN 25...80 / ANSI 1" ...3"	4...7	8.8...15.4
Flange connection DN 100...150 / ANSI 4" ...6"	7...12	15.4...26.5
Thread connection	3	6.6
Probes	[kg / m]	[lb / ft]
Single cable \varnothing 4 mm / 0.15	0.12	0.08
Single cable \varnothing 8 mm / 0.3"	0.41	0.28
Double cable \varnothing 4 mm / 0.15"	0.24	0.16
Single rod \varnothing 8 mm / 0.3"	0.41	0.28
Double rod \varnothing 8 mm / 0.3"	0.82	0.56
Coaxial \varnothing 22 mm / 0.9"	0.79	0.53

Note:

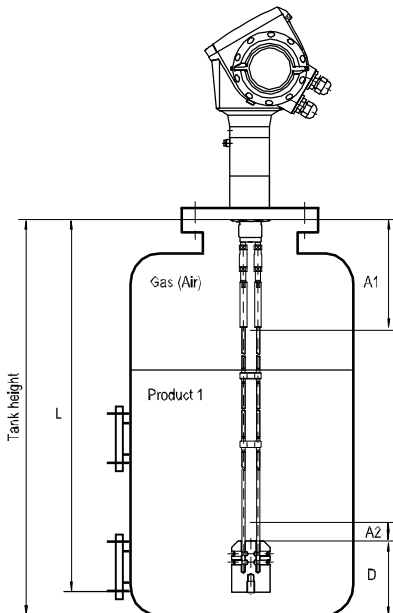
Wide range of counterweights and anchoring solutions available. Contact HYCONTROL for further information.

* Only single cable \varnothing 8 mm / \varnothing 0.3" (solids application)

Measurement limits

Probes	Top dead zone $\Sigma r = 80^*$ [mm / inch]	Bottom dead zone $\Sigma r = 80^*$ [mm / inch]	Top dead zone $\Sigma r = 2.3^*$ [mm / inch]	Bottom dead zone $\Sigma r = 2.3^*$ [mm / inch]
Double rod	125 / 4.9	10 / 0.4	165 / 6.5	50 / 1.95
Single rod	200 / 7.9	10 / 0.4	250 / 9.9	50 / 1.95
Coaxial	10 / 0.4	10 / 0.4	10 / 0.4	50 / 1.95
Double cable	125 / 4.9	10 / 0.4	165 / 6.5	50 / 1.95
Single cable $\varnothing 8$ mm / $\varnothing 0.3$ "	200 / 7.9	10 / 0.4	250 / 9.9	50 / 1.95
Single cable $\varnothing 4$ mm / $\varnothing 0.15$ "	200 / 7.9	10 / 0.4	250 / 9.9	50 / 1.95

* 80 is Σr of water; 2.3 is Σr of oil



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

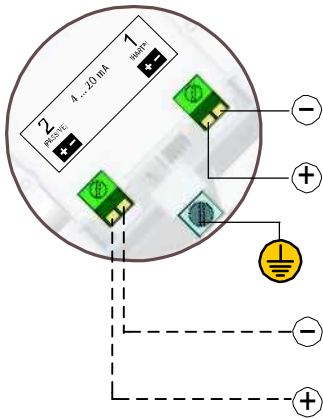
Length specified by customer in the order.

Probe selection

	Double rod	Single rod	Coaxial	Double cable	Single cable diam 8mm/0.3"	Single cable diam 4mm/0.15"
Maximum tank height						
4 m / 13 ft	◆	◆				
6 m / 20 ft			◆			
35 m / 115 ft				◆	◆	◆
Liquids						
Liquid application	◆	◆	◆	◆	◆	◆
LPG, LNG	◆		◆	◆		
Highly viscous liquids		◆				◆
Highly crystallising liquids		◆				◆
Highly corrosive liquids	◆	◆	◆			◆
Foam		◆	◆			◆
Agitated liquids	◆		◆	◆*		◆*
Spray in tank			◆			
Storage tanks	◆	◆	◆	◆		◆
Installation in bypass chamber	◆	◆	◆	◆		◆
Small diameter nozzles	◆		◆	◆		
Long nozzles	◆		◆	◆		
Stilling wells	◆	◆	◆	◆		◆
Interface measurement	◆		◆	◆		

* with anchor fitting

Electrical connection



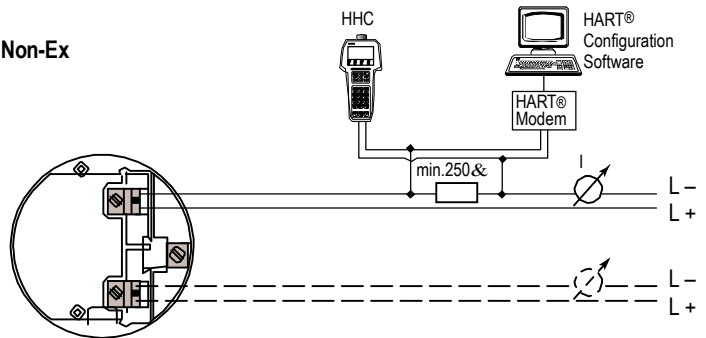
Output 1

4 ... 20 mA/HART
or
3.8 ... 20.5 mA/HART
acc. to NAMUR NE 43

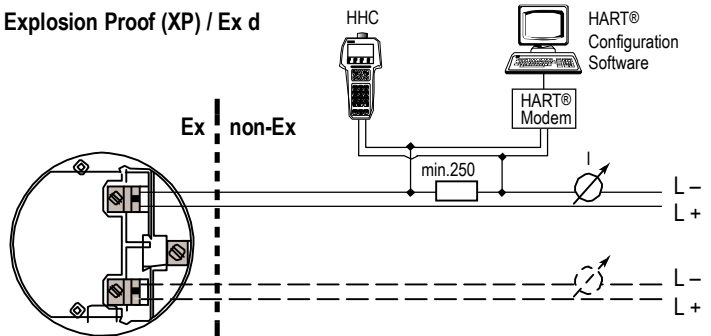
Output 2 (Option)

4 ... 20 mA
or
3.8 ... 20.5 mA
acc. to NAMUR NE 43

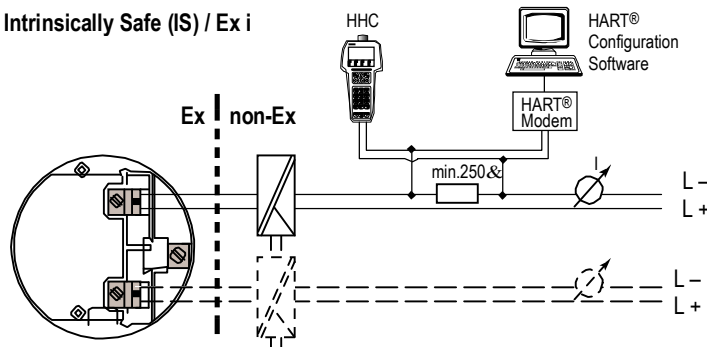
Non-Ex



Explosion Proof (XP) / Ex d



Intrinsically Safe (IS) / Ex i



Note: Other options how to connect the HHC (Hand Held Communicator) and modem to the HART® loop are available.

State-of-the-art with PACTware

The VF7 is PACTware-ready. Each device is supplied ex-factory with the appropriate DTM.

A DTM (Device Type Manager) is a device driver making available the device functionality independent from the FIELDBUS protocol and providing a graphical user interface optimized for device operation and configuration.

Simple on-screen and intuitive setup procedure for devices without a display, or for set up from the Central Control Room. Summarized setup provides perfect control of initial input, and a guarantees perfect results.

All features of PACTware are fully supported:

- ! Online device setup
- ! Displays measured values
- ! Records measured information during operation
- ! Shows status of device
- ! Gives stepwise setup with on-screen progress check
- ! Displays summary of setup selection for final supervision

