



VG4 RADAR
LEVEL GAUGE

WHY USE RADAR FOR LEVEL MEASUREMENT?

UNAFFECTED BY CHANGES IN

- ◆ Dielectric
- ◆ Pressure
- ◆ Vacuum
- ◆ Humidity
- ◆ Dust
- ◆ Viscosity
- ◆ Foam
- ◆ Temperature

VG4 RADAR'S KEY FEATURES INCLUDE

- ◆ Measuring range of up to 23 m(75 ft) with accuracy of +/- 3 mm (0.12")
- ◆ Versatile technology for liquids, slurries, emulsions and chemicals
- ◆ Measures level, distance or volume
- ◆ Flexible selection of horn and enclosed antenna types
- ◆ Two-wire loop powered 24 vDC
- ◆ Compact, durable IP67 design suitable for tough industrial environments
- ◆ Convenient, portable plug-in display and programming unit
- ◆ HART Protocol output for ease of system compatibility
- ◆ ATEX Ex ia hazardous area options available
- ◆ 25 GHz (K-band) pulse provides better focus, lower dead-band and smaller beam angle
- ◆ Simple to install and retrofit with a wide selection of process connections
- ◆ Options designed for corrosive and acidic atmospheres
- ◆ High-temperature variants available - up to 180°C
- ◆ Remote or local programming and configuration for maximum ease of use

APPLICATIONS IN MANY INDUSTRIES

- ◆ Petrochemical
- ◆ Food
- ◆ Water & Waste
- ◆ Bioenergy
- ◆ Oil & Gas
- ◆ Power Generation
- ◆ Process
- ◆ Chemicals
- ◆ Pharmaceutical
- ◆ Environmental
- ◆ Animal Feed
- ◆ Recycling

EFFECTIVE REPLACEMENT FOR

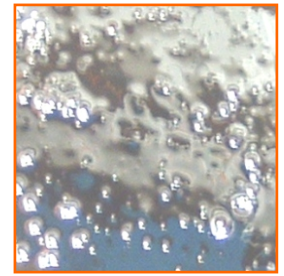
- ◆ Capacitance transmitters
- ◆ Laser transmitters
- ◆ Differential pressure transmitters
- ◆ Displacers
- ◆ Hydrostatic transmitters
- ◆ Ultrasonic transmitters

MANUFACTURED TO ISO9001 Q.M.S.



The standard of all Hycontrol products is strictly monitored to conform to all ISO quality requirements.

This ensures we meet the needs of customers as well as statutory and regulatory requirements.



Acids



Water



Slurry



Waste



Pastes



Oils

REFLEX VG4 SERIES RADAR

Hycontrol's VG4 pulse burst radar transmitter offers users a practical non-contact solution for measuring liquids, pastes and slurries. The robust, compact design and short antenna lengths make it an ideal choice for a wide variety of industrial level control applications.

The VG4 utilises higher 24 GHz (K-band) radar frequencies, which provide accuracies of up to 3mm, high measuring stability and a shortened dead band. The range of antennas incorporates stainless steel horns, and enclosed plastic tubes for corrosive applications, coupled with a selection of materials for the housing. The unit has been designed for ease of installation, with a wide range of process connections available to suit end user requirements.

The Hycontrol VG4 pulse radar is a budget-sensitive, simple level device with ATEX options and HART connectivity. It offers users across a wide range of industries an ideal solution for their level measurement and control requirements.

- ◆ Aluminium, plastic or stainless steel housing
- ◆ Measuring range up to 23 m (75 ft)
- ◆ Echo mapping for false signal rejection
- ◆ Variety of antennae and enclosures
- ◆ Detachable, plug-in programmable display
- ◆ ATEX options for hazardous areas
- ◆ 4~20mA & HART output
- ◆ Maximum temperature 180°C
- ◆ Suitable for aggressive media
- ◆ Variety of process connections
- ◆ Accuracy of +/-3 mm
- ◆ Two-wire loop powered



PROGRAMMING THE VG4



A key feature of the VG4 radar unit is the option to use the VGF-DISPLAY removable programming and display unit. The unit connects to the top of the radar unit, allowing programming via touch buttons and the LCD display screen. A simple menu system allows for fast programming and simple commissioning.

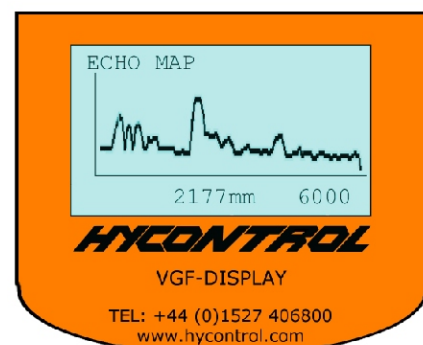
The portable nature of the VGF-DISPLAY unit is intended to provide a cost saving to users purchasing and installing multiple probes. Only one display unit is required to programme any number of installed VG4s, with output information being fed back to the site PLC or a panel via the 4~20mA or HART outputs. Alternatively a HART programmer can be used, or HYVIEW PC software for remote computer control which can be downloaded free from hycontrol.com.

The default display shows the primary measured value (which the output current is calculated from). Besides the numerical display, there is a bar graph on the right showing the value of the current output. Programming is conducted via a text-based menu, which is navigated with the unit's four buttons.

BACKGROUND ECHO MAPPING

The background echo mapping feature of the VG4 provides an excellent solution to the problem of unwanted false reflections from non-moving objects within the vessel; it enables detection of false reflections and aids the optimisation of the measurement configuration.

First, the instrument maps the totally empty tank in order to create a background image for reference. From then on, the onboard software will automatically recognise and ignore false reflections from the tank's internal geography. This ensures reliable level readings in tanks with complex internal features.




TECHNICAL DATA

TYPE	METAL HOUSING VG4□S-1□□-□ VG4□K-1□□-□	HIGH TEMPERATURE VERSION VG4H□-1□□-□, VG4J□-1□□-□
Measured and calculated values	Level, distance, volume and mass	
Measured media	Liquids	
Frequency of the measuring signal	~25 GHz (K-band)	
Minimum and maximum measuring range	Refer to information on pages 5 & 6	
Material of wetted parts		
Process connection		
Beam angle		
Minimum ϵ_r of the media		
Maximum media pressure (depending on the antenna)	25 bar (at 120 °C) with plastic antenna enclosure: 3 bar (at 25 °C)	
Media temperature	-30 ... + 100 °C (up to max. 2 min.: 120 °C) with PP antenna enclosure: max.: 80 °C	-30 ... + 180 °C
Ambient temperature	-20 ... +60 °C	
Resolution	1 mm	
Typical linearity error (as per EN 61298-2) ¹	< 0.5 m: ±25 mm, 0.5 - 1 m: ±15 mm, 1 - 1.5 m: ±10 mm, 1.5 - 8 m: ±3 mm, > 8 m: ±0.04% of the measured distance	
Temperature error (as per EN 61298-3)	0,05% FSK / 10 °C (-20 ... +60 °C)	
Output	Analogue	4 - 20 mA (3.9 - 20.5 mA)
	Digital communication	HART (minimum terminal resistor: 250 Ohm)
	Display	VG4-DISPLAY graphical display unit
Damping time	Selectable: 0 ... 99 sec	
Measuring frequency	10...60 sec as per the application settings	
Error indication	Output = 22 mA or 3.8 mA	
Output load	$R_t = (U_t - 20V) / 0.022 A$, $U_t =$ power supply voltage	
Power supply voltage	20 V ... 36 V DC, Ex: 20 V ... 30 V DC	
Electrical protection	Class III.	
Ingress protection	IP 67	
Electrical connection	2x M 20 x1.5 cable glands + internal thread for 2x ½" NPT cable protective pipe, cable outer diameter: \varnothing 7...13 mm, cross section: max. 1.5 mm ²	
Housing material	Paint coated aluminium (EN AC 4200), Stainless steel	
Sealing	Viton, EPDM	
Mass	2 - 2.6 kg	2.7 - 3.3 kg

¹ - Based on proper application settings at 95% sample rate level at constant temperature. The environment should be free from EMI noise and power supply voltage fluctuations in accordance with the standard. The reflector should be a plane plate reflector with ideal material, surface and dimensions (min. 3m x 3m). The largest false echo should be 20 dB smaller than the useful echo.

EX MARKINGS

TYPE	METAL HOUSING TYPE VG4□S-1□□-8Ex VG4□K-1□□-8Ex	HIGH TEMPERATURE VERSION WITH METAL HOUSING VG4H□-1□□-8Ex, VG4J□-1□□-8Ex
ATEX (ia)	 II 1G Ex ia IIB T6...T3 Ga Li: 200µH Ci: 16nF Ui:30V li:140mA Pi:1W	

TEMPERATURE LIMITS FOR EX CERTIFIED MODELS

TEMPERATURE DATA FOR HAZARDOUS GAS ATMOSPHERES (II B GROUP)	METAL HOUSING TYPE VG4□S-1□□-8Ex, VG4□K-1□□-8Ex			HIGH TEMPERATURE VERSION WITH METAL HOUSING VG4H□-1□□-8Ex, VG4J□-1□□-8Ex
Maximum permissible media temperature at the antenna	+80°C	+90°C	+100°C	+180°C
Maximum permissible surface temperature at the process connection	+75°C	+90°C	+100°C	+175°C
Temperature class	T6	T5	T4	T3

DIMENSIONS & DATA OF ANTENNA VARIATIONS

ALUMINIUM HOUSING, 1½" HORN ANTENNA VG4ES-140-□, VG4GS-140-□, VG4ES-14N-□, VG4GS-14N-□		ALUMINIUM HOUSING, 2" HORN ANTENNA VG4ES-150-□, VG4GS-150-□ VG4ES-15N-□, VG4GS-15N-□	
Material of wetted parts	316Ti, PTFE	316Ti, PTFE	
Process connection	1½" BSP, 1½" NPT	2" BSP, 2" NPT	
Beam angle (-3dB)	19°	16°	
Minimum measuring distance (L _{MIN})	200 mm	200 mm	

ALUMINIUM HOUSING, 1½" ANTENNA WITH PLASTIC ENCLOSURE VG4ES-140-□, VG4GS-140-□ + VG4AP-140-0, VG4AP-14N-0		ALUMINIUM HOUSING, 2" ANTENNA WITH PLASTIC ENCLOSURE VG4ES-150-□, VG4GS-150-□ + VG4AP-150-0, VG4AP-15N-0	
Material of wetted parts	PP	PP	
Process connection	1½" BSP, 1½" NPT	2" BSP, 2" NPT	
Minimum measuring distance (L _{MIN})	300 mm	300 mm	

ALUMINIUM HOUSING, 2" TRICLAMP ANTENNA WITH PTFE ENCLOSURE, HYGIENIC VERSION VG4ES-140-□, VG4GS-140-□ + VG4AT-14T-0		ALUMINIUM HOUSING, DN50 PIPE COUPLING ANTENNA WITH PTFE ENCLOSURE, HYGIENIC VERSION VG4ES-140-□, VG4GS-140-□ + VG4AT-14R-0	
Material of wetted parts	316Ti, PTFE	316Ti, PTFE	
Process connection	2" TRICLAMP	DN50 MILCH	
Minimum measuring distance (L _{MIN})	300 mm	300 mm	

ALUMINIUM HOUSING, HORN ANTENNA WITH FLANGE VG4ES-18□-□, VG4GS-18□-□	
Material of wetted parts	316Ti, PTFE
Process connection	Flange
Beam angle (-3dB)	11°
Minimal measuring distance (L _{MIN})	200 mm

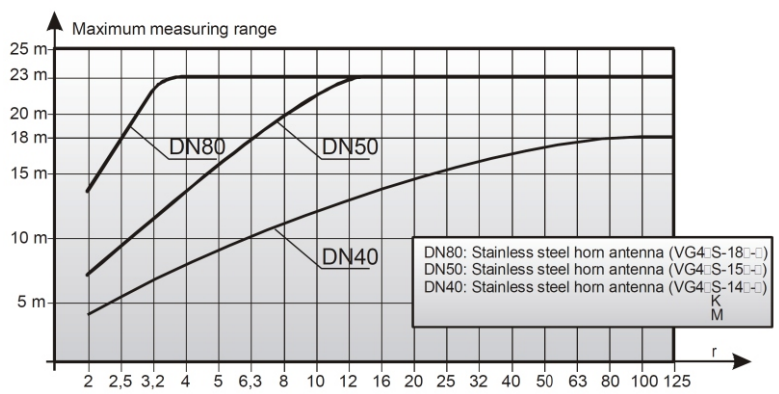
DIMENSIONS & DATA OF ANTENNA VARIATIONS

HIGH TEMPERATURE VERSION, ALUMINIUM HOUSING, 1½" HORN ANTENNA VG4HS-140-□, VG4JS-140-□, VG4HS-14N-□, VG4JS-14N-□		HIGH TEMPERATURE VERSION, ALUMINIUM HOUSING, 2" HORN ANTENNA VG4HS-150-□, VG4JS-150-□, VG4HS-15N-□, VG4JS-15N-□		HIGH TEMPERATURE VERSION, ALUMINIUM HOUSING, HORN ANTENNA WITH FLANGE VG4HS-18□-□, VG4JS-18□-□		HIGH TEMPERATURE VERSION, ALUMINIUM HOUSING, 2" TRICLAMP ANTENNA WITH PTFE ENCLOSURE, HYGIENIC VERSION VG4HS-140-□, VG4JS-140-□ + VG4AT-14T-0	
Material of wetted parts	316Ti, PTFE	316Ti, PTFE	316Ti, PTFE	316Ti, PTFE	316Ti, PTFE	316Ti, PTFE	316Ti, PTFE
Process connection	1½" BSP, 1½" NPT	2" BSP, 2"NPT	Flange	Flange	Flange	2" TRICLAMP	2" TRICLAMP
Beam angle (-3dB)	19°	16°	11°	11°	11°		
Minimal measuring distance (L _{MIN})	200 mm	200 mm	200 mm	200 mm	200 mm	300 mm	300 mm

DETERMINING MAXIMUM MEASURING RANGE

The maximum measuring range of the VG4 radar is affected by the application environment and the antenna type. Under extreme conditions the maximum measurement range may decrease by up to 85%, so it is important to consider this before choosing a device.

The maximum measuring distance is illustrated in the diagram, right, for materials with different relative dielectric constants. It is recommended that the following typical reducing factors are considered in order to calculate maximum achievable measuring range. When more than one reducing factor occurs at the same time then all factors should be considered:

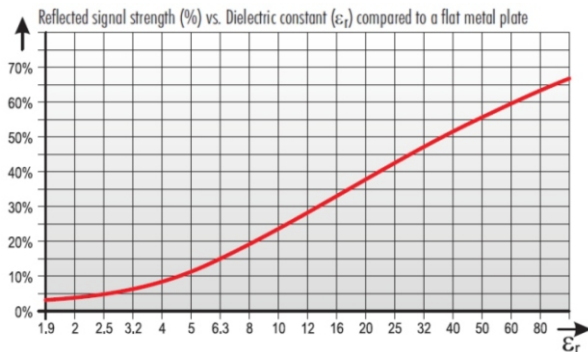


Process Condition	Reflection reduction in Amplitude	Max. measuring distance decrease by
Slow mixing or slightly waving	2...6 dB	20-50%
Foaming	2...6 dB	20-50%
Fast mixing, vortex	8...10 dB	60-70% (the measurement might be completely terminated)
Steaming, condensation	3...10 dB	30-70% (the measurement might be completely terminated)
PP antenna enclosure	2 dB	20%
PTFE antenna enclosure	1 dB	10%

OPERATION GUIDE

The VG4 level transmitter operates on the principle of measuring the time-of-flight of a microwave radar burst. The propagation speed of microwave pulses is practically the same in air, gases and vacuum; this is also independent of the process temperature and pressure, meaning that the measured distance is not affected by the physical properties of the media to be measured.

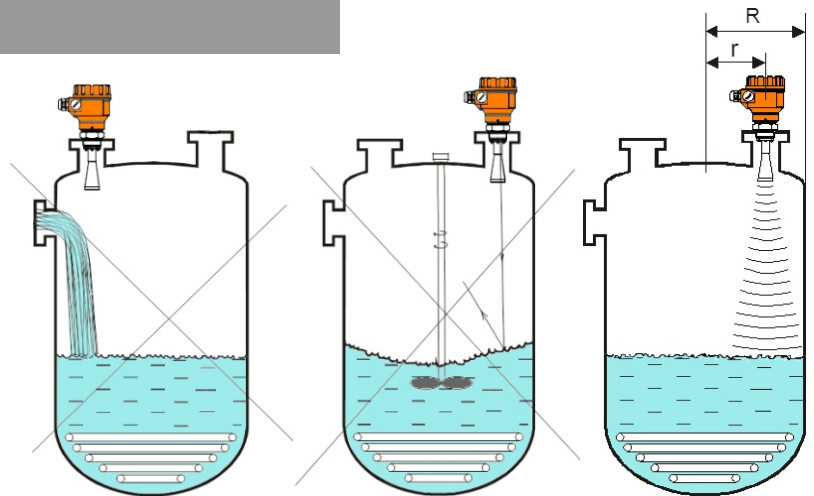
The level transmitter produces microwave pulses, lasting just a few nanoseconds, which are transmitted toward the surface of the product. A portion of the energy of this pulse is reflected back to the transmitter (the strength of this reflection is dependent upon the dielectric constant of the product), and the time-of-flight is measured and processed by the onboard electronics. This is then converted to proportional data for distance, level or volume. As mentioned on the previous page there are multiple factors that may affect reflection, including turbulence, foam and dielectric constant. The dielectric constant (ϵ_r) of the media should be greater than 1.9 - it is not practicable to measure lower than this with a radar device.



TYPICAL ϵ_r VALUES			
Petroleum	2.1	Acetone	21
Crude oil	2.1	Ethyl alcohol	24
Benzene	2.2	Ethanol	25.1
Gasoline	2.3	Methyl alcohol	33.1
Bitumen	2.6	Methanol	33.7
Carbon disulphide	4	Glycol	37
Diesel oil	4.4	Nitrobenzene	40
Ethers	6.2	Glycerol	80
Acetic acid	17-26	Sulphuric acid	84

MOUNTING THE VG4

To avoid unwanted reflections, the VG4 should not be mounted in the middle of the vessel. The ideal position for the instrument is when $r = (0.3 \dots 0.5)R$ in the case of a cylindrical tank. Due to the beam cone, the distance between the sensor and the tank wall should be at least 200 mm. Waves, vortex or strong vibrations can have a negative influence on the measurement accuracy and the maximum measuring range. To avoid these effects, the mounting should be as far as possible from the sources of the disturbing effects. The device should also be mounted as far as possible from the filling stream or the tank outlet.



ORDERING INFORMATION

VG4 - 1 - *

FUNCTION	CODE	ANTENNA / HOUSING MATERIAL	CODE	ANTENNA / DIAMETER	CODE	PROCESS CONNECTION	CODE	OUTPUT / Ex	CODE
Compact transmitter	E	316Ti / Aluminium housing	S	DN40 Horn / 1½"	4	BSP	0	4 - 20 mA + HART	4
Transmitter + display	G	316Ti / Stainless steel housing	K	DN50 Horn / 2"	5	NPT	N	4 - 20 mA + HART / Ex	8
High temperature transmitter	H			DN80 Horn / Flange	8	DN 80 PN25	2		
High temperature transmitter + display	J					DN 100 PN25	3		
						DN 125 PN25	4		
						DN 150 PN25	5		
						DN 80, PP	6		
						DN 100, PP	7		
						DN 125, PP	8		
						DN 150, PP	9		
						3" RF 150 psi	A		
						4" RF 150 psi	B		
						5" RF 150 psi	C		
						6" RF 150 psi	D		
						3" RF, PP	E		
						4" RF, PP	F		
						5" RF, PP	G		
						6" RF, PP	H		
						JIS 10K80A	J		
						JIS 10K100A	K		
						JIS 10K125A	L		
						JIS 10K 150A	M		
						JIS 80A, PP	P		
						JIS100A, PP	R		
						JIS125A, PP	S		
						JIS150A, PP	T		

ACCESSORIES TO BE ORDERED NON-SEPARATELY	ORDER CODES
PP antenna enclosure with 1½" BSP threaded process connection	VG4AP-140-0
PP antenna enclosure with 1½" NPT threaded process connection	VG4AP-14N-0
PTFE antenna enclosure with 1½" BSP threaded process connection	VG4AT-140-0
PTFE antenna enclosure with 1½" NPT threaded process connection	VG4AT-14N-0
PP antenna enclosure with 2" BSP threaded process connection	VG4AP-150-0
PP antenna enclosure with 2" NPT threaded process connection	VG4AP-15N-0
PTFE antenna enclosure with 2" BSP threaded process connection	VG4AT-150-0
PTFE antenna enclosure with 2" NPT threaded process connection	VG4AT-15N-0

* The order code of an Ex version should end in 'Ex'

Please note that not all combinations are possible - please speak to a Hycontrol representative to check your specifications can be met.

DISPLAY UNIT TECHNICAL DATA

Display	64x128 Dot-matrix LCD, glyphs, units and bargraph
Ambient temperature	- 20°C... +60°C
Housing material	PBT fiberglass, plastic (DuPont®)



HYCONTROL - THE COMPLETE LEVEL SOLUTION

Hycontrol has been at the forefront of level control and measurement technology for over thirty-five years, providing effective solutions for diverse applications across a wide range of industries ranging from quarrying to food; from nuclear power to chemical; and from animal feed to waste recycling. From our manufacturing base in Redditch, Worcestershire, we have been trusted to oversee thousands of applications across the UK and around the world.

At Hycontrol, we pride ourselves on providing a 'complete solution' service to our UK customers. We provide a turnkey solution for level equipment requirements, with the experience and skill to design, manufacture, install and maintain bespoke measurement and control systems that are crafted to suit the particular needs of each individual customer.

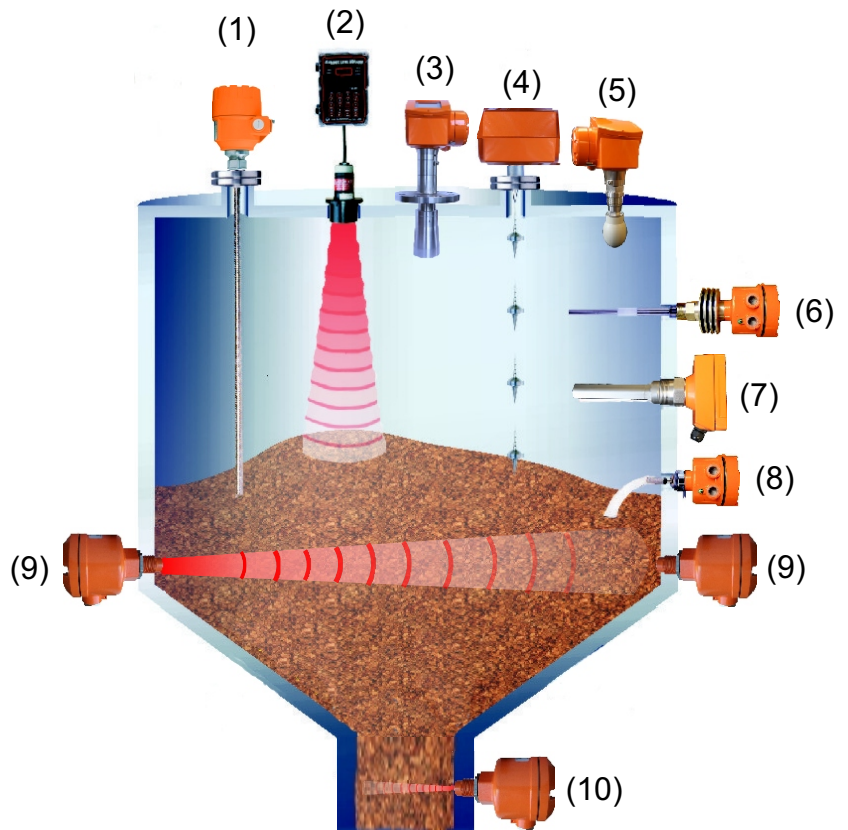
We understand the consequences of inaccurate or unreliable level systems, and therefore each Hycontrol installation is tailored precisely to match your application. Our goal is simple: to provide the best-engineered solution - *without compromise*.

With one of the widest ranges of level measurement technologies on the market including award-winning silo pressure safety systems and a patented range of foam detection and control equipment, backed up by a team of highly experienced engineers and technicians, Hycontrol is a leading force in the manufacture and supply of advanced level solutions.



Product Range For Solids:

- (1) TDR Radar for Solids
- (2) 2-Wire Ultrasonic Transmitter
- (3) FMCW 2-Wire Radar (Horn)
- (4) Continuous Servo Level Indicator
- (5) FMCW 2-Wire Radar (Drop)
- (6) Capacitance Level Switch
- (7) Vibrating Probe Level Switch
- (8) Rotating Paddle Level switch
- (9) Microwave Level Switch
- (10) Doppler Flow Switch



Product Range For Liquids:

- (1) Bypass Level Indicator with Radar
- (2) TDR Radar for Liquids
- (3) 2-Wire Ultrasonic Transmitter
- (4) FMCW 2-Wire Radar (Horn)
- (5) Magnetic Float Switches
- (6) FMCW 2-Wire Radar (Corrosion-Proof)
- (7) Capacitance Level Switch
- (8) RF Admittance Level Switch
- (9) Side Mounting 316 SS Float Switch
- (10) Tuning Fork Level Switch
- (11) Tuning Fork Level Switch
- (12) Ultrasonic Through Wall
- (13) Mini Magnetic Float Level Switch

