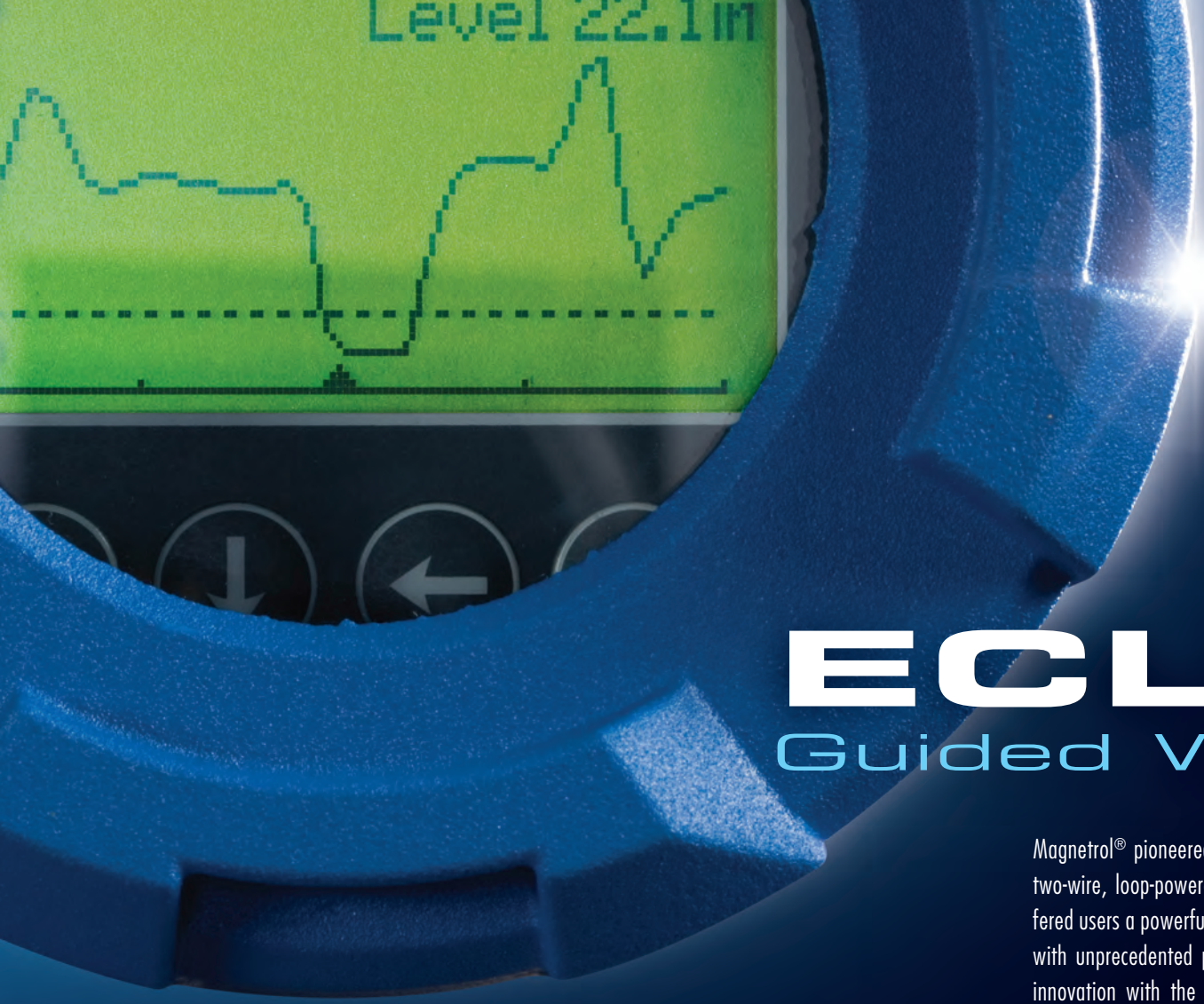
ECLIPSE® 706GWR

Advanced Guided Wave Radar Transmitter
for Level Measurement and Control

Magnetrol®



ECLIPSE®

Guided Wave Radar

Magnetrol® pioneered guided wave radar (GWR) by introducing the ECLIPSE® Model 705 two-wire, loop-powered transmitter for use in industrial liquid level applications. GWR offered users a powerful way to measure and control challenging media and process variations with unprecedented performance. Over the years, our engineers continued to drive GWR innovation with the release of the first high-temperature, high-pressure probe; the first patented steam probe; the first interface transmitter; and culminating in the incorporation of GWR into a patented Aurora® MLI chamber to offer true redundant measurement.

Now, Magnetrol is revolutionizing the next generation of GWR solutions. With the introduction of the ECLIPSE Model 706 guided wave radar transmitter, Magnetrol provides process control professionals with more power than ever before, improving operational safety, efficiency and performance.

ECLIPSE Model 706 GWR

Magnetrol®

Magnetrol International Incorporated – a global leader in level and flow control technology – designs, manufactures, markets and services level and flow instrumentation worldwide.

Magnetrol product groups are based upon these technologies:

- Air Sonar
- Buoyancy
- Contact Ultrasound
- Non-Contact Ultrasound
- Guided Wave Radar
- Pulse Burst Radar
- RF Capacitance
- Thermal Dispersion
- Vibration
- Visual Indicators

The industries we serve include:

- Petroleum Production
- Petroleum Refining
- Power Generation
- Petrochemical
- Chemical
- Water & Wastewater
- Pulp & Paper
- Food & Beverage
- Pharmaceutical

An Introduction to Guided Wave Radar Technology

When Magnetrol introduced guided wave radar technology to liquid level applications for the process industry, it filled a critical need of providing exceptionally robust level measurement under challenging process conditions. Guided wave radar continues to deliver premier performance because it is virtually unaffected by density variance, as well as media conditions where turbulence, vaporization, foaming, boiling and flashing can occur.

Principle of Operation

Guided wave radar functions according to the principle of time domain reflectometry (TDR). As shown at right, a generated pulse of electromagnetic energy travels down the probe. Upon reaching the surface of the medium, the pulse is reflected. Sophisticated high speed circuitry captures these signals in real time (nanoseconds) and reconstructs them in equivalent time (milliseconds) to make level measurement a practical reality.

Unlike conventional non-contact radar, which launches its signal into free space, the ECLIPSE GWR transmitter launches its signal within the contained path of a probe (waveguide) which is in direct contact with the process media. This direct contact makes the signal less vulnerable to distortion brought on by process conditions that might challenge other technologies.

ECLIPSE transmitters have been designed for easy setup and configuration. It is a compact instrument that is easy to handle and install, and the innovative dual-compartment angled housing makes for optimum viewing of the graphic LCD.

Process Connected

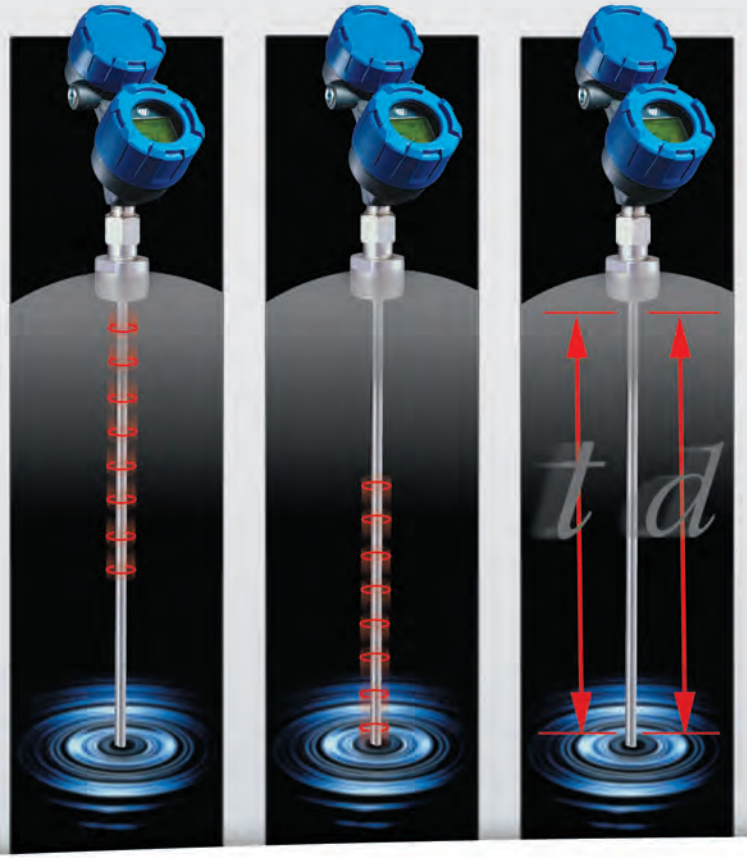
Because the guided wave radar signal is transmitted via the waveguide directly into the process media, it is not distorted by tank atmospheres, process conditions, tank obstructions or false echoes.

How Guided Wave Radar Works

ECLIPSE transmitters generate pulses of electromagnetic energy that are transmitted down the probe, or waveguide.

When the pulses reach a surface that has a higher dielectric than the air or vapor in which they travel, they are reflected back up the probe.

The pulses' transit time to and from the surface is measured by high speed circuitry, converted to distance and then displayed on the LCD as a level reading.



ECLIPSE Model 706 Transmitter

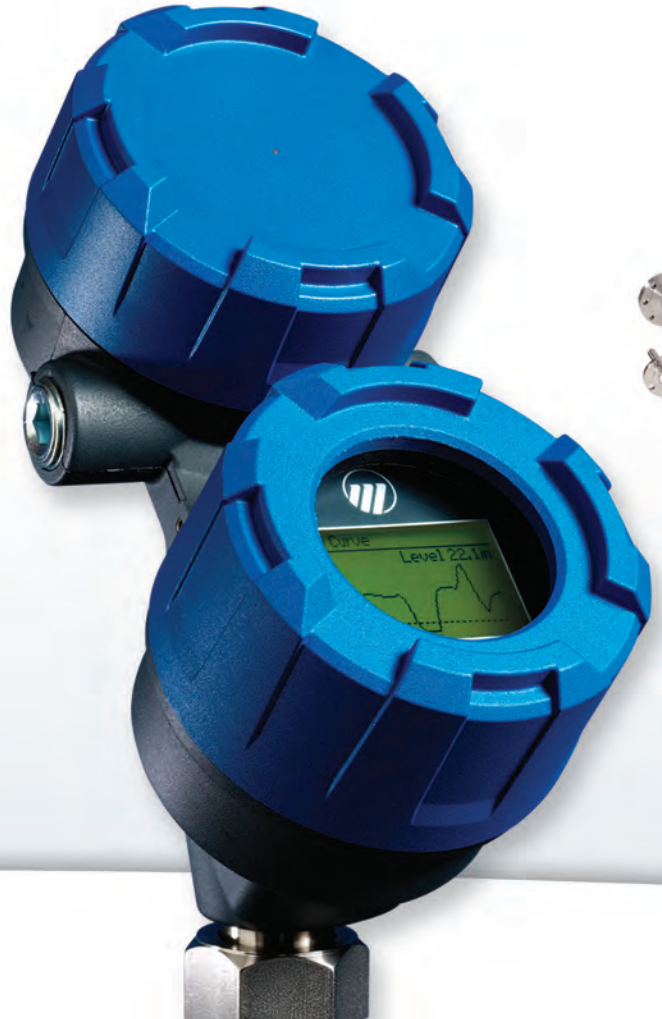
Advanced GWR Transmitter for Level Measurement

The ECLIPSE Model 706 transmitter has taken GWR to the next level with a strong, accurate signal, powerful diagnostics and an extensive probe offering.

With a very broad installed base of transmitters operating worldwide, ECLIPSE has demonstrated the ability to provide accurate and reliable measurement at a performance level that surpasses many traditional technologies. This is due to the efficiency of guided wave radar technology and the ECLIPSE Model 706's broad range of sensing probes designed to meet the special demands of temperature, pressure, viscosity, liquid interface, vessel depth and other variables.

ECLIPSE accurately measures top level and interface liquids, slurries and bulk solids with a dielectric range from 1.4 to 100, from hydrocarbons to water-based media. The transmitters perform in all conventional process and storage vessels, bridles, and bypass chambers whose temperatures and pressures are rated to the capabilities of the particular probe used. There is a probe for virtually every application, from routine water storage to vessels exhibiting corrosive vapors, foam, steam, coating and buildup, surface agitation, bubbling or boiling, high fill/empty rates, low level and varying dielectric or specific gravity.

ECLIPSE is at work in the most demanding applications, including those in petroleum refining, electric power generation, chemical manufacturing, water and wastewater, pulp and paper, food and beverage, and pharmaceutical processing. ECLIPSE also serves as the ideal retrofit transmitter, made possible by Magnetrol's wide range of adaptation hardware for easy and affordable replacement of antiquated level measurement technology.



Total Guided Wave Radar Solutions

ECLIPSE transmitters have been engineered to provide users with the total range of measurement solutions in guided wave radar. With user-friendly transmitters and an extensive line of dedicated coaxial, single and twin rod probes, ECLIPSE has emerged as the premier measurement instrument for today's level challenges.

ECLIPSE Model 706 Transmitter

Advanced GWR Transmitter for Level Measurement

High Performance, Low Power

The ECLIPSE Model 706 transmitter is an advanced two-wire, 24 VDC, loop-powered transmitter. Microprocessor-based circuitry controls the measurement engine and provides an analog 4-20 mA signal with HART® or FOUNDATION fieldbus™ digital communication output.

Using GWR technology, ECLIPSE measurement performance is not process-dependent; therefore, changing specific gravity and dielectric constant have little or no effect on measurement accuracy. The measurement engine of ECLIPSE is optimized under firmware control to provide continuous and reliable level detection, and even significant amounts of media buildup on a single rod probe will not affect accurate detection of liquid level.

The ECLIPSE Model 706 utilizes many special-purpose probes, including those having high-temperature (to +850° F / +454° C), high-pressure (to 6250 psig / 430 bar), ultra-low dielectric (≥1.4) and bulk solids with 3000 lb. pull-down capability.

Dual-Compartment Design

The ECLIPSE Model 706 innovative dual-compartment die-cast enclosures orient separate wiring and electronics compartments on the same plane – angled for convenient wiring, configuration and data display. The wiring compartment at the top of the transmitter isolates the power/signal conductors from the electronics compartment beneath it by way of an environmentally sealed feed-through. In addition to being potted and sealed to prevent water intrusion, the electronics are surge and transient protected. The Model 706 has received the pertinent Intrinsically Safe, Explosion Proof and Non-Incendive agency approvals.

A quick-disconnect probe coupling eases installation and servicing needs on all ECLIPSE models by allowing full 360° rotation of the transmitter housing. Probes may be installed without concern for their orientation to the transmitter head. To orient the transmitter, the user simply selects the desired transmitter position, tightens the coupling and then completes the wire terminations.

As an added convenience on all ECLIPSE models, no level change is required for configuration and no field calibration is necessary.

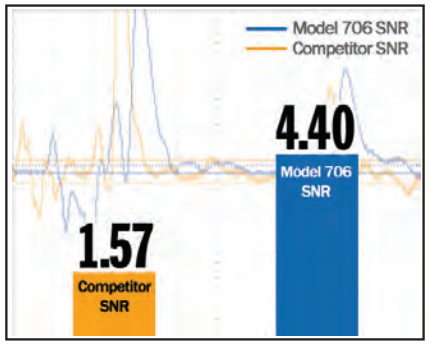
Superior Signal Performance

Breakthrough innovation in the transmitter GWR circuitry allows the Model 706 to achieve both a higher transmit pulse amplitude and improved receiver sensitivity, resulting in superior signal-to-noise ratio as compared to competitive GWR devices.

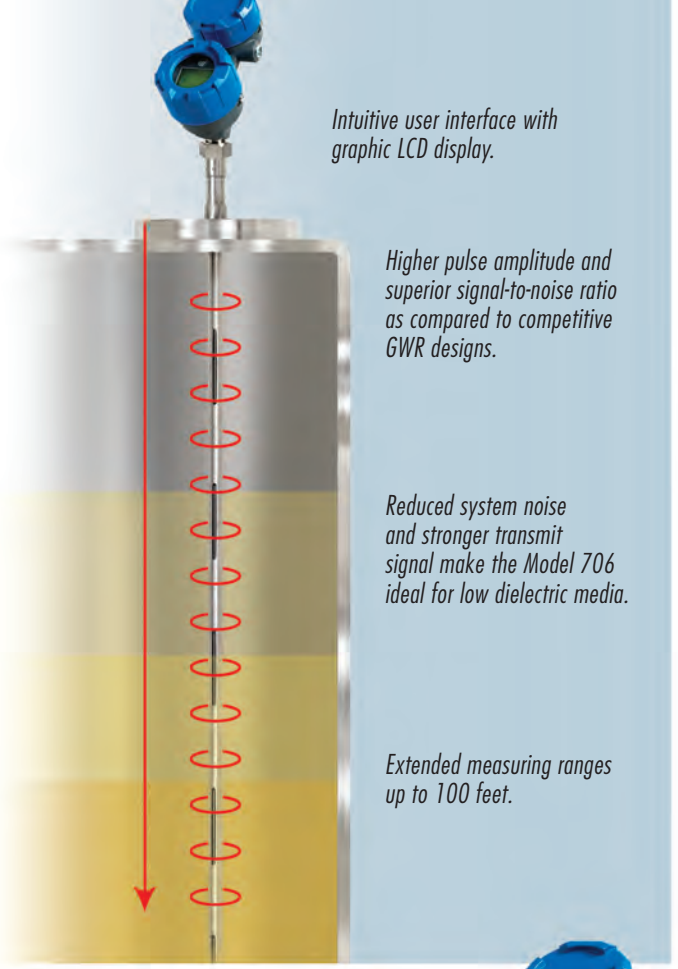
While GWR options on the market today promote the amplitude (size) of transmitted radar pulse, a far more important parameter in reliable level measurement in difficult applications is the overall signal-to-noise ratio (SNR).

Magnetrol's ECLIPSE Model 706 uses an innovative design concept called Diode Switched Front End to dramatically reduce the impact of noise and increase overall transmitter performance. This new circuit design completely isolates the transmit path from the receive path, thereby maximizing receiver sensitivity and impedance matching. Diode Switched Front End circuitry, along with a best-in-class, strong transmitted signal, enables the Model 706 to detect very small signal reflections from the process medium.

The reduction of system noise, in conjunction with a stronger transmit signal, enhances the overall SNR. The undeniable result is more margin and more robust operation in every level application, including extremely low dielectric media, extended measuring ranges and punishing conditions where foaming, boiling or flashing can occur.



The Model 706 has a signal-to-noise ratio (SNR) almost 300% higher than the nearest competitor!



Intuitive user interface with graphic LCD display.

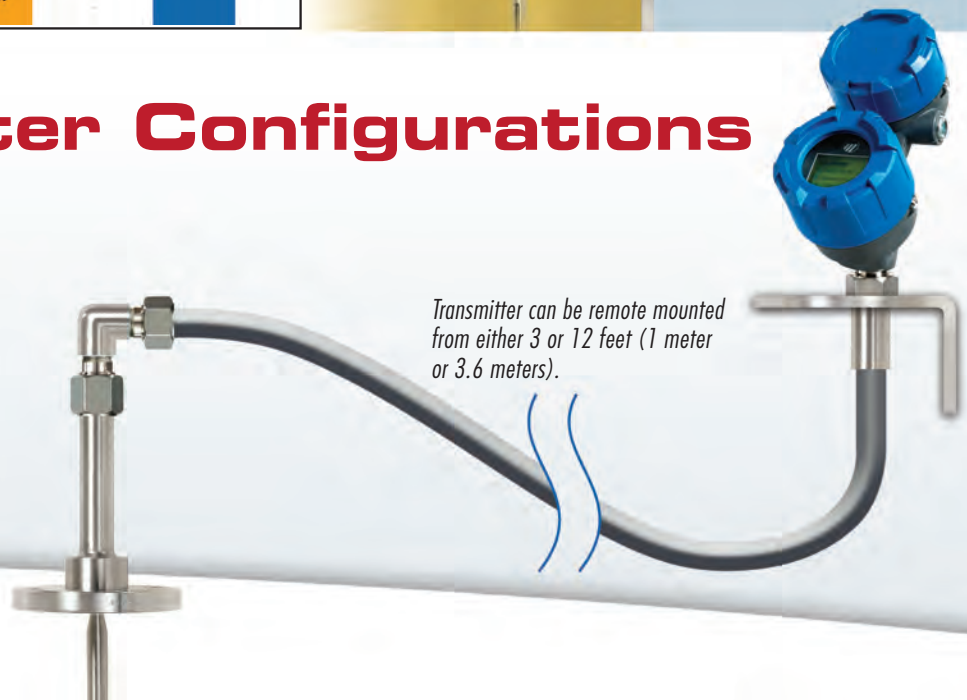
Higher pulse amplitude and superior signal-to-noise ratio as compared to competitive GWR designs.

Reduced system noise and stronger transmit signal make the Model 706 ideal for low dielectric media.

Extended measuring ranges up to 100 feet.

Remote Transmitter Configurations

The Model 706 is available in three different configurations. The standard integral transmitter is mounted directly onto the probe. However, for those applications involving high temperature or high vibration or simply for ease of viewing, the transmitter can be remote mounted from the probe by either 3 feet or 12 feet (1 meter or 3.6 meters).



Transmitter can be remote mounted from either 3 or 12 feet (1 meter or 3.6 meters).

Overfill Capable Probes

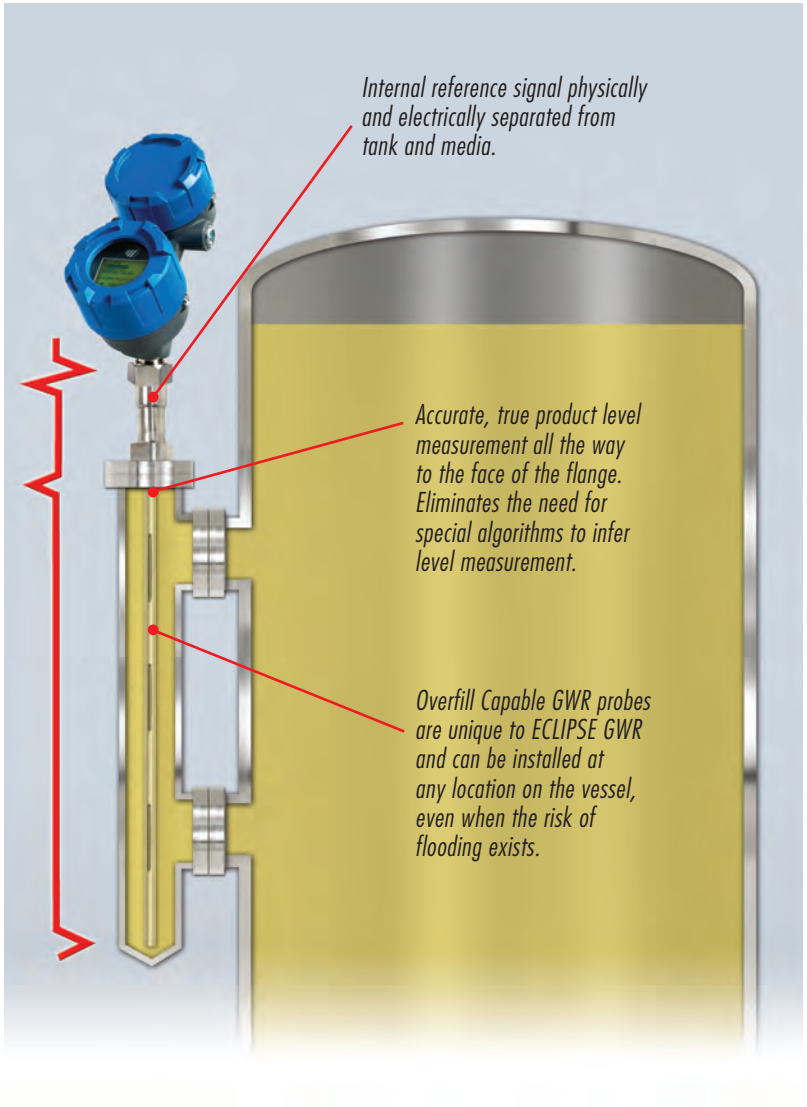
A unique feature to the ECLIPSE Model 706 transmitter is the Overfill Capability of many of the probes in its offering.

Although European agencies like WHG or VLAREM certify Overfill Proof protection, defined as the tested, reliable operation when the transmitter is used as an overfill alarm, it is assumed in their analysis that the installation is designed in such a way that the vessel or side-mounted cage cannot physically overfill.

Experience has shown us that there are practical applications where a GWR probe can be completely flooded with level all the way up to the process connection (face of the flange). Although the affected areas are application and probe dependent, typical GWR probes have a transition zone (or possibly dead zone) at the top of the probe where interacting signals can either affect the linearity of the measurement or, more dramatically, actually result in a complete loss of signal.

While many manufacturers of GWR transmitters may use special algorithms to "infer" level measurement when this undesirable signal interaction occurs and the actual level signal is lost, the ECLIPSE Model 706 offers a unique solution by utilizing a concept called Overfill Safe Operation.

An Overfill Safe probe is one defined by the fact that it has predictable and uniform characteristic impedance all the way down the entire length of the waveguide (probe). These probes allow the ECLIPSE Model 706 to measure accurate levels to within specification up to the process flange without any non-measureable zones at the top of the GWR probe. Overfill Safe GWR coaxial and single rod Overfill Capable Probes can be installed in various configurations, even when the risk of flooding exists.

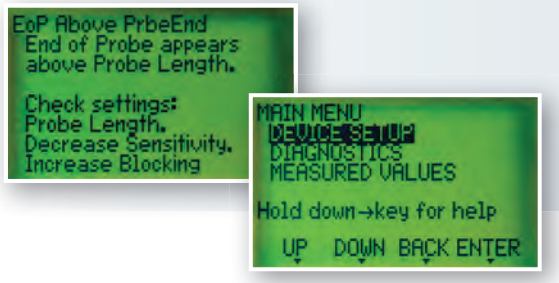


Convenient Pre-Configuration

At no additional cost, our exclusive "Pre-Configuration" feature allows for the Model 706 transmitter to be completely configured prior to shipment, giving you what you have always wanted…a transmitter you can take out of the box, apply 24 VDC to, and WALK AWAY!

Diagnostics

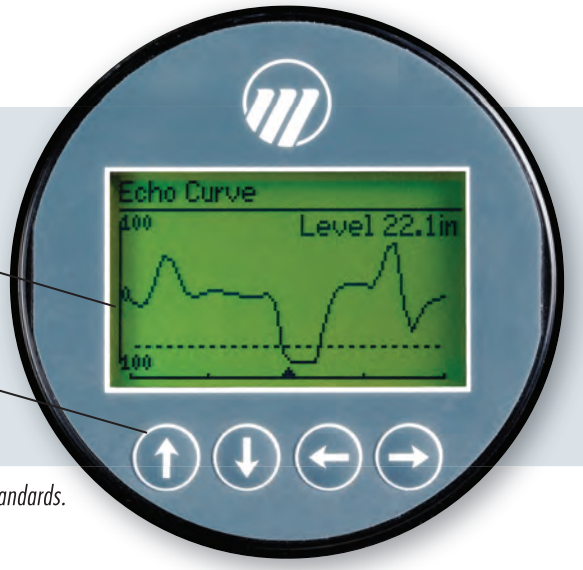
The ECLIPSE Model 706 takes the user interface experience to new levels of convenience and functionality. The LCD diagnostics convey critical real-time waveform and trend data with outstanding ease of use.



Can be programmed to automatically capture waveform data by time or by event occurrence.

4-button user interface and graphical LCD display provide enhanced depth of data, indicating on-screen waveforms and troubleshooting tips.

Conforms to NE 107 standards.

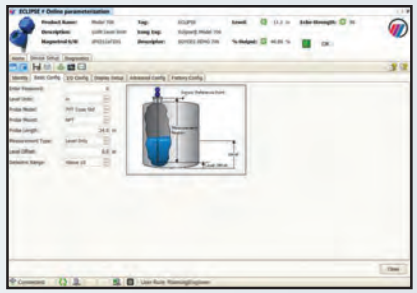


Configuration and Troubleshooting Software (DTM)

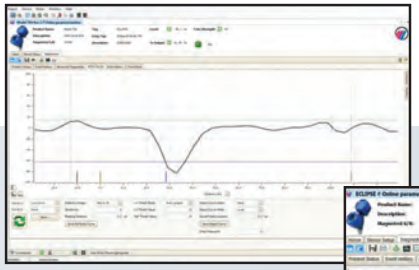
A fully redesigned and upgraded DTM puts real-time and historical trend data at your fingertips, utilizing an intuitive user interface that delivers powerful troubleshooting tools in just one or two clicks of the mouse.

PACTware

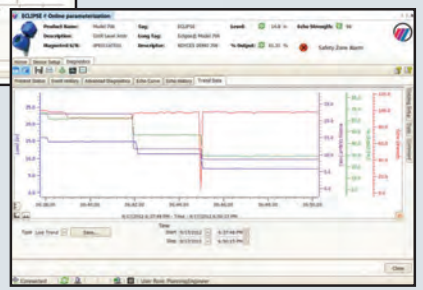
Home Screen
Critical performance data are no more than two clicks away.



Device Setup
Easy device setup allows for Identity, Basic, I/O Display, Advanced and Factory configuration.



Echo Curve
Real-time echo curve displays liquid level exactly as "seen" by transmitter — configurable for unattended echo captures based on time or event.



Trend Data
Data over time yield insight into performance vs. changing process levels and conditions -- configurable for unattended capture by the transmitter.

ECLIPSE Model 706 Transmitter Specifications

System Design

Measurement Principle	Guided time of flight via Time Domain Reflectometry (TDR)

Input

Measured Variable	Level, as determined by GWR time of flight
Span	6 inches to 100 feet (15 to 3048 cm)

Output

Type	4 to 20 mA with HART: 3.8 mA to 20.5 mA useable (per NAMUR NE43) FOUNDATION fieldbus
Resolution	Analog: 6 uA, Digital: 1 mm
Loop Resistance	634 ohms @ 24 VDC and 20.5 mA
Diagnostic Alarm	Adjustable: 3.6 mA, 22 mA, or HOLD (complies with NAMUR NE 107)
Damping	Adjustable 0–10 seconds

User Interface

Keypad	4-button menu-driven data entry
Display	Graphic Liquid Crystal Display
Digital Communication	HART Version 7– FOUNDATION fieldbus H1 protocol
Menu Languages	Transmitter LCD: English, French, German, Spanish, Russian HART DD: English, French, German, Spanish, Russian, Chinese, Portuguese FOUNDATION fieldbus Host System: English
Systems	AMS, PACT*ware*™ DTM, FOUNDATION fieldbus, Field Communicator

Power (at transmitter terminals)

	HART: General Purpose/Intrinsically Safe/Explosion Proof: 11 to 36 VDC FOUNDATION fieldbus: FISCO 9 to 17.5 VDC FNICO 9 to 32 VDC

Housing

Material	IP67/Die Cast Aluminum AH13 (<0.2% copper); optional 316 stainless steel
Net/Gross Weight	Aluminum: 4.5 lbs. (2.04 kg) 316 Stainless Steel: 10.0 lbs. (4.54 kg)
Overall Dimensions	H 8.35" (212 mm) x W 4.03" (102 mm) x D 7.56" (192 mm)
Cable Entry	½" NPT or M20
SIL 2 Hardware (Safety Integrity Level)	Functional Safety to SIL 2 as 1oo1 in accordance with IEC 61508 (Full FMEDA report available upon request)

Environment

Operating Temperature	-40° to +175° F (-40° to +80° C); LCD viewable -5° to +160° F (-20° to +71° C)
Storage Temperature	-40° to +185° F (-40° to +85° C)
Humidity	0 to 99%, non-condensing
Electromagnetic Compatibility	Meets CE requirement (EN 61326) and NAMUR NE 21 NOTE: Single Rod and Twin Cable probes must be used in metallic vessel or stillwell to maintain CE noise immunity
Surge Protection	Meets CE EN 61326 (1000V)
Shock/Vibration	ANSI/ISA-S71.03 Class SA1 (Shock); ANSI/ISA-S71.03 Class VC2 (Vibration)

Performance

Reference Conditions	Reflection from liquid, with dielectric constant in center of selected range, with a 72" coaxial probe at +70° F (+20° C), in Auto Threshold Mode
Linearity	Coaxial/Caged Probes: <0.1% of probe length or 0.1 inch (2.5 mm), whichever is greater Single Rod in Tanks/Twin Cable: <0.3% of probe length or 0.3 inch (8 mm), whichever is greater
Accuracy	Coaxial/Caged Probes: ±0.1% of probe length or ±0.1 inch (2.5 mm), whichever is greater Single Rod in Tanks/Twin Cable: ±0.5% of probe length or ±0.5 inch (13 mm), whichever is greater Interface Operation: ±1 inch (25 mm)
Resolution	±0.1 inch (25 mm)
Repeatability	<0.1 inch (25 mm)
Hysteresis	<0.1 inch (25 mm)
Response Time	<1 second
Warm-up Time	<5 seconds
Ambient Temperature Effect	Approximately ±0.02% of probe length per degree C (for probes greater than 8 feet (2.5 meters))
Process Dielectric Effect	<0.3 inch (7.5 mm) within selected range

FOUNDATION Fieldbus

ITK Version	6.0.1
H1 Device Class	Link Master (LAS) – selectable ON/OFF
H1 Profile Class	31PS, 32L
Function Blocks	(8) AI, (3) Transducer, (1) Resource, (1) Arithmetic, (1) Input Selector, (1) Signal Characterizer, (1) PID, (1) Integrator

ECLIPSE Model 706 Probe Offering Overview

Overfill Capable/Interface Probes

• Coaxial

- Standard Model 7yT	Standard general purpose coaxial probe for clean applications
- High Pressure Model 7yP	Coaxial probe for high pressure applications
- High Temperature High Pressure Model 7yD	Coaxial probe for high temperature applications
- Saturated Steam Model 7yS	Coaxial probe for saturated steam applications

• Single Rod

- Standard Model 7yG	Standard general purpose singe rod probe for external chamber applications
- High Pressure Model 7yL	Single rod probe for high pressure external chamber applications
- High Temperature High Pressure Model 7yJ	Single rod probe for high temperature external chamber applications

Standard Probes

• Single Rod Bare – Rigid

- Standard Model 7yF	Standard general purpose single rod probe for tank applications
- High Pressure Model 7yM	Single rod probe for high pressure tank mounted applications
- High Temperature High Pressure Model 7yN	Single rod probe for high temperature tank mounted applications

• Single Rod Coated – Rigid

- PFA Coated Model 7yF-4	PFA coated probe for viscous applications
- Corrosion Resistant Model 7yF-F	PFA faced flange probe for corrosive applications

• Flexible (Direct Insertion into Tanks)

- Single Cable Standard Model 7y1	Standard single cable probe for extended range applications
- Single Cable High Temperature High Pressure Model 7y3	High temperature single cable probe for extended range applications
- Twin Cable Standard Model 7y7	Standard twin cable probe for extended range applications

• Flexible (In Side-Mounted Chambers)

- Single Cable Standard Model 7y4	Standard single cable probe for external chamber applications
- Single Cable High Temperature High Pressure Model 7y6	High temperature single cable probe for external chamber applications

• Bulk Solids

- Single Cable Model 7y2	Single cable probe for bulk solids applications
- Twin Cable Model 7y5	Twin cable probe for bulk solids applications

Magnetrol®

Worldwide Level and Flow Solutions℠

CORPORATE HEADQUARTERS
5300 Belmont Road • Downers Grove, Illinois 60515-4499 USA
Phone: 630-969-4000 • Fax: 630-969-9489
magnetrol.com • info@magnetrol.com

EUROPEAN HEADQUARTERS
Heikensstraat 6 • 9240 Zele, Belgium
Phone: 052 45.11.11 • Fax: 052 45.09.93

BRAZIL: Av. Dr. Mauro Lindemberg Monteiro, 185, Quadrante 16 • CEP 06278-010 • Osasco • São Paulo
CANADA: 145 Jardin Drive, Units 1 & 2 • Concord, Ontario L4K 1X7
CHINA: Plant 6, No. 191, Huajin Road • Minhang District • Shanghai 201108
DEUTSCHLAND: Alte Ziegelei 2-4 • D-51491 Overath
DUBAI: DAFZA Office 5EA 722, P.O. Box 293671 • Dubai, United Arab Emirates
INDIA: C-20 Community Centre • Janakpuri, New Delhi 110 058
ITALIA: Via Arese, 12 • 20159 Milano
RUSSIA: 190895, Saint-Petersburg, Marshala Govorova Street, House 35A, Office 532
SINGAPORE: 33 Ubi Avenue 3 • #05-10 Vertex • Singapore 408868
UNITED KINGDOM: Regent Business Centre • Jubilee Road • Burgess Hill, West Sussex RH15 9TL

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