



MACH 10® ULTRASONIC METER

Sizes: 5/8", 3/4", and 1"

The MACH 10® is Neptune's newest water meter that offers solid state metrology with a rugged, lead free bronze maincase. The MACH 10 was designed to have the look and feel of a traditional water meter to help eliminate new technology concerns of your customers. Engineered to fit into even the smallest residential meter boxes, the MACH 10 fits the bill for all meter applications. At first glance you know the MACH 10 is a water meter... "Made in America."



MAXIMIZE REVENUE

The extended low-flow accuracy of the MACH 10 allows you to measure virtually every drop used by your customers. Maintaining this level of meter performance over the life of the meter will maximize your utility's revenue stream from your metering program. The MACH 10 features no moving parts. Because there are no internal parts that can wear over time, there is no opportunity for accuracy loss over the life of the meter (flat accuracy curve).

No wear = No accuracy loss = Maximum revenue dollars

NO MAINTENANCE REQUIRED

Imagine having a residential meter with no moving parts and a 20-year battery life. Is that really possible? The answer is, "Yes" – the MACH 10.

No moving parts = No wear + 20-year battery = Maintenance free for life

SOLID STATE METROLOGY WITH SOLID BRONZE MAINCASE

The MACH 10 provides the best of both worlds, solid state metrology with a rugged, lead free, bronze maincase. With the MACH 10, there is no concern over breaking plastic meter spuds or cross-threading of plastic threads because there are none. Neptune believes that if a meter is capable of providing sustained accuracy over its life, the maincase should be designed to last the meter's lifetime as well. This is why we designed the MACH 10 solid state meter with a solid bronze maincase. The corrosion-resistant, lead-free, high-copper alloy maincase is built to withstand demanding service conditions; internal water pressure, rough handling during installation, and in-line piping stresses.

Field proven NSF/ANSI 61 bronze maincase = Confidence = No stranded assets

OPERATING CHARACTERISTICS

Meter Size	Normal Operating Range @ 100% Accuracy (+/- 1.5%)	AWWA Standard	Low Flow @ 97% Accuracy
5/8"	0.10 to 25 US gpm 0.02 to 4.55 m³/h	1 to 20 US gpm 0.23 to 4.5 m³/h	0.05 US gpm 0.01 m³/h
3/4"	0.10 to 35 US gpm 0.02 to 6.82 m³/h	2 to 30 US gpm 0.45 to 6.8 m³/h	0.05 US gpm 0.01 m³/h
1"	0.40 to 55 US gpm 0.11 to 11.36 m³/h	3 to 50 US gpm 0.68 to 11.4 m³/h	0.25 US gpm 0.03 m³/h

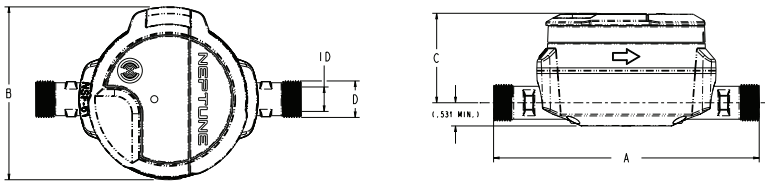
KEY BENEFITS

- Extended low-flow range and accuracy
- No maintenance plus accuracy sustained over meter life
- Regulatory compliance – peace of mind
- Health and asset protection with the highest lead free legislation compliance
- Supports Water Conservation
 - Provides leak history/diagnostics
 - Enables proactive leak notification
- Onsite customer event troubleshooting tools
- Increased operational efficiencies
 - Workorder reduction for high water bill inquiries
 - Drought management
 - Reduction of water loss through proactive notification of water leaks
- Tamper management
 - Identification and prioritization of potential tamper situations

KEY FEATURES

- Advanced ultrasonic technology
- No moving parts
- NSF/ANSI 61 approved meter – lead free, bronze maincase
- 20-year battery life
- "Absolute" 9-digit meter reading on display
- 8-digit remote meter reading
- Long-life lithium thionyl-chloride batteries
- Single design for pit and inside set applications
- Submersible in pit environments
- True point-of-use leak detection*
- Tamper detection*
- Reverse flow detection*
- LCD leak indicators
- Directional flow indicator
- Rate of flow on LCD display
- Data logging**

* When connected to Neptune R900® or R450® RF MIUs.
** When connected to R900v4 or newer version.



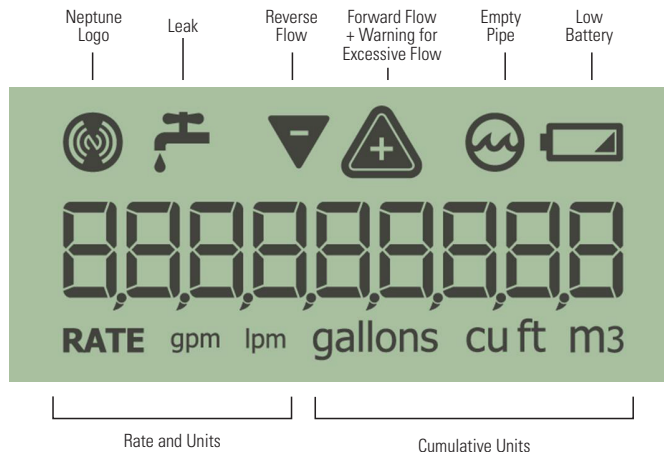
DIMENSIONS

Meter Size	A	B	C	D NSPM	ID
5/8"	7 1/2"	4 7/8"	2 17/32"	1.030	0.69"
5/8" x 3/4"	7 1/2"	4 7/8"	2 17/32"	1.290	0.69"
3/4"	9"	4 7/8"	2 19/32"	1.290	0.755"
3/4" SL	7 1/2"	4 7/8"	2 19/32"	1.290	0.755"
3/4" x 1"	9"	4 7/8"	2 19/32"	1.626	0.755"
1"	10 3/4"	4 7/8"	2 23/32"	1.626	1"
1" x 1 1/4"	10 3/4"	4 7/8"	2 23/32"	1.865	1"

REGISTRATION

High Resolution (8-digit reading)		5/8"	3/4" & 1"
0.1	US Gallons	✓	✓
0.1	Imperial Gallons	✓	✓
0.01	Cubic Feet	✓	✓
0.001	Cubic Metres	✓	✓

LCD DISPLAY



SPECIFICATIONS

- AWWA C700 compliant
- NSF/ANSI 61 certified
- Application: Cold water measurement of flow in residential potable, combination potable and fire service, and reclaim/secondary water applications.
- Maximum operating water pressure: 175 psi
- Maximum operating water temperature: 122°F (50°C)

OPTIONS

- Sizes:
 - 5/8", 5/8" x 3/4"
 - 3/4", 3/4" x 1"
 - 1", 1" x 1 1/4"
- Units of measure: U.S. gallons, Imperial gallons, cubic feet, cubic metres
- Meter options:
 - Potable water
 - Reclaim water
 - Residential fire service (combo or standalone meter service lines)
- Environmental conditions:
 - Operating temperature: +14°F to +149°F (-10°C to +65°C)
 - Storage temperature: -40°F to +158°F (-40°C to +70°C)

WARRANTY

Neptune provides a limited warranty with respect to its MACH 10 residential line of ultrasonic meters for performance, materials, and workmanship.

AMR/AMI SYSTEM COMPATIBILITY

All MACH 10 residential ultrasonic meters provide ProRead™, E-CODER® 8-digit, and E-CoderPLUS protocols to interface with Neptune and third-party AMR/AMI meter reading systems.

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MACH 10® ULTRASONIC METER

Sizes: 1 1/2" and 2"



The MACH 10® is Neptune's newest water meter that offers solid state metrology with a rugged, lead free bronze maincase. The MACH 10 was designed to have the look and feel of a traditional water meter to help eliminate new technology concerns of your customers. Engineered to fit into even the smallest residential meter boxes, the MACH 10 fits the bill for all meter applications. At first glance, you know the MACH 10 is a water meter... "Made in America".

MAXIMIZE REVENUE

The extended low-flow accuracy of the MACH 10 allows you to catch virtually every drop used by your customers. Maintaining this level of meter performance over the life of the meter will maximize your utility's revenue stream from your metering program. The MACH 10 features no moving parts. Because there are no internal parts that can wear over time, there is no opportunity for accuracy loss over the life of the meter (flat accuracy curve).

No wear = No accuracy loss = Maximum revenue dollars

NO MAINTENANCE REQUIRED

Imagine having a residential meter with no moving parts and a 20-year battery life. Is that really possible? The answer is Yes, the MACH 10.

No moving parts = No wear + 20 year battery = Maintenance-free for life

SOLID STATE METROLOGY WITH SOLID BRONZE MAINCASE

With the MACH 10, there is no concern over breaking plastic meter spuds or cross-threading of plastic threads. Neptune believes that if a meter is capable of providing sustained accuracy over its life, the maincase should be designed to last the meter's lifetime as well. This is why we designed the MACH 10 solid state meter with a solid bronze maincase. The corrosion-resistant, lead-free, high-copper alloy maincase is built to withstand demanding service conditions; internal water pressure, rough handling during installation, and in-line piping stresses.

Field-proven NSF 61/ANSI bronze maincase = Confidence = No stranded assets

KEY BENEFITS

- Extended low-flow range and accuracy
- No maintenance and accuracy sustained over meter life
- Regulatory compliance – peace of mind
- Health and asset protection with the highest lead free legislation compliance
- Supports Water Conservation
 - Provides leak history/diagnostics
 - Enables proactive leak notification
 - On-site customer event troubleshooting tools
- Increased operational efficiencies
 - Workorder reduction for high water bill inquiries
 - Drought management
 - Reduction of water loss through proactive notification of water leaks
- Tamper management
 - Identification and prioritization of potential tamper situations

KEY FEATURES

- Advanced ultrasonic technology
- No moving parts
- NSF/ANSI 61 approved meter – lead free bronze maincase
- 20-year battery life
- "Absolute" 9-digit meter reading on display
- 8-digit remote meter reading
- Long-life lithium thionyl-chloride batteries
- Single design for pit and inside set applications
- IP68-certified for moisture protection
- True point-of-use leak detection*
- Tamper detection*
- Reverse flow detection*
- LCD leak indicators
- Directional flow indicator
- Rate of flow on LCD display
- Data logging**
- Optional integrated R900® or R450™ radio

* When connected to Neptune R900 or R450 RF MIUs.

** When connected to R900v4 or newer version.

OPERATING CHARACTERISTICS

Meter Size	Normal Operating Range @ 100% Accuracy (+/- 1.5%)	Safe Maximum Operating Capacity	Extended Low Flow Accuracy (+/- 3.0%)
1½"	0.80 to 160 US gpm	125 US gpm	0.30 US gpm
2"	1.50 to 200 US gpm	200 US gpm	0.50 US gpm

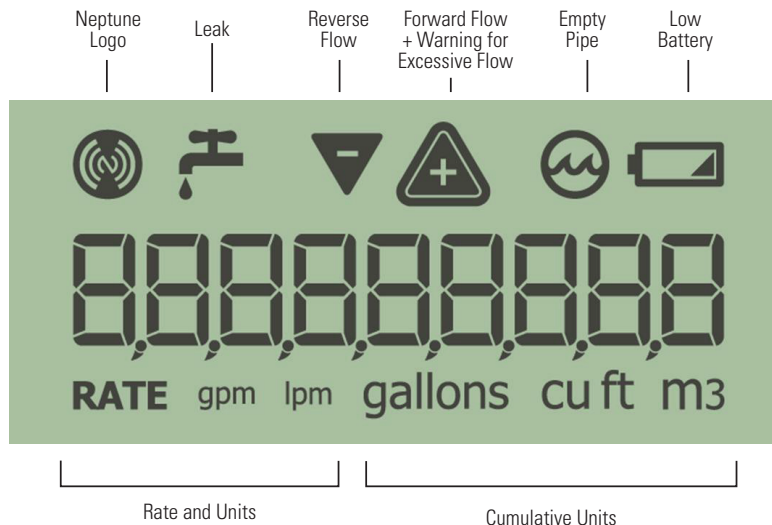
DIMENSIONS

METER SIZE	LENGTH (L)		HEIGHT (H)		FLANGES
	IN	MM	IN	MM	
1½"	10", 13"	254, 330	6 ¹ / ₃₂	158	OVAL
2"	10", 15.25", 17"	254, 387, 432	6 ¹⁴ / ₃₂	163.5	OVAL

REGISTRATION

High Resolution (8-digit reading)		1½"	2"
1	US Gallons	√	√
1	Imperial Gallons	√	√
0.1	Cubic Feet	√	√
0.001	Cubic Meter	√	√

LCD DISPLAY



SPECIFICATIONS

- AWWA C750 compliant
- AWWA C700, C701 performance compliant
- NSF/ANSI 61 certified
- Application: Cold water measurement of flow in potable, combination potable-and-fire service, and reclaim/secondary water applications.
- Maximum operating water pressure: 175 psi
- Maximum operating water temperature: +122°F

OPTIONS

- Sizes:
 - 1½"
 - 2"
- Units of measure: U.S. gallons, Imperial gallons, cubic feet, cubic meters
- Meter options:
 - Potable/fire service (combo or standalone meter service lines)
 - Reclaim water
- Environmental conditions:
 - Operating temperature: +14°F to +149°F (-10°C to +65°C)
 - Storage temperature: -40°F to +158°F (-40°C to +70°C)

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- Neptune provides a limited warranty with respect to its MACH 10 line of ultrasonic meters for performance, materials, and workmanship.

AMR/AMI SYSTEM COMPATIBILITY

- All MACH 10 ultrasonic meters provide ProRead™, E-CODER® 8-digit, and E-CoderPLUS protocols to interface with Neptune and third-party AMR/AMI meter reading systems.

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MACH 10® ULTRASONIC METER

Why did Neptune design the MACH 10® ultrasonic meter with a bronze maincase?

- The corrosion-resistant, lead-free, high-copper alloy maincase is built to withstand demanding service conditions; internal water pressure, rough handling, and in-line piping stress. With the MACH 10 there is no concern over the breakage of plastic meter spuds or cross-threading of plastic threads. Neptune believes that if a meter is capable of providing sustained accuracy over its life, the maincase must be designed to last the meter's life as well.

Does the MACH 10 utilize a battery?

- Yes. All solid state meter technologies require a battery to operate. The battery powers the metrology and the LCD odometer.

Does the MACH 10's LCD remain on when the lid is closed?

- No. A photo cell senses when the lid is closed and turns off the LCD for battery conservation.

If the lid is broken off the MACH 10, will the LCD remain on?

- No. After a few minutes, the LCD will power down for battery conservation. The LCD can be reactivated by temporarily covering the photo cell.

Can the MACH 10 be installed in flooded meter pit applications?

- Yes. The MACH 10 electronics and battery are fully potted, suitable for submersion in a pit environment.

What happens if an empty pipe condition occurs?

- The MACH 10 will display an empty pipe icon.

Can the MACH 10 register reverse flow?

- Yes. The MACH 10 is capable of measuring reverse flow accurately. The LCD odometer will run in reverse when reverse flow occurs. A flag is set in the meter firmware to communicate this occurrence to the host software for notification when the meter is read. The MACH 10 communicates reverse flow exactly like the E-Coder®.

What meter protocol does the MACH 10 output?

- MACH 10 outputs standard E-CoderPLUS protocol and is compatible with Neptune R900®, R450™, Pocket ProReader, and Advantage Reading System as well as competitive AMR/AMI endpoints.

Is the MACH 10 AMR/AMI capable?

- Yes. The MACH 10 is compatible with Neptune and third-party AMR/AMI meter reading systems.

Does the MACH 10 have any internal moving parts?

- No. The MACH 10 utilizes "transit time" ultrasonic technology featuring no moving parts.

What is the pressure rating of the MACH 10?

- Maximum operating water pressure is 175 psi.

Does the MACH 10 have excessive pressure loss due to the flow conditioner and mirrors inside the maincase?

- No. The pressure loss meets AWWA C700 and is comparable to a PD meter.

What sizes are offered in the MACH 10?

- We currently offer the same residential sizes that are available in our T-10® line: 5/8", 5/8" x 3/4", 3/4", 3/4" x 1", 3/4" short length, 1", and 1" x 1 1/4".

Can the MACH 10 easily retrofit existing PD meter installations?

- Yes. The MACH 10 meter lay lengths are the same as the PD meter lay lengths for drop-in replacements.

Can the register be replaced on the MACH 10?

- No. The electronic register of the MACH 10 is permanently potted and sealed as part of the meter assembly for protection against moisture intrusion.

Can the MACH 10 battery be replaced?

- No. The battery in the MACH 10 is permanently potted and sealed as part of the meter assembly for protection against moisture intrusion.

Does accuracy diminish over time with the MACH 10?

- No. A benefit of solid state meter technologies is no moving parts, so there is no wear over time that can diminish meter accuracy.

Is the orange rubber seal a critical sealing point for eliminating moisture intrusion?

- No. The meter electronics and battery inside the enclosure are fully potted. The orange rubber seal is primarily installed for aesthetic reasons.

Is a ground strap required for the MACH 10?

- No. The maincase is continuous bronze for continuity. Check your local ordinances, however, to make sure ground straps are not required on (all) inside set meters in your state.

What is the significance of the serial number on the dial face?

- This number will be used to identify the meter.

Is the MACH 10 bronze maincase “lead free”?

- Yes. Just like all Neptune meters, the MACH 10 meter is lead free and NSF/ANSI 61 approved.

Is the MACH 10 meter UL approved?

- Yes.

What is the significance of the Neptune logo located on the top left corner of the LCD panel?

- Aesthetics only.

Does the MACH 10 measure the speed of particles moving with the flow of water?

- No. The MACH 10 measures fluid velocity by measuring transit times of upstream and downstream ultrasonic waves; the difference in these times is proportional to flow rate. Flow rate times pipe diameter equals volume.

How will I know if a MACH 10 battery is low on power?

- The MACH 10 features low battery detection and notification. A low battery icon will flash on the LCD panel. With enhanced R900® v4, the low battery condition will also be reported to the host software for reporting.

How much lower will the 5/8” MACH 10 measure flow than a 5/8” T-10 with accuracy of 100% +/- 3.0%?

- The 5/8” MACH 10 is capable of measuring down to 1/20 gpm for the life of the meter.

Does the MACH 10 provide data logging?

- Yes, when connected to an R900 v4 or newer MIU.

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COLD-WATER METERS / SOLID STATE METERS SPECIFICATIONS

SIZES: 5/8" - 1"

GENERAL

All cold water meters (solid state type 5/8" - 1") furnished shall be produced from an ISO 9001C manufacturing facility and shall meet or exceed the accuracy requirements specified in the "Standard Specifications for Cold-Water Meters" C700 latest revision issued by AWWA.

LEAD FREE LEGISLATION

The utility requires that all water meters submitted in this proposal be compliant with NSF/ANSI 61, which exceeds the requirements of NSF/ANSI 372 that became effective January 2014:

- The utility wishes to ensure the safety of its drinking water.
- The utility wishes to safeguard its investment in metering infrastructure.
- Meters shall be made of "lead free" high-copper alloy as defined by NSF/ANSI 61.

TYPE

Only meters featuring solid state metrology will be accepted because of enhanced low flow accuracy performance and extended accuracy over meter life.

MEASUREMENT TECHNOLOGY

The measurement technology shall be based on ultrasonic sensing featuring no moving parts.

The electronics (which could include but not be limited to PCBs, transducers, magnetic coils, LCDs, and battery), shall be warranted for twenty (20) years; ten (10) year full replacement at no charge and ten (10) year prorated cost at the current list price.

SIZE, CAPACITY, LENGTH

The meter's size, capacity, and length shall be as specified in AWWA Standard C700 (latest revision).

MAINCASE

The meter maincase shall be cast from NSF/ANSI 61 certified lead free alloy containing a minimum of 85% copper. Plastic maincases or flow tubes are not acceptable as the spuds are susceptible to cross-threading or breaking during installation, or from pipe stress over time. The serial number should be displayed in a permanent location on the register. Meter markings shall indicate size, model, direction of flow, and NSF 61 certification.

All lead free maincases shall be guaranteed free from manufacturing defects in workmanship and material for the life of the meter.

All maincase screws or bolts shall be of 300 series non-magnetic stainless steel to prevent corrosion.

ELECTRONIC REGISTER

The solid state meter electronic enclosure shall be constructed of a durable engineered composite designed to last the life of the meter. The meter shall provide a fully potted wire connection for use with AMR/AMI devices.

ENVIRONMENTAL

The solid state meter must feature fully-potted electronics and battery as well as carry an IP68 rating for submersion in flooded meter pits.

REGISTRATION

- The register shall provide at least a 9-digit visual registration at the meter.
- The register shall provide an 8-digit meter reading for transmission through the RF AMR/AMI MIU.
- The register shall employ a visual LCD leak detection indicator as well as provide remote leak detection through an ASCII format to the RF AMR/AMI MIU.
- The register shall provide reverse flow detection, communicated as ASCII format data to the RF AMR/AMI MIU.
- The register shall provide an indication of days of zero consumption, communicated as ASCII format data to the RF AMR/AMI MIU.
- The register should accumulate and register consumption without connecting to a receptacle or RF AMR/AMI MIU.
- The register shall display flow rate information (interleaved with the current meter reading).
- The register shall subtract reverse flow from the total registration.

STRAINERS

Solid state meters shall not require a strainer for accurate operation.

PERFORMANCE

Meter manufacturer's solid state meters shall exceed AWWA C700 accuracy standards and warrant their published accuracy levels for the life of their meters. Each meter shipment must be accompanied by factory test data showing the accuracy of the meter as tested at their factory.

MANUFACTURER

Solid state meters shall be assembled and tested within the United States. Manufacturers may be required to provide proof of where and what percentage of the meter is manufactured in the United States.

Manufacturers shall be a member of AWWA with a minimum of twenty-five (25) years of field and production experience in water measurement technologies and serving water utilities in the United States.

SYSTEMS GUARANTEE

All solid state meters shall be guaranteed compatible to the following Neptune AMR/AMI systems – R900® and R450™ – without special programming of the meter.

TECHNOLOGY PREFERENCE

It is the utility's preference that the solid state meter technology provided be ultrasonic-based technology featuring continuous measurements (> 3x per second) to ensure desired accuracy at low end flows and during typical start/stop residential conditions.

Acceptable meters shall be Neptune MACH 10® or approved equal.

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