



Commercial & Industrial (C&I) MACH 10[®] Ultrasonic Meters

Maincase

[Why did Neptune design the C&I 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 C&I MACH 10 meter, there is no concern of corrosion due to the casing material. 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.

[Is the C&I MACH 10 meter bronze maincase lead free?](#)

Yes. Like all Neptune MACH 10 meters, the C&I MACH 10 meter is lead free and ANSI/NSF 61 approved.

Battery

[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.

[What is the battery life of the C&I MACH 10?](#)

The battery inside the UME has a life of 10 years.

[Can the C&I MACH 10 meter's battery be replaced?](#)

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

[How will I know if a C&I MACH 10 meter's battery is low on power?](#)

The C&I MACH 10 meter features low battery detection and notification. A low battery icon will appear on the LCD panel. With an enhanced R900[®], the low battery condition will also be reported to the host software.

Unitized Measuring Element (UME)

[Does the C&I MACH 10 meter have a replaceable UME?](#)

Yes, if required, the meter's UME can be replaced easily, eliminating the need to replace the entire meter.

[Can the battery in the UME be replaced?](#)

No. Because the electronics are fully potted for waterproofing, the UME must be replaced when the battery dies.

[Can the C&I MACH 10 UME be used with a mechanical meter's maincase?](#)

The unique shape of the C&I MACH 10 flow tube and internal sealing requirements make the UME incompatible with existing turbine and compound maincases.

[Can I order replacement parts?](#)

If the plastic meter lid becomes damaged or broken, it can be replaced. The UME assembly for sizes 3"-6" may also be replaced, but there are no other replacement parts for the MACH 10 ultrasonic meter.



Warranty

What is the C&I MACH 10 warranty?

The C&I MACH 10 meters have a 10-year accuracy and electronics warranty. Coverage for the electronics, which includes the battery, is five years full and five years prorated. The maincase is covered for the life of the meter and can remain in service during a UME changeout. Please contact your TM for a copy of the full warranty.

Liquid Crystal Display (LCD)

Does the MACH 10 meter'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.

Will the LCD remain on if the lid is broken off of the C&I MACH 10 meter?

No. After ten minutes the LCD will power down for battery conservation. The LCD can be reactivated by temporarily covering the photo cell sensor.

Applications

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

Yes. The C&I MACH 10 meter's electronics and battery are fully potted, suitable for submersion in a pit environment.

What happens if an empty pipe condition occurs?

The C&I MACH 10 meter will not be able to register consumption and will display an empty pipe icon on the LCD.

Can the MACH 10 register reverse flow?

Yes. The C&I MACH 10 meter is capable of measuring reverse flow. 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 C&I MACH 10 meter communicates reverse flow exactly like the E-CODER[®].

Does the C&I MACH 10 meter measure the speed of particles moving with the flow of water?

No. The C&I MACH 10 meter measures fluid velocity by measuring transit times of upstream and downstream ultrasonic waves; the difference in these times is proportional to flow rate. Volume is determined by the multiplication of the velocity of water, area of the pipe, and elapsed time.

Is a ground strap required for the C&I MACH 10 meter?

Neptune does not specifically require a ground strap for correct meter operation. Check your local codes to ensure ground straps are not required for your particular installation.

Does air in the meter chamber affect its accuracy?

Yes. If air remains in the meter chamber, accuracy can be affected. The C&I MACH 10 meter provides an air bleed screw to facilitate purging air at the time of installation.

Are there any upstream or downstream straight pipe length requirements when installing a MACH 10 meter?

The C&I MACH 10 does not require any straight pipe upstream or downstream the meter to meet AWWA C715 standards. Neptune's flow ranges and accuracy standards exceed those of AWWA, so in order to meet our more stringent standards some configurations may require minimum amounts of straight pipe. Any configuration with five (5) diameters of straight pipe upstream the meter will meet Neptune accuracy standards.



What length of straight pipe is required upstream and downstream the meter in order to maximize accuracy?

While no straight pipe is required to meet AWWA C715 accuracy standards, in order to meet Neptune's standards and maximize the accuracy of your measurements, consider following recommendations below:

Strainer: The meter does not require the use of a strainer. If a strainer is desired, it may be installed immediately downstream the meter or five (5) diameters upstream the meter. During meter replacement, if a strainer is already installed upstream, the C&I MACH 10 will meet all AWWA C715 accuracy standards for static meters. To attain the meter's highest accuracy capabilities, consider moving the strainer downstream the meter.

Elbows: Elbows (90°) may be installed five (5) pipe diameters upstream the meter and/or directly downstream the meter.

Valves: Fully open gate valves or ball valves may be installed immediately upstream or downstream the meter. Fully open isolation valves or butterfly valves may be installed at least five (5) pipe diameters upstream the meter or immediately downstream the meter. If control valves, check valves, or backflow preventers are needed, install them downstream of the meter to avoid cavitation. Do not install the meter on a pump suction side.

Test Tee: If a test tee is desired, install it so that the test port is facing straight up, aligned with the meter's register. The center of the test port must be a minimum of one (1) pipe diameter from the outlet flange of the meter. 2" test ports are recommended.

Can the C&I MACH 10 meter be installed vertically?

Yes, the MACH 10 can be mounted horizontally, vertically, or in a slanted orientation.

Will the C&I MACH 10 meter be UL Listed and FM approved?

Yes, all C&I MACH 10 meters come standard with both UL Listing and FM Approval. They can be used as a replacement for both Fire Service HP Turbine and PROTECTUS® meters. Refer to the product sheet for the meter flow rate specifications.

Is the C&I MACH 10 susceptible to build-up on the mirrors?

Our tests show that the material we selected for transducers and mirrors/reflectors resists build-up and the MACH 10 generates a robust signal. However, no metering technology is completely immune to build-up.

Can I use the C&I MACH 10 in an application where water is known to freeze in-line?

Unlike traditional positive displacement meters, MACH 10 meters do not offer traditional frost protection bottom caps, since they are not repairable. MACH 10 meters should not be placed in settings where freezing is possible.

Can I use a TRICON/E/S with my C&I MACH 10?

The TRICON/E® and TRICON/S® cannot be used with a MACH 10. Neptune has evaluated third-party output module products from Scadmetrics® and F.S. Brainard & Co., and confirmed their compatibility with the C&I MACH 10. Compatible interfaces include: 1) 4-20mA current loop 2) scaled switch closure 3) digital pulse output. These modules allow for simultaneous ARB and industrial output and are available through the manufacturer.

Communication

What meter protocol does the MACH 10 output?

The C&I MACH 10 meter outputs standard E-CoderPLUS protocol and is compatible with Neptune R900, Pocket ProReader, and Advantage Reading Systems. In addition, the C&I MACH 10 meter is compatible with other suppliers' endpoints, such as the Itron 100W, Sensus RadioRead and FlexNet, Aclara MTUs, and Badger Orion LTE-M (so long as these companies continue to follow the published E-CODER 8-digit mode specifications).



Does the MACH 10 transmit alarms/flags to competitive radios?

Neptune shares the details of our E-CODER 8-digit protocol with Badger, Sensus, Aclara, and Itron so that they can interface their reading devices to the MACH 10. Meter generated alarm flags are only available with Neptune endpoints. Most competitive radios/HES generate alarms independently using volume data from the meter, please consult with these suppliers for details on which alarms they generate.

Is the C&I MACH 10 meter AMR/AMI capable?

Yes. The C&I MACH 10 supports operation with Neptune's full range of endpoints, which provide Smart Water AMI Network Connectivity via LoRaWAN, cellular/LTE, Neptune's proprietary AMI protocols, and select third-party AMR/AMI meter reading systems.

Does the C&I MACH 10 meter provide data logging?

Yes, data logging is provided when connected to, or integrated with, an R900 v4 or newer endpoint.

How many digits of volume does the C&I MACH 10 provide?

LCD resolution for visual reading and test purposes is nine digits. E-CoderPLUS protocol output provides 8-digit resolution to all Neptune endpoints, and many competitive endpoints (Aclara, Sensus, Itron, Badger) when these are configured appropriately.

Specifications & Performance

Does the C&I MACH 10 meter have any internal moving parts?

No. The C&I MACH 10 meter utilizes "transit time" ultrasonic technology featuring no moving parts.

What is the pressure rating of the C&I MACH 10 meter?

Maximum operational pressure is 175PSI.

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

No. The pressure loss exceeds all requirements of AWWA C715. Additionally, the C&I MACH 10 meters utilize a mirror position that does not impede flow and also does not use an adjunct flow conditioner.

What sizes are offered in the C&I MACH 10 meter?

The C&I MACH 10 meter is offered in 3", 4", 6", 8", 10", and 12" sizes.

Can the C&I MACH 10 meter easily retrofit existing turbine and compound meter installations?

Yes. The C&I MACH 10 meter's lay lengths are the same as common turbine and compound meter lay lengths for drop in replacements.

Does accuracy diminish over time with the C&I MACH 10 meter?

No. A benefit of solid state meter technologies is no moving parts, meaning no wear over time to diminish meter accuracy.

Does the MACH 10 need to be calibrated?

All MACH 10 meters are individually calibrated in our factory. The calibration lasts for the life of the meter. No field calibration is necessary or possible.

How does the C&I MACH 10 low flow compare to a TRU/FLO® compound meter?

Overall, the C&I MACH 10 accuracy is comparable to the TRU/FLO. While extended low flow rates are not the same, the MACH 10 benefits from not having a crossover range which negatively impacts the compound meter's accuracy. Because a significant portion of metered consumption happens in the crossover range, the MACH 10 has a significant advantage in measurement accuracy over compound meters.



A tool for comparing the details of the C&I MACH 10 to Neptune's mechanical meters can be found at neptunetg.com/mach10.

Does stray noise affect the ultrasonic measurement?

There are several ways that we manage the effect of stray signals. The transducers themselves have a specific resonance frequency so any other noise does not excite the receiving transducer. There is a time window based on pipe size and time of flight in which the transducers are looking for the signal and everything outside of that window is ignored. This window takes into account the minimum and maximum time of flight based on flow rate and water temperature. Additionally, there are checks in place to correct for stray signals based on the history of the time of flight.

Do particulates in the water affect the meter's accuracy?

Small particles and small bubbles suspended in solution do not adversely affect ultrasonic wave propagation, so high turbidity is not a problem. However, larger solids and voids (bubbles) can adversely affect sound propagation and should be avoided.

Does Neptune recommend a testing program?

Because all C&I MACH 10 meters have guaranteed accuracy for 10 years, Neptune recommends that regular sample/testing programs are not necessary. For utilities wishing to verify accuracy, Neptune recommends following the AWWA M6 standard for testing. While the AWWA M6 committee is still in the process of reviewing of the standard to add guidance pertinent to ultrasonic meters, we have created a Product Support Document (PSD) detailing some best testing practices for the C&I MACH 10 meters. This PSD can be found at neptunetg.com.

Register

Can the register be replaced on the C&I MACH 10 meter?

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

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

This number will be used to identify the meter.



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