CALMAC

Ice Inventory Meter

230V

INSTALLATION AND OPERATION MANUAL

The CALMAC Ice Inventory Meter measures the changes in the water level in the IceBank® Ice Storage tank as ice is made or melted. The water level in the tank changes because ice takes up approximately nine percent more volume than water. This measurable change in the water level is proportional to the ice in the Ice Storage tank.

The inventory meter design is simple. A small volume of air is pumped from the air pump in the inventory meter box, through one of two tubes which is connected to the insertion probe. This air continuously bubbles out of the bottom of the insertion probe. The pressure required to discharge these bubbles will vary depending on the immersion depth of the probe. As the water rises because of the ice formation, the pressure goes up. This pressure is transferred through the second tube, back to the meter.

The magnehelic (white faced gauge) senses the pressure and displays it as the percentage of ice in the tank. The meter also has an internal pressure tranducer that senses the pressure and produces an electrical signal of from 4 to 20 milliamps DC. This electrical signal correlates with the 0 to 100 percent charge shown on the magnehelic. **The magnehelic and transducer are factory calibrated and the only field adjustment required is the insertion depth of the probe.**

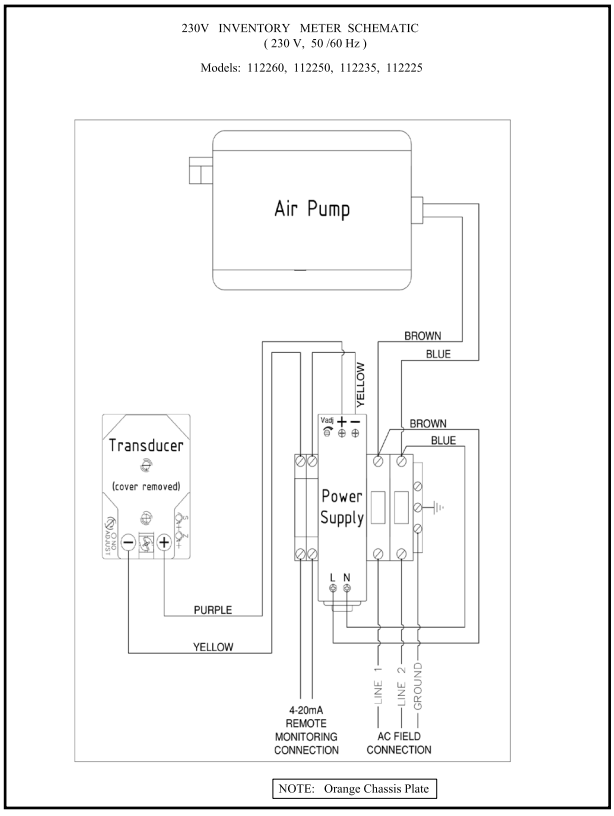


Figure1. Electrical Component Schematic

A. Voltage/Electrical

A1. Meters are available with operating voltages of 115 and 230 VAC. The correct line voltage should be specified when the meter is purchased and is marked on the meter name plate located on the inside of the door. To avoid damaging meter components, verify that the supply voltage matches the meter specifications. Although the power supply is adjustable for the range of line voltages, it should not be changed other than to make slight adjustments for actual line voltage.

WARNING: Should the line voltage vary more than ±10 percent from the meter's design, call CALMAC for technical support, 1-201-797-1511.

A2. The meter will work with 100/200 volts AC/50 Hertz. However, the air pump adjustment may have to be increased. The control is located on the left side of the air pump, inside the meter box.

A3. Unit is calibrated with 250 ohm load resistance. The maximum recommended load resistance is 400 ohm.

B. Mounting of Ice Meter Boxes (All Models)

B1. Select a location free from vibration and where the ambient temperature will not exceed 120°F (50°C). Avoid direct sunlight which will discolor the clear plastic front cover of the magnehelic. The meter box may be located up to 150 feet (45m) away from the insertion probe, however only 15 feet of twin tubing is supplied with the meter. Tubing lengths greater than 15 feet (4.5m) can be ordered if needed.

B2. The meter enclosure must be mounted vertically. Knockouts or other holes for pneumatic and electrical connections are to be made by the installer.

B3. Make electrical connections per the electrical component layout. (See Figure 1.) Model LL-102 has a terminal strip with two AC power connections, a ground and two low voltage connections for the 4 to 20 milliamp signal to the monitoring equipment.

WARNING: The signal supplied by the ice meter should never be used to control the termination of the ice making cycle of the chiller(s). Refer to Section D2 for proper method of control. The information supplied by the meter is for information purposes only.

C. Probe Installation for Above Ground Tanks (For Totally Buried Models, see Section F.)

C1. Refer to Figure 2 to determine the probe location. The applicable tank model can be found on the rating plate, located on the tank cover, adjacent to the connections. It is the manufacturer's recommendation that no drill bit extend more than 4 inches (100mm) beyond the drill chuck for "A" Models and 7 inches (170mm) for "C" models. Longer drill bits could damage the tank's heat exchanger.

C2. Drill a 5/8 inch (16mm) hole vertically down through the ice tank cover (you will first be drilling through the cover's upper plastic shell, then through the insulation and finally through the cover's lower plastic shell), a total of approximately 3 inches (76mm) for "A" models or 6.5 inches (165mm) for "C" models.

C3. Using a ¾-inch (20mm) drill bit, enlarge only the 5/8-inch hole in the upper plastic shell of the cover. Refer to Figure 3 for details. Clean all drill cuttings and insulation from the hole.

C4. Using the probe as a guide, use a wrench to screw the N.P.T. threads on the compression fitting into the ¾-inch hole in the tank cover. The compression fitting will cut its own threads in the plastic.

C5. After the installation of the plastic com-

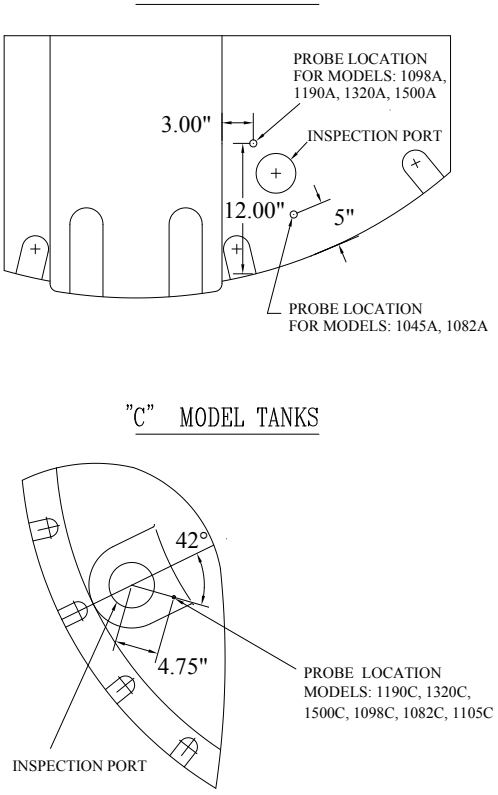


Figure 2. Insertion Probe Location

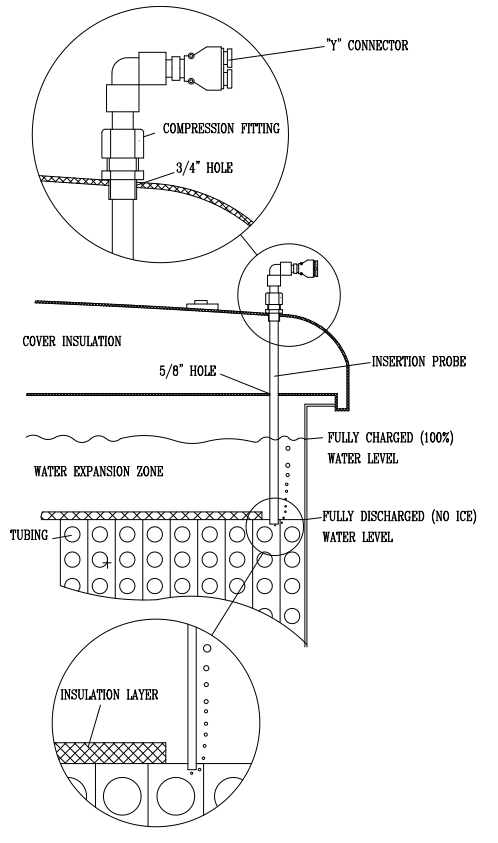


Figure 3. Insertion Probe Assembly and Installation

pression fitting is completed, there should be no further need for the use of wrenches. Tightening the black plastic compression fitting by hand will secure the probe. Loosen the compression fitting and move the probe down until you can see it is just above the top tube. This is only a temporary setting. See Figure 3.

C6. Run the flexible pneumatic twin tubing from the 'Y' connection on the top end of the probe to the two brass barbed connections inside the ice meter enclosure. All four connections are press fit and do not need clamps. Use care not to crimp, crush or otherwise restrict the air flow through either tube.

D. Adjustments and Calibrations

D1. The water level in the tank should be filled to a level just covering the top tube of the heat exchanger. **This does not apply for MIXAIR or Sublce™ Eutectic Salt tanks. See MIXAIR Installation Manual, IB-158 or Sublce Manual IB-171 for details.** Switch on the power for the Ice Inventory Meter.

D2. The storage system will operate most efficiently if the chiller controls are set to terminate charging at the highest return temperature that will charge the tanks in the available hours. In most cases, with a 6°F (3.3°C) temperature difference across the chiller, the average leaving chilled coolant temperature will be approximately 25°F (-3.9°C) with a 31°F (-0.5°C) return. Most commonly, if the chiller unit is set to turn off when the coolant temperature leaving the tank reaches 28°F (-2.2°C) **(see project engineers specification for exact temperature)** the tanks will be completely charged. If the chiller is allowed to run at lower conditions than required, this will usually not damage the tanks, however the free water above the heat exchanger may freeze causing an "ice cap". This ice cap will in turn cause a shortage of water during discharge, thereby impairing the discharge performance and wasting energy.

D3. Once the chiller operation has been automatically terminated and before any ice consumption has occurred, the meter installation can be completed.

D4. The internal air pump should be running so that a small amount of air continuously bubbles from the probe. If no bubbles are observed, turn the rheostat, which is located on the side of the air pump. Slight oscillations in the magnehelic's needle indicate that air is bubbling. The power must be supplied to the LL-102 meters for at least 5 minutes for the transducer components to stabilize.

D5. Loosen the compression nut on the insertion probe and slide the probe out of the compression fitting. Lay it down on top of the tank being sure not to crimp the tubing. The magnehelic has been factory set and should read zero. If not, slight adjustments to the zeroing screw on the front of the meter can now be made (see enclosed magnehelic instruction manual). Re-insert the probe into the compression fitting, setting the probe depth so that the inventory meters magnehelic reads 100%. Tighten the compression fitting and recheck reading and adjust if necessary.

D6. The pressure tranducer has been factory calibrated. No further calibration should be necessary on the tranducer itself. The precalibration is as follows:

0% = 4.0 mA $\pm$ 0.1 mA = 0" inches of water (immersion depth) and

100% = 20.0 mA $\pm$ 0.1 mA =
6.0" (152mm): Models 1105, 1190, 1320, & 1500
5.0" (127mm): Model 1082
3.5" (89mm): Model 1098
2.5" (63mm): Model 1045

NOTE: The above numbers are for water as the storage medium. For salt tanks, consult factory.

E. Verification of Transducer and Magnehelic Operation (Outside of the Ice Tank)

E1. Correct operation of the meter can be confirmed out side the tank using the following steps.

E2. Fill a bucket with about 8 inches of water.

E3. Bring the bucket to the tank where the ice inventory probe is installed.

E4. Make a mark on the probe at the point where it enters the fitting. Remove the probe from the fitting by loosening the compression nut and sliding the probe up out of the fitting.

E5. Consult the table in section D6 to determine the full scale immersion depth for your model tank. Measure up this length from the end of the probe with the opening (not the end where the twin tubing is connected) and make a mark with a pen or marker.

E6. Hold the probe vertically, with the connection end up and lower it until the end with the opening just touches the surface of the water in the bucket. You should see bubbles exiting from the end of the probe and the needle on the inventory meter should be "bouncing" at around zero. The magnehelic gauge should read zero; if not, gently turn the zeroing screw on the front of the magnehelic gauge.

E7. Disconnect the field installed wires from the terminals labeled "4-20 mA" and connect a multi-meter capable of measuring milliamps; the milliamp output should be approximately 4 mA.

E8. The transducer is calibrated at the factory but if the mA reading is not correct, slightly turn the zero (z) adjustment screw (See Figure 1.) to correct the reading.

E9. Now, lower the probe so that it is submerged to the mark. A steady stream of individual bubbles should still be exiting the end of the probe and the meter should read 100%. The multi-meter should display approximately 20 mA.

E10. The transducer is calibrated at the factory but if the mA reading is not correct, slightly turn the zero (z) adjustment screw (See Figure 1.) to correct the reading.

E11. If bubbles are not observed or the stream is very sporadic, check the connections and tubing for leaks. There is also an output control knob located on the air pump inside the inventory meter box that may need to be turned up.

E12. The air pump may need to be replaced if the previous step does not produce a consistent stream of bubbles.

E13. If steps E6 through E10 check out, the proper operation of the inventory meter is confirmed and the probe can be re-installed into the fitting located in the tank cover. See step D5.

E14. Remove the inspection port cover on the tank and observe the location of the probe end to confirm that there is no ice build in the expansion zone (top 7 inches of the tank, above the plastic tubing HX). Ice in this area is referred to as an "Ice cap" and will cause erratic ice inventory readings.

F. Buried Tank Installation

F1. For buried tanks, (see CALMAC's buried tanks specification, CS-4), a special housing is supplied for the insertion probe. The function of this housing is to protect the insertion probe and enable adjustment, even when the tanks are buried.

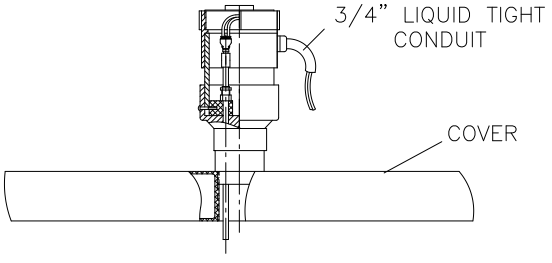


Figure 4. Buried Tank Probe Housing

F2. Remove the inspection port fitting from the cover of the tank.

F3. Insert the buried tank probe housing into the inspection port opening in the cover.

F4. Run liquidtight, flexible electrical conduit, suitable for underground use, from the probe housing to the inventory meter control box. (See Figure 4.)

F5. Thread air tubes through conduit and follow standard installation instructions from C6 onward.

G. SubIce™ Eutectic Salts

For IceBank® tanks that use eutectic salts, for lower temperature applications, please consult with the factory for information concerning specialized inventory meters.

H. Troubleshooting

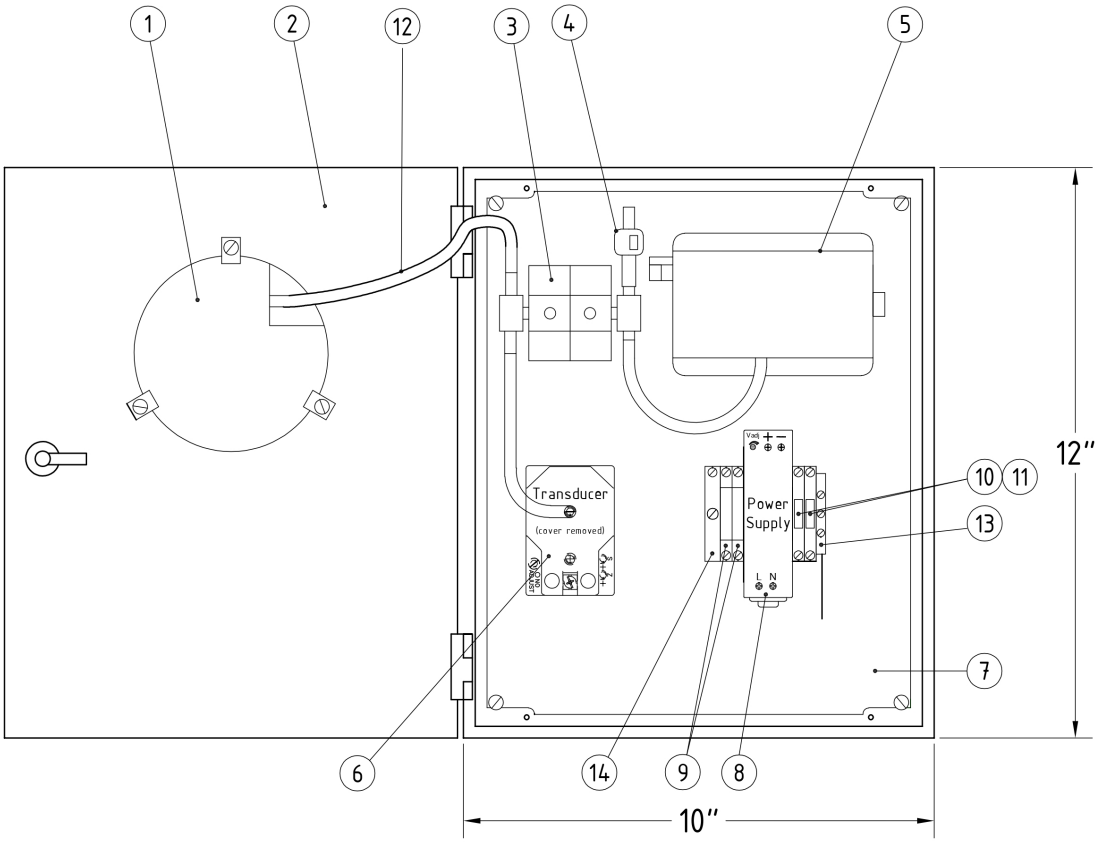
Before using this table, review the second paragraph of this manual for a basic overview and understanding of how the meter works. Section E provides the overall procedure for confirming the meter operation.

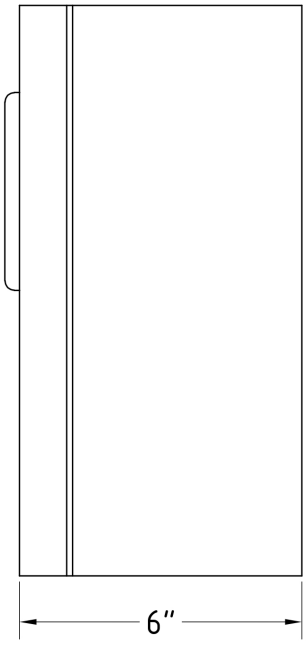
Table 1.

SYMPTOM	POSSIBLE PROBLEM	CORRECTIVE ACTION
1. Nothing Operating	No electrical power	Establish electrification
2. No air bubbles in tank	Air pump is not running	Check AC to air pump, if ok feel pump for vibration. If no vibration, replace pump.
	Air pump rheostat	Increase air flow by adjusting rheostat
	Pressure relief valve stuck open or leaking.	Close off valve exhaust. If reading on the magnehelic changes, replace relief valve.
	Air tubes	Check the tubing for loose connections, kinks or cracks.
	Probe obstructions	Mark probe for each replacing. Remove probe from tank and remove obstructions and return to original position.
3. No response from Magnehilic only	Kinked or pinched tubing inside meter box	Correct problem and re-check magnehelic.
4. No signal from pressure tranducer to monitoring equipment but the magnehelic is showing a percentage of ice remaining in the ice tank.	Loose connections or broken wires	Tighten connections, splice or replace wires
	Electrical output from power supply	Use meter to check power supply output per spec. sheet supplied. If no power, replace power supply unit.
	Pressure transducer	Disconnect signal wires to monitoring equipment and use mA meter to check tranducer output signal. If no mA signal, replace tranducer.
5. Magnelic out of calibration	Magnehelic adjustment	See sections E1-E5
6. Pressure tranducer mA signal does not correspond with magnehelic percentage reading	Operation of pressure tranducer	See sections E1-E6
7. Magnehelic and transducer both indicate extremely rapid inventory loss	Ice-capping (unwanted ice build-up in expansion area above heat exchanger)	Melt all ice that has formed more than 1/2" above top heat exchanger tube. Call factory for procedure.

230V INVENTORY METER LAYOUT
(230 V, 50 /60 Hz)

Models: 112260, 112250, 112235, 112225





ITEM	DESCRIPTION	PART NUMBER
14	TERMINAL BLOCK END STOP	300035
13	GROUND TERMINAL BLOCK	300032
12	AIR HOSE	110037
11	1.6A FUSE	300028
10	FUSED TERMINAL BLOCK	300036
9	SINGLE TERMINAL BLOCK	300031
8	POWER SUPPLY	110155A
7	CHASSIS PLATE	110118
6	TRANSDUCER	CALL FACTORY
5	AIR PUMP	110144
4	CHECK VALVE	110044
3	DROP EAR ELBOW ASSEMBLY	110109
2	ENCLOSURE (PRE-PUNCHED)	110036
1	MAGNEHELIC	CALL FACTORY

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