Model 1101

# MATURITY METER

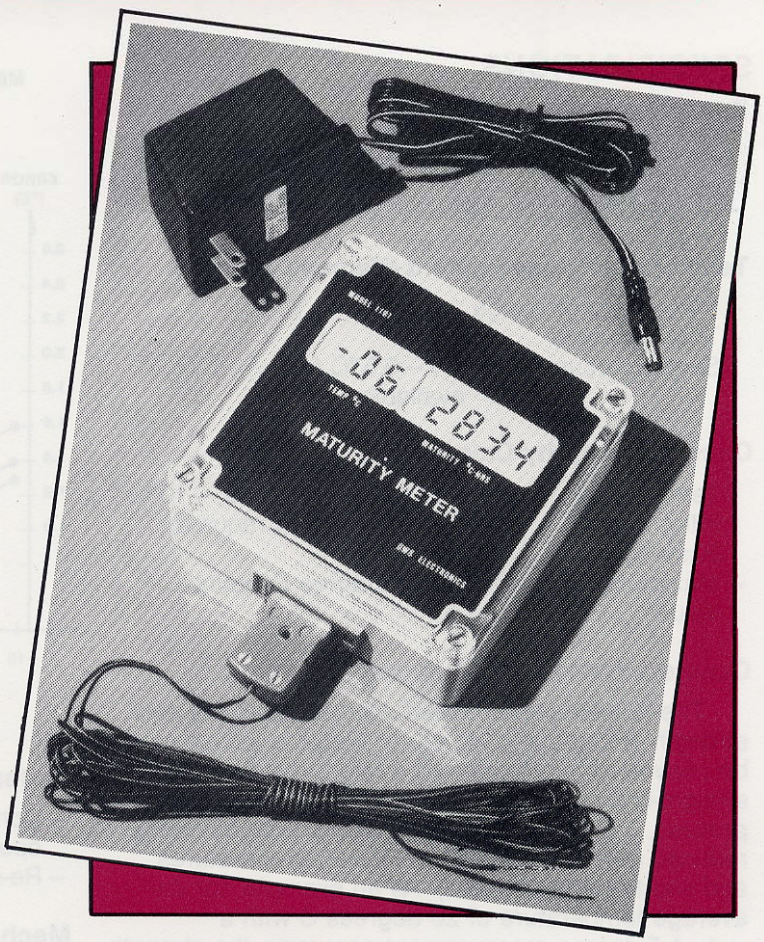
Technical Data

## APPLICATIONS

- Accurate, Predictable Concrete Strength Determination
- Form and Shoring Removal Time Prediction
- Loading and Post-Tensioning Time Prediction
- Control of Winter Heating and Insulation Requirements
- Accelerated Construction Scheduling

## FEATURES

- Water-Tight, Impact Resistant Enclosure
- Low Power CMOS Design
- Built-in Rechargeable Batteries
- 2½ Months of Continuous Operation
- Low Battery Indicator
- Thermocouple Temperature Sensing
- Low Cost, High Accuracy Type "T" Thermocouple Wire Used
- High Impedance, Differential Input
- Cold Junction Compensation
- Transducer Linearization
- Open Circuit Indicator
- Over and Under Range Indicators
- Simultaneous Display of Both Temperature and Maturity Values
- Magnetic Power ON/OFF and Reset (No Switches or Buttons)




## DESCRIPTION

This electronic meter enables accurate, predictable strength determination of cast-in-place concrete using the "Maturity Concept." It is housed in a water-tight, impact resistant enclosure and includes rechargeable batteries 2½ months of continuous operation) and a low battery indicator.

Thermocouple temperature sensing is utilized to enable long or short cable runs and to allow flexibility and ease of placement of the temperature sensor. Low cost, type "T" thermocouple wire is used and is available in +/−0.5 or +/−1 degree C accuracies. Cold junction compensation, linearization and a high impedance differential input provide accurate temperature measurement. Status indicators include transducer open-circuit and over/under range monitors. Connections are made via a quick-connect thermocouple jack.

Temperature and cumulative degree-hour values are displayed simultaneously on a ½" high liquid crystal display. There are no switches or buttons to fail or break — the unit power/reset circuit is magnetically operated.

## UNIT OPERATION

This meter is housed in an impact resistant, water-tight enclosure. Because of its small size, light weight and durability, the unit may be placed almost anywhere it is required. Thermocouple temperature sensing is relatively insensitive to cable length so concrete temperatures can be monitored far from the actual pour location.

The temperature sensor is formed by stripping and twisting the end of the thermocouple wire pair together. The temperature sensor end should be soldered and plastic dipping is recommended. After the monitoring task is completed, the wires may be cut off at the concrete interface and re-used immediately.

For complete technical information on the use of the "Maturity Concept" please refer to the Technical Manual.

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## SPECIFICATIONS:

**Temperature Measurement:**

- Sensor measurement range: −10°C to +90°C
- Accuracy: +/− 1°C
- Thermocouple wire: Type "T"

**Data Record:**

- Memory Capacity: 32K bytes
- Data capacity: 10 months x 4 channels
- Recording interval: Every ½ hour up to 48 hours
  Every 1 hour thereafter

**Communications:**

- I/O Port: Serial RS-232C
- Handshaking: XON/XOFF
- Data format: ASCII
- Baud rates: 300, 1200, 2400, 4800, 9600 (selectable)

**Power:**

- * 9V Kodak Ultralife Lithium (U9VL) battery
  -1.0 Amp hour capacity
  -Up to 2 years of service life at 20°C
- 3.6V Lithium, ½AA cell memory/clock battery
  -0.750 Amp hour capacity
  -10 year service life at 20°C

  * Note: Use of a standard 9-volt alkaline battery may reduce capacity up to 60%.

**Mechanical:**

- Dimensions: 7.8" x 4.7" x 2.9"
- Case material: Polycarbonate
- Weight: 1.75 lbs.
- Thermocouple connectors: Omega "flat pin" miniature
- I/O connector: AMP "CPC" Series 4

**Environmental:**

- Operating temp: −20°C to +50°C
- Enclosure: Watertight, impact-resistant

**Maturity Value Calculations:**

- Constant programmable range:
  - -Datum temperature: −20°C to +40°C (temperature integration base)
  - -Equivalent Age Temperature: 0 to −40°C
  - -Activation Energy Constant: 0 to 20,000°K
- Maximum maturity values displayed:
  - -Temperature-time factor: 99999°C hours
  - -Equivalent Age factor: 9999 hours

## INTRODUCTION TO THE "MATURITY CONCEPT"

In the last few years there has been a good deal of investigative work done in the area of concrete strength determination through electronic temperature measurement. This work is based on the findings of J.M. Plowman, who first advanced the non-linear, time-temperature, or "Maturity Concept" of rate of gain of strength in portland cement concrete.

There are various methods of relating the concrete time-temperature data to strength, but all methods employ the integrated value of temperature with time. Interpolation of integrated temperature values on pre-determined strength versus time-temperature graphs enables instant strength calculations (if a suitable electronic instrument is available which performs the temperature integration function).

Although different concrete mix designs exhibit similar curing characteristics, each must be tested to determine its exact strength versus time-temperature relationship. This is done by making a number of cylinders, monitoring one or more of the cylinders with an integrating thermometer, and breaking pairs of cylinders at 3, 7, 14, 28 ... days.

Values are plotted on a graph (temperature-time on x axis, strength on y axis). The result of this process will be a relationship which, when used in conjunction with maturity meters, will enable instantaneous concrete strength determination in the field.