

A Practical Guide to Reading Water Meters

Developed for Irrigators
in the SE of SA



Government of South Australia
Department of Water, Land and
Biodiversity Conservation

A Practical Guide to Reading Water Meters

Resource Allocation Division

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Working with Volumetric Allocations

Volumetric allocations entitle each water licence holder with an annual volume that can be extracted from the aquifer each water use year (1st July to 30th June). Therefore it is fundamental that irrigators have a good understanding of volumetric measurement and the units of measure displayed by their water meter/s.

This booklet 'A Practical Guide to Reading Water Meters' is intended to aid irrigators manage volumetric allocations by understanding volumetric measurement and the units of measure displayed by their water meter/s and ultimately tracking usage over the irrigation season.

Understanding Volumetric Measurement

Volume and flow rates can be measured in any unit of metric measurement. Units commonly used in measuring volumes pumped in irrigation include the following:

Unit	Litres	Kilolitres	Megalitre	Gigalitre
1 Litre (L)	1 L	0.001 KL		
1 Kilolitre (KL)	1 000 L	1 KL	0.001 ML	
1 Megalitre (ML)	1 000 000 L	1 000 KL	1 ML	0.001 GL
1 Gigalitre (GL)	1 000 000 000 L	1 000 000 KL	1 000 ML	1 GL

Example:

Volume in litres (L): 1 234 367 123 **L**

Volume in kilolitres (KL): 1 234 367.1 **KL**

Volume in megalitres (ML): 1 234.3 **ML**

Volume in gigalitres (GL): 1.2 **GL**

Decimal places

Depending on the unit of measure, it can be important to understand the value of each decimal place. The table below explains the value of each decimal place in relation to the unit of measure.

Table 1. Decimal places for volumetric measurement

Unit of Measure	First decimal <i>0.1</i>	Second decimal <i>0.01</i>	Third decimal <i>0.001</i>
Kilolitres (KL)	100's of litres	10's of litres	litres
Megalitres (ML)	100's of kilolitres	10's of kilolitres	kilolitres
Gigalitres (GL)	100's of megalitres	10's of megalitres	megalitres

Reading Water Meters

Water meters can measure and display volumes in many different ways.

This may depend on the manufacturer, the type of water meter or often the size of the meter. Some water meters may display the volume as factors of 10 or 100.

The following table provides a definition and details on the units of measure commonly used for irrigation water meters.

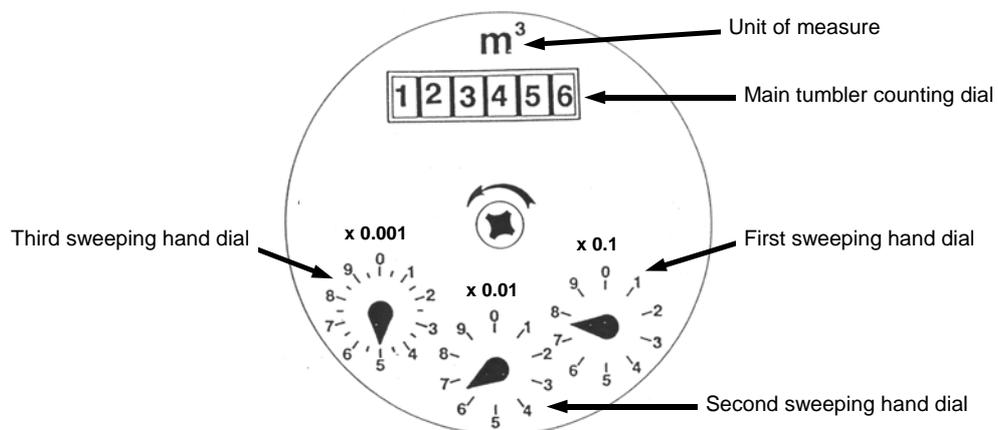
Table 2. Units of measure used for irrigation water meters

Units of Measure	Description	Conversion	Notes on Reading
KL	Kilolitre	1 KL = 1000 L	4th digit represents ML
ML	Megalitre	1 ML = 1000 KL	1st decimal place represent KL
m³	Cubic metre	1 m ³ = 1 KL	Same as KL
m³ x 10	Cubic metre times 10	1 m ³ x 10 = 10 KL	3rd digit represents ML
m³ x 100	Cubic metre times 100	1 m ³ x 100 = 100 KL	2nd digit represents ML

Water Meter Dials

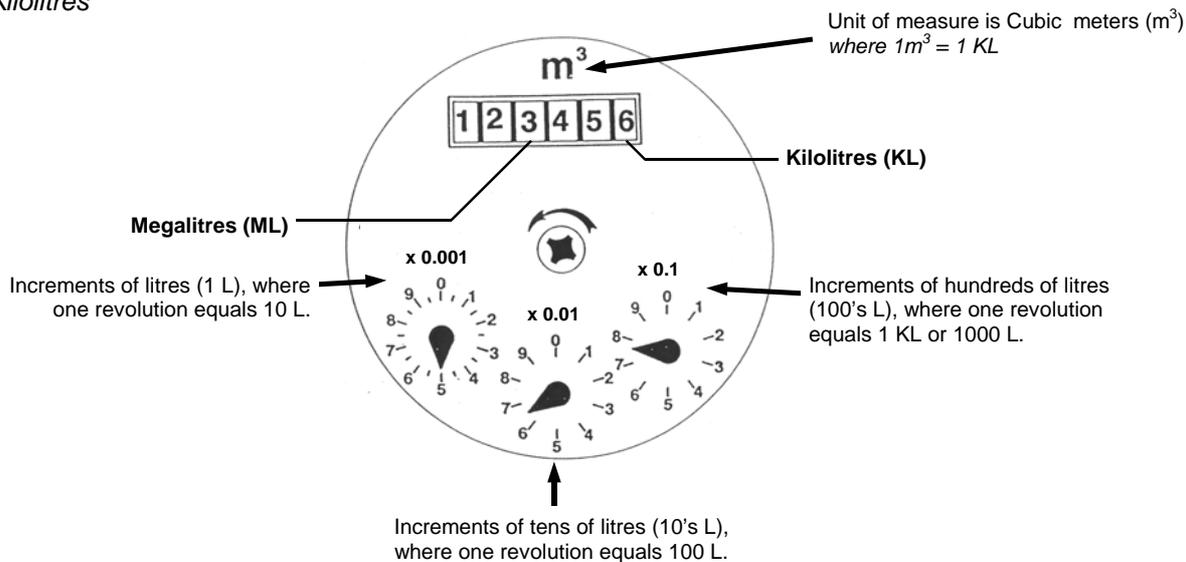
Dials on water meters come in a wide variety of designs with volumes display in any number of units as seen in the table above (Table 2).

The following diagrams provide examples of common water meter dials.



Mechanical meter recording in cubic meters (m^3)

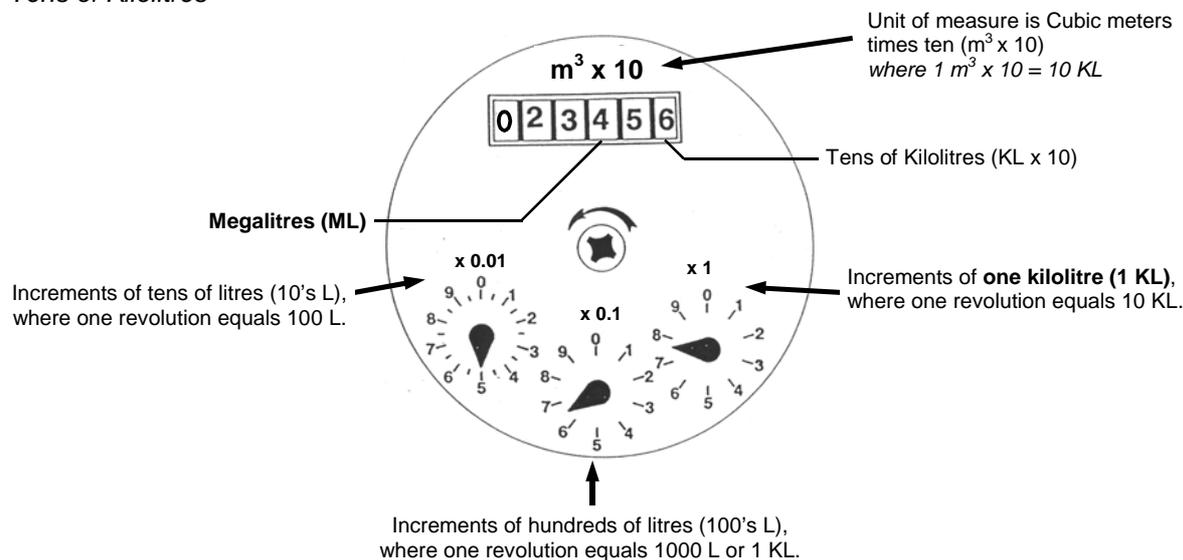
Kilolitres



Meter Reading: 123.456 ML or 123 456.765 KL

Mechanical meter recording in cubic meters times ten ($m^3 \times 10$)

Tens of Kilolitres

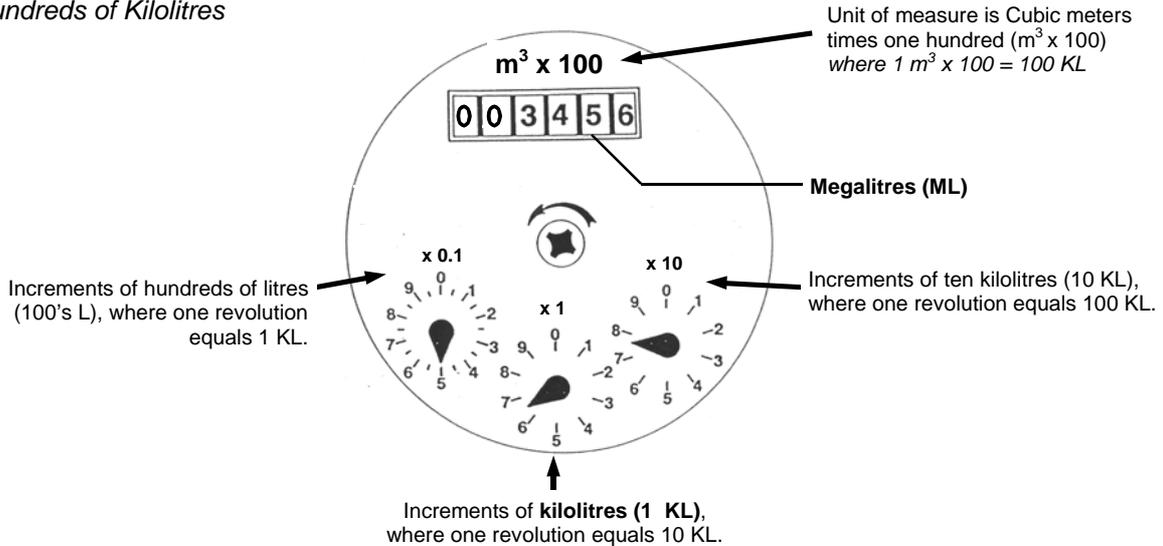


Meter Reading: 234.567 ML or 234 567.65 KL

Note: As an alternative to reading the sweeping hand dials, a zero can be added as the final digit to the number on the main tumbler counting dial, to give volume to the nearest ten kilolitres (KL). Some manufactures may even print a permanent zero on the dial face directly after the number '6' on the main tumbler counting dial (i.e. it would then read **234 560 KL**).

Mechanical meter recording in cubic meters times one hundred ($m^3 \times 100$)

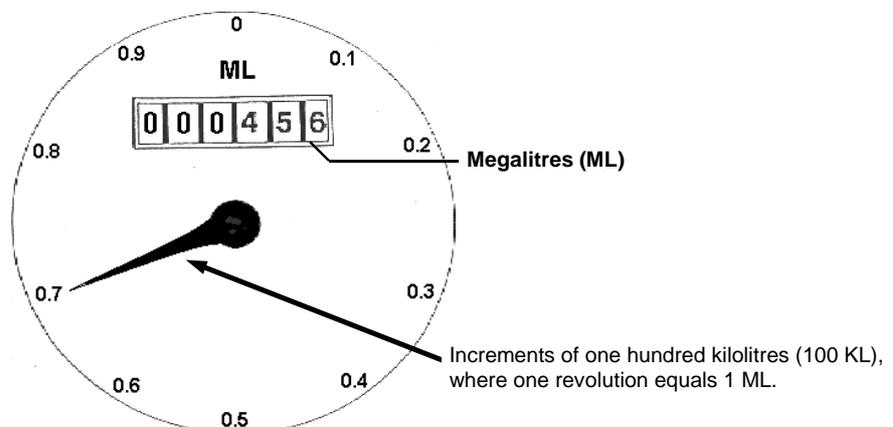
Hundreds of Kilolitres



Meter Reading: 345.676 ML or 345 676.5 KL

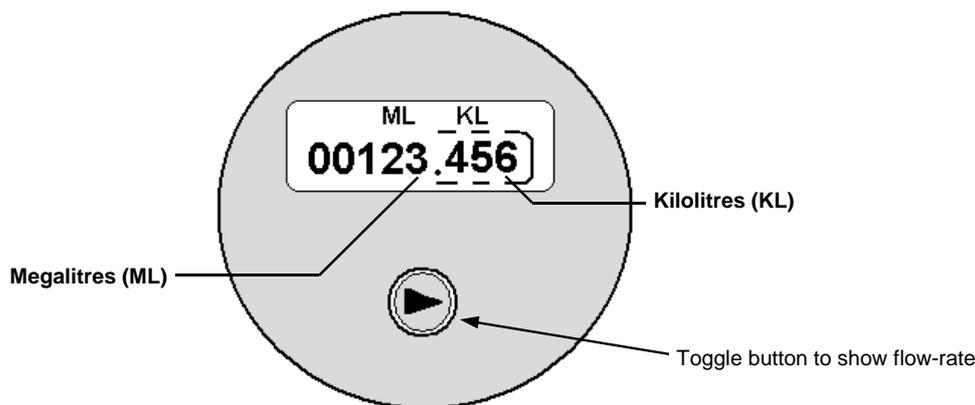
Note: As an alternative to reading the first two sweeping hand dials, two zeros can be added as the final two digits to the number on the main tumbler counting dial, to give volume to the nearest hundred kilolitres (100's KL). Some manufactures may even print two permanent zeros on the dial face directly after the number '6' on the main tumbler counting dial (i.e. it would then read **345 600 KL**).

Mechanical meter recording in Megalitres (ML)



Meter Reading: 456.7 ML or 456 700 KL

Electronic display recording in Megalitres (ML) and Kilotres (KL)



Meter Reading: 123.456 ML or 123 456 KL

Calculating Irrigation Depth

Water meters are a very useful way of calculating the average (or nominal) depth of water applied to irrigated crops. All you need to know to calculate the irrigation depth is the area irrigated along with regular meter readings. Irrigation depth can be calculated per irrigation event, per month or for the season, using the calculations shown below:

$$\text{Irrigation Rate (ML/ha)} = \frac{\text{Volume pumped (ML)}}{\text{Area irrigated (ha)}}$$
$$\text{Irrigation Depth (mm)} = \left(\frac{\text{Volume pumped (ML)}}{\text{Area irrigated (ha)}} \right) \times 100$$

(method 1)

$$\text{Irrigation Depth (mm)} = \left(\frac{\text{Volume pumped (KL)}}{(\text{Area irrigated (ha)}) \times 10} \right)$$

(method 2)

Method 2 is more suited to calculating irrigation depth for individual events or sites pumping small volumes (i.e. Drip)

Remember: 1 ML over 1 ha = 100 mm

Example 1:
Average depth per irrigation event.

One megalitre (1 ML) pumped to water
10 ha of crop.

$$\text{Depth (mm)} = \left(\frac{1}{10}\right) \times 100 = 10 \text{ mm}$$

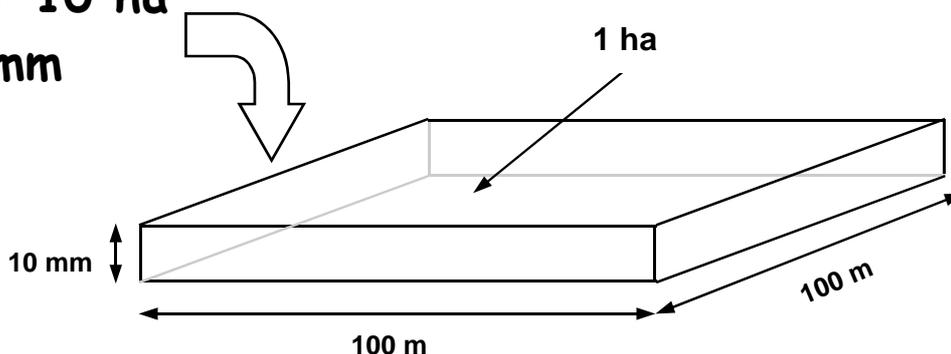
Example 2:
Average depth for irrigation season.

220 ML pumped to water 40 ha of crop
over the season

$$\text{Depth (mm)} = \left(\frac{220}{40}\right) \times 100 = 550 \text{ mm}$$

or 5.5 ML/ha

**1 ML over 10 ha
= 10 mm**



Note: When calculating the irrigation depth some allowance should be made for losses that inevitably occur due to evaporation and wind drift. For flood irrigation systems the depth applied will obviously be greater at the top of the bay and lower at the end of the bay.

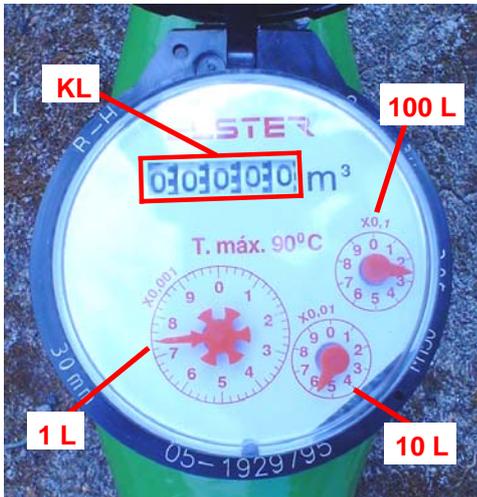
Calculating the volume required to apply a given depth of water

If you know what depth of irrigation water you want to apply per event, you can calculate how much water you need to pump to apply that target depth. The calculation is shown below along with an example:

$$\text{Volume (KL)} = \text{Depth (mm)} \times \text{Area (ha)} \times 10$$

Example: Want to apply 12 mm of irrigation water to a 30 ha crop.

$$\begin{aligned} \text{Volume (KL)} &= 12 \text{ mm} \times 30 \text{ ha} \times 10 \\ &= 3\,600 \text{ KL} \quad \text{or} \quad 3.6 \text{ ML} \end{aligned}$$



ELSTER M150 (m³)

This meter records volume in cubic metres (KL or every 1000 litres). The black numbers on the main tumbler dial represents KL (1 kilolitre increments). The red swing arm dial on the right represents 100 L increments (where one revolution equals 1000 L or 1 KL). The red swing arm dial in the middle represents 10 L increments (where one revolution equals 100 KL). The large red swing arm dial on the left represents 1 L increments (where one revolution equals 10 L).

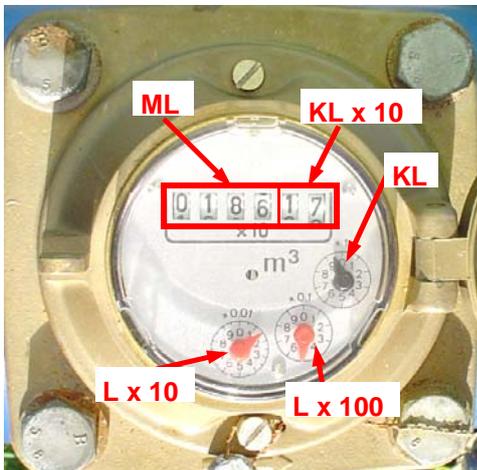
Meter Reading: 257 L or 0.257 KL



Dorot DWMA (x100 m³)

This meter records volume in cubic metres times 100 (m³ x 100). The first number on the main tumbler dial represents KL x 100 (100 kilolitre increments). The second number on the main tumbler dial represents megalitres. The small sweeping hand dial represents KL x 10 (10 kilolitre increments where one revolution equals 100 KL). The large sweeping hand dial represents KL (1 kilolitre increments where one revolution equals 10 KL).

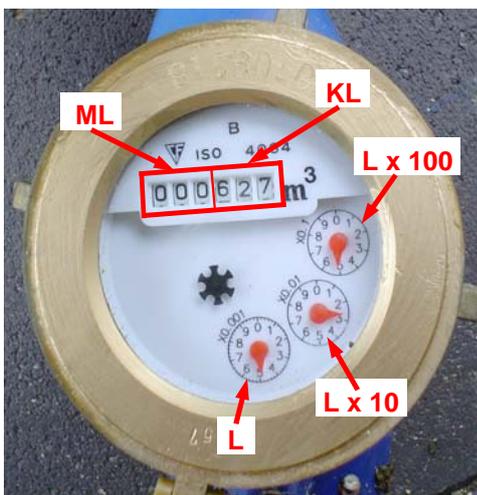
Meter Reading: 27.5 KL or 0.00275 ML



ZENNER M059 (m³ x 10)

This meter records volume in cubic metres times 10 (m³ x 10). The first number on the main tumbler dial represents KL x 10 (10 kilolitre increments). The third number on the main tumbler dial represents megalitres. The black sweeping hand dial represents 1 KL increments (where one revolution equals 10 KL). The red sweeping hand dial on the right represents 100 L increments (where one revolution equals 1000 L or 1 KL).

Meter Reading: 186.179 ML or 186 179 KL



Fuzhou MT-EX (m³)

This meter records volume in cubic metres (m³ or KL). The first 3 numbers on the main tumbler dial represents KL (1 kilolitre increments). The fourth number on the main tumbler dial represents megalitres. The red sweeping hand dial on the right represents 100 L increments (where one revolution equals 1000 L or 1 KL). The red sweeping hand dial in the middle represents 10 L increments (where one revolution equals 100 L). The red sweeping hand dial on the left represents 1 L increments (where one revolution equals 10 L).

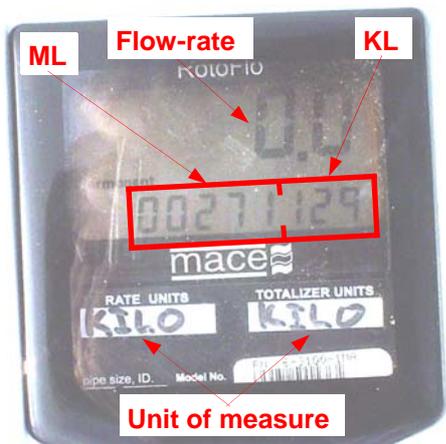
Meter Reading: 627.525 KL or 627 525 L



Danfoss / Siemens SONOCELL Ultrasonic (ML)

This meter simply records volume in megalitres (ML), with kilolitres (KL) after the decimal place. The numbers shown in the display before the decimal place is the total volume in ML. The numbers shown in the display after the decimal place is KL (where 1000 KL equals 1 ML). This meter also displays the instantaneous flow rate in cubic meters (or kilolitres) per hour (m^3/hr or KL/hr).

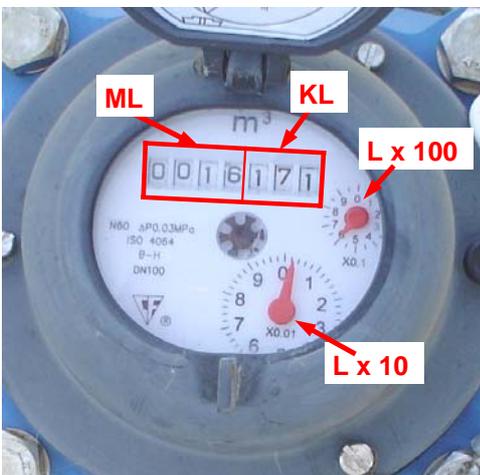
Meter Reading: 4.411 ML or 4 411 KL



MACE Rotoflo (KL)

This meter can record volume in any metric form as specified during configuration by the installer. Blank spaces on the cover plate allow the installer to show the units of measure that has been set. Most will be set to record megalitres or kilolitres (as shown). When set as kilolitres (KL) the fourth digit represents megalitres (ML). This meter also displays the instantaneous flow rate along with the number of hours since the last reading.

Meter Reading: 271.129 ML or 271 129 KL



Fuzhou LXLG (m^3)

This meter records volume in cubic metres (m^3 or KL). The first three numbers on the main tumbler dial represents KL (1 kilolitre increments). The fourth number on the main tumbler dial represents megalitres. The small red sweeping hand dial represents 100 L increments (where one revolution equals 1000 L or 1 KL). The large red sweeping hand dial represents 10 L increments (where one revolution equals 100 L).

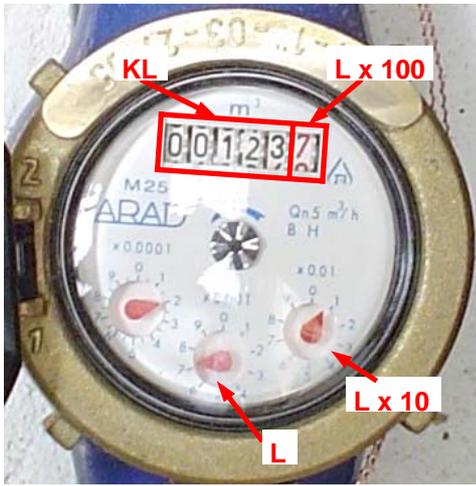
Meter Reading: 16.171 ML or 16 171.6 KL



Tyco Emflux M300 (KL)

This meter simply records volume in kilolitres (KL). The number shown in the bottom half of the display is the total volume in KL (where 1000 KL equals 1 ML). The number shown in the upper half of the display is the instantaneous flow rate in litres per second (L/sec).

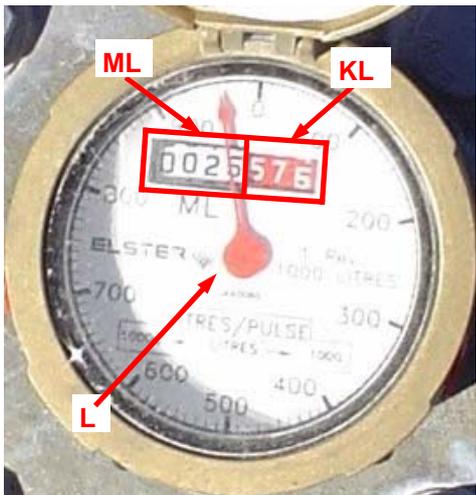
Meter Reading: 11 KL or 11 000 L



ARAD (m³)

This meter records volume in cubic meters (m³ or KL) . The first red numbers on the main tumbler dial represents hundreds of litres (L x 100). The black numbers on the main tumbler dial represents KL. The red sweeping hand dial on the right represents tens of litres (where one revolution equals 100 L). The red sweeping hand dial in the middle represents litres (where one revolution equals 10 L).

Meter Reading: 123.7072 KL or 123 707.2 L



Elster (ML)

This meter records volume in megalitres (ML) and kilolitres (KL). The first three white numbers on the red tumblers represents KL. The black numbers on the white tumblers represents ML. The red sweeping hand dial represents hundreds of litres (where one revolution equals 1 KL)

Meter Reading: 25.575 ML or 25 575 KL

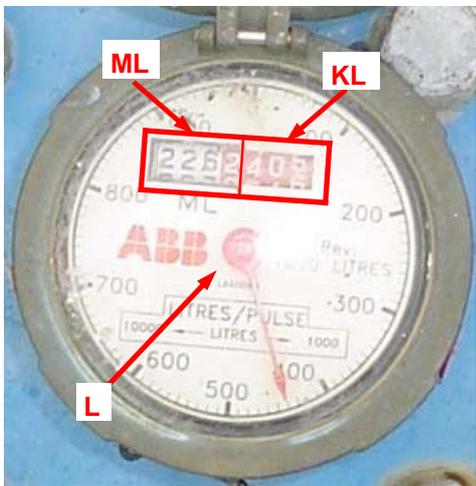
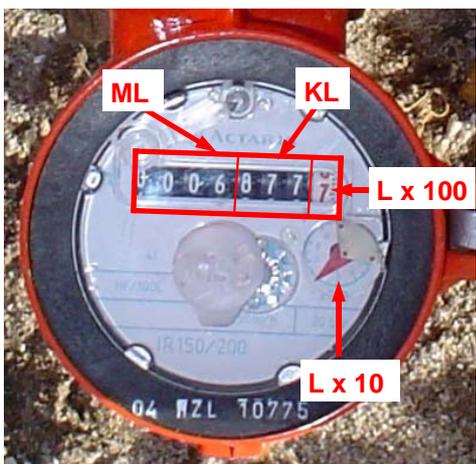


ABB (ML)

This meter records volume in megalitres (ML) and kilolitres (KL). The first three white numbers on the red tumblers represents KL. The fourth white number on the red tumbler and the black numbers on the white tumblers represents ML. The red sweeping hand dial represents hundreds of litres (where one revolution equals 1 KL)

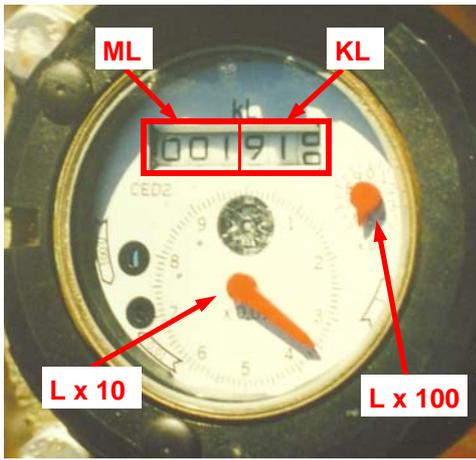
**Meter Reading: 2 262.40544 ML or 2 262 405.44 KL
or 2.262 GL**



ACTARIS (KL)

This meter records volume in kilolitres (KL). The first three white numbers on the black tumblers represents KL. The fourth white number on the black tumbler represents ML. The last red number on the white tumbler represents hundreds of litres (100's L). The red sweeping hand dial represents tens of litres (where one revolution equals 100 L)

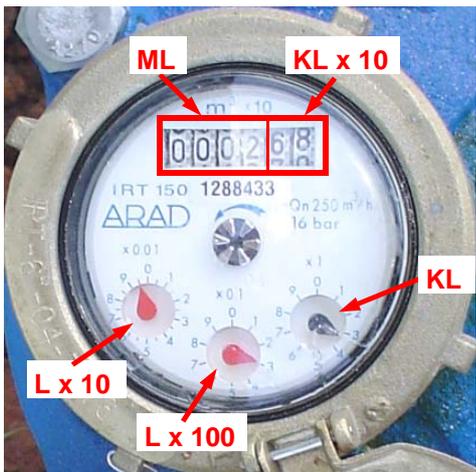
**Meter Reading: 6.877 ML or 6 877.76 KL
or 6 877 760 L**



Elster H 4000 (KL)

This meter records volume in kilolitres (KL). The first three numbers on the main tumbler dial represents KL. The fourth number on the main tumbler dial represents megalitres. The small sweeping hand dial on the right represents 100 L increments (where one revolution equals 1 KL). The large sweeping hand dial in the middle represents 10 L increments (where one revolution equals 100 L).

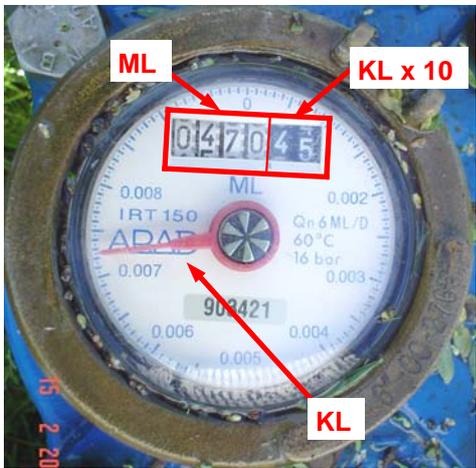
Meter Reading: 1.918 ML or 1 918.5 KL



ARAD IRT 150 (m³ x 10)

This meter records volume in cubic metres times 10 (m³ x 10). The first number on the main tumbler dial represents KL x 10 (10 kilolitre increments). The third number on the main tumbler dial represents megalitres. The black sweeping hand dial on the right represents 1 KL increments (where one revolution equals 10 KL). The sweeping hand dial in the middle represents 100 L increments (where one revolution equals 1000 L or 1 KL). The sweeping hand dial on the left represents 10 L increments (where one revolution equals 100 L).

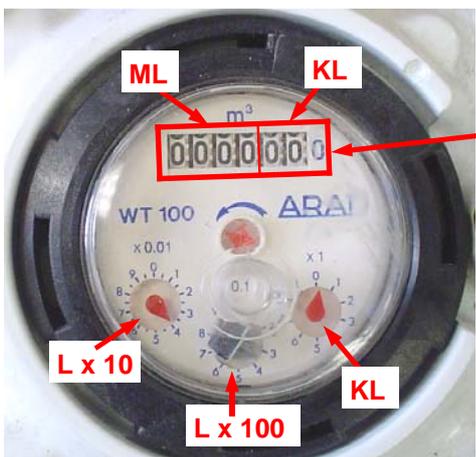
Meter Reading: 2.683 ML or 2 683.39 KL



ARAD IRT 150 (ML)

This meter records volume in megalitres (ML). The black numbers on the white tumblers represents ML. The first two white numbers on the black tumblers represents kilolitres times 10 (KL x 10). The red sweeping hand dial represents kilolitres (where one revolution equals 10 KL)

Meter Reading: 470.447 ML or 470 447 KL



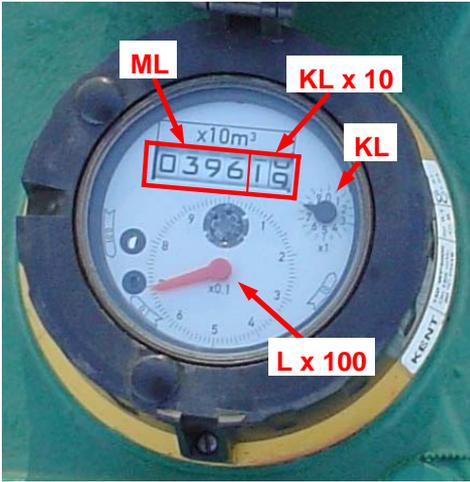
ARAD WT 100 (m³)

This meter records volume in kilolitres (KL).

Note when reading the main tumbler dial only, a zero (as shown) must be added as the last digit to give KL.

The last two numbers on the tumbler dial represents KL (when the zero is added). The third numbers on the tumbler dial represents megalitres (ML). The red sweeping hand dial on the right represents kilolitres (where one revolution equals 10 KL). The red sweeping hand dial in the middle represents litres time 100 (where one revolution equals 1 KL).

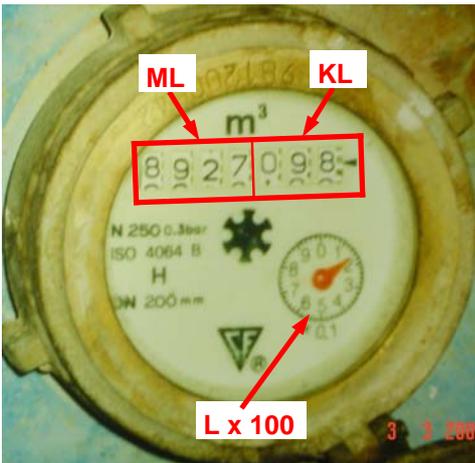
Meter Reading: 0.34 KL or 340 L



KENT (x10m³)

This meter records volume in cubic metres times 10 (m³ x 10). The first two numbers on the main tumbler dial represents KL x 10 (10 kilolitre increments). The third number on the main tumbler dial represents megalitres. The black sweeping hand dial represents 1 KL increments (where one revolution equals 10 KL). The red swing arm dial on the right represents 100 L increments (where one revolution equals 1000 L or 1 KL).

Meter Reading: 396.1877 ML or 396 187.7 KL



Fuzhoe (m³)

This meter records volume in cubic metres (m³ or KL). The first three numbers on the main tumbler dial represents kilolitres (KL). The fourth number on the main tumbler dial represents megalitres. The red sweeping hand dial represents 100 L increments (where one revolution equals 1 KL).

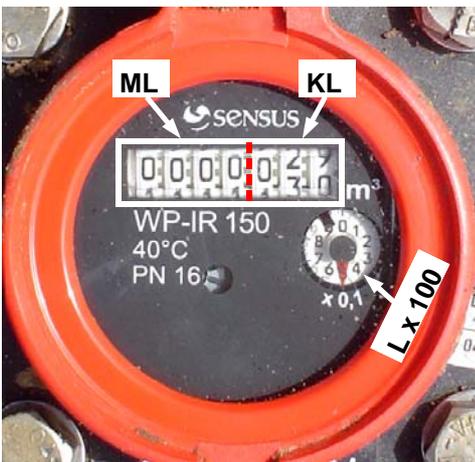
**Meter Reading: 8927.098 ML or 8 927 098 KL
or 8.927 GL**



Meinecke WPD200 (KL x 10)

This meter records volume in kilolitres times 10 (KL x 10). The first two numbers on the main tumbler dial represents tens of kilolitres (KL x 10). The third number onwards on the main tumbler dial represents megalitres. The black sweeping hand dial on the right represents single kilolitre (where one revolution equals 10 KL). The red sweeping hand in the middle represents 100 L increments (where one revolution equals 1 KL).

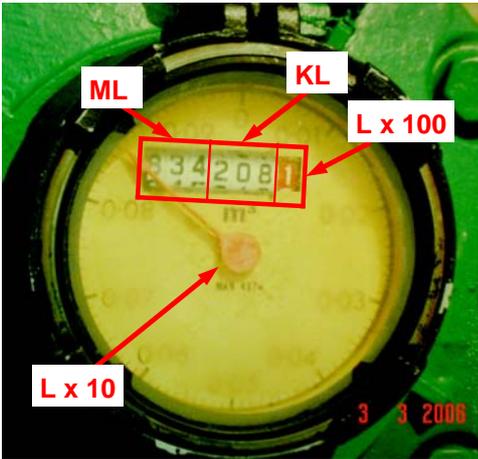
Meter Reading: 423.358 ML or 423 358.7 KL



Meinecke / Sensus WPIR (m³)

This meter records volume in cubic metres (m³ or KL). The first three numbers on the main tumbler dial represents kilolitres (KL). The fourth number onwards on the main tumbler dial represents megalitres. The small sweeping hand dial represents 100 L increments (where one revolution equals 1 KL).

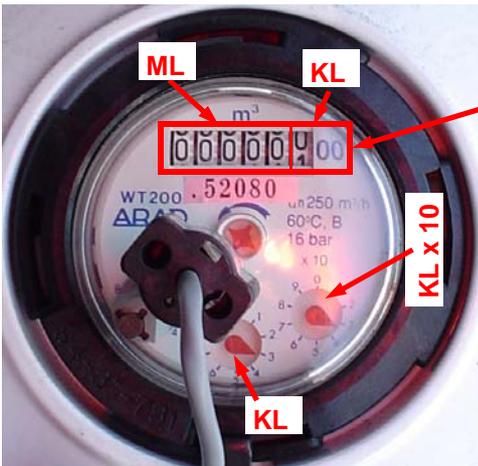
Meter Reading: 29.5 KL or 29 500 L



Kent TWS (m³)

This meter records volume in cubic metres (m³ or KL). The first three black numbers on the main tumbler dial represents KL (1 kilolitre increments). The fourth black number on the main tumbler dial represents megalitres. The first red number on the main tumbler dial represents litres times 100 (100 L increments). The red sweeping hand dial represents 10 KL increments (where one revolution equals 100 L).

Meter Reading: 834.2081 ML or 834 208.1 KL



ARAD WT200 (m³)

This meter records volume in cubic metres (m³).

Note when reading the main tumbler dial only, the two zeros (as shown in blue) must be added as the last two digits to give KL. The right & middle swing arms can be used in place of the two zeros.

The first number on the main tumbler dial represents KL x 100 (100 kilolitre increments). The second number onwards on the main tumbler dial represents megalitres. The sweeping hand dial on the right represents 10 KL increments (where one revolution equals 100 KL). The sweeping hand dial in the middle represents 1 KL increments (where one revolution equals 1000 L or 1 KL).

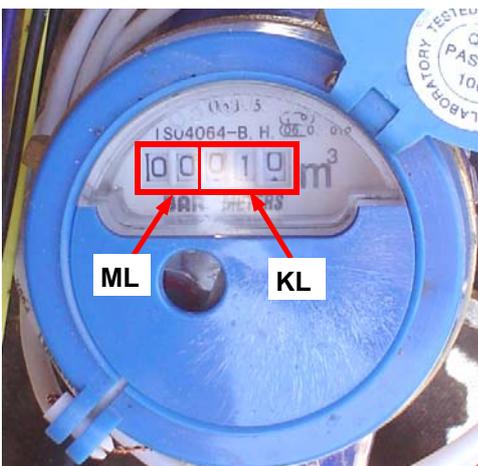
Meter Reading: 33 KL or 33 000 L



WELTER (m³ x 10)

This meter records volume in cubic metres times 10 (m³ x 10). The first two numbers on the main tumbler dial represents KL x 10 (10 kilolitre increments) therefore a zero must be added as the last digit to give KL. The third number onwards on the main tumbler dial represents megalitres. Ignore the m³ symbol on the plate as this refers to the swing arm dials which is obscured by the plate.

Meter Reading: 30 KL or 30 000 L

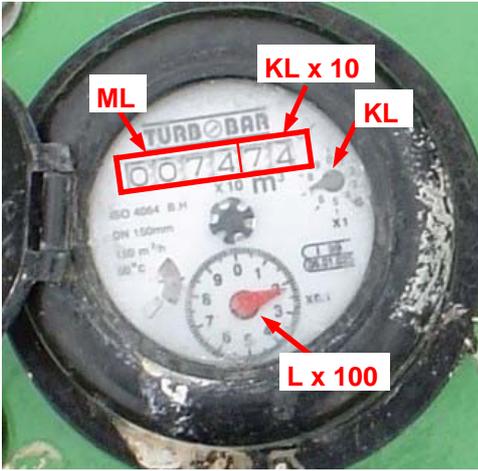


TURBOBAR MT-KD-P (m³)

This meter records volume in cubic metres (m³ or KL).

The first three numbers on the main tumbler dial represents KL (1 kilolitre increments). The fourth number onwards on the main tumbler dial represents megalitres.

Meter Reading: 10 KL or 10 000 L



TURBOBAR ($m^3 \times 10$)

This meter records volume in cubic metres times 10 ($m^3 \times 10$). The first two numbers on the main tumbler dial represents KL x 10 (10 kilolitre increments). The third number onwards on the main tumbler dial represents megalitres. The small black sweeping hand dial represents 1 KL increments (where one revolution equals 10 KL). The large red sweeping hand dial on the right represents 100 L increments (where one revolution equals 1000 L or 1 KL).

Meter Reading: 74.747 ML or 74 747 KL



Siemens MAG8000 (ML.KL)

This meter simply records volume in megalitres (ML), with kilolitres (KL) after the decimal place. The numbers shown in the display before the decimal place is the total volume in ML. The numbers shown in the display after the decimal place is KL (where 1000 KL equals 1 ML).

Meter Reading: 8.555 ML or 8 555 KL