

# Socrates™

## Night-flow and leakage analyser



**Socrates** is an instrument for analysing night-flows, leakage and legitimate customer use, in water distribution systems. **Socrates** uses patented, autocorrelation techniques, plus artefact filtering, to carry out high accuracy surveys of district meter areas.

- **Troubleshooting District Meter Area's**

With its diagnostic precision **Socrates** probes deep into night-flows to reveal the lowest baseline flows, pointing leakage engineers towards real areas of high leakage. This is very useful on DMA's with trade users who are using water intermittently.

- **Determination of legitimate night-use**

When used on smaller District Meter Areas **Socrates** shows baseline leakage with user events clearly superimposed. This enables the accurate determination of Company specific legitimate night-use values.

- **Realistic estimation of leakage**

**Socrates** forms a statistical model over several weeks. On larger DMA's the baseline leakage is deduced from this information.

### Socrates measures minimum night-flows accurately

**Socrates** collects thousands of data values per night. After removing measurement system error, the data is autocorrelated to find its *micro-period*. This is the shortest period over which values must be averaged to

remove extraneous hydraulic effects such as oscillations and surges. This reduces the raw data to, typically, 500 *micro-period values* and these expose the crucial details of the night flow.

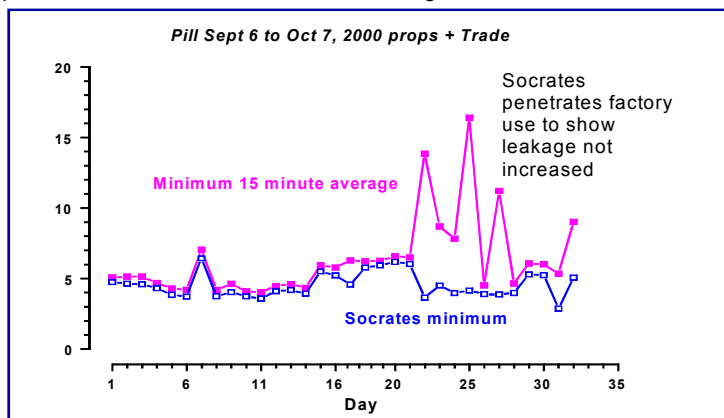


Figure 1. Daily plot of minimum night-flows. Socrates shows true minimum flow and separates out trade flows. High night flow is due to usage and not leakage.



Primayer

### Measurement of Core-Flow

Conventionally, averaged nightline data is collected (typically 15 minute averages) and from this a fixed estimate of night-use is subtracted. However, night-use varies! Fixed values can never reflect the changing conditions that actually prevail on site.

**Socrates** penetrates deep into the night-flow. In consumption monitor areas and small District Meter Areas the night flow comprises intermittent user events, such as toilet flushes, superimposed on a core flow level which will be very close to the actual leakage level. **Socrates** penetrates to the core flow.

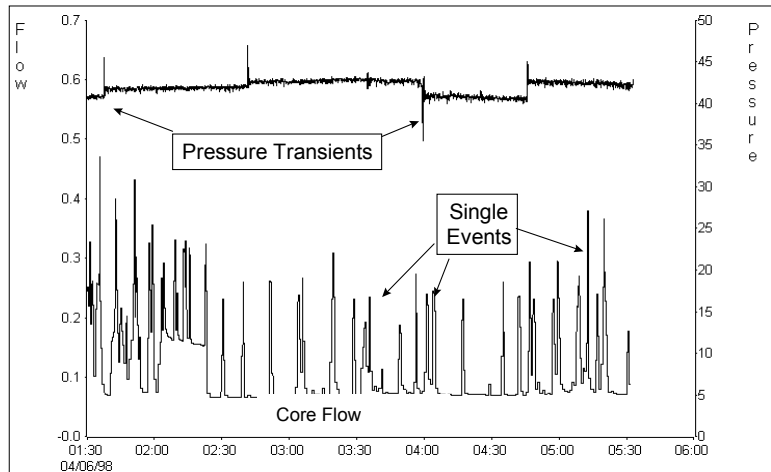
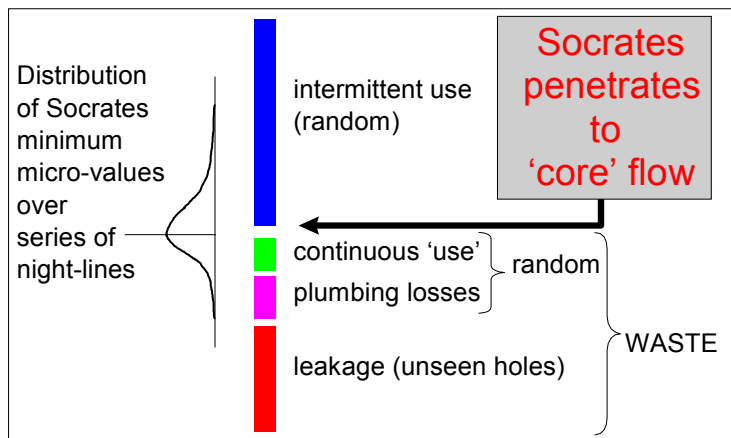


Figure 2. Intermittent events (toilet flushes, etc.) superimposed on the core flow.



### Determination of Legitimate Night Use

In small District Meters Areas the minimum nightly *micro-values* vary about mean levels and the distribution of these values indicates the likely position where random use tails-off to insignificant levels. This is the estimate of steady state leakage.

The leakage value is subtracted from the average nightly (two hour) flow value to obtain a value for average nights' legitimate use.

Figure 3. Components of core flow in small, domestic only, DMA

### Leakage in Large DMA's

In District Meter Areas up to approximately 250 properties **Socrates** cuts through intermittent use to reveal the core flow. With larger numbers of properties user events merge together to prevent **Socrates** penetrating to the core flow level. This effect is termed penetration error and this is proportional to property count. The **Socrates** statistical method incorporates penetration error to determine leakage in larger District Meter Areas.

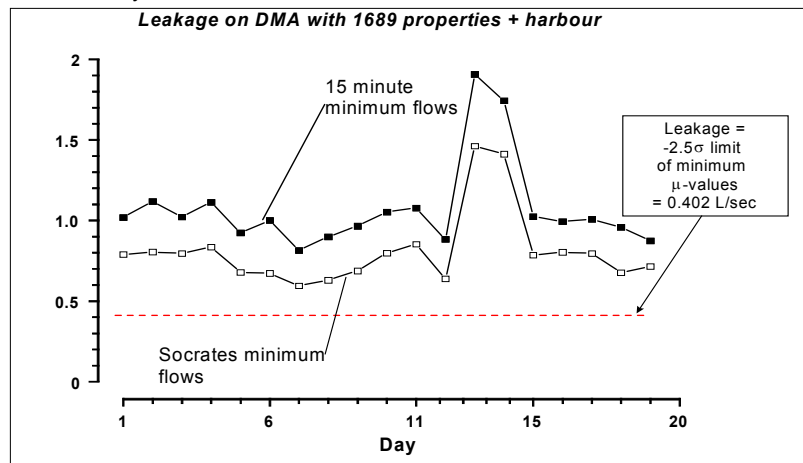


Figure 4. Socrates unique statistical method estimates leakage at DMA level