

# KRAL

KRAL Electronics BEM 300 and BEM 500.



**Electronic units that are coordinated to KRAL flowmeters and their diverse applications.**



**Coordinated to the flowmeters and their applications.**

Users of conventional universal display units often cannot make use of their device's options. There is often a lack of functions that are important for special applications.

KRAL BEM 300 to 500 electronic units aid in the performance of the KRAL Volumeter. The high quality electronic components and evaluation algorithms used, maintain precisely measured flow values to be shown on the display as well as the signal outputs. The BEM 500 uses KRAL calibration values for linearization. Temperature differences and liquid pulsations which can falsify the readings are corrected.

**Perfect operation, informative display.**

A display unit must supply the required information and assure accurate operation.

The KRAL BEM 300 and 500 always display the measured flow values with their units. The display is clear and very easy to read. There is a choice of four languages. KRAL sets up the units, the calibration factors and the density tables to meet customer specifications. If you need to make changes, an easy to follow menu is available including configuration software for PCs. Contrast and brightness are adjustable.

**The fast route to the measurement result.**

Fitting the BEM 300 and 500:	Control cabinet mounting, on the flow measuring device, wall mounting or on the piping.
Connecting the sensors:	Max. 6 sensors, each with 3 terminals.
Connecting power:	Mains supply: direct voltage 24 V DC ± 20 %.
Reading the measured values:	Total, rate, temperature.

**Self-diagnostic and monitoring.**



The BEM 300 and 500 protect the KRAL Volumeter and the customer's installation.

The flow and temperature ranges of the flowmeters are stored in the electronics and if values are exceeded then the alarms are displayed. A bypass relay can be activated using flow rate limit value. The function of the temperature sensors is monitored. Knowing the temperature, the flow volume, the flow direction and the consumption assures the integrity of the installation.

**Data evaluation, signal forwarding.**



KRAL provides special PC software for data capture, storage and evaluation as an option. Measured values can be stored for longer periods and evaluated at a later date. Immediate data analysis allows instant result of set-up and installation.

Universal signal forwarding includes scalable analog and pulse outputs, as well as a Modbus RTU interface.

Additional displays can be connected for remote indication.



**Performance characteristics.\***

<b>Display:</b>	3 x 1 inches LCD, contrast and illumination software-adjustable.
<b>Keys:</b>	5 robust micro-switches.
<b>Measured value:</b>	Total, flow rate, accumulated total.
<b>Units:</b>	SI, UK or US units. Total, rate as volume or mass. Temperature, density.
<b>Signal forwarding:</b>	Scalable 4 to 20 mA or 0 to 10 V analog outputs, scalable pulse outputs, Modbus.
<b>Power supply:</b>	24 V DC.
<b>Environment:</b>	Degree of protection IP65, robust plastic casing. Operating temperature -4 to 158 °F.
<b>Mounting:</b>	In the control cabinet, on the flow measuring device, wall mounting or on the piping.

**Decision aid.**

**Advantages of the BEM 300.**

- Low-cost version.
- Simple basic functions for precise flow measurement.
- Pressure pulse compensation.
- Mass calculation with constant density.

**Advantages of the BEM 500.**

- Temperature compensation.
- Pressure pulse compensation with counter of flow direction change.
- Two-channel, e.g. for differential measurement.
- Mass conversion and density tables.
- 7 point linearization.
- Limit value for a relay output (bypass valve).
- Threshold value for signal suppression.

\* The performance characteristics depend on the type of device. For details, see the ratings section on page 10.

For a description of our precision flowmeters, please ask for our product brochures, or visit us on the Internet at [www.kral-usa.com](http://www.kral-usa.com).

**BEM 300 and BEM 500 – Easy to use and informative measurement display.**



**Clear menu structure.**

Settings are made using 7 structured menus. Menu 1 contains the measured values, menu 2 and 3 the units and the settings. The **←** and **→** keys are used to navigate through the menus. Each menu has several pages. The display menu has pages for displaying the rate, the total, and the consumption. Use **↶** and **↷** to change pages.

**Shortcuts.**

To give you fast access to important information, both the BEM 300 and the BEM 500 use shortcuts. Simultaneously pressing the SET and **↶** keys will give you a choice of languages. For fast help, press both **←** and **→** to bring up a quick reference guide. Pressing **↶** and **↷** simultaneously takes you straight to the consumption measurement result.

**Retracing your steps.**

Do you want to quickly check the changed settings? Sometimes just pressing a button is enough to take you back to the display you want to change. For example: if you are in the consumption display and want to change the units. Use **↶** to move to Menu 2. This is where the settings are made. Once you have made the change, **↶** will take you back to the consumption display.

**Informative display.**

The ability to view four lines at once makes for a useful display. The first line always contains the menu and page numbers. The information on flow measurement appears in line 2. The measured values are given with their accompanying unit. The contrast and brightness are adjustable.

## Standard flow measurement.



### Flow rate.

The flow rate is displayed with a choice of units, such as l/min, galUS/min or kg/hr. The temperature indicates the actual temperature of the liquid in Volumeter A. If the temperature is outside the valid range for this Volumeter, an alarm message is displayed.



### Total.

The flow volume is displayed with a choice of units such as l, gal or kg. Total 1 can be reset without a password, Total 2 requires a password.



### Connecting a second Volumeter.

The flow rate and flow volume of the second Volumeter B are also displayed with a choice of units. The temperature for the rate is given in °C or °F. Two Volumeters are usually connected to measure consumption. With the BEM 500, it is possible to take two independent measurements with just one set of electronics and two KRAL Volumeter.



### Consumption measurement.

When measuring consumption, for example in engines or burners, the measurement result is calculated by subtraction. Because of error propagation, the individual measuring devices need to be very precise to ensure that the system keeps measuring accurately. Since KRAL Volumeter are robust precision flowmeters, they are very often used to measure consumption. So with the BEM 500, consumption is the first display 1.01.

**KRAL Volumeter are volumetric PD-flowmeters. With the BEM 500, temperature measurement and density tables are used to convert to units of mass.**



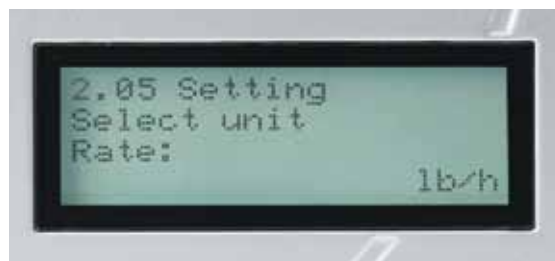
**Temperature.**

Being able to connect up to two temperature sensors gives the following options: mass conversion via density tables, flow display relative to a preset temperature, conversion of the flows of two Volumeters to the inlet temperature, Volumeter overheating warning and installation monitoring.



**Density.**

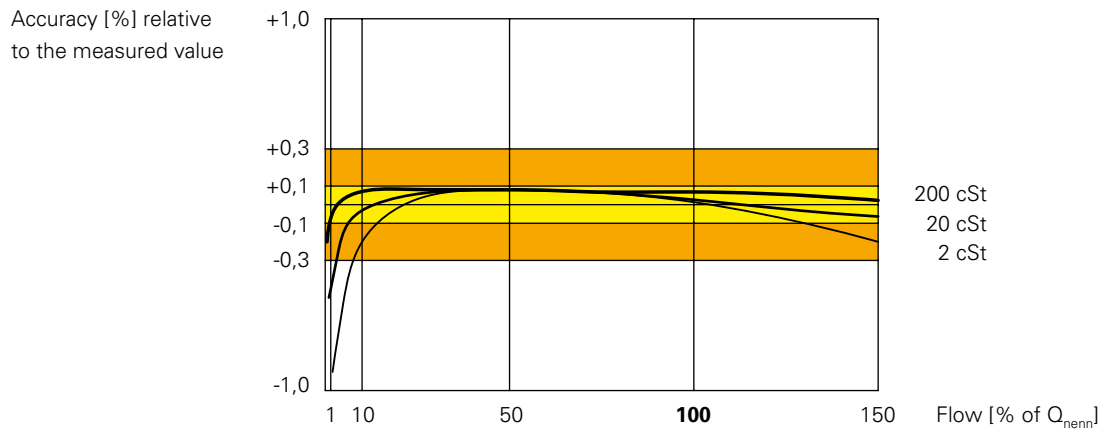
Two density tables can be entered. Density tables allow conversion to units of mass and allow conversion of the flow to a pre-selected temperature. Each density table has up to 10 temperature density pairs. The density table can be selected in Menu 2.



**Setting the units.**

The units of flow rate, total, temperature, and density can be selected in accordance with SI, UK and US units as volume and mass units.

**Measuring accuracy is further increased by linearization.**



**KRAL Volumeter® linearity.**

KRAL Volumeter measure very precisely, with an accuracy of  $\pm 0.1\%$  of the measured value. The wide turn down ratio of approx. 100:1 shows the linear characteristic of our robust measuring devices. With linearization at 4.6 cSt, the curve is stored in the electronics. This further increases the accuracy of evaluation of the perfectly coordinated complete system of flow measuring device and electronics unit.



**Calibration.**

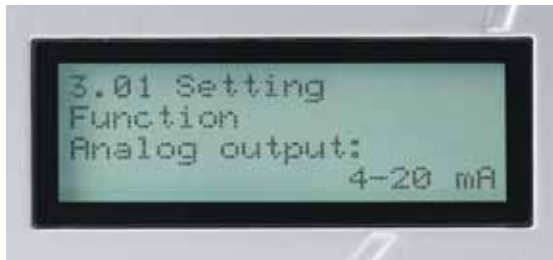
Each KRAL Volumeter is calibrated to our calibration standard. The calibration factors (K-factors) can be taken from the calibration certificate and entered into the electronics.



**Linearization.**

The factory calibration certificate contains 7 calibration factors (pulses per liter) with the associated frequency. The mean value specified on the calibration certificate is generally the one used. In addition, 7 individual K-factors can also be entered into the electronics. The electronics calculate the calibration curve. In this way, each frequency is given the associated K-factor. The characteristic curve of the Volumeter is stored in the electronics thus ensuring precision.

**BEM 300 and BEM 500 are highly flexible about exchanging data.**



**Analog output.**

There are either two 4 to 20 mA or 0 to 10 V analog outputs available. Analog outputs are assigned to the flow rate or total. Scaling is effected by adjusting the maximum value. If the flows fluctuate, signal forwarding can be smoothed.



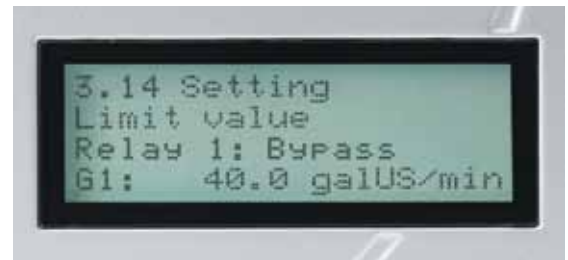
**Pulse output.**

The BEM 500 has two pulse outputs, to which the totals of Volumeters A and B, as well as the consumption can be assigned independently. In the "Encoder" setting, two 90° out of phase square wave signals are output to detect the flow direction. The pulse value, for example, 1 pulse corresponds to 200 pounds, is adjustable.



**Modbus.**

With the BEM 500, data forwarding via Modbus RTU is possible via the serial interface. The address can be adjusted.



**Relay for bypass and batching.**

This function allows the automatic activation of a bypass valve when a volumeter blocks. Furthermore, a simple filling function can be implemented with the BEM 500.



**BEM 300 and BEM 500 have numerous mounting options.**



**Fast attachment options.**

The universal mount is best suited for the various attachment options. The mounting frame and a KRAL toolkit are included among the items supplied as standard, in order to facilitate easier installation.



**Control cabinet mounting.**

With the mounting frame, the BEM 300 and the BEM 500 are set up for mounting in the control cabinet.



**Wall mounting.**

With the universal mount, the BEM 300 and the BEM 500 can be mounted on the wall. Degree of protection IP65.



**Volumeter mounting.**

For mounting directly on the KRAL Volumeter, use the universal holder and the Volumeter holder.



You can easily use the same components for mounting on horizontal or vertical pipes. Degree of protection IP65.



# BEM 300 and BEM 500 – Device Selection

Technical data.		BEM 300	BEM 500
<b>Description</b>		one channel, display of flow rate, 2 resettable totals, pulsation compensation, analog and pulse output, Modbus RTU interface	two channels, display of flow rate, 6 resettable totals, temperature, linearization, pulsation compensation with counter of flow direction change, analog, relay and pulse outputs, Modbus RTU interface
<b>Power supply</b>		24 V DC $\pm$ 20 %	same as BEM 300
<b>Environment</b>	Operating temperature Storage temperature Air moisture content EMC Shock Vibration	-4 to 158 °F -4 to 176 °F 97 % relative humidity EN 61 326 EN 61 373 EN 60 068-2-47 EN 60 068-2-64	same as BEM 300
<b>Casing</b>	Mounting Dimensions Degree of protection Material Weight	wall mounting, installation, control cabinet mounting 4.5 x 4.5 x 4.6 inches (WxHxD) IP65 plastic, UV-resistant coating 2.2 pounds	same as BEM 300
<b>Sensor</b>	Sensor type Sensor supply $U_b$ Rate accuracy Frequency	PNP, NPN, Namur 24 V DC, 8.2 V < 0.1 % 20 kHz	PNP, NPN, Namur, PT100 24 V DC, 8.2 V < 0.1 % 20 kHz
<b>Operation and electronics</b>	Display Keyboard	LCD, 4 lines, 20 characters, with backlighting 5 robust micro-switches	same as BEM 300
<b>Analog output</b>	Range Resolution	1 at 4 to 20 mA or 0 to 10 V (Cycle time 20 ms) 16 bit	2 at 4 to 20 mA or 0 to 10 V (Cycle time 20 ms) 16 bit
<b>Pulse output</b>	Maximum frequency	1 output at 250 Hz	2 outputs at 250 Hz direction of rotation option
<b>Relay output</b>	Function Voltage at nominal load Switching current, resistive Switching current, inductive		break contact, make contact 250 V AC, 30 V DC 6 A AC/DC 2 A AC/DC
<b>Bus</b>	Type Baud rate Data format	Modbus RTU via RS 232 or RS 485 (slave) 9600 baud 8N1 (8 data bits, no parity, 1 stop bit)	same as BEM 300

## Precise flow measurement in practice.



### Test bench.

KRAL Volumeter provide laboratory measuring accuracy even in rough operating conditions. The BEM 300 and BEM 500 electronic units achieve this goal and put measured values of the Volumeter on display. You only have to hold the KRAL electronics in your hand to feel the sturdy construction. The casing is made from high quality plastic, has a UV-resistant coating and rates a degree of protection IP65.

Typical applications for BEM 300 and BEM 500 include test benches for aircraft components as well as measuring fuel consumption on engine and turbine test benches.



### Fuel consumption measurement.

The complete system of KRAL Volumeter, sensor technology and BEM 500 is perfectly designed for measuring fuel consumption.

With two connected KRAL Volumeter, the BEM 500 calculates consumption by inlet flow rate and return flow rate subtraction.

There can be a vast difference in temperature between the inlet flow and return flow. The electronic unit relates every flow to the according temperature. Patented pressure pulse compensation balances the fuel return flows of the pulsating liquid column, which is excited by the pressure surges of the injection pumps. The bypass can be activated via a relay.



### Precise cylinder lubricating oil measurement for diesel engines.

High running costs reduce the profit in power generation. KRAL Volumeter in combination with KRAL electronics ensure precise cylinder lubricating oil measurement for diesel engines. This results in major savings in generator running costs.



### Joint projects.

Our business associates are particularly appreciative of the cooperative working relationship they have with the KRAL AG. From the best-possible support to the successful conclusion of the project, business relations are always friendly. We talk to our customers and collaborate closely on technical matters. You can rely on us.

### BEM 900.

For complex applications with up to 16 flowmeters, the pre-programmed BEM 900 is the optimum in electronics. Flow, consumption measurement, monitoring, data capture and data evaluation are also possible.



