DDM 900
Precision thermometer for laboratory and quality assurance

- **Uncertainty: ±0,005°C**
- **Resolution: 0,001 °C**
- **Range: -200 °C … +962 °C**
- **Excellent long-term stability**
- **Display of both measuring channels**
- **Pt25, Pt100, Pt500, Pt1000-probes**
- **Compensation of self heating error**
- **Fast measuring: up to 8/sec**
- **2 channels (up to 81 with MUX)**
- **Serial interface as standard**
- **4-conductor-technology, Lemo-plugs**
- **Highly interference-proof**
- **Comfortable input and highest safety of sensor data**
- **Controllable from your PC**

The DDM 900 is designed for precise temperature measurements as demanded in calibration-laboratory use and quality assurance. For DDM 900-100/25 Pt-25- and Pt-100-Sensors can be used at the same time.
For DDM 900-100/1000 Pt-100, Pt-500 and Pt-1000-Sensors can be used at the same time, too.
Both versions are available with an integrated 8-channel-multiplexer as an option.

Mode of operation

All temperature measurements by means of resistive sensors (RTD) consist of two steps which is due to its principle. In the first step the resistance value of the temperature sensitive sensor is taken. In the second step the measured temperature value must be calculated from the sensor´s resistance value.

Measuring of resistance

Apart from a sufficient accuracy a temperature measuring device should offer the interchangeability of sensors without calibrating the respective sensor with the measuring instrument. For this purpose it is necessary that the measuring of resistance occurs with a sufficiently small inaccuracy. The inaccuracy in the measuring of resistance is mainly determined by the reproducible resolution as well as by the linearity of the measurement and the accuracy of the reference element.
In the DDM 900 the high resolution and the excellent linearity are ensured by a analog/digital-converter which was developed especially for this instrument. The measuring of resistance is done with the help of switched direct currents. Thus the effects of thermoelectric voltage on the measured values are avoided without ending up with the problems concerning parasitic capacity and inductances which are typical of many AC-based devices. A hermetically sealed precision resistor integrated into the DDM 900 is used as a reference element. Doing so it is guaranteed that the measuring of resistance is ensured even without an external resistance-normal with an accuracy of up to ±0,0005 per cent.

Determination of the temperature value

The conversion of the measured resistance into a temperature value makes completely different demands on the measuring instrument than the measuring of resistance. Accuracy is of immediate importance for resistance measurements, whereas determining the appropriate temperature value often requires an input of sensor specific coefficients and thus has to be as user-friendly as possible. Additionally it has to be ensured that those sensor coefficients which have been set by the operator are not inadvertently deleted or changed.
In the DDM 900 the coefficients of standard sensors according to EN 60751 and ITS 90 are set by the manufacturer. In case other sensor coefficients have to be put in both data security and user-friendliness are most important. The key-controlled input of sensor specific coefficients (up to 12 coefficients for ITS 90-sensors) often proves to be quite laborious. Apart from that – in doing so - only a limited data security can be guaranteed. No matter whether the sensor coefficients or the value couples follow DIN or ITS 90, the resistance value for about 0° C usually must be put in, which is around 100 ohms for Pt-100 sensors. If, for example, it is only possible to put in this value with a resolution of 1.0 mohms, this leads to inaccuracies of up to 10 mK at a measured temperature of about 800° C. On top of that one has to add mistakes in digitization and linearity as well as mistakes of the reference resistor. For these reasons sensor specific coefficients for the DDM 900 are established with the help of easy-to-use software on the PC. Doing so automatically plausibility checks are carried out to avoid almost any mistakes. Afterwards the sensor data is transmitted from the PC into the DDM 900. As in any precison multichannel thermometer in the DDM 900 the sensor coefficients have to be assigned to the appropriate channels. In the DDM 900 this assignment is conveniently carried out with short user-defined descriptions of the sensors. The DDM 900 is able to store up to 21 (optionally up to 81) different sets of coeffients, a fact which has two substantial advantages: if multiplexers are used, the appropriate sensor coefficients can

be assigned to each measuring channel. And apart from that it is likely that in many cases there are no more than 21 precision sensors, so that coefficients have to be added only when a new RTD is used for the first time. In case the coefficients of a sensor have been stored in the DDM 900 at an earlier time, they do not have to be put in again, but can be selected with the help of the user-defined descriptions. Even if more than 21 (optionally 81) sensors are in use, new sensor coefficients don't have to be put in when changing over from one sensor to another which has been used before, they only need to be transmitted again from the PC. Thus special coefficients of new precision sensors only have to be put in once by the user. The user may not have to put in any sensor coefficients at all if he is provided with the appropriate calibration data by the sensors' manufacturer on disk. In this way the DDM 900 offers a maximum of user-friendliness and data security.

Fast temperature measurements

In particular when using multiplexers the measuring time should be kept at a minimum. With a lot of self-adjusting measuring bridges this demand can be fulfilled only imperfectly. Operated with full accuracy the DDM 900 achieves a measuring time of 1 sec. If operated with a reduced accuracy about 8 measurements per second are typical.

Eigenerwärmung des Fühlers

Bei Genauigkeiten im mK-Bereich können selbst kleine Messströme von weniger als 1 mA zu signifikanten Fühler-erwärmungen führen. Diese Erwärmungen können durch eine Halbierung der Verlustleistung am Messwiderstand (√2-Funktion) ermittelt werden, um sie anschließend zu eliminieren.

Operation with external multiplexers

Up to five multiplexers can be cascade-connected, so that a maximum of 81 measuring channels can be realized with an DDM 900. The connection of the temperature sensors is done with the same robust Lemo -plugs as in the DDM 900.

Technical data

The following specifications are only valid for a nominal operating voltage and an environmental temperature of 23°C.

DDM 900-100/25	
Sensors:	Pt-100 and Pt-25 (at the same time), true 4-wire
Range:	-200°C … 962°C (ITS-90) -200°C … 850°C (DIN EN60751)
Resolution:	1 mK
Uncertainty:	10 mK (5 mK for Range -50 C … 250°C)
Channel:	2 (with a Multiplexer up to 81 as an option)
Connectors:	Lemo 1S, 4-pole
Measuring current:	appr. 0,5 mA switched DC (1mA for Pt-25), elimination of self heating error by √2-function
Measuring time:	appr. 1 s per channel, appr. 0,1 s per channel by reduced resolution
Long term stability:	≤ 5 mK/year
Temp.-coefficient:	≤ 1 mK/°C
Display:	2 line LCD, à 16 letters, 9 mm hight
Unit:	°C, °F, K, Ω
Interface:	RS-232, galvanic isolated
Handling:	Menu structure, changing by using keyboard, alternative by PC
Memory:	128 KB (512 KB as an option)
Power supply:	230 V, 50 Hz or 115 V, 60 Hz appr. 15 VA
Dimensions:	300 x 160 x 300 mm
Weight:	appr. 8 kg

DDM 900-100/10000	
Sensors:	Pt-100, P-500 and Pt-1000 (at the same time), true 4-wire
Range:	-200°C … 962°C (ITS-90) -200°C … 850°C (DIN EN60751)
Resolution:	1 mK
Uncertainty:	10 mK (5 mK for Range -50 C … 250°C)
Channel:	2 (with a Multiplexer up to 81 as an option)
Connectors:	Lemo 1S, 4-pole
Measuring current:	appr. 0,5 mA switched DC (Pt500 und Pt1000: appr. 0,15 mA), elimination of self heating error by √2-function
Measuring time:	appr. 1 s per channel, appr. 0,1 s per channel by reduced resolution
Long term stability:	≤ 5 mK/year
Temp.-coefficient:	≤ 1 mK/°C
Display:	2 line LCD, à 16 letters, 9 mm hight
Unit:	°C, °F, K, Ω

Information regarding Interface, Handling, Memory, Power supply, Dimensions and weight please note DDM 900-100/25