

2.1 ALMEMO® measuring instruments

Although measured values processing and the functions are virtually identical on all ALMEMO® measuring instruments, there are nonetheless numerous different variants to cover all conceivable requirements. The most important variants are listed below.

Hand-held devices:

2390-1 1 input, 2 channels, analog output

2390-3 2 inputs, differential / max./ min./ hold functions, interface

2390-5/8 3 or 5 inputs, all functions accessible via the keypad; option of data logger also with external memory connectors

450-1L 1 input, maximum / minimum / hold functions; option with interface

2490-1/2L 1 or 2 inputs, maximum / minimum functions, memory for 100 values; options with interface, analog outputs, electrically isolated

2590-2/3/4 2, 3, or 4 inputs, graphics display, data logger, and sleep mode; option of memory or MMC card

2690-8 5 inputs, graphics display, data logger, sleep mode

2890-9 9 inputs, graphics display, data logger, sleep mode



Desktop devices:

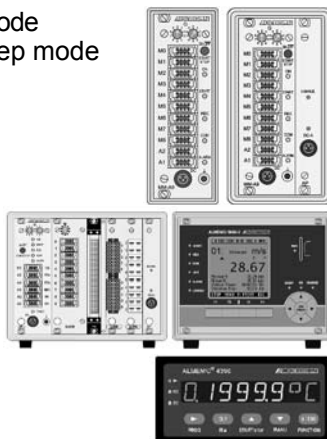
8590-9 9 inputs, 1 key, without display, data logger, and sleep mode; option of memory or MMC card

8690-9A As above but with rechargeable battery pack

Data acquisition systems:

5690-1 19-inch system with 9 inputs, maximum 99, with selector switch boards, data logger; option of memory or MMC card

5690-2 As above but with keypad, graphics display, MMC memory; option of rechargeable battery pack



Control panel and control cabinet devices:

4390-2 Control panel device with 8-character LED display, 1 input, 5 keys, 2 relays; option of electrically isolated double analog output

8390-1 Transmitter, 1 input, interface, mains adapter

8390-2 As above but with display and 5 keys (functions as on 2390-5); option of RS485, electrically isolated analog output, 24-V power supply



Instrument with built-in printer:

6290-7 2 inputs, 6 keys, display, and built-in thermal printer, list printout, plotting function; option with rechargeable battery; option with memory

A detailed list of the equipment and functions of these device variants is provided in the following table.

2.2 Equipment and function

Standard equipment

Sensor inputs, maximum
 Channels per input
 Measuring channels, maximum
 Maximum conversion rate, 2.5 / 10 / 50 / 100 mops (measuring operations per second)
 Output socket / option
 Connection for analog output, relays / triggers
 Connection for serial interface, network
 Display type (C = LCD / G = graphics LCD / L = LED)
 Display illumination, white LEDs
 Function keys (S = softkeys / B = thumbwheel)
 Measuring and programming menus
 Real-time clock with date
 EEPROM, internal, in KB

Storage on external MMC memory card
 Sleep mode for long-term recording
 Power supply (B = battery / A = rechargeable battery pack / /N = mains)
 Power supply from rechargeable battery (with rapid charging)
 Power supply, 9 to 36 V, electrically isolated
 Sensor / battery voltage monitoring

Functions for sensor parameters

Measuring range, programmable
 Function channels (maximum, minimum, average, differential, summation)
 Reference channels, programmable
 Units, any 2 characters
 Measuring channel designation, 10 characters
 Time constant for measured value smoothing
 Averaging mode (manual start and stop, individually)
 Averaging mode (continuous, cyclic)
 Input of cross-section or diameter
 Limit values, maximum and minimum

| 2450 | 2490 | 2490 | 2590 | 2590 | 2590 | 2690 | 2890 | 8590 | 5690 | 5690 | 4390 | 8390 | 8390 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| -1 | -1 | -2 | -2 | -3S | -4S | -8 | -9 | -9 | -1 | -2 | -2 | -1 | -2 |
| 1 | 1 | 2 | 2 | 3 | 4 | 5 | 9 | 9 | 99 | 99 | 1 | 1 | 1 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1-4 | 1-4 | 4 | 4 | 4 |
| 4 | 4 | 12 | 12 | 16 | 20 | 24 | 40 | 40 | 99 | 99 | 4 | 4 | 4 |
| 2.5 | 10 | 10 | 10 | 10 | 10 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| T2/3 | T2/3 | T2/3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2/3 | 1 | 1 |
| T | T | T | • | • | • | • | • | • | • | • | • | O/• | O/• |
| T | T | T | • | • | • | • | • | • | • | • | • | • | • |
| 11C | 11C | 11C | 168G | 168G | 168G | 336G | 336G | - | - | 336G | 8L | - | 8C |
| - | - | - | • | • | • | • | • | - | - | • | - | - | - |
| 7 | 7 | 7 | 7S | 7S | 7S | 9S | 9SB | 1 | 1 | 9S | 5 | - | 5 |
| - | - | - | • | • | • | • | • | - | - | • | • | - | - |
| T | T | T | • | • | • | • | • | • | • | • | • | - | - |
| - | - | - | - | 64 | 64 | 512 | 512 | O512 | O512 | O512 | 128 | - | - |
| - | - | - | Z | Z | Z | Z | Z | Z | Z | • | Z | - | - |
| - | - | - | Z | • | • | • | • | • | • | • | - | - | - |
| B/O | B/O | B/O | B/N | B/N | B/N | B/N | A/N | N | N | N | N | N | N |
| - | - | - | - | - | - | Z | • | T | Z | Z | - | - | - |
| O | O | O | Z | Z | Z | Z | Z | Z | Z | Z | O | O | O |
| • | • | • | • | • | • | • | • | • | • | • | • | • | • |

| | | | | | | | | | | | | | |
|-----|-----|-----|---|---|---|---|---|---|---|---|---|---|---|
| TV | TV | TV | • | • | • | • | • | V | V | • | • | V | • |
| oTV | oTV | oTV | • | • | • | • | • | V | V | • | • | V | • |
| oTV | oTV | oTV | • | • | • | • | • | V | V | • | V | V | V |
| TV | TV | TV | • | • | • | • | • | V | V | • | • | V | • |
| TV | TV | TV | • | • | • | • | • | V | V | • | V | V | V |
| oTV | oTV | oTV | • | • | • | • | • | V | V | • | • | V | • |
| - | - | - | • | • | • | • | • | - | - | • | • | - | • |
| TV | TV | TV | • | • | • | • | • | V | V | • | • | V | V |
| TV | TV | TV | • | • | • | • | • | V | V | • | • | V | • |
| TV | TV | TV | • | • | • | • | • | V | V | • | • | V | • |

Equipment and function

Hysteresis for alarms, programmable

| | | | | | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| TV | TV | TV | ● | ● | ● | ● | ● | V | V | ● | ● | V | V |
| 24 50 | 24 90 | 24 90 | 25 90 | 25 90 | 25 90 | 26 90 | 28 90 | 85 90 | 56 90 | 56 90 | 43 90 | 83 90 | 83 90 |
| TV | TV | TV | ● | ● | ● | ● | ● | V | V | ● | ● | V | V |
| oTV | oTV | oTV | ● | ● | ● | ● | ● | V | V | ● | ● | V | ● |
| o | o | o | o | o | o | o/O | o/O | o/O | o/O | o/O | o | - | - |
| - | - | - | F | F | F | F | F | V | V | F | - | - | - |
| oTV | oTV | oTV | ● | ● | ● | ● | ● | V | V | ● | ● | V | V |
| ● | ● | ● | ● | ● | ● | ● | ● | V | V | ● | ● | V | ● |
| oTV | oTV | oTV | ● | ● | ● | ● | ● | V | V | ● | V | V | V |
| TV | TV | TV | ● | ● | ● | ● | ● | V | V | ● | ● | V | ● |

Assigning of alarm relays to limit values

Zero-point correction, gain correction

Multi-point calibration / programming

Emissivity factor

Base value, factor, exponent

Analog output scaling (start / end)

Minimum sensor voltage, programmable

Locking the sensor programming

Measuring functions :

Measured value

B = bar chart, line chart

Differential measurement

Maximum value and minimum value

Date and time-of-day of maximum and minimum values

Individual values memory (hold function), number

Average value, number of averaged values

Volume flow (average value x cross-section)

Atmospheric pressure compensation (psychrometer, O₂)

Cold junction compensation, internal, external, fixed

Temperature compensation (RH, pH, conductivity, dynamic pressure, O₂)

Sensor adjustment

Setpoint input

Linearization, multi-point correction in the connector

| | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|---|---|---|---|---|---|---|---|
| ● | ● | ● | ● | ● | ● | ● | ● | V | V | ● | ● | V | ● |
| - | - | - | B | B | B | ● | ● | - | - | ● | - | - | - |
| oTV | oTV | ● | ● | ● | ● | ● | ● | V | V | ● | V | V | V |
| ● | ● | ● | ● | ● | ● | ● | ● | V | V | ● | ● | V | ● |
| TV | TV | TV | ● | ● | ● | ● | ● | V | V | ● | V | - | - |
| 1 | 100 | 100 | 100 | 100 | 100 | - | - | - | - | - | - | - | - |
| - | - | - | ● | ● | ● | ● | ● | V | V | ● | ● | V | ● |
| - | - | - | ● | ● | ● | ● | ● | V | V | ● | ● | - | - |
| TV | TV | TV | ● | ● | ● | ● | ● | V | V | ● | ● | V | ● |
| TV | TV | TV | ● | ● | ● | ● | ● | V | V | ● | ● | V | V |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| TV | TV | TV | ● | ● | ● | ● | ● | V | V | ● | ● | V | ● |
| TV | TV | TV | ● | ● | ● | ● | ● | V | V | ● | ● | - | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | - | - |
| | | | | | | | | | | | | | |

Functions, device parameters

Device designation, 40 characters

Keypad locking

Choice of language

Continuous measuring point scanning with output

Date and time-of-day

Cycle

Baud rate, device address

Output format - list / columns / table

Once-only measured value scanning and output

| | | | | | | | | | | | | | |
|----|----|----|-----|---|---|---|---|---|---|---|---|---|---|
| TV | TV | TV | ● | ● | ● | ● | ● | V | V | ● | V | V | V |
| - | - | - | - | - | - | O | O | - | - | O | - | - | - |
| - | - | - | ● | ● | ● | ● | ● | - | - | ● | ● | ● | ● |
| TV | TV | TV | V | V | V | ● | ● | V | V | ● | V | V | V |
| TV | TV | TV | ● | ● | ● | ● | ● | V | V | ● | ● | V | ● |
| TV | TV | TV | Z/V | ● | ● | ● | ● | V | V | ● | ● | V | ● |
| TV | TV | TV | Z/V | ● | ● | ● | ● | V | V | ● | V | V | ● |
| TV | TV | TV | Z/V | ● | ● | ● | ● | V | V | ● | ● | V | ● |

Cyclic measured value scanning and output
 Numbering of measuring operations
 Numbers list, output
 Start and stop by date and time-of-day
 Start and stop by limit value / external trigger
 Command macros
 Measured value memory, available memory capacity
 Continuous saving to memory
 Selective read-out from memory, according to start and end date and time
 Output relays, controllable

| | | | | | | | | | | | | | |
|----|----|----|-----|---|---|---|---|----|----|---|-----|-----|-----|
| TV | TV | TV | Z/V | • | • | • | • | V | V | • | • | V | • |
| TV | TV | TV | Z | • | • | • | • | V | V | • | V | - | - |
| - | - | - | ZV | V | V | V | V | V | V | V | V | - | - |
| TV | TV | TV | Z/V | • | • | • | • | V | V | • | • | - | - |
| TV | TV | TV | Z/V | • | • | • | • | V | V | • | V/• | V/• | V/• |
| TV | TV | TV | V | V | V | V | V | V | V | V | V | - | - |
| - | - | - | Z | • | • | • | • | OZ | OZ | • | • | - | - |
| - | - | - | Z | • | • | • | • | OZ | OZ | • | V | - | - |
| - | - | - | - | • | • | • | • | OZ | OZ | 0 | - | - | - |
| TV | TV | TV | • | • | • | • | • | V | V | • | V | 0 | 0 |

- Function is provided as standard and if appropriate can be programmed.
- Programmed value is considered but cannot be programmed.
- F Function is activated by the appropriate sensor(s).
- V Function can only be called up and / or programmed via the serial interface.
- T Function depends on the device type.
- O Function is available as an option.
- Z Function is available as an accessory

2.3 Measuring ranges

| Sensor type | Type | Measuring range | Dim | Resol. | Accuracy | Linearisation |
|--|-------------|---------------------|-------|-----------|----------|------------------|
| Resistance-based temperature sensors: | | | | | | |
| Pt100/Pt1000-1 4-conductors | FP Axxx | -200.0... +850.0 | °C | 0.1 K | ± 0.05 K | ± 0.05 % of m.v. |
| Pt100/Pt1000-2 4-conductors | FP Axxx | -200.00... +400.00* | °C | 0.01 K | | ± 0.05 K |
| Pt100-3 4-conductors | FP Axxx | 0.000... +65.000* | °C | 0.001 K | | ± 0.002 K |
| Ni100/Ni1000 4-conductors | | -60.0 ... +240.0 | °C | 0.1 K | | ± 0.05 K |
| Ntc Typ N | FN Axxx | -50.00 ... +125.00 | °C | 0.01 K | | ± 0.05 K |
| Thermocouples: | | | | | | |
| NiCr-Ni (K) | FT Axxx | -200.0 ... +1370.0 | °C | 0.1 K | ± 0.05 K | ± 0.05 % of m.v. |
| NiCrSiL-Nisil (N) | | -200.0 ... +1300.0 | °C | 0.1 K | ± 0.05 K | ± 0.05 % of m.v. |
| Fe-CuNi (L) | | -200.0 ... +900.0 | °C | 0.1 K | ± 0.05 K | ± 0.05 % of m.v. |
| Fe-CuNi (J) | | -200.0 ... +1000.0 | °C | 0.1 K | ± 0.05 K | ± 0.05 % of m.v. |
| Cu-CuNi (U) | | -200.0 ... +600.0 | °C | 0.1 K | ± 0.05 K | ± 0.05 % of m.v. |
| Cu-CuNi (T) | | -200.0 ... +400.0 | °C | 0.1 K | ± 0.05 K | ± 0.05 % of m.v. |
| PtRh10-Pt (S) | | 0.0 ... +1760.0 | °C | 0.1 K | | ± 0.3 K |
| PtRh13-Pt (R) | | 0.0 ... +1760.0 | °C | 0.1 K | | ± 0.3 K |
| PtRh30-PtRh6 (B) | | +400.0 ... +1800.0 | °C | 0.1 K | | ± 0.3 K |
| AuFe-Cr | | -270.0 ... +60.0 | °C | 0.1 K | | ± 0.1 K |
| Electrical signals: | | | | | | |
| Millivolts DC | | -10.0 ... +55.0 | mV | 1 uV | | - |
| Millivolts 1 DC | | -26.0 ... +26.0 | mV | 1 uV | | - |
| Millivolts 2 DC | | -260.0 ... +260.0 | mV | 0.01 mV | | - |
| Volt DC | | -2.6 ... +2.6* | V | 0.1 mV | | - |
| Volt DC | | -26.0 ... +26.0 | V | 1 mV | | - |
| Difference-millivolts DC | | -10.0 ... +55.0 | mV | 1 uV | | - |
| Difference-millivolts1 DC | | -26.0 ... +26.0 | mV | 1 uV | | - |
| Difference-millivolts2 DC | | -260.0 ... +260.0 | mV | 0.01 mV | | - |
| Difference-volts DC | | -2.6 ... +2.6* | V | 0.1 mV | | - |
| Milliamperes DC | | -32.0 ... +32.0* | mA | 1 uA | | - |
| Percent (4-20mA DC) | | 0.0 ... 100.0 | % | 0.01 % | | - |
| Ohms 1 | | 0.00 ... 500.00* | Ω | 0.01 Ω | | - |
| Ohms 2 | | 0.00 ... 5000.0* | Ω | 0.1 Ω | | - |
| Frequency | ZA 9909-AK1 | 0 ... 15000 | Hz | 1 Hz | | - |
| Pulses / measuring cycle | ZA 9909-AK2 | 0 ... 65000 | | | | - |
| Rotational speed | ZA 9909-AK4 | 8 ... 32000 | UpM | 1UpM | | - |
| Digital input | ZA 9000-ES2 | 0.00 ... 100.00 | % | | | - |
| Capacitive humidity sensors: | | | | | | |
| Relative humidity | FH A646 | -5.0 ... 98.0 | %H | 0.1 % | | - |
| Relative humidity with TC | FH A646-R/C | 5.0 ... 98.0 | %H | 0.1 % | | ± 0.5 % |
| Dew-point temperature | FH A646 | -25.0 ... 100.0 | °C | 0.1 K | | ± 0.2 K |
| Mixture ratio with PC | FH A646 | 0.0 ... 500.0 | g/kg | 0.1 g/kg | | ± 0.5 % of m.v. |
| Partial vapor pressure | FH A646 | 0.0 ... 1013.2 | mbar | 0.1 mbar | ±0.1mbar | ± 0.1% of m.v. |
| Enthalpy with PC | FH A646 | 0.0 ... 400.0 | kJ/kg | 0.1 kJ/kg | | ± 0.5 % of m.v. |
| Psychrometer | | | | | | |
| Humid temperature | FN A846 | 0.00 ... +100.00 | °C | 0.01 K | | ± 0.05 K |
| Relative humidity with PC | FN A846 | 0.0 ... 100.0 | %H | 0.1 % | | ± 1.0 %H |
| Dew-point temperature with PC | FN A846 | -25.0 ... 100.0 | °C | 0.1 K | | ± 0.2 K |

| Sensor type | Type | Measuring range | Dim | Resol. | Accuracy | Linearisation |
|--|---------------------|-------------------|-------------------|---------------------|---------------------------|---------------|
| Mixture ratio with PC | FN A846 | 0.0 ... 500.0 | g/kg | 0.1 g/kg | ± 0.5 % of m.v. | |
| Partial vapor pressure with PC | FN A846 | 0.0 ... 1013.2 | mbar | 0.1 mbar | ±0.1mbar ± 0.1% of m.v. | |
| Enthalpy with PC | FN A846 | 0.0 ... 400.0 | kJ/kg | 0.1 kJ/kg | ± 0.5 % of m.v. | |
| Rotating vane, normal | FV A915-S120 | 0.30 ... 20.00 | m/s | 0.01 m/s | ± 0.1 m/s ± 0.2 % of m.v. | |
| Rotating vane, normal | FV A915-S140 | 0.40 ... 40.00 | m/s | 0.01 m/s | ± 0.2 m/s ± 0.2 % of m.v. | |
| Rotating vane, micro | FV A915-S220 | 0.50 ... 20.00 | m/s | 0.01 m/s | ± 0.1 m/s ± 0.2 % of m.v. | |
| Rotating vane, micro | FV A915-S240 | 0.60 ... 40.00 | m/s | 0.01 m/s | ± 0.2 m/s ± 0.2 % of m.v. | |
| Rotating vane, macro | FVA915-SMA1 | 0.10 ... 20.00 | m/s | 0.01 m/s | ± 0.1 m/s ± 0.2 % of m.v. | |
| Water turbine | FV A915-WM1 | 0.00 ... 5.00 | m/s | 0.01 m/s | ± 0.1 m/s ± 0.2 % of m.v. | |
| Dynamic pressure sensor with TC and PC | FD A602-M1K | 0.5 ... 40.0 | m/s | 0.1 m/s | ± 0.1 m/s | |
| Dynamic pressure sensor with TC and PC | FD A602-M6 | 1.8 ... 90.0 | m/s | 0.1 m/s | ± 0.1 m/s | |
| Chemical probes | | | | | | |
| Conductivity probe with TC | FY A641-LF/2/3 | 0.0 ... 20.000 | mS | 0.001 mS | ± 0.2 % of m.v. | |
| CO ₂ probe | FY A600-CO2 | 0.0 ... 25.00 | % | 0.01 % | ± 0.2 % of m.v. | |
| O ₂ saturation with TC and PC | FY A640-O2 | 0 ... 260 | % | 1 % | - | |
| O ₂ concentration with TC | FY A640-O2 | 0.0 ... 40.0 | mg/l | 0.1 mg/l | ± 0.2 mg/l | |
| Function values | | | | | | |
| Difference | | | | | | - |
| Maximum value | | | | | | - |
| Minimum value | | | | | | - |
| Average value over time | | | | | | - |
| Average value over measuring points | | | | | | - |
| Summation over measuring points | | 0 ... 65000 | | | | - |
| Total number of pulses | ZA 9909-AK2 | 0 ... 65000 | | | | - |
| Pulses / print cycle | ZA 9909-AK2 | 0 ... 65000 | | | | - |
| Alarm value | | 0.0 ... 100.00 | % | | | - |
| Thermal coefficient | M(q) / M(Δ T) | | | | | - |
| Wet bulb globe temperature (WBGT) | (0.1TT+0.7HT+0.2GT) | | | | | - |
| Digital interface | ZA 9919-AKxx | 0 ... 65000 | | | | - |
| Battery voltage | | 0,00 ... 20.00 | V | 0.01V | | - |
| Measured value * | | | | | | - |
| Cold junction temperature * | | -30.00... +100.00 | °C | 0.01K | ± 0.05 K | |
| Number of averaged values * | | 0 ... 65000 | | 1 | | - |
| Volume flow * | | 0 ... 65000 | m ³ /h | 1 m ³ /h | | - |
| Timer 1s * | | 0 ... 60000 | s | 1 s | | - |
| Timer 0.1s * | | 0 ... 6000.0 | s | 0.1 s | | - |

* The measuring range provided depends on the device type and version; in some cases this data may differ; (see device instructions).

TC = With temperature compensation

PC = With atmospheric pressure compensation

2.4 Special measuring ranges

| Type of Sensor | V5 Option | V6Connector* | Meas. range | Dim | Resol. | Accuracy Linearisation. |
|---|-----------|---------------|---------------------|----------|--------|----------------------------|
| Resistor-based Temperature Sensor | | | | | | |
| NTC Typ N FNA xxx | SB0000 N3 | ZA9040SS3 | 5.000...+46.000 °C | 0.001 K | | ± 0.005 K |
| KTY 84 | SB0000 K | ZA9040SS4 | -40.0... +200.0 °C | 0.1 K | | ± 0.1 K |
| YSI 400 | SB0000 Y | ZA9641SS | -40.0... +130.0 °C | 0.01 K | | 0..50°C:± 0.05K; or:±0.1K |
| 50 Ohm | - | ZA9003SS3 | 0.000... 50.000 Ω | 0.001Ω | | - |
| 110 kOhm | - | ZA9003SS4 | 0.00... 110.00 Ω | 0.01kΩ | | ± 0.2 % v.Mw. ± 0.02KΩ |
| Infrared Sensors: | | | | | | |
| Infrared 1 | | FIA628-1/5xSS | 0.0 ... +200.0 °C | 0.1 K | | ±0.05 K ± 0.05 % of m.v. |
| Infrared 4 | | FIA628-4xSS | -30.0 ... +100.0 °C | 0.1 K | | ± 0.05 K . |
| Infrared 6 | | FIA628-6xSS | 0.0 ... +500.0 °C | 0.1 K | | ± 0.1 K ± 0.05 % of m.v. |
| Thermocouples | | | | | | |
| W5Re-W26Re (C) | SB0000W5 | ZA9000SSC | 0.0...+2320.0 °C | 0.1 K | | ± 0.25 K |
| NiCr-Ni (K) | SB0000 N2 | ZA9020SS2 | -100.0...+500.00 °C | 0.01 K | | ± 0.025 K |
| Flow sensors | | | | | | |
| Thermosensor SS20 | SB0000 S | ZA9602SSS | 0.50... +20.00 m/s | 0.01 m/s | | ± 0.02 m/s |
| Temp. Measuring Range for Refrigerants | | | | | | |
| Only with device option SB0000 R* : | | | | | | |
| R22 (0...36 bar ^{absolut}) | | dewpressure | -90.0... +79.0 °C | 0.1 K | | <-24°C:± 0.2K;>-24°C:±0.1K |
| R23 (0...49 bar ^{absolut}) | | dewpressure | -100.0... +26.0 °C | 0.1 K | | <-24°C:± 0.2K;>-24°C:±0.1K |
| R134a (0...40 bar ^{absolut}) | | dewpressure | -75.0... +101.0 °C | 0.1 K | | <-16°C:± 0.2K;>-16°C:±0.1K |
| R404a (0...32 bar ^{absolut}) | | dewpressure | -60.0... +65.0 °C | 0.1 K | | ± 0.1 K |
| R404a (0...32 bar ^{absolut}) | | boilpressure | -60.0... +65.0 °C | 0.1 K | | ± 0.1 K |
| R407c (0... 46 bar ^{absolut}) | | dewpressure | -50.0... +86.0 °C | 0.1 K | | <-30°C:± 0.2K;>-30°C:±0.1K |
| R407c (0... 46 bar ^{absolut}) | | boilpressure | -50.0... +86.0 °C | 0.1 K | | <-30°C:± 0.2K;>-30°C:±0.1K |
| R410 (0... 49 bar ^{absolut}) | | dewpressure | -70.0... +70.0 °C | 0.1 K | | <-30°C:± 0.2K;>-30°C:±0.1K |
| R417a (0... 27 bar ^{absolut}) | | dewpressure | -50.0... +70.0 °C | 0.1 K | | <-35°C:± 0.2K;>-35°C:±0.1K |
| R507 (0... 37 bar ^{absolut}) | | dewpressure | -70.0... +70.0 °C | 0.1 K | | <-30°C:± 0.2K;>-30°C:±0.1K |

- This is not supported by devices 8390-1, 8390-2

2.5 Technical data

Inputs

| | |
|----------------------------|---|
| Channel switching | 4-contact with photo-MOS relay, offset voltage <5 µV |
| between input sockets | Potential separation maximum 50 V |
| | Measuring modules with higher potential separation, see 4.2.8 |
| Sensor power supply | 6 to 12 V, depending on power supply |
| Self-calibration | Automatic zero-point correction, measuring current |
| calibration | |
| Nominal temperature | 22 °C ± 2 K |
| Cold junction compensation | -30 to +100 °C |
| Accuracy | ±0.2 K (±0.01 K / °C) |
| Monitoring functions | Automatic sensor recognition and sensor breakage detection |

A/D converter

V5 device

| | |
|-------------------------|---|
| Measuring current | Multi-slope integrating, 16-bit resolution Pt100 approx. 1 mA; Pt1000 approx. 0.1 mA |
| Common-mode input range | -4 to +4 V |
| Overload | maximum ± 5 V |
| Input current | < 50 nA |
| Measuring rate | 2.5 or 10 mops |
| System accuracy | ± 0.03 % of measured value ± 2 digits (at 2.5 mops) |
| Temperature drift | 0.005 % / °C |

V6 devices 2420, 2450

| | |
|-------------------------|--|
| Common-mode input range | Delta-sigma, 16-bit resolution -0.26 to +2.6 V Overload max. -4 to +5 V |
| Input current | < 2 nA |
| Measuring rate | 2.5 mops |
| System accuracy | ± 0.1 % of measured value ± 3 digits |
| Temperature drift | 0.01 % / °C |

V6 devices

2390, 2490, 2590, 8390

| | |
|-------------------------|---|
| Measuring current | Delta-sigma, 16-bit resolution Pt100, Pt1000 0.3 mA |
| Common-mode input range | -2 to +5 V Overload max. -2 to +5 V |
| Input current | < 20 nA |
| Measuring rate | 2.5 or 10 mops |
| System accuracy | ± 0.03 % of measured value ± 2 digits (at 2.5 mops) |
| Temperature drift | 0.005 % / °C |

V6 devices

2690, 2890, 5690, 8590, 8690

| | |
|---|--|
| Measuring current | Delta-sigma, 24-bit resolution Pt100 approx. 1 mA; Pt1000 approx. 0.1 mA |
| Common-mode input range | -3.0 to +3.0 V in DC voltage range (2.6 V) -2.0 to +1.7 V in all other measuring ranges |
| Overload | maximum ± 12 V |
| Input current | 500 nA in DC voltage range (2.6 V) 500 pA in all other measuring ranges |
| Measuring rate | 2.5 / 10 / 50 / 100 mops |
| System accuracy | 0.02% ± 1 digit (at 2.5 and 10 mops) 0.05% ± 3 digits (at 50 mops) |
| Temperature drift | 0.003 % / °C |
| Functional restrictions at 50 mops and above | Sensor breakage detection and higher interference - caused by : Mains hum (suppression no longer possible, can be remedied by using twisted wiring) |

Outputs

ALMEMO® socket A1

Digital interfaces

Baud rate 1200, 2400, 4800, 9600, 57.6k, 115.2k
Data : 8 bit serial, 1 start bit, 1 stop bit, no parity
RS232 with data cable ZA 1909-DK5
USB with data cable ZA 1919-DKU
USB with adapter cable ZB 1909-USB
Optic fiber with data cable ZA 1909-DKL
RS422 with network distributor ZA 5099-NVB/NVL
Ethernet with adapter cable ZA 1945-DK
Wireless with Bluetooth modules ZA 1709BTxDK
-1.25 to +2.0 V with recording cable ZA 1601-RK
0 to 10 V / 20 mA with relay trigger adapter
ZA8006-RTA3

Analog output

ALMEMO® socket A2

Saving data

ALMEMO® memory connector, 128 / 256 KB,
ZA1904-SS
ALMEMO® memory connector for multi-media card,
ZA 1904MMC

Networking

Current loop with network cable ZA 1999-NK5
Wireless with Bluetooth modules ZA 1709BTxNK

Analog output

-1.2 to +2.0 V with recording cable ZA 1601-RK
0 to 10 V / 20 mA with relay trigger adapter
ZA 8006-RTA3

Resolution 32000 digits

Accuracy $\pm 0.1\% \pm 6$ digits

Drift 1 digit / K

Trigger input

with trigger cable ZA 1000-ET / EK / EAK,
ZA 800x-RTAx

Relay output

with relay cable ZA 100x-EGK / EAK, ZA 800x-RTAx

Device

Interface to all connectors

I²C bus

Operating temperature

-10 to +60 °C

Storage temperature

-30 to +60 °C

Humidity range

10 to 90 % (non-condensing)

Electromagnetic compatibility (EMC)

IEC 61 326, IEC 61 000-6-1, IEC 61 000-6-3,
IEC 61 000 -4 -2, IEC 61 000-4 -3,
IEC 61 000 -4 -4

Mains adapter

ZB 2290-NA for 2390

12 VDC, 0.2 A, coaxial connector

ZA 1312-NA1 for 2490

12 VDC, 0.2 A, ALMEMO® connector

ZB 1112-NA4 for 6290-7

12 VDC, 0.6 A, coaxial connector

ZA 2690-NA1 for 2690-8

12 VDC, 0.6 A, ALMEMO® connector

ZB 2590-NA for 2890-9

12 VDC, 0.8 A, coaxial connector

ZB 1212-NA4 for 8590

12 VDC, 0.6 A, 3-pin bayonet coupling

ZB 5090-NA2 for 8690

12 VDC, 0.8 A, 3-pin bayonet coupling

ZB 1212-NA6 for 5690

12 VDC, 3.0 A, 3-pin bayonet coupling

ZB 5090-VK05

Extension cable, 5 meters, 3-pin bayonet plug