Customer-specific linearization for all sensors
Galvanically isolated output
Permanent min. and max. value storage (slave pointer)
Tare function
Sample & hold amplifier
Filter with suppression bandwidth (adjustable)
Einstellbare Auflösung der Anzeige
Settings can be blocked via password and internal switch for high security
Extended temperature range up to 60 °C allows mounting close to the process
Easy 2-point or offset measurement correction
Logical combination of digital outputs, e.g. for general alarm
RS 422/485 Modbus RTU interface
Built-in transmitter power supply
Splash-water proof front (IP 65)

APPLICATIONS
- Furnaces and ovens
- Burners and boilers
- Weighing and batching
- Process control
- Plastics processing
- ... 

DESCRIPTION

Front interface and Engineering Tools
Control parameter adjustment in seconds has now also been implemented in the KS 40 class of instruments. Via the BlueControl software incl. its simulation functions, and especially the convenient BluePort® front panel interface, the required set-up for a specific control task can be determined without a detailed study of the operating instructions.
Off cause almost all adjustments can be done comfortably over the instrument front. (see page 5, BlueControl)

Limit values
The measured signal can be scaled freely and monitored for limit values and sensor break. Process status signalling is possible by two relays and six LEDs in total. Moreover, an alarm or the displayed value can be output as a 0/4…20 mA or 0/2…10 V signal via an analog output.

Alarm hold function
Alarm statuses can be configured so that they remain unchanged until acknowledgement.

Controller
Apart from application as an indicator, Digital 280-1 can be used as a signaler or on/off controller, as a two-point or a continuous controller.

Oxygen measurement:
When using a heated lambda probe, the oxygen concentration can be displayed, controlled and output directly as a standard signal.
Range with O₂ measurement: 0,0001% (1ppm) to 100.00%
Indication of values below 1 ppm is possible via the voltage value display.

Linearization with 15 segments
Non-linear signals, e.g. filling quantities, flows, etc. can be adapted by means of user-specific linearization.

Plug-in module
As a plug-in module, Digital 280-1 can be replaced very quickly without tools and without impairing the wiring.

Password protection
If required, access to the various operating levels can be protected with a password.
### TECHNICAL DATA

#### INPUTS

**PROCESS VALUE INPUT INP1**

- **Resolution:** > 15 Bit
- **Decimal point:** 0 bis 4 Nachkommastellen
- **Limiting frequency:** 2 Hz (analog)
- **Digital input filter:** adjustable 0,1...100 s
- **Scanning cycle:** 100 ms
- **Measured value correction:** 2-point or offset correction

**Thermocouples** *(Table 1)*

<table>
<thead>
<tr>
<th>Type</th>
<th>Sensor current</th>
<th>Range</th>
<th>Accuracy</th>
<th>Resolution (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Fe-CuNi (DIN)</td>
<td>-100...900°C</td>
<td>≤ 2 K</td>
<td>0,05 K</td>
</tr>
<tr>
<td></td>
<td>Fe-CuNi</td>
<td>-148...1652°F</td>
<td>≥ 2 K</td>
<td>0,05 K</td>
</tr>
<tr>
<td>J</td>
<td>NiCr-Ni</td>
<td>-100...1350°C</td>
<td>≤ 2 K</td>
<td>0,05 K</td>
</tr>
<tr>
<td>N</td>
<td>NiCr-Ni</td>
<td>-148...2462°F</td>
<td>≤ 2 K</td>
<td>0,05 K</td>
</tr>
<tr>
<td>S</td>
<td>PtRh-Pt 10%</td>
<td>0...1760°C</td>
<td>≤ 2 K</td>
<td>0,1 K</td>
</tr>
<tr>
<td>R</td>
<td>PtRh-Pt 13%</td>
<td>32...3200°F</td>
<td>≤ 2 K</td>
<td>0,1 K</td>
</tr>
<tr>
<td>T</td>
<td>W5%Re-W25%Re</td>
<td>0...2315°C</td>
<td>≤ 2 K</td>
<td>0,2 K</td>
</tr>
<tr>
<td>D</td>
<td>W3%Re-W25%Re</td>
<td>32...4199°F</td>
<td>≤ 2 K</td>
<td>0,2 K</td>
</tr>
<tr>
<td>E</td>
<td>NiCr-CuNi</td>
<td>-100...1000°C</td>
<td>≤ 2 K</td>
<td>0,05 K</td>
</tr>
<tr>
<td>B**</td>
<td>PtRh-Pt6%</td>
<td>32/212...3308°F</td>
<td>≤ 3 K</td>
<td>0,15 K</td>
</tr>
</tbody>
</table>

**Cold junction compensation**

- **Internal temperature compensation**
- **Max. additional error:** ± 0,5 K
- **External temperature compensation:** adjustable within 0 and 100 °C or 32 and 212 °F

**Sensor break monitoring**

- **Sensor current:** ≤ 1 µA

**Resistance thermometer** *(Table 2)*

**Connection:** 3-wire

**Lead resistance:** max. 30 Ω

**Input circuit monitor:** Break and short circuit

**Resistance measuring range**

The BlueControl software can be used to match the input to the sensor KTY 11-6 (characteristic is stored in the controller).

**Physical measuring range:** 0...450 Ohm

**Linearization segments:** 15

**Current and voltage signals** *(Table 2)*

**Span start, end of span:** anywhere within measuring range

**Scaling:** selectable

**Linearization:** 15 segments, adaptable with BlueControl

**Decimal point:** selectable

**Input circuit monitor:** with 4..20mA and 2...10V 12,5% below span start (2mA, 1V)

**FILTER**

A 1st order mathematic filter adjustable for time constant and bandwidth is built in.

**CONTROL INPUTS DI2, DI3 (OPTION)**

In control mode DI1 configurable as switch or push-button !

**Optocoupler input for active triggering**

- **Nominal voltage:** 24 V DC, external
- **Current sink (IEC 1131 Type 1)**
- **Logic ‘0’:** -3...5 V
- **Logic ‘1’:** 15...30 V
- **Current requirement:** approx. 5 mA

**TRANSMITTER SUPPLY UT (OPTION)**

**Output:** 22 mA / ≥ 18 V

If the universal output OUT3 is used there may be no external galvanic connection between measuring and output circuits!

**CONFIGURABLE AS DIRECT OR INVERS SWITCH OR PUSH-BUTTON!**

**Connection of a potential-free contact suitable for switching „dry“ circuits.**

- **Switched voltage:** 2,5 V
- **Switched current:** 50 µA

**FILTER**

A 1st order mathematic filter adjustable for time constant and bandwidth is built in.

* Specifications for type B are valid from 100°C.

** inclusive of lead resistance

** high-impedance voltage ranges without break monitoring

---

**Table 1 Thermocouple ranges**

<table>
<thead>
<tr>
<th>Thermocouple</th>
<th>Range</th>
<th>Accuracy</th>
<th>Resolution (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Fe-CuNi (DIN)</td>
<td>-100...900°C</td>
<td>≤ 2 K</td>
</tr>
<tr>
<td>J</td>
<td>Fe-CuNi</td>
<td>-148...1652°F</td>
<td>≥ 2 K</td>
</tr>
<tr>
<td>K</td>
<td>NiCr-Ni</td>
<td>-100...1350°C</td>
<td>≤ 2 K</td>
</tr>
<tr>
<td>N</td>
<td>NiCr-Ni</td>
<td>-148...2462°F</td>
<td>≤ 2 K</td>
</tr>
<tr>
<td>S</td>
<td>PtRh-Pt 10%</td>
<td>0...1760°C</td>
<td>≤ 2 K</td>
</tr>
<tr>
<td>R</td>
<td>PtRh-Pt 13%</td>
<td>32...3200°F</td>
<td>≤ 2 K</td>
</tr>
<tr>
<td>T</td>
<td>W5%Re-W25%Re</td>
<td>0...2315°C</td>
<td>≤ 2 K</td>
</tr>
<tr>
<td>D</td>
<td>W3%Re-W25%Re</td>
<td>32...4199°F</td>
<td>≤ 2 K</td>
</tr>
<tr>
<td>E</td>
<td>NiCr-CuNi</td>
<td>-100...1000°C</td>
<td>≤ 2 K</td>
</tr>
<tr>
<td>B**</td>
<td>PtRh-Pt6%</td>
<td>32/212...3308°F</td>
<td>≤ 3 K</td>
</tr>
</tbody>
</table>

**Table 2 Resistance transducers**

<table>
<thead>
<tr>
<th>Type</th>
<th>Sensor current</th>
<th>Range</th>
<th>Accuracy</th>
<th>Resolution (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100</td>
<td></td>
<td>-200...850°C</td>
<td>≤ 1 K</td>
<td>0,05 K</td>
</tr>
<tr>
<td>Pt1000</td>
<td></td>
<td>-200...200°C</td>
<td>≤ 2 K</td>
<td>0,05 K</td>
</tr>
<tr>
<td>Special**</td>
<td>0,2 mA</td>
<td>0...450 Ω**</td>
<td>≤ 0,1 %</td>
<td>0,005 %</td>
</tr>
<tr>
<td>Special</td>
<td></td>
<td>≤ 0,1 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potti</td>
<td></td>
<td>0...160 Ω**</td>
<td>≤ 0,1 %</td>
<td>0,005 %</td>
</tr>
<tr>
<td>Potti</td>
<td></td>
<td>≤ 0,1 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potti</td>
<td></td>
<td>≤ 0,1 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 3 Current and voltage**

<table>
<thead>
<tr>
<th>Range</th>
<th>Input resistance</th>
<th>Accuracy</th>
<th>Resolution (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...20mA</td>
<td></td>
<td>≤ 0,1 %</td>
<td>0,75 µA</td>
</tr>
<tr>
<td>0...10Volt</td>
<td></td>
<td>≤ 0,1 %</td>
<td>0,4 mV</td>
</tr>
<tr>
<td>2,5...115mV*</td>
<td></td>
<td>≤ 0,1 %</td>
<td>0,4 mV</td>
</tr>
<tr>
<td>25...1150mV*</td>
<td></td>
<td>≤ 0,1 %</td>
<td>0,4 mV</td>
</tr>
<tr>
<td>50...50mV*</td>
<td></td>
<td>≤ 0,1 %</td>
<td>0,4 mV</td>
</tr>
<tr>
<td>500...500mV*</td>
<td></td>
<td>≤ 0,1 %</td>
<td>0,4 mV</td>
</tr>
<tr>
<td>5...5Volt</td>
<td>≈ 110 kΩ</td>
<td>≤ 0,1 %</td>
<td>0,4 mV</td>
</tr>
<tr>
<td>Special</td>
<td>**</td>
<td>≤ 0,1 %</td>
<td>0,005 %</td>
</tr>
</tbody>
</table>

* specifications for type B are valid from 100°C.
OUTPUTS

Survey of the outputs

<table>
<thead>
<tr>
<th>Output</th>
<th>Used for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT1 (relay)</td>
<td>Limit contacts, alarms</td>
</tr>
<tr>
<td>OUT2 (relay)</td>
<td>Control output</td>
</tr>
<tr>
<td>OUT3 (continuous)</td>
<td>Control output, process value,</td>
</tr>
<tr>
<td></td>
<td>set-point, control deviation,</td>
</tr>
<tr>
<td></td>
<td>transmitter supply 13 V / 22 mA</td>
</tr>
</tbody>
</table>

* All logic signals can be OR-linked!

RELAY OUTPUTS OUT1, OUT2

Contacts: 2 NO contacts with common connection
Max. contact rating: 500 VA, 250 VAC, 2A at 48...62 Hz, resistive load
Min. contact rating: 6 V, 1 mA DC
Operating life (electric): 800,000 duty cycles with max. rating

Note: If the relays OUT1...OUT3 operate external contactors, these must be fitted with RC snubber circuits to manufacturer specifications to prevent excessive switch-off voltage peaks.

OUT3 AS UNIVERSAL OUTPUT

Galvanically isolated from the inputs.
Freely scalable
DA-converter limiting frequency T90: 50 ms
Limiting frequency of the complete continuous controller: > 2 Hz
Resolution: 11 bits

Current output
0/4...20 mA, configurable.
Signal range: 0...approx. 21.5 mA
Load: ≤ 500 Ω
Load effect: 0.02 % / 100 Ω
Resolution: ≤ 22 μA (0.1%)
Error: ≤ 40 μA (0.2%)

Voltage output
0/2...10V, configurable
Signal range: 0...11 V
Load: ≥ 2 kΩ
Load effect: no Effect
Resolution: ≤ 11 mV (0.1%)
Error: ≤ 20 mV (0.2%)

OUT3 used as transmitter supply
Output: 22 mA / ≥ 13 V

OUT3 used as logic output
Load ≤ 500 Ω: 0/≤ 20 mA
Load > 500 Ω: 0/> 13 V

FUNCTIONS

Control behaviour
- Signaler with adjustable switching differential (ON/OFF controller)
- PID controller (2-point and continuous)
- Self-tuning control parameters or adjustable manually via front keys or BlueControl software.

Limit signalling functions
Monitoring for: exceeded max., min. or max. and min. limit value is provided.

Signals which can be monitored:
- Input signal
- Process value
- Control deviation
- Control deviation with suppression during start-up or set-point changes
- set-point
- Output signal Y

Functions
- Input signal monitoring
- Input signal monitoring with latch (reset via front key or digital input)
- Measured value change
- Measured value change and storage

Several limit signals or alarms can be OR-linked before being output. General alarms, etc.

ALARM + MAINTENANCE MANAGER

Display of error signals, warnings, and latched limit messages in the error list. Signals are latched, and can be reset manually.

Possible signals in the error list:
- Sensor break, short circuit, reversed polarity
- Fault during self-tuning
- Latched limit messages e.g. re-calibration warning
  - (If the adjusted operating hours are exceeded a message is displayed)
  - (If the adjusted switching cycles are exceeded a message is displayed)
- Internal fault (RAM, EEPROM, ...)

Flashing Error LED indicates active alarm in the error list:
Display
5-digit, 19mm LED

Power Supply
Depending on version:

AC Supply
Voltage: 90...260 VAC
Frequency: 48...62 Hz
Power consumption: approx. 7 VA

Universal Supply 24 V UC
AC Voltage: 20.4...26.4 VAC
Frequency: 48...62 Hz
DC Voltage: 18...31 V DC
Power consumption: approx. 7 VA (W)

Behaviour with Power Failure
Configuration, parameters, and adjusted set-points and the operating statuses are stored in non-volatile EEPROM.

BluePort Front Interface
Connection of PC via PC adapter (see “Accessories”). The BlueControl software is used to configure, set parameters, and operate the Digital 280-1.

Bus Interface (Option)
Galvanically isolated
Physical: RS 422/485
Protocol: Modbus RTU
Transmission speed: 2400, 4800, 9600, 19.200 bits/s
Address range: 1...247
Number of controllers per bus: 32
Repeaters must be used to connect more controllers.

Environmental Conditions
Protection modes
Front panel: IP 65
Housing: IP 20
Terminals: IP 00

Permissible temperatures
For specified accuracy: 0...60°C
Warm-up time: < 15 minutes
Temperature effect: < 100ppm/K
For operation: -20...65°C
For storage: -40...70°C

Humidity
75% yearly average, no condensation

Shock and vibration
Vibration test Fc (DIN 68-2-6)
Frequency: 10...150 Hz
Unit in operation: 1g or 0.075 mm
Unit not in operation: 2g or 0.15 mm

Shock test Ea (DIN IEC 68-2-27)
Shock: 15g
Duration: 11ms

Electromagnetic compatibility
Complies with EN 61 326-1
● Complies with the immunity requirements for continuous, unattended operation
● Complies with the emission requirements class B for rural areas
Surge disturbances may increase the measurement error

General
Housing
Material: Makrolon 9415, flame-retardant
Flammability class: UL 94 VO, self-extinguishing
Plug-in module, inserted from the front

Safety Tests
Complies with EN 61010-1
(VDE 0411-1):
Over voltage category II
Contamination class 2
Working voltage range 300 VAC
Protection class II

Certifications
Type test to DIN 3440
With certified sensors it can be used in:
● Heat generating plants with outflow temperatures up to 120°C to DIN 4751
● Hot-water plants with outflow temperatures above 110°C to DIN 4752
● Thermal transfer plants with organic transfer media to DIN 4754

Oil-heated plants to DIN 475
UL certification (applied for)

Electrical Connections
● Screw terminals for conductor cross-section from 0.5 to 2.5 mm²

Mounting
Panel mounting with two fixing clamps at top/bottom or left/right
Close mounting possible

Mounting position: not critical
Weight: 0.27 kg (9.52 oz)

Accessories supplied with unit
Operating instructions
2 fixing clamps

Overall Dimensions:

<table>
<thead>
<tr>
<th>Width</th>
<th>Height</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>92+0.8</td>
<td>48</td>
<td>45+0.6</td>
</tr>
<tr>
<td>7...10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. 48</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Digital 280-1
BlueControl (Engineering Tool)

PC-based program for configuring, setting parameters, and operating (commissioning) Digital indicator, controller and temperature limiter of the BluePort® series.

The built-in simulation serves to test the controller settings, but can also be used for general training and observing the interaction between controller and control loop.

Display of two parameters was suppressed:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Visible</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Lower limit 1</td>
<td></td>
</tr>
<tr>
<td>H1</td>
<td>Upper limit 1</td>
<td></td>
</tr>
<tr>
<td>HYST</td>
<td>Hysteresis constant</td>
<td></td>
</tr>
<tr>
<td>CEL1</td>
<td>Limit 1 delay</td>
<td></td>
</tr>
<tr>
<td>L2</td>
<td>Lower limit 2</td>
<td></td>
</tr>
</tbody>
</table>

Simulation

Configurations that can only be implemented via the BlueControl software (not via the front-panel keys):

- Customer-specific linearizations
- Enable „forcing“ for inputs/outputs. Forcing allows to write the analog and digital inputs and outputs via Modbus interface.
- Adjustment of limits for operating hours and switching cycles
- Switch-over to 60 Hz mains frequency
- Disable operator actions and operating levels, plus password definition
- Prevent automatic optimization of cycle times T1, T2

Hardware requirements:
A PC adapter (see „Accessories“) is required for connecting the controller.

Updates and demo software can be downloaded from: www.pma-online.de

ORDERING INFORMATION

Digital 280-1

Screw terminals

- 90..250V AC
- 24VAC / 18..30VDC
- 90..250V AC, 2 relays + mA/V/logic
- 24VAC / 18..30VDC, 2 relays + mA/V/logic

Modbus RTU + Transmitter power supply + digital input di2, di3 (optical coupler)

- Standard configuration
- Configuration to specification
- no manual
- manual german
- manual english
- manual french

Standard (CE - certified)
UL-certified

ACCESSORIES

<table>
<thead>
<tr>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC adapter, for connecting BlueControl software to the BluePort</td>
<td>9407-998-00001</td>
</tr>
<tr>
<td>Standard rail adapter</td>
<td>9407-998-00061</td>
</tr>
<tr>
<td>Operating manual German</td>
<td>9499-040-67316</td>
</tr>
<tr>
<td>Operating manual English</td>
<td>9499-040-67311</td>
</tr>
<tr>
<td>Operating manual French</td>
<td>9499-040-67332</td>
</tr>
<tr>
<td>BlueControl Mini German/English/French</td>
<td><a href="http://www.pma-online.de">www.pma-online.de</a></td>
</tr>
<tr>
<td>BlueControl Basic German/English/French</td>
<td>9407-999-11001</td>
</tr>
<tr>
<td>BlueControl Expert German/English/French</td>
<td>9407-999-11011</td>
</tr>
</tbody>
</table>

BlueControl, versions and functions:

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Mini</th>
<th>Basic</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>parameter and configuration setting</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>controller and control loop simulation</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>download: writes an engineering to the controller</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>online mode/ visualisation</td>
<td>SIM only</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>creation of user defined linearizations</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>configuration of extended operating level</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>upload: reads an engineering from the controller</td>
<td>SIM only</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>basic diagnosis function</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>file, save engineering data</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>printer function</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>online documentation, help system</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>measurement correction (calibration procedure)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>data acquisition and trend function</td>
<td>SIM only</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>network and multiuser licence</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>personal assistant function</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>extended simulation</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>extended diagnostic and service functions</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>