PROFILE

The KS 98 is a compact automation device, whose functions are freely structurable by means of function blocks. This enables multi-input control operations, sequence functions and complex mathematical computations to be performed. Depending on its configuration, the KS 98 can be operated as PLC, controller, programmer, or data logger.

The unit provides the operating facilities for all of these alternatives as standard. Trend and bargraph displays, plus input/output masks for analog and digital signals are the basis for simple, confident operation of plants and processes.

For several frequently-used standard applications, predefined controller options are available. They only need to be configured and have their parameters set via the front-panel keys.

DESCRIPTION

Inputs and outputs

Input INP1 is designed as a universal input for direct connection of all conventional sensors and standard signals. All other analog inputs are dedicated for current, voltage or potentiometer signals.

Galvanically isolated areas are marked in the connecting diagram (Fig. 8). All digital I/O are designed for 0/24 V signal levels, and have opto-coupler isolation.

Signal processing

Every KS 98 contains a library of functions, from which up to 350 can be selected, combined, configured and have their parameters set with the software Engineering Tool. Signal processing within the KS 98 is executed in true engineering units, so that debugging and possible extensions to the configuration are easily carried out.

In addition, there are functions available for I/O processing and for communication via the interface. Depending on version, supplementary functions are available, e.g. a „real-time clock” for controlling the optional timer.

Functions

The functions of the KS 98 are computed and executed within fixed time groups of 100, 200, 400 or 800 ms. The individual time groups and the sequence of execution are defined with the Engineering Tool.

Signal conversion and output

The outputs of the KS 98 are controlled via the functions AOUT and DIGOUT. By connecting (soft wiring) the selected functions with these output functions, the computed values are routed to the respective output terminals.

Serial interfaces

By means of „soft wiring”, any configured data can be sent to an interface. The front interface is always fitted. It is not bussable, but is used to connect the PC with the Engineering Tool.

The rear bus interface is optional and can be used for networking the KS 98 within an automation system.

GALVANIC ISOLATION

Galvanically isolated groups of terminals are marked in the connecting diagram Fig. 8.

Signal and measurement circuits

Isolation of working voltages up to 50 Vr.m.s. against ground according EN 61010 (for functional reasons; dotted lines).

Mains circuits 90 … 250AC

Isolation of working voltages up to 300 Vr.m.s. against each other and against ground according EN 61010 (for safety reasons; full lines).
FUNCTION LIBRARY

Max. 350 functions are available. Every function needs a certain amount of working memory and a certain amount of computing time.

Survey

Scaling and computing:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSV</td>
<td>0,2 0,2</td>
</tr>
<tr>
<td>ADSU</td>
<td>0,5 0,3</td>
</tr>
<tr>
<td>SQT</td>
<td>0,4 0,2</td>
</tr>
<tr>
<td>SCAL</td>
<td>0,2 0,2</td>
</tr>
<tr>
<td>MUDY</td>
<td>0,5 0,3</td>
</tr>
<tr>
<td>LN</td>
<td>1,0 0,2</td>
</tr>
<tr>
<td>10EXP</td>
<td>0,6 0,2</td>
</tr>
<tr>
<td>EXP e^x</td>
<td>1,0 0,2</td>
</tr>
</tbody>
</table>

Limits and limit values:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALLP</td>
<td>0,4 0,3</td>
</tr>
<tr>
<td>ALLV</td>
<td>0,4 0,3</td>
</tr>
<tr>
<td>TGL</td>
<td>0,2 0,2</td>
</tr>
<tr>
<td>ALARM</td>
<td>0,2 0,3</td>
</tr>
<tr>
<td>LIMIT</td>
<td>0,6 0,4</td>
</tr>
</tbody>
</table>

Non-linear functions:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAP</td>
<td>0,2 0,2</td>
</tr>
<tr>
<td>CHAR</td>
<td>0,5 0,5</td>
</tr>
</tbody>
</table>

Timing functions:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEAD</td>
<td>0,4 0,3</td>
</tr>
<tr>
<td>INTE</td>
<td>0,5 0,3</td>
</tr>
<tr>
<td>LAGT</td>
<td>0,3 0,2</td>
</tr>
<tr>
<td>FILT</td>
<td>0,4 0,2</td>
</tr>
<tr>
<td>DELT1</td>
<td>0,4 0,1</td>
</tr>
<tr>
<td>DELT2</td>
<td>0,4 0,1</td>
</tr>
<tr>
<td>TIME1</td>
<td>0,3 0,2</td>
</tr>
<tr>
<td>TIME2</td>
<td>0,2 0,2</td>
</tr>
</tbody>
</table>

Logical and PLC functions:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND</td>
<td>0,1 0,2</td>
</tr>
<tr>
<td>OR</td>
<td>0,1 0,2</td>
</tr>
<tr>
<td>NOT</td>
<td>0,1 0,2</td>
</tr>
<tr>
<td>EXOR</td>
<td>0,1 0,2</td>
</tr>
<tr>
<td>RJP</td>
<td>0,1 0,2</td>
</tr>
<tr>
<td>MONO</td>
<td>0,5 0,3</td>
</tr>
<tr>
<td>TIME1</td>
<td>0,4 0,2</td>
</tr>
<tr>
<td>STEP</td>
<td>0,4 0,3</td>
</tr>
<tr>
<td>BOUNCE</td>
<td>0,1 0,2</td>
</tr>
</tbody>
</table>

Controller and programmer:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTR</td>
<td>5,8 3,1</td>
</tr>
<tr>
<td>CONTOR</td>
<td>5,8 3,5</td>
</tr>
<tr>
<td>APROG</td>
<td>2,9 3,2</td>
</tr>
<tr>
<td>APROGD</td>
<td>0,6 0,5</td>
</tr>
<tr>
<td>DPROMD</td>
<td>2,8 3,1</td>
</tr>
<tr>
<td>DPROMDG</td>
<td>0,6 0,5</td>
</tr>
</tbody>
</table>

Signal processing:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>PULS</td>
<td>0,5 0,2</td>
</tr>
<tr>
<td>COUN</td>
<td>0,3 0,3</td>
</tr>
<tr>
<td>2OF3</td>
<td>0,7 0,3</td>
</tr>
<tr>
<td>MEAN</td>
<td>0,5 0,9</td>
</tr>
<tr>
<td>ABIN</td>
<td>0,4 0,3</td>
</tr>
<tr>
<td>TRUNC</td>
<td>0,1 0,2</td>
</tr>
</tbody>
</table>

Selection and storage:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXTR</td>
<td>0,3 0,2</td>
</tr>
<tr>
<td>PEAK</td>
<td>0,1 0,2</td>
</tr>
<tr>
<td>TRST</td>
<td>0,1 0,2</td>
</tr>
<tr>
<td>SELC</td>
<td>0,1 0,3</td>
</tr>
<tr>
<td>SELP</td>
<td>0,1 0,3</td>
</tr>
<tr>
<td>SELV1</td>
<td>0,1 0,2</td>
</tr>
<tr>
<td>SELV2</td>
<td>0,2 0,2</td>
</tr>
<tr>
<td>SOUT</td>
<td>0,1 0,2</td>
</tr>
<tr>
<td>REZP</td>
<td>0,5 0,5</td>
</tr>
<tr>
<td>SAFE</td>
<td>0,2 0,5</td>
</tr>
</tbody>
</table>

Trigonometric functions:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIN</td>
<td>1,1 0,2</td>
</tr>
<tr>
<td>COS</td>
<td>1,2 0,2</td>
</tr>
<tr>
<td>TAN</td>
<td>1,1 0,2</td>
</tr>
<tr>
<td>COT</td>
<td>2,0 0,2</td>
</tr>
<tr>
<td>ARCSIN</td>
<td>1,1 0,2</td>
</tr>
<tr>
<td>ARCCOS</td>
<td>1,1 0,2</td>
</tr>
<tr>
<td>ARCTAN</td>
<td>1,1 0,2</td>
</tr>
<tr>
<td>ARCCOT</td>
<td>1,2 0,2</td>
</tr>
</tbody>
</table>

Supplementary functions:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONST</td>
<td>0,1 0,5</td>
</tr>
<tr>
<td>STATUS</td>
<td>0,6 0,3</td>
</tr>
</tbody>
</table>

Display and operation:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>VITREN</td>
<td>0,7 1,2</td>
</tr>
<tr>
<td>VBAR</td>
<td>0,2 0,7</td>
</tr>
<tr>
<td>VWERT</td>
<td>0,3 1,7</td>
</tr>
<tr>
<td>WPARA</td>
<td>0,2 1,1</td>
</tr>
<tr>
<td>LED</td>
<td>0,1 0,2</td>
</tr>
<tr>
<td>INFO</td>
<td>0,1 0,9</td>
</tr>
</tbody>
</table>

Interface:

in % Time Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1READ</td>
<td>0,4</td>
</tr>
<tr>
<td>L1WRIT</td>
<td>0,2 0,4</td>
</tr>
<tr>
<td>DPREAD</td>
<td>0,4 0,2</td>
</tr>
<tr>
<td>DPWRIT</td>
<td>0,4 0,2</td>
</tr>
</tbody>
</table>

Determination of capacity

In order to check whether a particular application is possible with the KS 98, the quantity and type of inputs/outputs, the number of required functions, and the corresponding memory requirements must be determined roughly.

Ein-/Auszüge

Scanning times

<table>
<thead>
<tr>
<th>Function</th>
<th>Time Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>INP1</td>
<td>200 ms</td>
</tr>
<tr>
<td>INP3, INP4</td>
<td>100 ms</td>
</tr>
<tr>
<td>INP5</td>
<td>800 ms</td>
</tr>
<tr>
<td>INP6</td>
<td>400 ms</td>
</tr>
<tr>
<td>d1...d12</td>
<td>100 ms</td>
</tr>
<tr>
<td>OUT1...OUT4</td>
<td>100 ms</td>
</tr>
<tr>
<td>d1...d6</td>
<td>100 ms</td>
</tr>
</tbody>
</table>

Determining computing capacity

Computation of the function blocks is executed in „time slots“ of fixed duration, the cycle time $\tau$. The cycle time is defined by selecting a particular „time group“. Thus, the relevant function block will be executed in every time slot (every 100 ms), in every second time slot (every 200 ms), etc. For every time slot, a net computing time (= 100 %) is available. Because each function requires a certain amount of computing time, the sum of all the functions in a time slot must not exceed 100 % of the available time.
**Operation and display**

All configuration, parameter setting and operational data of the selected function blocks can be changed via the front-panel keys of the KS 98. For commissioning, the input and output values can be displayed.

**Operating displays**

Operation of a controller needs a different display than operation of a programmer. With its point-matrix display, the KS 98 is ideally suited for such different displays. Switching between the displays is always possible.

**Disabling**

Depending on the application, different demands are placed on the disabling functions for operation, parameter setting, or configuration. Disabling can be controlled via the digital inputs, by means of internal wire-hook switches, by a defined internal status, or with access codes. Typically, the entire operating level, parameter adjustment and configuration, or the operation of certain functions can be disabled.

**Engineering Tool ET/KS98plus**

In principle, the Engineering Tool for the KS 98 consists of a function block editor, based on the international IEC 1131-3 standard.

**Functions**

- Functions are selected from menus, and placed in the working area of the PC’s display.
- Graphical connections between inputs and outputs.
- If a function is moved on the screen, its connections are maintained automatically.
- Configuration and parameter setting of the functions.
- Down-loading the completed program to the KS 98.
- Management of all adjustments and settings.
- Connection to PC via front-panel interface (PC adapter required).
- If the connection is made via the rear bus interface, an RS 232, RS 422/485 adapter, and possibly an interface adapter are necessary.
- The manual of the KS 98 is part of the Help system.
**TECHNICAL DATA**

### INPUTS

Depending on version and selected options, the following inputs and outputs are available:

<table>
<thead>
<tr>
<th>STANDARD (4 relays)</th>
<th>DI</th>
<th>DO</th>
<th>AI</th>
<th>AO</th>
</tr>
</thead>
<tbody>
<tr>
<td>d1</td>
<td>d2</td>
<td>OUT1</td>
<td>OUT2</td>
<td>INP1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STANDARD (2 relays + 2 AO)</th>
<th>DI</th>
<th>DO</th>
<th>AI</th>
<th>AO</th>
</tr>
</thead>
<tbody>
<tr>
<td>d1</td>
<td>d2</td>
<td>OUT4</td>
<td>INP5</td>
<td>INP6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPTION B (additional)</th>
<th>DI</th>
<th>DO</th>
<th>AI</th>
<th>AO</th>
</tr>
</thead>
<tbody>
<tr>
<td>d3</td>
<td>d4</td>
<td>d5</td>
<td>d6</td>
<td>d7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPTION C (additional)</th>
<th>DI</th>
<th>DO</th>
<th>AI</th>
<th>AO</th>
</tr>
</thead>
<tbody>
<tr>
<td>d8</td>
<td>d9</td>
<td>d10</td>
<td>d11</td>
<td>d12</td>
</tr>
</tbody>
</table>

**Universal input INP1**

Limiting frequency: 1 Hz
Measurement cycle: 200 ms

**Thermocouples**

according to DIN IEC 584

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Error</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>–200...900°C</td>
<td>≤ 2 K</td>
<td>0,05 K</td>
</tr>
<tr>
<td>J</td>
<td>–200...900°C</td>
<td>≤ 2 K</td>
<td>0,05 K</td>
</tr>
<tr>
<td>K</td>
<td>–200...1350°C</td>
<td>≤ 2 K</td>
<td>0,07 K</td>
</tr>
<tr>
<td>N</td>
<td>–200...1300°C</td>
<td>≤ 2 K</td>
<td>0,08 K</td>
</tr>
<tr>
<td>S</td>
<td>–50...1760°C</td>
<td>≤ 3 K</td>
<td>0,275 K</td>
</tr>
<tr>
<td>R</td>
<td>–50...1760°C</td>
<td>≤ 3 K</td>
<td>0,244 K</td>
</tr>
<tr>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
<td>0...2300°C</td>
<td>≤ 3 K</td>
<td>0,132 K</td>
</tr>
<tr>
<td>T</td>
<td>–200...400°C</td>
<td>≤ 2 K</td>
<td>0,06 K</td>
</tr>
<tr>
<td>WCr&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0...200°C</td>
<td>≤ 2 K</td>
<td>0,18 K</td>
</tr>
<tr>
<td>E</td>
<td>–200...900°C</td>
<td>≤ 2 K</td>
<td>0,038 K</td>
</tr>
</tbody>
</table>

(1) Error & resolution values for 400...1820°C.
(2) W5Re/W26Re

With linearization
(temperature-linear in °C or °F)
Input resistance: ≥ 1MΩ
Cold-junction compensation (CJC): built in

**Input circuit monitor**

Current through sensor: ≤ 1 µA
Reverse-polarity monitor is triggered at 10 °C below span start.
The sensor’s status can be processed in the engineering as a logical signal.

**Additional error of internal CJC**

0,5 K per 10 K terminal temperature
External temperature selectable: 0...60 °C or 32...140 °F

---

**Fig. 7 Hardware and software structure**

**Fig. 8 Electrical connections**

**Fig. 9 Overall dimensions (in mm)**
**Resistance thermometer**

Pt 100 to DIN IEC 751, and temperature difference 2 x Pt 100

<table>
<thead>
<tr>
<th>Range</th>
<th>Error</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>−200...500 °C</td>
<td>±0,5 K</td>
<td>0,024 K</td>
</tr>
<tr>
<td>−200...850 °C</td>
<td>±1,0 K</td>
<td>0,05 K</td>
</tr>
<tr>
<td>2 x −200...250 °C</td>
<td>±0,5 K</td>
<td>0,024 K</td>
</tr>
<tr>
<td>2 x −200...250 °C</td>
<td>±1,0 K</td>
<td>0,05 K</td>
</tr>
</tbody>
</table>

Linearization in °C or ° F

Two or three-wire connection.

Two-wire connection with lead resistance adjustment.

Lead resistance: ≤ 30 Ω per lead

Sensor current: ≤ 1 mA

Input circuit monitoring for sensor/lead break, and lead short circuit.

**Potentiometric transducer**

\[ R_{\text{total incl. 2 x RL Error Resolution}} \]

Input resistance: 50 k

Direct current: −50...1300 mV linear

Resolution: 0,34 mV

Input resistance: > 1 M

**Input resistance (voltage):**

Measurement cycle: 800 ms

Limiting frequency: = 0,25 Hz

Technical data as for INP1, except for:

- **Ri incl. 2 x RL Error Resolution**
- **Resolution**

**Direct current 0/4...20 mA**

Measurement cycle: 100 ms

Limiting frequency: = 0,5Hz

Technical data as for INP1

**Optional signal inputs INP3, INP4**

Galvanically-isolated differential amplifier inputs.

Measurement cycle: 100 ms

Direct current

Technical data as for INP1 except for:

- **Ri = 43Ω**

**INP3 as mV signal**

(KS98: 9407 9xx x2x1)

Direct current: −50...1300 mV linear

Resolution: 0,34 mV

Input resistance: > 1 M

**Control inputs di1...di12**

di1, di2: standard

di3...d7: Option B

di8...di12: Option C

**Opto-coupler**

Nominal voltage: 24 VDC, external

Current sink (IEC 1131 Type 1)

Logic „0“ (Low): >-3...-5 V

Logic „1“ (High): 15...30 V

Current demand: approx. 6 mA

(see Fig. 8 for galvanic connections and isolation).

**Built-in transmitter supply (optional)**

Can be used to energize a two-wire transmitter or up to 4 opto-coupler inputs.

Galvanically isolated.

Output: ≥ 17,5 VDC, max. 22 mA

**Factory setting**

The transmitter supply is available at terminals A12 and A14, if INP1 is configured for current input and thermocouples. By means of internal switches, the voltage can be applied to terminals A1 and A4, where it is always available, irrespective of the configuration.

**Signal input INP6**

- **Limiting frequency:** = 0,5Hz
- **Measurement cycle:** 400 ms

**Potentiometric transducer**

Technical data as for INP1, except for:

- **Ri incl. 2 x RL Error Resolution**
- **Resolution**

<table>
<thead>
<tr>
<th>Error</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...1000 Ω</td>
<td>≤ 0,1 %</td>
</tr>
</tbody>
</table>

**Direct current 0/4...20 mA**

Technical data as for INP1

**Optional signal inputs INP3, INP4**

Galvanically-isolated differential amplifier inputs.

Measurement cycle: 100 ms

Direct current

Technical data as for INP1 except for:

- **Ri = 43Ω**

**INP3 as mV signal**

(KS98: 9407 9xx x2x1)

Direct current: −50...1300 mV linear

Resolution: 0,34 mV

Input resistance: > 1 M

**Control inputs di1...di12**

di1, di2: standard

di3...d7: Option B

di8...di12: Option C

**Opto-coupler**

Nominal voltage: 24 VDC, external

Current sink (IEC 1131 Type 1)

Logic „0“ (Low): >-3...-5 V

Logic „1“ (High): 15...30 V

Current demand: approx. 6 mA

(see Fig. 8 for galvanic connections and isolation).

**Built-in transmitter supply (optional)**

Can be used to energize a two-wire transmitter or up to 4 opto-coupler inputs.

Galvanically isolated.

Output: ≥ 17,5 VDC, max. 22 mA

**Factory setting**

The transmitter supply is available at terminals A12 and A14, if INP1 is configured for current input and thermocouples. By means of internal switches, the voltage can be applied to terminals A1 and A4, where it is always available, irrespective of the configuration.

**Outputs OUT1, OUT2, OUT4, OUT5**

Relay or current/logic signal, depending on version.

**Relay outputs**

Relays have potential-free change-over contacts.

- **Max. contact rating:**
  - 500 VA, 250 V, 2 A with 48...62 Hz, cos 0,9
- **Minimum rating:** 12 V, 10 mA AC/DC
- **Useful life:** 10^9 switching cycles under max. load

**Note:**

If the relays operate external contactors, these must be fitted with RC snubber circuits to prevent excessive switch-off voltage peaks!

**OUT1, OUT2 as current outputs**

Galvanically isolated from the inputs

0/4...20 mA, selectable

Signal range: 0...22 mA

Resolution: ≤ 6 μA (12 bits)

Error: ≤ 0,5%

Load: ≤ 600 Ω

Load effect: ≤ 0,1%

Limiting frequency: approx. 1 Hz

**OUT1, OUT2 as logic signal**

0 / ≥ 20 mA with a load ≥ 600 Ω

0 / > 12 V with a load > 600 Ω

**Output OUT3 (Option C)**

Galvanically isolated

Technical data as for OUT1, OUT2

**Control outputs do1...do6**

do1...do4: with Option B

do5, do6: with Option C

**Opto-coupler outputs**

(see Fig. 8 for galvanic isolation).

**Grounded load:** common positive control voltage

**Switch rating:** 18...32 VDC; \( I_{\text{max}} \) ≤ 70 mA

**Internal voltage drop:** ≤ 0,7V with \( I_{\text{max}} \)

Protective circuit: thermal, switches off with overload.
**POWER SUPPLY**
Depends on version, see Ordering Data.

**Alternating current**
90...250 V AC
Frequency: 48...62 Hz
Power consumption: approx. 14.2 VA; 8.5 W (max. configuration).

**Universal current 24 V UC**
24 V AC, 48...62 Hz/24 VDC
Tolerance: +10...−15% AC
18...31,2 VDC
Power consumption
AC: approx. 14.2 VA; 8.5 W
DC: 14.2 W (max. configuration).

**Behaviour after power failure**
Structure, configuration, parameters, set-points
Permanent data storage in an EEPROM

Data for timer, programmer, integrator, counter, etc.
Temporary storage in a capacitor-buffered RAM (≥ 0.5 hours).

Real-time clock (optional)
Buffer capacitor provides back-up for at least 2 days.

**FRONT INTERFACE PORT (STANDARD)**
Front-panel socket for PC adapter (see „Accessories“). By means of the Engineering Tool ET/KS 98, the controller can be remotely structured, configured, and its parameters set.

**BUS INTERFACE**
Galvanically isolated, choice of TTL or RS 422/485 operation.

Note: In order to convert TTL signals to RS 422/485, an interface module is required (see „Accessories“).
Protocol: ISO 1745
Transmission speed: 2400 / 4800 / 9600 /19.200 bits/s
Address range: 00...99
Number of controllers per bus:
With RS 422/485: 32
With TTL signals: max. 32 interface modules on one bus. Above this value, the only limit is the address range (00...99)

**PROFIBUS-DP INTERFACE**
According to EN 50 170, Vol. 2.
Reading and writing of all process data, parameters, and configuration data.

Configurable process data modules
The Engineering Tool ET/KS 98 is used to select the functions DPREAD and DPWRITE max. 4 times each.

By suitable internal connections with the inputs/outputs of these two, functions, any internal signal can be applied to the PROFIBUS-DP interface.
The parameter channel provides non-cyclical access to all operational parameters and configuration data.

<table>
<thead>
<tr>
<th>Module</th>
<th>DPREAD</th>
<th>DPWRITE</th>
<th>Parameter-channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>b</td>
<td>1</td>
<td>1</td>
<td>x</td>
</tr>
<tr>
<td>c</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>3</td>
<td>3</td>
<td>x</td>
</tr>
<tr>
<td>e</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Data format (configurable)
Real values are transmitted in the IEEE format (REAL) or in the 16-bit fixed point format (FIX) with one decimal digit (configurable).

Memory requirements

<table>
<thead>
<tr>
<th>Module</th>
<th>Read</th>
<th>Write</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FIX</td>
<td>REAL</td>
</tr>
<tr>
<td>a</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td>b</td>
<td>26</td>
<td>25</td>
</tr>
<tr>
<td>c</td>
<td>44</td>
<td>60</td>
</tr>
<tr>
<td>d</td>
<td>62</td>
<td>86</td>
</tr>
<tr>
<td>e</td>
<td>80</td>
<td>112</td>
</tr>
</tbody>
</table>

Diagnostics/behaviour on error
The functions DPREAD and DPWRITE have digital status outputs for signalling various error conditions.

Transmission speeds and cable lengths (automatic transm. speed detection)

<table>
<thead>
<tr>
<th>Speed</th>
<th>Max. cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>9,5 kbit/s</td>
<td>1200 m</td>
</tr>
<tr>
<td>187,5 kbit/s</td>
<td>1000 m</td>
</tr>
<tr>
<td>500 kbit/s</td>
<td>400 m</td>
</tr>
<tr>
<td>1.5 Mbit/s</td>
<td>200 m</td>
</tr>
<tr>
<td>12,0 Mbit/s</td>
<td>100 m</td>
</tr>
</tbody>
</table>

Addresses
0...126 (factory setting: 126)
Remote addressing is possible.

Other functions
Sync and Freeze
Connection
AMP flat-pin connector, (via adapter to screw terminals or Sub-D connector, see Accessories).
Terminating resistors
Internally selectable with wire-hook switches.
Cable
According to EN 50 170, Vol. 2.

Required accessories
Engineering Set PROFIBUS-DP, consisting of:
- GSD file, Type file
- PROFIBUS manual
- Function block(s) for Simatic S5/S7

**DISPLAYS**
LCD point-matrix display with back lighting.
Display area: 64 x 128 points
Status display:
4 yellow LEDs for logic status

**ENVIRONMENTAL CONDITIONS**

**Permissible temperatures**
For operation: 0...60 °C
For specified accuracy: 0...55 °C
Combination of INTERBUS and standard or modular Option C: Max. operating temperature 0...45°C !
Storage and transport: −20...60 °C
Temperature effect: ± 0.15% / 10 K

**Climatic category**
KUF to DIN 40 040
Relative humidity: ≤ 75% yearly average, no condensation

**Shock and vibration**
Vibration test Fc
To DIN 68-2-6 (10...150 Hz)
Unit in operation: 1g or 0,075 mm,
Unit not in operation: 2g or 0,15 mm

Shock test Ea
To DIN IEC 68-2-27 (15g, 11 ms)

**ELECTROMAGNETIC COMPATIBILITY**

Complies with EN 50 081-1 and EN 50 082-2 for unrestricted use in rural and industrial areas.

Electrostatic discharge
Test to IEC 801-2, 8 kVairdischarge
4 kV contact discharge

High-frequency interference
Test to ENV 50 140 (IEC 801-3)
80...1000 MHz, 10 V/m
Effect: ≤ 1%

HF interference on leads
Test to ENV 50141 (IEC 801-6)
0,15...80 MHz, 10 V
Effect: ≤ 1%

Low-frequency magnetic field
Test to IEC 1000-4-8
No effect with 50 Hz, 30 A/m

Fast pulse trains (burst)
Test to IEC 801-4 2 kV applied to leads for supply voltage, and signal leads

High-energy single pulses (surge)
Test to IEC 801-5
1 kV symmetric or 2 kV asymmetric on leads for supply voltage.
0,5 kV symmetric or 1 kV asymmetric on signal leads.
**GENERAL**

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

**Protection mode**  
(to EN 60 529, DIN/VDE 0470)  
Front: IP 65  
Housing: IP 20  
Terminals: IP 00

**Safety tests**  
To EN 61 010-1 (VDE 0411-1)  
Overvoltage category: III  
Contamination class: 2  
Working voltage range: 300 VAC  
Protection class: I  
CE marking
The controller meets the European Directives regarding “Electromagnetic Compatibility” and “Low-voltage equipment” (see also „Safety tests“)

**Electrical connections**  
Flat-pin connectors to DIN 46 244 for  
1 x 6,3 mm or 2x 2,8mm

**Mounting method**  
Panel mounting with 4 fixing clamps at top/bottom

**Mounting position**  
Not critical

**Weight**  
Approx. 0,75 kg with all options

**Accessories**  
3-language operating and safety instructions (GB/D/F)  
4 fixing clamps

**ACCESSORY EQUIPMENT**

**Interface module and interface cable**  
Up to 16 controllers with TTL interface can be connected to the interface module.  
Connection is by means of the separately-ordered interface cable (1m long).  
Via the RS 422/485 interface (D-type connectors), the data are transmitted up to a distance of 1 km.

**Supply voltage**  
230 VAC / 115 VAC / 24 VAC, depending on version

**Electrical connections**  
Supply voltage: via screw terminals  
Interfaces: Sub-D connectors

**Mounting**  
To standard rail, e.g. to EN50035

**Dimensions**  
158 x 78 x 60 mm (LxWxH)

**Engineering Tool ET/KS 98plus**  
For scope of functions, see page 3.

**Hardware & software platform**  
Windows 3.1/3.11 or Windows 95 must be installed and operable.  
Graphic resolution: at least 800 x 600 pixels.  
Operation with mouse (preferred).

**Simulation SIM/KS 98**  
Software package for simulating the KS 98 on a standard PC under Windows.  
All functions of the KS 98 are possible, plus:  
- Simulation of inputs/outputs  
- Trend display  
- „Turbo“ mode

**PC-Adapter**  
Adapter cable for connecting a PC (Engineering Tool) to the front-panel interface socket of the KS 98.

**ORDERING INFORMATION**

Every controller can be operated, configured, and the parameters set via the front-panel keys.  

By means of the Engineering Tool ET/KS 98, every KS 98 can be matched precisely to the individual requirements.

**Ex-factory settings for controllers with standard configuration**

**Basic version 9407 963 00001 (switching output)**
- Signal, 2-point, 3-point, 3-point stepping  
- Process value conditioning (filter and characterizer)  
- 2 alarms (selectable: x, xx, weff, y)  
- Trend display for x and xx, weff  
- Bargraph display for x and weff  
- Program controller with 4 profiles of 20 segments each

**Basic version 9407 965 00001 (continuous output)**

as above for switching outputs, except:  
- Continuous controller including „split range“ operation, switching outputs (logic)  
- Analog output for x, xx, weff or y2

**Controllers with Option B Functions**

as above for corresponding basic version, plus:  
- Disabling of front-panel keys via a control input  
- 4 control outputs from programmer  
- 7-day clock for start/stop of programmer (Option B with clock)

**Controllers with Option C**  
Functions as above for corresponding basic version, plus:  
- Three-element control  
- Override control +, or „hard manual“  
- Galvanically isolated ratio control for x1÷x2  
- Output for the programmer set-point  
- Two additional control outputs from programmer

**Settings for application-specific controllers**

**Cascade controller**

**MASTER CONTROLLER**

- Process value input INP5  
- Process value conditioning (filter and characterizer)  
- Trend displays for control deviation and process value

**SLAVE CONTROLLER**

- Same as master controller, but with process value input INP1  
- Selectable controller type depending on switching/continuous basic version  
- Position feedback via input INP6

**FLOW CONTROLLER**

- Temperature and pressure-corrected flow measurement for mass-flow control (with or without square root extraction)  
- Trend displays for flow and control deviation  
- Flow totalizing with creep flow cut-off  
- Display of flow up to 99.999.999  
- Re-set of flow counter from the front after entering an access code  
- Output of counter pulses (all and every 1000)  
- Selectable controller type depending on switching/continuous basic version

**PROGRAM CONTROLLER WITH 10 PROFILES**

- 10 profiles, each with 20 segments  
- 2 analog control outputs  
- 6 digital control outputs  
- One controller per analog output  
- Operation from the front of the analog programmer  
- Operation can be disabled via control input  
- Selectable controller type depending on switching/continuous basic version

- 6 digital control outputs do1...do6 (opto-coupler isolated, only with Option B)
Calorimetric counter
- Totalizing of flow and heating/cooling energy
- Creep flow cut-off
- Output of counting pulses for flow and heating/cooling energy (OUT4,5)
- Output of flow and calorimetric values as 0...20mA signals
- Galvanically isolated flow output signal (Option C)
- Alarm monitoring for temperature and flow (Option C)
- Measuring cycle 400 ms
- Trend displays for flow and control deviation
- Creep flow cut-off
- Output of counter pulses (OUT4)
- Alarm monitoring for temperature, pressure and flow (OUT5)
- Flow calculator (Possible without Option B and C)
- Temperature and pressure-corrected flow measurement for mass-flow control (with or without square root extraction)
- Dedicated control functions can be changed with Engineering Tool!

Flow calculator
(Without Option C)
- Temperature and pressure-corrected flow measurement for mass-flow control
- Temperature and pressure-corrected flow measurement for mass-flow control (with or without square root extraction)
- Dedicated control functions can be changed with Engineering Tool!

AUSFÜHRUNGEN

<table>
<thead>
<tr>
<th>Basic version</th>
<th>Option B</th>
<th>Option C</th>
</tr>
</thead>
<tbody>
<tr>
<td>KS 98 standard</td>
<td>Without Option B</td>
<td>Without Option C</td>
</tr>
<tr>
<td>KS 98 with transmitter power supply</td>
<td>TTL interface + di/do</td>
<td>Single-loop controller (basic version)</td>
</tr>
<tr>
<td>90...250 V AC 4 relays</td>
<td>RS422 + di/do + watch</td>
<td>INP3, INP4, OUT3, di/do</td>
</tr>
<tr>
<td>90...250 V AC 2 relays + 2 current outputs</td>
<td>PROFIBUS-DP + di/do</td>
<td>INP3 Im0, INP4, OUT3, di/do</td>
</tr>
<tr>
<td>24 V UC, 4 relays</td>
<td>Interbus + di/do</td>
<td></td>
</tr>
<tr>
<td>24 V UC, 2 relays + 2 current outputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Configuration
- Standard configuration: 0
- Customer-specific configuration: 9

1) Option C is necessary
2) Basic version with 2 current outputs is necessary
3) The required configuration is defined by means of a CONF-XXXXX number which is generated with the necessary engineering service.
4) To connect Engineering Tool ET/KS 98 plus via the front interface
5) Upgrade from ET/KS 98 c < V 2.x to ET/KS 98 plus V 3.x
6) Incl. RS232 cable, 10 m cable for RS422
7) 3-languages

Accessories
- PC-Adapter: 9407 998 00001
- Engineering Tool ET/KS 98plus: 9407 999 06401
- Engineering Tool ET/KS 98plus (10): 9407 999 06411
- ET/KS 98plus Update: 9407 999 06421
- ET/KS 98plus Upgrade: 9407 999 06431

Documents
- Simulation SIM/KS 98: 9407 999 08801
- Simulation SIM/KS 98 (10): 9407 999 08811
- SIM/KS 98 Update: 9407 999 08821
- MSSIserver – 32Bit DDE-Server: 9407 999 07101
- Converter RS232/RS4222: 9407 998 00041
- Interface cable 1 m: 9404 407 50011
- Interface module 230 V AC: 9404 429 98001
- Interface module 115 V AC: 9404 429 98011
- Interface module 24 V AC: 9404 429 98021
- ES KS 98/PROFIBUS (D): 9407 999 10011
- ES KS 98/PROFIBUS (E): 9407 999 10001
- ES KS 98/Interbus (D): 9407 999 10211
- ES KS 98/Interbus (E): 9407 999 10201
- Screw-terminal adapter: 9407 998 00021
- D-type connector adapter: 9407 998 00031

Your local representative:
PMA Prozess- und Maschinen-Automation GmbH
P.O Box 31 02 29
D - 34058 Kassel
Tel.: +49 - 561 - 505 1307
Fax: +49 - 561 - 505 1710
E-mail: mailbox@pma-online.de
Internet: http://www.pma-online.de

Printed in Germany - Edition 0102 - Subject to alteration without notice - 9498 737 32113