



KS 98

Modular inputs/outputs

Optimum matching to the application

Up to 4 plug-in I/O modules

Wide range of sensors and signals

Frequency and counter inputs

High-impedance voltage inputs

Modules can be retro-fitted without calibration

2 I/O channels per modul

Modules galvanically isolated in pairs

advanced line



PROFILE

Flexible adaptation of automation systems to the number and type of required inputs/outputs is essential for the optimization of decentralized application solutions in terms of function, availability, and cost. Additional signal transmitters and the associated costs for installation can be omitted, if these functions are already provided, and are supported by suitable Engineering Tools.

Decentralized solutions reduce the investment costs and increase system transparency. Connection possibilities for widely used field busses such as PROFIBUS or INTERBUS allow the implementation of logical and spatially distributed concepts with local operation and display facilities.

DESCRIPTION

By means of the "Modular Option C", the inputs and outputs of the multi-function unit KS 98 can be adapted individually to the application. The motherboard is mounted firmly in the unit. It contains four sockets for various types of I/O modules that can be combined in the same unit. Exceptions see **POWER LIMITATIONS!** Every module is designed for two channels (a, b) exceptions → connecting diagram.

Depending on the ordered version, the modules are mounted in the KS 98 or shipped separately. Retrofitting by the

customer is possible without recalibration. The modules are simply clipped into the sockets on the motherboard.

MODULE TYPES

Analog inputs

- Resistive measurements
- Thermocouples, mV, mA
- Voltage ($R_{in} > 1\text{G}\Omega$)

Analog outputs

- Standard voltage signals
- Standard current signals

Combined digital I/O

Both channels can be configured separately as input or output. The operating sense is reversible.

Frequency & counter inputs

The following functions can be selected:

- Digital input
- Frequency counter

For measurement of rpm, mass flows of energy, gases or liquids that are available as a frequency signal.

- Up counter

For totalizing mass flows of energy, gases or liquids that are available as a frequency signal.

- Up/down counter

Measurement of differences between two flow quantities that are available as a frequency signal. Every negative flank at di_a increases the result by "1", every negative flank at di_b decreases it. The

result remains unchanged, if a signal change is detected at both inputs simultaneously.

- Up/down counter with direction signal

For the connection of shaft encoders, position measurement systems or flow meters that provide a direction signal (di_b) together with the measurement signal (di_a). The direction signal must either be static (0 or 1) or be identical to the measurement frequency but with a 90° shift.

Depending on the direction signal (di_b=0/1) counting is upwards or downward if a negative flank is detected at di_a.

- Quadrature counter

Same function as for the "Up/down counter with direction signal", but the double amount of pulses is measured, because every signal change at di_a is registered (doubled resolution!).

Control signals

All counter functions provide a STOP and a RESET input, which can be configured via the Engineering.

GALVANIC ISOLATION

The I/O modules are isolated galvanically in pairs from each other and from the remaining electronics (sockets 1 and 2 from sockets 3 and 4). Analog I/O channels of the same module are not isolated from each other. Digital I/Os are isolated individually via opto-couplers. Galvanic isolations are indicated with dashed lines in the connecting diagram.

POWER LIMITATIONS

For reasons of max. permissible self-warming, the number of usable analog output modules per basic card is limited:

- The sum of power factors (P-factor, →TECHNICAL DATA) must not exceed 100%!
- Maximum one I_OUT module!
- Maximum one additional U_OUT module, if already a I_OUT module is plugged (but in a different galvanically isolated module group)!
- Modules I_OUT or U_OUT must not be combined with input module U_INP within the same galvanically isolated module group!

Exceedings are indicated in the Engineering Tool.

Without a current output module plugged, all modules can be combined without limitation.

Example:

Current output module on socket 1 or 2, and voltage output module on socket 3 or 4. The sum of P-factors is 95%. Thus, a further module (either RT or TC/mV/mA) can be added.

TECHNICAL DATA

In the following, only the technical data of the I/O modules will be described. Detailed data and descriptions of the general functions are given in the data sheet of the multi-function unit KS 98: 9498 737 32113

ANALOG INPUTS

GENERAL

A/D-Converter

Resolution: 20.000 (50Hz) or 16.667 (60Hz) steps for the selected measuring range.

Conversion time: 20ms (50Hz) or 16,7ms (60Hz).

Measurement cycle: 100 ms per module

Method: Charge balancing

Input filter

Analog: 1st order, $f_g=10\text{Hz}$

Digital: 1st order, $f_g=2\text{Hz}$

RESISTIVE INPUT MODULE R_INP

(9407-998-0x201, P-factor=5%)

Number of channels: 2 (with 3 and 4-wire connection, only one channel can be used).

With 2-wire connection, sensor types can be combined within one module!

Sensor current: $\leq 0,25\text{mA}$

Resistance thermometer

Connection method: 2-, 3- or 4-wire connection

| Type | Range °C | Overall error | Resolution K/Digit |
|--------|--------------|-------------------|--------------------|
| Pt100 | -200...850°C | $\leq 2\text{ K}$ | 0,071 |
| Pt100 | -200...100°C | $\leq 2\text{ K}$ | 0,022 |
| Pt1000 | -200...850°C | $\leq 2\text{ K}$ | 0,071 |
| Pt1000 | -200...100°C | $\leq 2\text{ K}$ | 0,022 |
| Ni100 | -60...180°C | $\leq 2\text{ K}$ | 0,039 |
| Ni1000 | -60...180°C | $\leq 2\text{ K}$ | 0,039 |

Linearization: in °C oder °F

Lead resistance

Pt (-200...850°C): $\leq 30\Omega$ per lead

Pt (-200...100°C), Ni: $\leq 10\Omega$ per lead

Lead resistance compensation

3 and 4-wire connection: not necessary.

2-wire connection: compensation via the front with short-circuited sensor. The calibration values are stored in a non-volatile memory.

Lead resistance effect

3 and 4-wire connection: negligible

Sensor monitoring

Break: sensor or lead

Short-circuit: triggers at 20K below measuring range.

Resistance / Potentiometer

Connection method: 2, 3 or 4-wire connection

Number of channels: 2 (with 3 and 4-wire connection only channel can be used).

| Range Rges / Ω | Overall error | Resolution Ω /Digit |
|-----------------------|---------------|----------------------------|
| 0...160 | $\leq 1\%$ | 0,012 |
| 0...450 | $\leq 1\%$ | 0,025 |
| 0...1600 | $\leq 1\%$ | 0,089 |
| 0...4500 | $\leq 1\%$ | 0,025 |

Characteristic: resistance-linear

Lead resistance or 0%/100%

compensation: via the front with short-circuited sensor. The calibration values are stored in a non-volatile memory.

- Variable resistance (only 2-wire connection): calibration for 0%
- Potentiometer: calibration for 0% and 100%

Lead resistance effect

3 and 4-wire connection: negligible

Sensor monitoring: break: sensor or lead

THERMOCOUPLE, mV, mA MODUL TC_INP

(9407-998-0x211, P-factor=5%)

Number of channels: 2 (difference input).

Sensor types can be combined within one module!

Thermocouples

To DIN IEC 60584 (except L, W/C, D)

| Type | Range | Overall error | K/Digit |
|------------------|-------------------|-------------------|---------|
| L | -200...900°C | $\leq 2\text{ K}$ | 0,080 |
| J | -200...900°C | $\leq 2\text{ K}$ | 0,082 |
| K | -200...1350°C | $\leq 2\text{ K}$ | 0,114 |
| N | -200...1300°C | $\leq 2\text{ K}$ | 0,129 |
| S | -50...1760°C | $\leq 3\text{ K}$ | 0,132 |
| R | -50...1760°C | $\leq 3\text{ K}$ | 0,117 |
| B ⁽¹⁾ | (25) 400...1820°C | $\leq 3\text{ K}$ | 0,184 |
| T | -200...400°C | $\leq 2\text{ K}$ | 0,031 |
| W(C) | 0...2300°C | $\leq 2\text{ K}$ | 0,277 |
| D | 0...2300°C | $\leq 2\text{ K}$ | 0,260 |
| E | -200...900°C | $\leq 2\text{ K}$ | 0,063 |

(1) Values apply from 400°C

Linearization: in °C or °F

Linearity error: negligible

Input resistance: $\geq 1\text{M}\Omega$

Source resistance effect: $1\text{mV/k}\Omega$

Temp. compensation (CJC): built in

Error: $\leq 0,5\text{K}/10\text{K}$

External CJC possible: 0...60 °C or

32...140 °F

Sensor monitoring:

Sensor current: $\leq 1\mu\text{A}$

Reversed polarity monitor: triggers at

10K below measuring range

mV input

| Range | Overall error | Resolution |
|------------|-----------------------|-------------------|
| 0...30 mV | $\leq 45\mu\text{V}$ | 1,7 μV |
| 0...100 mV | $\leq 150\mu\text{V}$ | 5,6 μV |
| 0...300 mV | $\leq 450\mu\text{V}$ | 17 μV |

Input resistance: $\geq 1\text{M}\Omega$

Break monitoring: built in.

Sensor current: $\leq 1\mu\text{A}$

mA input

| Range | Overall error | Resolution |
|-------------|----------------------|-----------------|
| 0/4...20 mA | $\leq 40\mu\text{A}$ | 2 μA |

Input resistance: 10 Ω

Break monitor: $< 2\text{mA}$ (only for 4...20 mA)

Over range monitor: $> 22\text{mA}$

HIGH-IMPEDANCE VOLTAGE INPUT MODULE U_INP

(9407-998-0x221, P-factor=8%)

Number of channels: 2

Measuring ranges can be combined within one module!

| Range | Overall error | Resolution mV/Digit |
|---------------|----------------------|---------------------|
| -50...1500 mV | $\leq 1,5\text{ mV}$ | 0,09 |
| 0...10 V | $\leq 10\text{ mV}$ | 0,56 |

Characteristic: voltage-linear

Input resistance: $> 1\text{G}\Omega$

Source resistance effect: $\leq 0,25\text{ mV/M}\Omega$

Sensor monitoring: none

ANALOG OUTPUTS

D/A-CONVERTER

Resolution: 12 Bit
Refresh rate: 100 ms

VOLTAGE OUTPUT MODULE U_OUT

(9407-998-0x301, P-factor = 25%)
Max. 1 module, if a current output module is already used, → POWER LIMITATIONS!
Number of channels: 2
Signal ranges: 0/2...10V, -10...10V (configurable by channel)
Resolution: approx. 5,4 mV/digit
Load: $\geq 2k\Omega$
Load effect: $\leq 0,1\%$

CURRENT OUTPUT MODULE I_OUT

(9407-998-0x311, P-factor=70%)
Max. 1 module, → POWER LIMITATIONS!
Number of channels: 2
Signal ranges: 0/4...20mA, -20...20mA (configurable by channel)
Resolution: ca. 11 μ A/Digit
Load: $\leq 400 \Omega$
Load effect: $\leq 0,1\%/100\Omega$

DIGITAL INPUTS/OUTPUTS

DIGITAL I/O MODULE DIDO

(9407-998-0x401, P-factor=15%)
Number of channels: 2 (configurable as input or output by channel)
Polarity protection.

Input

Current sink: to IEC 1131 Type 1)
Logic „0“: -3...5V
Logic „1“: 15...30V
Measurement cycle: 100 ms
Galvanic isolation : via opto-couplers
Nominal voltage: 24 VDC external
Input resistance: 5 k Ω

Output

Grounded load (common positive control voltage)
Switch rating: 18...32 VDC; ≤ 70 mA
Internal voltage drop: $\leq 0,7$ V
Refresh-Rate: 100 ms
Galvanic isolation : via opto-couplers
Protective circuit: thermal, switches off with overload.

FREQUENCY/COUNTER MODULE F_INP

(9407-998-0x411, P-factor=8%)
Number of channels: 2; function configurable by channel (not with up/down or quadrature counters!).

Fig. 1: Connecting diagram (Basic instrument)

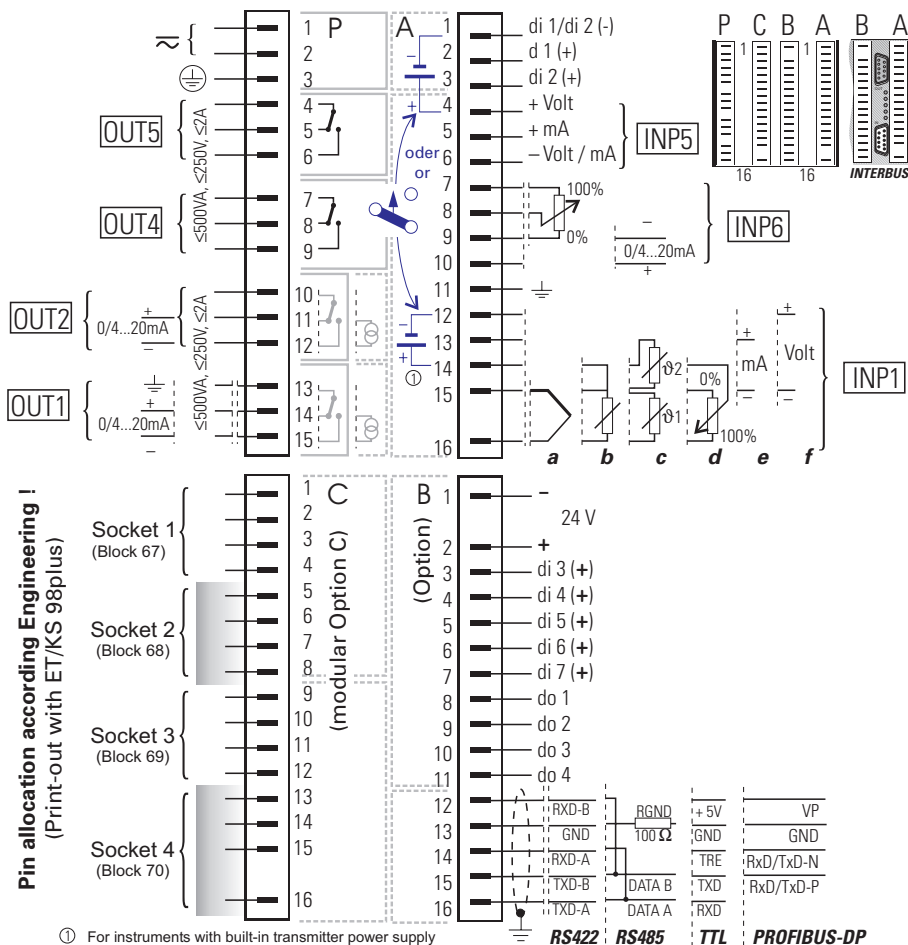
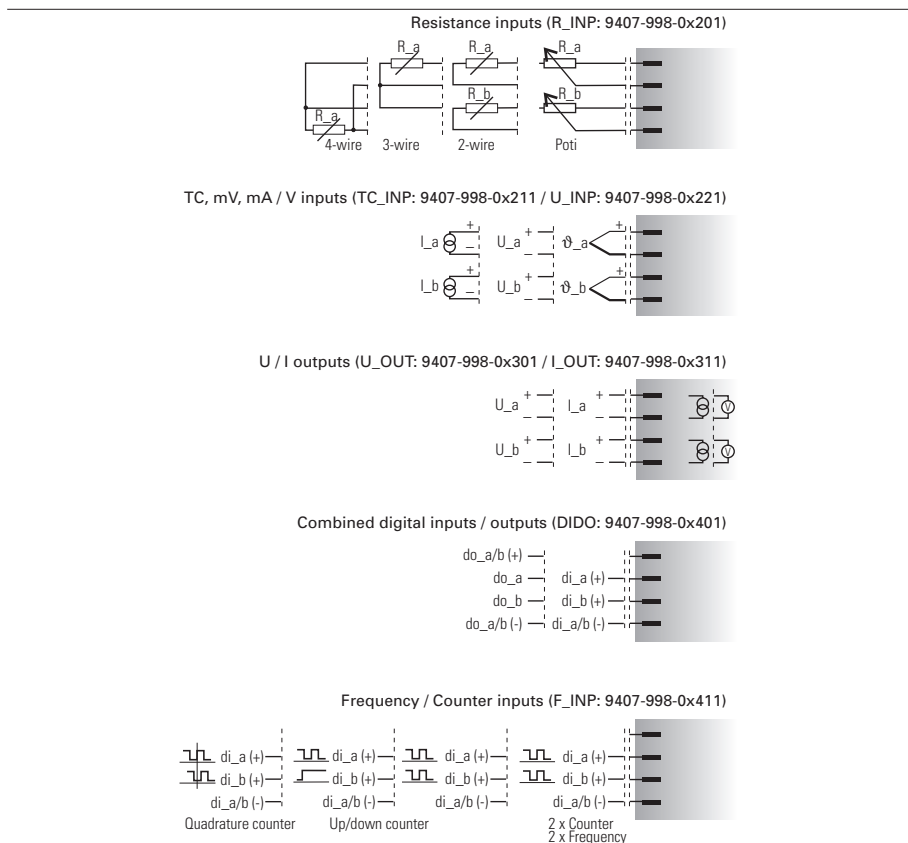


Fig. 2: Connecting diagram (modules)



Current sink: to IEC 1131 Type 1

Logic „0“: -3...5V

Logic „1“: 15...30V

Galvanic isolation: via Opto-couplers

Nominal voltage: 24 VDC external

Input resistance: 12 kΩ

Selectable functions:

- Control input (2 channels)
- Pulse counter (2 channels)
- Frequency counter (2 channels)
- Up/down counter (1 channel)
- Quadrature counter (1 channel)

Frequency range: ≤ 20 kHz

Signal shape: any (square 1:1 with 20kHz)

Gate time: 0,1...20s adjustable (only relevant with frequency measurement)

INFLUENCING FACTORS

Temperature effect: ≤ 0,1%/10K

Supply voltage: negligible

Common mode interference: negligible up to 50 V_{rms}

Series mode interference: negligible up to 300 mV_{rms} (TC), 30 mV_{rms} (RT), 10 V_{rms} (U), 5 V_{rms} (F)

ENGINEERING TOOL

The described functionality can be modified with the following Tools:

ET/KS 98plus from Version 4.1SR1

SIM/KS 98 from Version 4.1 SR1

ORDERING EXAMPLE

Pos.1: Multi-function unit KS 98

9407-9xx-x40x1

Pos.2: I/O-module (fitted in Pos.1)

Socket 1: 9407-998-01201 (Pt 100)

Socket 2: 9407-998-02301 (I output)

Socket 3: 9407-998-03311 (U output)

Socket 4: not used

View of P-factors

R_INP: 5%
 TC_INP: 5%
 U_INP: 8%
 U_OUT: 25%
 I_OUT: 70%
 DIDO: 15%
 F_INP: 8%

ORDERING DATA KS 98

| | 9 | 4 | 0 | 9 | 9 | 8 | 0 | 1 |
|---|---|---|---|---|---|---|---|---|
| Flat pin connectors | | | | 7 | | | | |
| Screw terminal connectors | | | | 8 | | | | |
| BASIC UNIT | | | | | 6 | | | |
| KS 98 standard | | | | | 6 | | | |
| KS 98 with transmitter power supply | | | | | 7 | | | |
| POWER SUPPLY AND CONTROL OUTPUTS | | | | | | | | |
| 90...250V AC 4 relays | | | | | | | 3 | |
| 90...250V AC 2 relays+ 2 current outputs | | | | | | | 5 | |
| 24V UC, 4 relays | | | | | | | 7 | |
| 24V UC, 2 relays+ 2 current outputs | | | | | | | 9 | |
| OPTION B INTERFACE | | | | | | | | |
| no interface | | | | | | | | 0 |
| TTL-interface + di/do | | | | | | | | 1 |
| RS422 + di/do + clock | | | | | | | | 2 |
| PROFIBUS DP + di/do | | | | | | | | 3 |
| INTERBUS + di/do | | | | | | | | 4 |
| OPTION C (standard) | | | | | | | | |
| no extensions | | | | | | | | 0 |
| INP3, INP4, OUT3, di/do | | | | | | | | 1 |
| INP3 (mV), INP4, OUT3, di/do | | | | | | | | 2 |
| OPTION C (modular) | | | | | | | | |
| Motherboard without modules | | | | | | | | 3 |
| Motherboard with ordered modules inserted | | | | | | | | 4 |
| SETTING | | | | | | | | |
| Standard configuration | | | | | | | | 0 |
| Customer-specific configuration | | | | | | | | 9 |

1) Modules must be ordered separately, → ORDERING DATA MODULES" !

2) The required configuration (CONF-098-XXXXX) must be specified!

ORDERING DATA MODULES

| | 9 | 4 | 0 | 9 | 9 | 8 | 0 | 1 |
|--|---|---|---|---|---|---|---|-----|
| Flat pin connectors | | | | 7 | | | | |
| Screw terminal connectors | | | | 8 | | | | |
| SOCKET module group 1 | | | | | | | | |
| Individual order (separate delivery) | | | | | | | | 0 |
| Inserted in socket 1 ³⁾ | | | | | | | | 1 |
| Inserted in socket 2 ³⁾ | | | | | | | | 2 |
| module group 2 | | | | | | | | |
| Inserted in socket 3 ³⁾ | | | | | | | | 3 |
| Inserted in socket 4 ³⁾ | | | | | | | | 4 |
| ANALOG INPUTS | | | | | | | | |
| Pt100/1000, Ni100/1000, Resistance | | | | | | | | 2 0 |
| Thermocouple, mV, 0/4...20mA | | | | | | | | 2 1 |
| -50...1500mV (z.B. Lambda sensor), 0...10V | | | | | | | | 2 2 |
| ANALOG OUTPUTS | | | | | | | | |
| Voltage output | | | | | | | | 3 0 |
| Current output ⁴⁾ | | | | | | | | 3 1 |
| DIGITAL SIGNALS | | | | | | | | |
| Digital inputs/outputs | | | | | | | | 4 0 |
| Frequency/counter inputs | | | | | | | | 4 1 |

3) Specify when ordering: "Fitted in KS98, position X of order"

4) Max. 1 current output module (→ "POWER LIMITATION")!



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