Digital 380
Digital indicator

One version for all sensor types

Menu-guided adjustment, without codes

Built-in mathematical functions

Input circuit intrinsically safe EEx ib

Standard interface RS 485/RS 422

Two limit contacts

Galvanically isolated analog output signal

Automatic channel selector for 8 freely-configurable input signals

PROFILE

Digital 380 is a 96 x 48mm panel indicator with microprocessor and full digital signal processing. Thermocouples, resistance thermometers, potentiometric transducers, current and voltage signals can be connected directly.

Digital 380 is designed for four specific applications:
Universal indicator, for all types of input signal.
Low-cost computing unit with analog output.
Monitoring station with 8 input channels.
Data acquisition station e.g. for process guidance systems.

DESCRIPTION

Universal indicator
If necessary, Digital 380 can be configured for the input signal via front panel keys.

Computing unit
Indication of temperature changes or quantities, input signal linearization, square root extraction or taring are possible with the Digital 380 basic version. External computing units and additional wiring are not necessary. The calculated value can also be accessed via the analog output.

Monitoring station
A separate channel selector unit converts the Digital 380 into an 8-channel indicator.

Channel selection is either manual by pressing keys, or automatic in „scanner mode". The selector unit is fitted with two switching outputs per channel for relay control, i.e. in the scanner mode, all channels can be monitored for two limit values. Additionally, two built-in relays provide common alarm signalling for all measured channels (Fig. 1).

Data acquisition station
Combination of a digital indicator, a selector unit and an interface module permits data acquisition from 8 channels using only one indicator. For this purpose, Digital 380 can be connected to an interface module together with KS 4290, KS 40 and KS 92/94. True system integration (Fig. 2) is possible by common connection of all these units, including KS 4580, via a bus to a visualization software.

The A/D converter with more than 25 000 steps has a resolution of 0,004% of span.

Analog output (option)
The analog output delivers the result of the second computing function as a standard 0(4)...20mA signal. The value range of this signal is selectable. Zooming permits precise examination of a section of the displayed variable.- The D/A converter operates with a 10-bit resolution, i.e. the smallest step is 0,1% of the selected output span. Analog output and all other parts of the indicator are galvanically isolated.

Limit contacts (option)
The indicator is fitted with two built-in relays. Two set-points can be adjusted for each relay. Hysteresis and alarm mode (normally-open or normally-closed) are configurable.

Channel selector
Mounted side by side with the indicator, the selector switches 8 input signals to the digital indicator. The selector has no controls of its own, but has indicator LEDs for identification of the selected channel. Channel selection is controlled by the digital indicator. In scanner mode, the unit selects the channels at an adjustable time interval. Irrelevant channels can be skipped.

TECHNICAL DATA

INPUT

Reactiontime 340 . . . 500 m sec for 0 . . . 100 %

Thermocouples
Input resistance: > 500 kΩ
Effect of source resistance: approx. 1 µV/Ω

Temperature compensation: internal or external (configurable)
Additional error of internal compensation with the channel selector connected: < 0,5 K
Reference temp. of external compensation is configurable: 0. . .60 °C

Display in °C or °F.

Resistance thermometers
Pt100 to DIN/IEC with built-in linearization.
Display in °C or °F.
Sensor current: approx. 1,5 mA

3-wire connection without lead resistance adjustment.
2-wire connection with lead resistance adjustment.
Max. lead resistance with 3-wire connection: 20Ω per lead, symmetrical.
Effect of lead resistance: ≦ 0,6 K

Potentiometric transducer
Resistance change: ≧ 30% of R_{total}

Calibration possible for 0 and 100 %.
3-wire connection without lead resistance adjustment.
Lead resistance: ≦ 10 Ω per lead, symmetrical.

Resistance
Scaling:
Span start in Ω ≙ 0% display value.
End of span in Ω ≙ 100% display value.
2 or 3-wire connection.
Lead resistance: ≦ 10Ω per lead, symmetrical.

Standard signals
0 . . . 20 mA, 4 . . . 20 mA or 0 . . . 10 V configurable.
Input resistance:
50Ω for current signals,
100 kΩ for voltage signals.
Linearization possible for thermocouple types L, J, K, S, R, B, T and N, or Pt100 (see Tables 2 and 3).
Display in °C or °F.

Start and end of span configurable, e.g. 4mA ≙ 200°C, 20 mA ≙ 800°C.

Direct voltage
Ranges: see Table 3.

Input circuit monitoring
With thermocouples: for TC break and wrong polarity.
With resistive input: for short circuit (R < 10Ω).
With 4 . . . 20mA signals: for I<2 mA.
Output action is configurable.

Fig. 1 The monitoring station

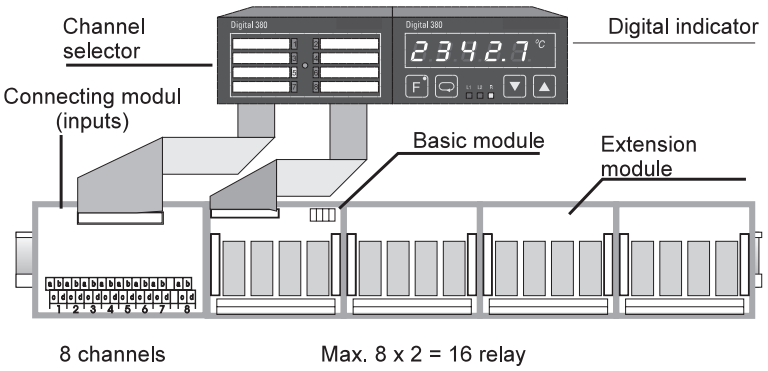


Fig. 2 The data acquisition station

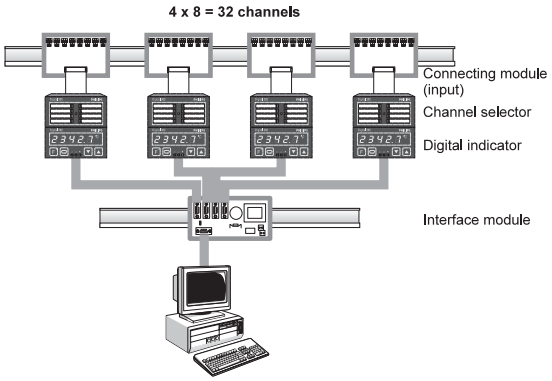
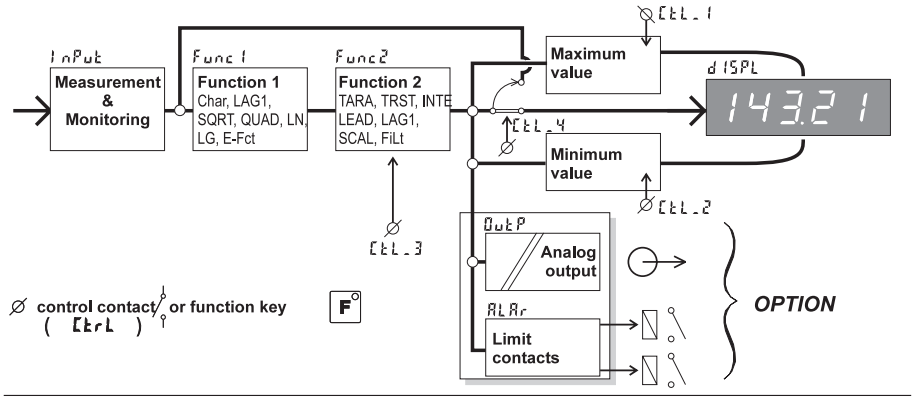


Fig. 3 Block diagram



Influencing factors
Temperature effect: ≦ 0,2%/ 10K
Voltage effect: ≦ 0,1%/ 10% change in supply voltage.

Effect of series-mode interference: ≦ 0,1% with ≦ 0,2V AC

Effect of common-mode interference: none with ≦ 250V AC

Control inputs
Two control inputs for potential-free contacts or logic signal 0/5V.
1 function key on the indicator.

Control input functions
- reset of max. value
- reset of min. value
- trigger for computing function 2
- start/stop of scanner mode
- remote/local switchover (remote operation only via interface)

TRANSMITTER SUPPLY

Voltage $U_T > 18V$ with 20mA, short circuit proof.
Only for use with a transmitter connected to Digital 380.

INTERFACE

RS 485/RS 422 with protocol similar to ISO 1745.
Connection via interface module.

Max. four indicators can be connected to an interface module. 32 interface modules can be connected to a bus.
Addresses: 00...99
Transmission speed: 2400...19.200 bits/s
Drivers for Wizcon, FIX DEMACS and InTouch are available.

MATHEMATICAL FUNCTIONS

Functions without control input
Linearization with 16 segments
Low-pass filter, $\sqrt{x}$, x^2 ln, lg, e-function

Note:
With channel selector operation, the linearization parameters (CHAR) are valid for all channels.

Functions with control input
Integrator, differentiator, sample & hold, taring, low-pass filter, scale (ax + b), filter with operating range (bandwidth).

One function without and one function with control input can be selected for each channel (Fig. 3).

Maximum and minimum values are always stored and may be displayed on the front.

POWER SUPPLY

AC versions
230 V – 15%...+10%, 48...62 Hz
115 V – 15%...+10%, 48...62 Hz
Power consumption: 7,5 VA
Thermal fuse in mains transformer

Universal current versions
24 V AC –15%...+10%, 48...62 Hz or 18...31,2 V DC, built-in fuse
Power consumption: 4 VA(W)

Table 1: Thermocouple measurement

Sensor	Type	Input range		Display error	Resolution
Fe-CuNi (DIN)	L	–200... 900°C	–328...1642°F	≦ 2K ± 1 digit	< 2,7 µV
Fe-CuNi	J	–200... 900°C	–328...1652°F		< 2,7 µV
NiCr-Ni	K	–200...1350°C	–328...2462°F		< 2,7 µV
PtRh-Pt 10%	S	– 50...1760°C	– 58...3200°F		< 1,4 µV
PtRh-Pt 13%	R	– 50...1760°C	– 58...3200°F		< 1,4 µV
PtRh-Pt 6%	B	400...1820°C	752...3308°F		< 1,1 µV
Cu-CuNi	T	–200... 400°C	–328... 752°F		< 1,4 µV
Nicrosil/Nisil	N	–200...1300°C	–328...2372°F		< 2,7 µV

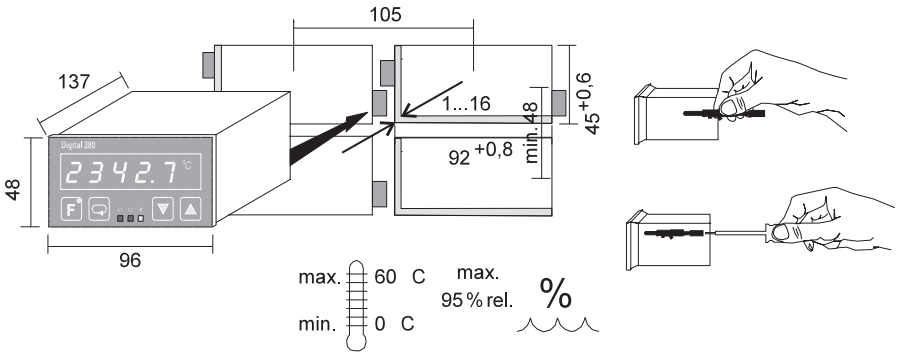
Table 2: Resistive measurement

Sensor	Input range		Display error	Resolution
Pt100 DIN	–200,0...150,0°C	–328,0... 302,0°F	≦ 0,4K ± 1 digit	< 13 mΩ
Pt100 DIN	–200,0...850,0°C	–328,0...1562,0°F	≦ 1,0K ± 1 digit	< 27 mΩ
Transducer	100...180 Ω		≦ 0,05% ± 1 digit	< 13 mΩ
Transducer	100...450 Ω			< 27 mΩ
Resistance	0...180 Ω			< 13 mΩ
Resistance	0...450 Ω			< 27 mΩ

Table 3: Direct voltage measurement

Input signal	Display error	Resolution
0... 10 V	≦ 0,05% ± 1 digit	< 400 µV
0... 5 V		< 200 µV
0... 1 V		< 40 µV
0...500 mV		< 20 µV
–10... 50 mV		< 2,7 µV
–10... 20 mV		< 1,4 µV
–10... 15 mV		< 1,1 µV

Fig. 4 Overall dimensions (mm)



Intrinsically safe indicators must be protected by means of the following external cartridge fuses (DIN 41 662):
230 V: 0,1 A slow
115 V: 0,16 A slow

ENVIRONMENTAL CONDITIONS

Permissible temperatures
For operation: 0...55 °C
Storage and transport: –20...80 °C

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

Shock and vibration
Vibration test Fc to DIN/IEC 68-2-6:
Operation and transport 10...150 Hz, 0,15 mm, max. 2g

Shock test Eb to DIN/IEC 68-2-29:
Transport 10g, 16 ms

EXPLOSION PROTECTION

Intrinsic safety according to EN 50 014 and EN 50 020.
Certificate of conformity:
PTB Nr. Ex-93.C.2053 X

Protection type
Input circuits and transmitter supply:
EEx ib IIC

Installation
Outside the explosion-hazarded area

The channel selector type 9404 380 70021 is also intrinsically safe!

ELECTROMAGNETIC COMPATIBILITY

Complies with EN 50081-1 and EN 50082-1 for use within rural areas.
Complies with EN 50081-1 and EN 50082-2 for unlimited use within rural and industrial areas if shielded cables are used (not for mains cables).

Low-frequency magnetic field
Field strength of 400A/m at 50 Hz: no effect

High-frequency magnetic field
Conforms to IEC 801-3, section 9.2.
Frequency range: 25 . . . 1000 MHz
Field strength: 3V/m
Effect: ≦ 0,5%

GENERAL

Housing
Material: Makrolon 9415, flame-retardant, self-extinguishing. Flammability class: UL 94 V0

Display
5-digit LED, height 14mm

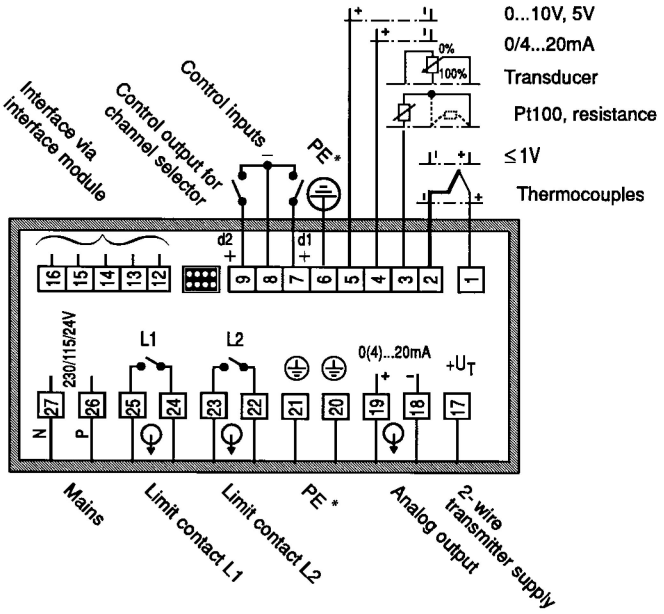
Protection mode
According to IEC 529 (DIN 40 050)
Front: IP 52
Housing: IP 20
Terminals: IP 10

Safety Characteristics
According to EN 61010-1:
Over voltage category II
Pollution degree 2
Operating voltage range 300 V
Protective class I

CE-marking
According to European directives for → „Electromagnetic compatibility" and „Electrical equipement use within specified voltage limits" (→ Safety Characteristics)

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

Fig. 5 Electrical connections of indicator



*These connections must be connected with protective earth the shortest way possible, separate from power supply!

Fig. 6 Connections of connecting module (channel selector)

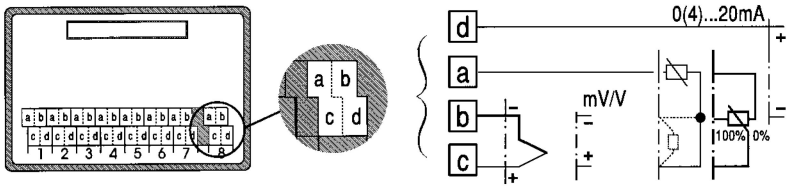
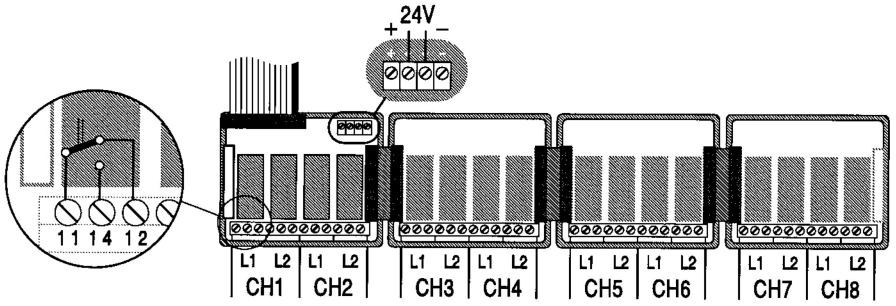


Fig. 7 Connections of relay module (channel selector)



Mounting method
In panel cut-out, with two clamps at the sides

Mounting position: not critical

Weight: 0,54 kg

OPTIONS

Limit contacts
Potential-free, normally open contact.
Contact rating: ≦ 500VA; ≦ 3A; ≦ 250V, resistive load.
Hysteresis and operating mode configurable.
The relays have gold-plated contacts and are suitable for switching „low-power" circuits (<20 mA).

Analog output
Galvanically isolated from the remaining indicator!
Range: 0(4) . . . 20mA
Current limiting: < 22 mA
Ripple: ≦ 0,2 $\%_{pp}$
Resolution: better than 0,1%
Settling time: < 0,2 s referred to display
Temp. effect: < 0,2 K/10 K referred to display
Load: ≦ 500 Ω
Load effect: ≦ 0,1%

TABLE 4: CONFIGURATION TO SPECIFICATION

Input signal

Thermocouple	*Internal temp. comp.*	*External temp. comp.*
Type	**CO . .** ↑↑	**CO . .** ↑↑
L Fe-CuNi (DIN)	00	10
J Fe-CUNi (IEC)	01	11
K NiCr-Ni	02	12
S PtRh-Pt 10 %	03	13
R PtRh-Pt 13 %	04	14
B PtRh-Pt 6 %	05	15
T Cu-CuNi	06	16
N Nicrosil/Nisil	07	17

Standard signals [1] linearized for:	*0...20 mA* **CO . .** ↑↑	*4...20 mA* **CO . .** ↑↑	*0...10 V* **CO . .** ↑↑
L Fe-CuNi (DIN)	20	30	40
J Fe-CUNi (IEC)	21	31	41
K NiCr-Ni	22	32	42
S PtRh-Pt 10 %	23	33	43
R PtRh-Pt 13 %	24	34	44
B PtRh-Pt 6 %	25	35	45
T Cu-CuNi	26	36	46
N Nicrosil/Nisil	27	37	47
Pt 100 DIN/IEC	28	38	48
not linearized	29	39	49

Resistance/ Voltage [2]	Range	CO . . ↑↑
Pt 100 DIN/IEC	– 200 ... 140,0 °C	50
Pt 100 DIN/IEC	– 200 ... 850,0 °C	51
Resistance	0 ... 180 Ω	52
Resistance	0 ... 450 Ω	53
Potentiometer	100 ... 180 Ω	54
Potentiometer	100 ... 450 Ω	55
Voltage	0 ... 5 V	60
Voltage	0 ... 1 V	61
Voltage	0 ... 500 mV	62
Voltage	– 10 ... 50 mV	63
Voltage	– 10 ... 20 mV	64
Voltage	– 10 ... 15 mV	65

Display and sensor monitoring [6] C1 . . ↑↑

Display in °C or to specification [3]	0 .
Display in °F	1 .
Sensor monitoring up-scale (> 100 %)	. 0
Sensor monitoring down-scale (< 0 %)	. 1

Analog output signal (optional) [4]

0 ... 20 mA (y_0 ... y_{100})	C200
4 ... 20 mA (y_0 ... y_{100})	C202

Limit contacts (optional)

Limit contact L1	
Normally closed	C400
Normally open	C410
Limit contact L2	
Normally closed	C500
Normally open	C510

Interface

Transmission speed	2400 bits/s	C803
	4800 bits/s	C804
	9600 bits/s	C805
	19200 bits/s	C806

Mathematical functions [5]

FUNC1 (without control input)	
CHAR	Linearization with 16 segments
LAG1	1st-order filter
SQRT	Square root $\sqrt{x}$
QUAD	Squaring x^2
LG	Common logarithm
LN	Natural logarithm
E-FCT	e-function e^x
FUNC2 (with control input)	
TARA	Taring
TRST	Sample & Hold
INTE	Integrator
LEAD	Differentiator
LAG1	1st-order filter
SCAL	Scaling ax + b
FILT	Filter with bandwidth

1) With input codes C020 ... C049 the measuring span w_0 ... w_{100} of the external transmitter must also be specified. Sensor monitoring only with 4 ... 20 mA.
2) With input codes C052, C053 and C060 ... C065 the required span and display range must be specified. ($x_0 \triangleq w_0$ and $x_{100} \triangleq w_{100}$).
3) The required engineering unit (e.g. m^3/h) must be specified in plain text and will be supplied as an adhesive label.
4) Span y_0 ... y_{100} can be specified out of the measuring span w_0 ... w_{100}.
5) The abbreviations for the required functions must be specified. Without this, no function will be configured.
6) For limitation of sensor monitoring function with standard signals, see Note 1).

TECHNICAL DATA OF CHANNEL SELECTOR UNIT

Because the Digital 380 controls the channel switching, the channel selector can only be used together with the indicator.

Relays
Special relays are used for channel selection, with a life of 2×10^8 operations (> 10 years at a switching frequency of 2s). The relays have UL and CSA certification.

Mounting
Directly above or at left of indicator

Operating modes
Manual: channel selection by pressing keys
Scanner: automatic channel selection, with scanning interval configurable 2 . . . 60s/channel

One of the eight channels can be connected to the analog output.

The inputs of channel selector type 9404 380 70021 are intrinsically safe!

With current measurement, the voltage drop across the channel selector is max. 7,5V.

Connection
Connecting module for standard rail mounting (order separately).
Dimensions: 112,5 x 77 x 55 mm
Sensor for temperature compensation built into the connecting module.

Weight: 0,33 kg

Alarm outputs (option)
2 switching outputs per channel as limit contacts.
Ground potentials are connected.

Electrical connection
Basic relay module with 4 plug-in relays and connecting terminals for 24V DC supply.
Extension relay module with 4 plug-in relays.
Dimensions: 87,5 x 77 x 65 mm
Relays used: potential-free changeover contacts for ≦ 500VA, ≦ 250V, ≦ 3A at 48 . . . 62Hz, resistive load.

Max. 1 basic and 3 extension modules can be used with one channel selector.

To energize the galvanically isolated output stages, a 24V DC supply, +15% . . . –20%, must be connected to the basic module.
Current consumption: approx. 10mA plus 25mA per relay (max. 500mA).

Recommended power supplies
For max. 8 relays:
Weidmüller RS-T/AC230 (250mA)

For more than 8 relays:
Phoenix CM62-PS-220AC/24DC/ 0,6(A)

Channel selector [1)]

9404 380 700 1	
Standard, intrinsically safe	**2**
With 16 switching outputs[2)]	**3**

1) Complete with connecting cables to indicator. The connecting module for 8 inputs must be ordered separately, see Accessories.

2) Includes the ribbon cable (length 1 m) for connecting to the basic relay module.

ACCESSORIES

Description	Order no.
Connecting module for 8 inputs of the channel selector (including 1 m ribbon cable)	**9404 380 75021**
Basic relay module with 4 relays[3)]	**9404 380 75031**
Extension relay module with 4 relays and ribbon cable	**9404 380 75041**
Also available:	
Ribbon cable for extension module, length to specification (max. 8 m)	**9404 380 75051**
Ribbon cable for basic relay module, length to specification (max. 8 m)	**9404 380 75061**

3) Ribbon cable is supplied with the channel selector.

Digital 380

9404 380 6 _ _ _ 1

Red display, standard configuration [1]	2
Red display, configured to specification [2]	3
Green display, standard configuration [1]	4
Green display, configured to specification [2]	5
Supply voltage 230 VAC	0
Supply voltage 115 VAC	1
Supply voltage 24 V UC (universal)	3
Supply voltage 230 VAC and intrinsic safety [3]	4
Supply voltage 115 VAC and intrinsic safety [3]	5
Supply voltage 24 V UC (universal) and intr. safety	7
Without options	0
With 2 limit contacts and analog output	1

[1] See Ordering Information.
[2] See Ordering Information and Table 4.
[3] Not intrinsically safe with channel selector type 9404 380 70011.

ORDERING INFORMATION

If not specified otherwise, the indicator will be delivered with the following standard settings:
Input: Pt100, – 200,0 . . . 150°C
Sensor monitoring: "upscale"
Limit contacts: not active
No mathematical functions
Analog output: 4 . . . 20 mA
(≙ – 200 . . . 150°C)
Function key: as start/stop for scanner
Interface: 19.200 bits/s
Address: 00

For a customer-specific configuration, the corresponding C-codes must be selected from Table 4.

On-site changes to configuration are always possible.

ACCESSORIES

Description	Order no.
Interface module 230 VAC	**9404 492 98001**
Interface module 115 VAC	**9404 492 98011**
Interface module 24 VAC	**9404 492 98021**
Interface cable, length 1 m	**9404 407 50011**

ORDERING EXAMPLES

Example 1
An indicator with the following configuration is required:
Supply voltage: 230 VAC
Input 4 . . . 20mA ≙ 0.00 . . . 50.00 bar
Break monitoring: upscale
Analog output: 4 . . . 20mA
(corresponding to 25.00 . . . 50.00 bar)
Relays L1 and L2 for normally-closed operation.
Interface: 19.200 bits/s
Math. function 1: 1st-order filter
Math. function 2: sample-&-hold amplifier

Ordering text:

Pos.	Order no./ Description	Qty.
01	9404 380 63011 C039, C100, C202, C400, C500, C806, Func1 = LAG1 Func2 = TRST w_0/w_{100}: 0,00 . . . 50,00 bar y_0/y_{100}: 25,00 . . . 50,00 bar	1

Example 2
An indicator with the following configuration, a channel selector and two relay modules are required:

Indicator
Supply voltage: 24 VUC
Input: NiCrNi
Break monitoring: upscale
Analog output: 4 . . . 20mA
(corresponding to 600 . . . 1200 °C)
Relays L1 and L2: not active
Interface: not used
Math. function 1: not used
Math. function 2: not used

Channel selector
With 16 switching outputs.

Ordering text:

Pos.	Order no./ Description	Qty.
01	9404 380 63311 C002, C100, C202, w_0/w_{100}: 200 . . . 1200 °C y_0/y_{100}: 600 . . . 1200 °C	1
02	9404 380 70031	1
03	9404 380 75021	1
04	9404 380 75031	1
05	9404 380 75041	1

If each channel is to have a different configuration, the individual configurations must be specified (max. 8).

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