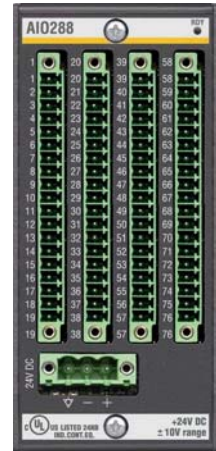


## Analog output module AO288/x

With the combined input / output modules AIO288/x, analog signals can be read from analog sources such as analog sensors, potentiometers or Pt100 type temperature sensors as well as sent to receivers with high impedance inputs like control devices for servo drives or analog valves.



## Features

- power supplies for 4 potentiometers
- current sources for 4 Pt100 sensors
- terminal to connect an external reference ground AGND
- internal power supply via backplane BS2xx
- yellow state indicating LED for ready (RDY)
- possibility to monitor wire breakage on the inputs
- overload detection for potentiometer power supply
- possibility to monitor overload of the potentiometer power supply
- technology to connect inputs in single ended or differential mode
- eight analog inputs and eight analog output channels, isolated towards the system
- connector for external 24 V DC power supply

As many analog input / output modules AIO288/x as module slots are available, may be used in a controller system. Any combination of AIO288/x with other input / output modules is allowed. Nevertheless, the maximum capacity of the power supply module must be considered.

General Data	AIO288
number of analog inputs	8
number of analog outputs	8
potentiometer power supplies	4
current sources for temperature sensors	4
power supply	internal, via backplane BS2xx + external power supply
current consumption via backplane, without potentiometer supply	230 mA @ + 5 V DC

Voltage Inputs ±10V	AIO288
quantity	max. 8
isolation towards bus	yes
input type	differential or single ended
input impedance	> 100 kΩ
digital resolution	14 Bit
value of the LSB	1.22 mV
error @ 25 °C	max. ± 0.025 % of the input range (20 V)
temperature coefficient	max. ± 0.005 % of the input range. (20 V) / K
error, full temperature range	max. ± 0.1 % of the input range (20 V)
linearity error	max. ± 0.025 % of the input range (20 V)

Voltage Inputs $\pm 10V$	AIO288
repetition accuracy (at a defined temperature and after building-up time)	max. $\pm 0.025$ % of the input range (20 V)
preselection filter	low-pass filter, 1 <sup>st</sup> order, $f_q = 1.5$ kHz
allowed common mode voltage	max. $\pm 1V$
CMRR	DC, 50 Hz, 60 Hz: $> 60$ dB
cross-talk attenuation between the channels	DC: $> 60$ dB sine wave (50 Hz, 20 $V_{pp}$ ): $> 60$ dB
stability against extraneous voltage	- 36 V .. + 36 V
sample time	200 $\mu s$

Voltage Inputs $\pm 1V$	AIO288
quantity	max. 8
Isolation towards bus	yes
input type	differential or single ended
input impedance	$> 100$ k $\Omega$
digital resolution	14 Bits
value of the LSB	122 $\mu V$
error @ 25 °C	max. $\pm 0.05$ % of the input range (2 V)
temperature coefficient	max. $\pm 0.005$ % of the input range. (2 V) / K
error, full temperature range	max. $\pm 0.2$ % of the input range (2 V)
linearity error	max. $\pm 0.025$ % of the input range (2 V)
repetition accuracy (at a defined temperature and after building-up time)	max. $\pm 0.025$ % of the input range (2 V)
preselection filter	low-pass filter, 1 <sup>st</sup> order, $f_q = 1.5$ kHz
allowed common mode voltage	max. $\pm 1V$
CMRR	DC: $> 60$ dB 50 Hz, 60 Hz: $> 60$ dB
cross-talk attenuation between the channels	DC: $> 60$ dB sine wave (50 Hz, 2 $V_{pp}$ ): $> 60$ dB
stability against extraneous voltage	- 36 V .. + 36 V
sample time	200 $\mu s$

Current Inputs	AIO288
quantity	max. 8
isolation towards bus	yes
input current range	0 .. 20 mA
input impedance (shunt)	243 $\Omega$
digital resolution	14 Bits
value of the LSB	1.22 $\mu A$
error @ 25 °C	max. $\pm 0.1$ % of the input range (20 mA)
temperature coefficient	max. $\pm 0.01$ % of the input range (20 mA) / K
error, full temperature range	max. $\pm 0.2$ % of the input range (20 mA)
linearity error	max. $\pm 0.1$ % of the input range (20 mA)
repetition accuracy (at a defined temperature and after building-up time)	max. $\pm 0.1$ % of the input range (20 mA)
preselection filter	low-pass filter, 1 <sup>st</sup> order, $f_q = 1.5$ kHz
maximum input current (destruction limit)	35 mA
sample time	200 $\mu s$

Pt100 Inputs	AIO288
quantity	max. 4
isolation towards bus	yes
temperature range	-100 .. + 500 °C
input type	2 or 4 wire technology

Pt100 Inputs	AIO288
input impedance	> 100 k $\Omega$
value of the LSB	0.1 K (0 °C equals 2732)
error @ 25 °C	max. $\pm$ 0.1 % of the input range (600 °C)
temperature coefficient	max. $\pm$ 0.01 % of the input range (600 °C) / K
error, full temperature range	max. $\pm$ 0.2 % of the input range (600 °C)
stability against extraneous voltage	- 36 V .. + 36 V
sample time	200 $\mu$ s

Potentiometer Power Supply	AIO288
number	max. 4
isolation towards bus	yes
error @ 25 °C	max. $\pm$ 25 mV
temperature coefficient	max. $\pm$ 0.005 % of the voltage range (20 V) / K
error, full temperature range	max. $\pm$ 45 mV
load	max. 40 mA
short circuit stability	yes, permanent

Voltage Outputs	AIO288
quantity	max. 8
isolation towards bus	yes
output voltage range	$\pm$ 10 V
short circuit stability	yes, permanent
output impedance	output is readjusted up to $\pm$ 2 mA
digital resolution	14 Bits
value of the LSB	1.22 mV
error @ 25 °C	max. $\pm$ 0.025 % of the output range (20 V)
temperature coefficient	max. $\pm$ 0.002 % of the output range (20 V) / K
error, full temperature range	max. $\pm$ 0.1 % of the output range (20 V)
linearity error	max. $\pm$ 0.025 % of the output range (20 V)
repetition accuracy (at a defined temperature and after building-up time)	max. $\pm$ 0.025 % of the output range (20 V)
settling time of one channel (full range step)	max. 400 $\mu$ s
overshoot (full range step)	max. $\pm$ 1 % of the output range (20 V)
ripple	max. $\pm$ 0.015 % of the output range (20 V)
maximum common mode voltage	max. $\pm$ 1 V
CMRR	DC: > 60 dB 50 Hz, 60 Hz: > 60 dB
cross-talk attenuation between the channels	DC: > 60 dB sine wave (50 Hz, 20 V <sub>pp</sub> ): > 60 dB
stability against extraneous voltage	- 15 V .. + 28 V
refresh cycle time	200 $\mu$ s



**attention:** To maintain the interference stability and signal quality the maximum cable length of all signal lines must not exceed 30 m!


### Error messages

Error message	Meaning
voltage (module)	Error in the internal voltage generation or in the external supplier in the supply through the bus rail
cable break (channel)	Voltage at U+ or U/- > 13,5 V (voltage inputs $\pm$ 1 V / $\pm$ 10 V)
short circuit	R <sub>load</sub> < ca. 500 $\Omega$ (only supply of the potentiometer)


## External Power Supply

External Power Supply	Description
input voltage, nominal	24 V DC
input voltage, range	18 .. 34 V DC
input voltage, peak value, if $t < 1$ s / min	40 V DC
current consumption	typ. 180 mA @ 24 V DC
polarity reversal protection	yes

## Pin Assignments

Conn. 1/2/3/4	Pin				Signal	Description	Channel			
	1	20	39	58	screen	screen	1	2	3	4
	2	21	40	59	U+	positive input $\pm 10$ V, $\pm 1$ V	1	2	3	4
	3	22	41	60	U/-	negative input $\pm 10$ V, $\pm 1$ V, I	1	2	3	4
	4	23	42	61	0V Ref	reference GND for $\pm 10$ V, $\pm 1$ V input	1	2	3	4
	5	24	43	62	I+	positive input for current input	1	2	3	4
	6	25	44	63	+10V	potentiometer power supply +10 V	1	2	3	4
	7	26	45	64	-10V	potentiometer power supply -10 V	1	2	3	4
	8	27	46	65	screen	screen	5	6	7	8
	9	28	47	66	U+	positive input for $\pm 10$ V, $\pm 1$ V, Pt100	5	6	7	8
	10	29	48	67	U/-	negative input for $\pm 10$ V, $\pm 1$ V, I, Pt100	5	6	7	8
	11	30	49	68	0V Ref	reference GND for $\pm 10$ V, $\pm 1$ V, Pt input	5	6	7	8
	12	31	50	69	I+	positive input for current input	5	6	7	8
	13	32	51	70	Pt100	drain for Pt100	5	6	7	8
	14	33	52	71	U+	voltage output $\pm 10$ V	9	10	11	12
	15	34	53	72	0V Ref	reference GND for $\pm 10$ V output	9	10	11	12
	16	35	54	73	screen	screen	9	10	11	12
	17	36	55	74	U+	voltage output $\pm 10$ V	13	14	15	16
	18	37	56	75	0V Ref	reference GND for $\pm 10$ V output	13	14	15	16
	19	38	57	76	screen	screen	13	14	15	16

## External Power Supply

Connector	Pin	Signal	Description
	1	+	external power + 24 V DC (only AIO288)
	2	-	external power ground (only AIO288)
	3	AGND	reference input for all analog channels (analog ground)

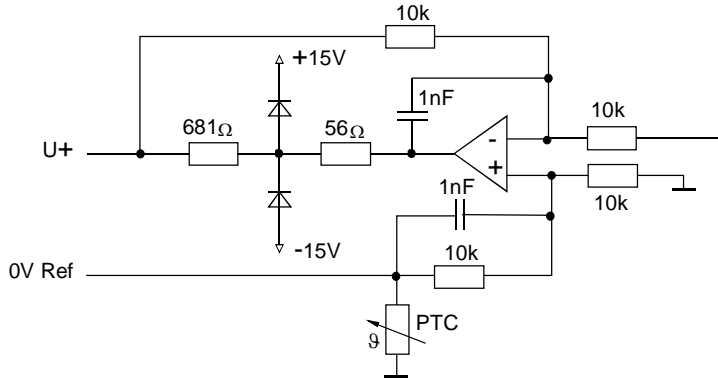


**remark:** A signal on *AGND* will be added to all analog signals. The *AGND* pin may only be connected to a reference point (e.g. central ground) if all used inputs and outputs of a module are connected in *single ended* mode and refer to the same ground level. The maximum allowed common mode voltage must not be exceeded. The *AGND* pin must remain open on all other wiring modes!

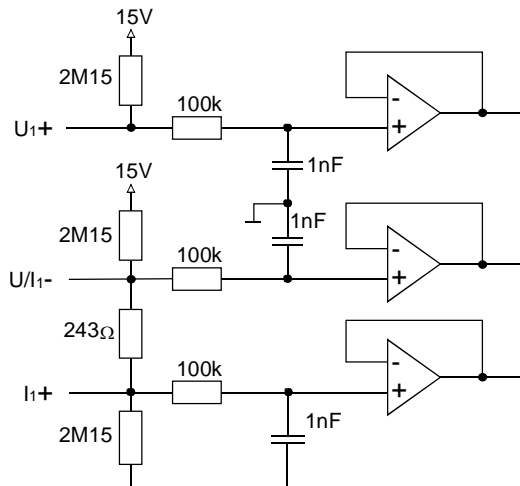
### Order Codes for Modules and Accessories

Order Code	Order #	Description
RMAIO288	0067586.001	Analog input / output module (8xin, 8xout)
RMSSAIO288	0067587.001	terminal set Phönix screw terminals, side (4x SS35/19; 1x KZ51/03)

### Output Circuit AIO288 (Principle)

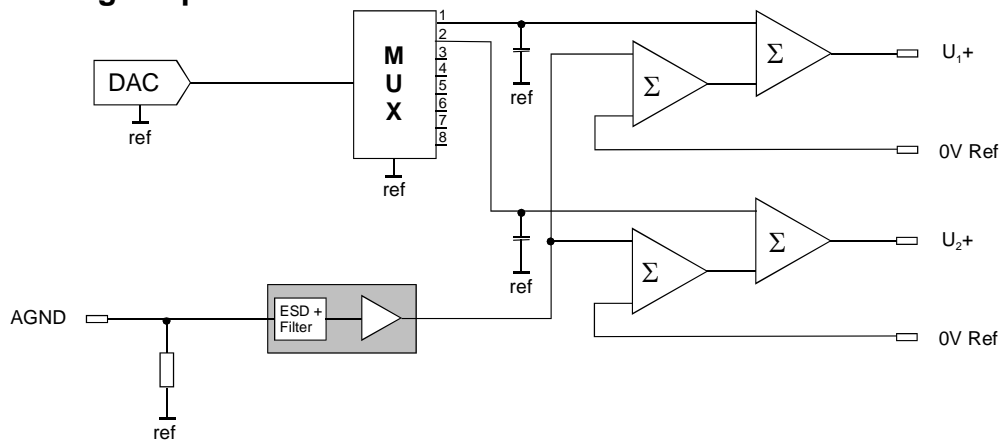


### Input Circuit AIO288 (Principle)

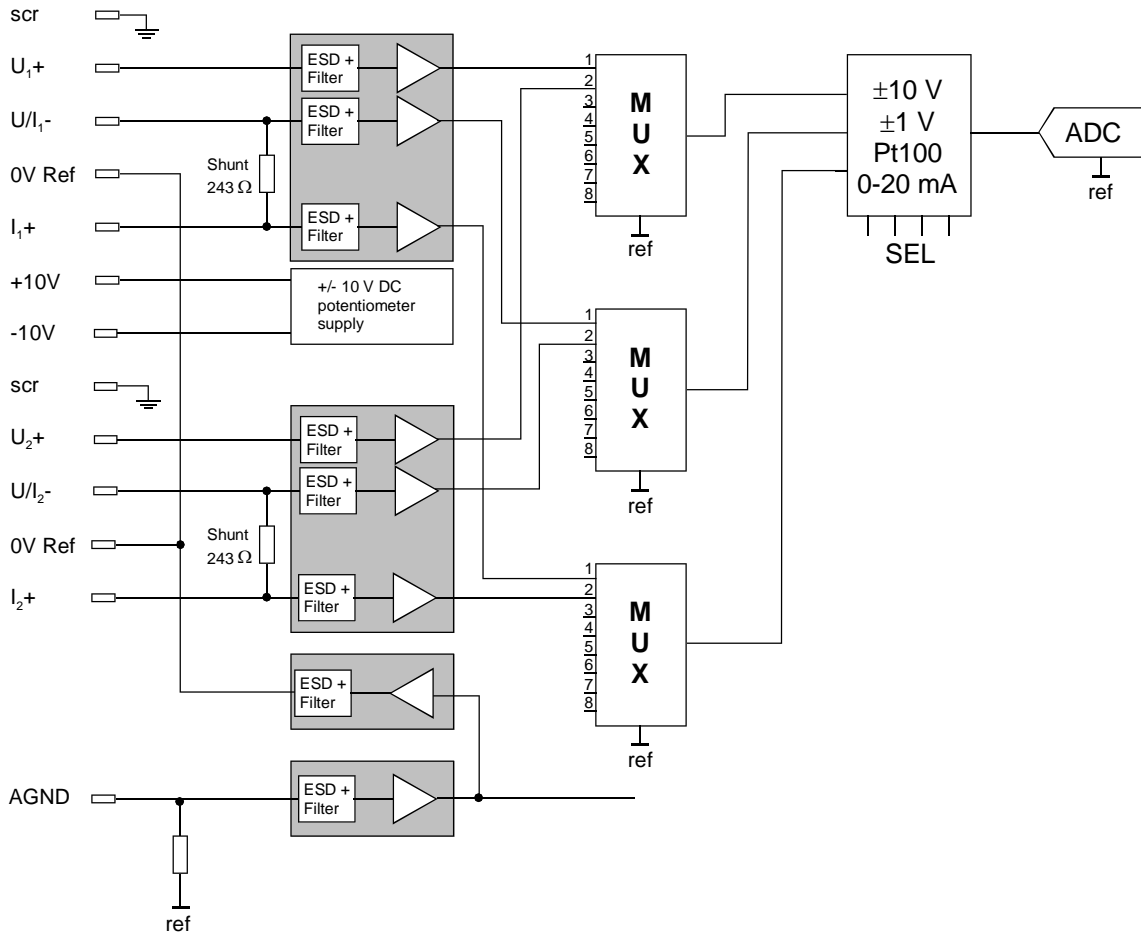


### Ground Wiring

#### Analog Outputs



### Analog Inputs



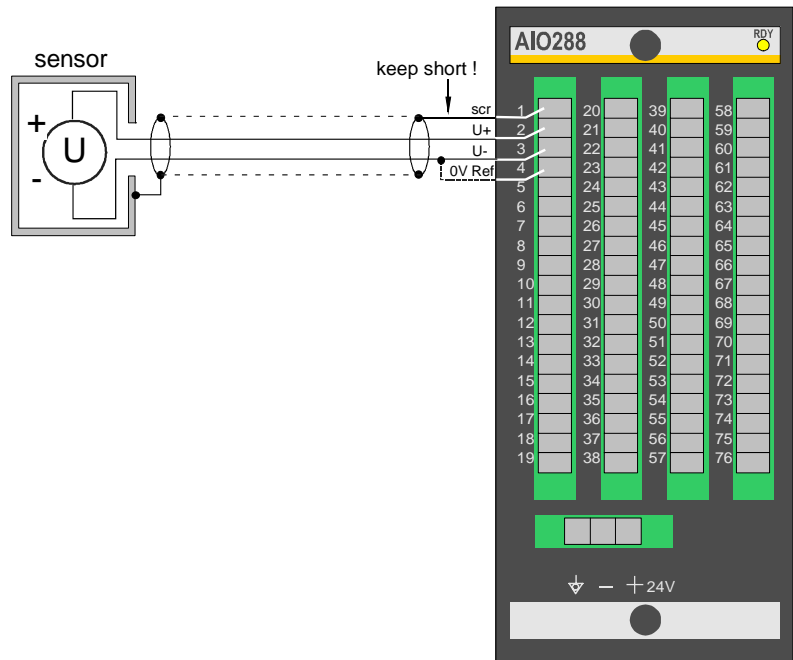
**remark:** The the non-isolated modules (AIO288/1), the reference ground (ref) is connected to the ground of the backplane and thus to the functional earthing. At the isolated modules (AIO288), the reference ground (ref) is connected to the ground of the backplane and to the functional earthing via a 5 MΩ high-voltage resistor.



**attention:** The terminals with the designation "0V Ref" of the inputs are not connected to the terminals with the designation "0V Ref" of the outputs and do not have the same potential.

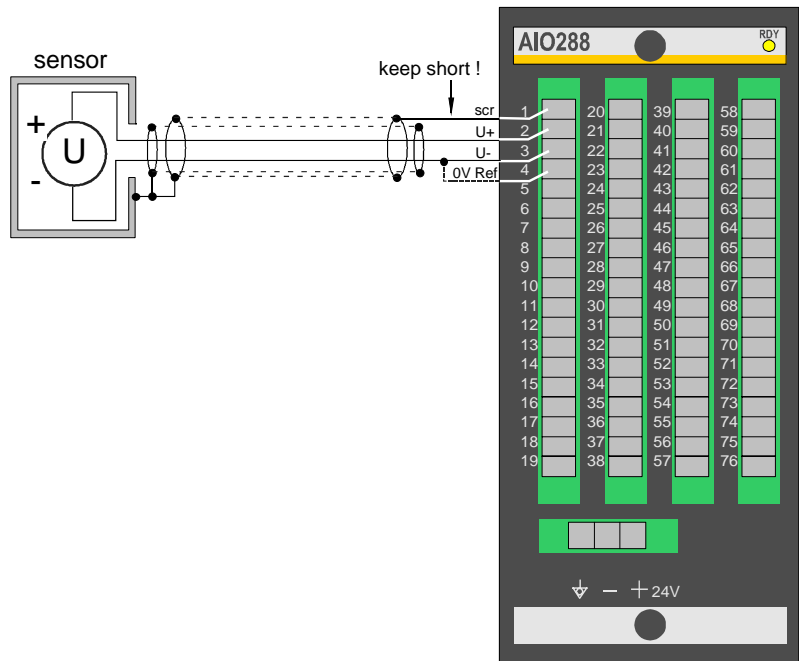
# Sensor with Voltage Output

## Differential



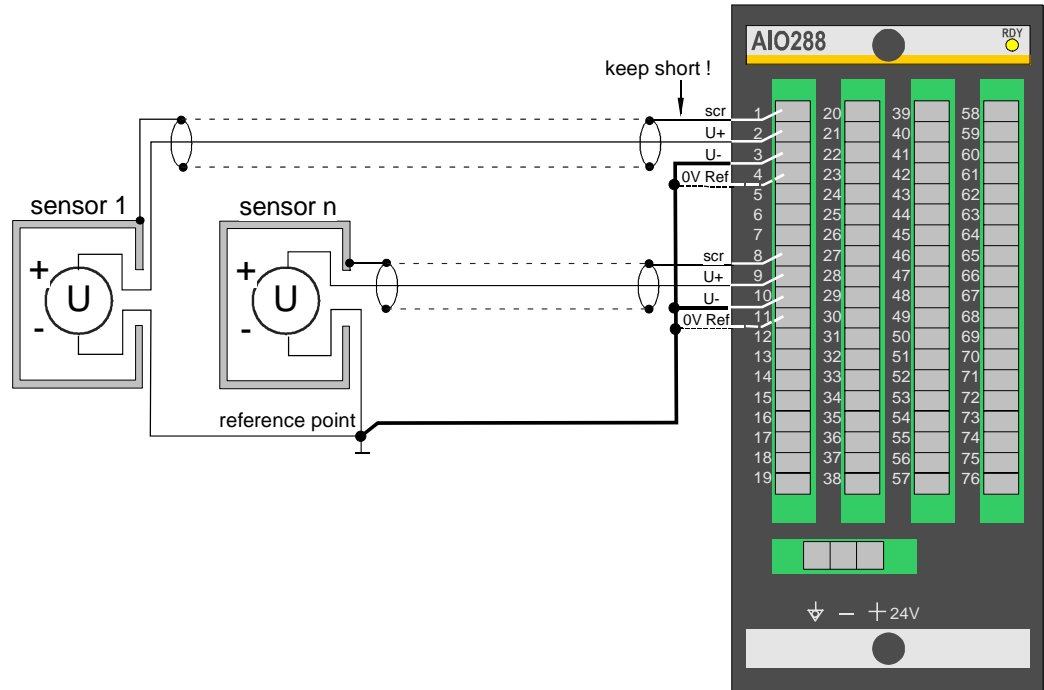
**remark:** When using galvanically separated sensors or floating potentials the clamps *U-* and *OVRef* must be connected.

## Differential, Double Shielded



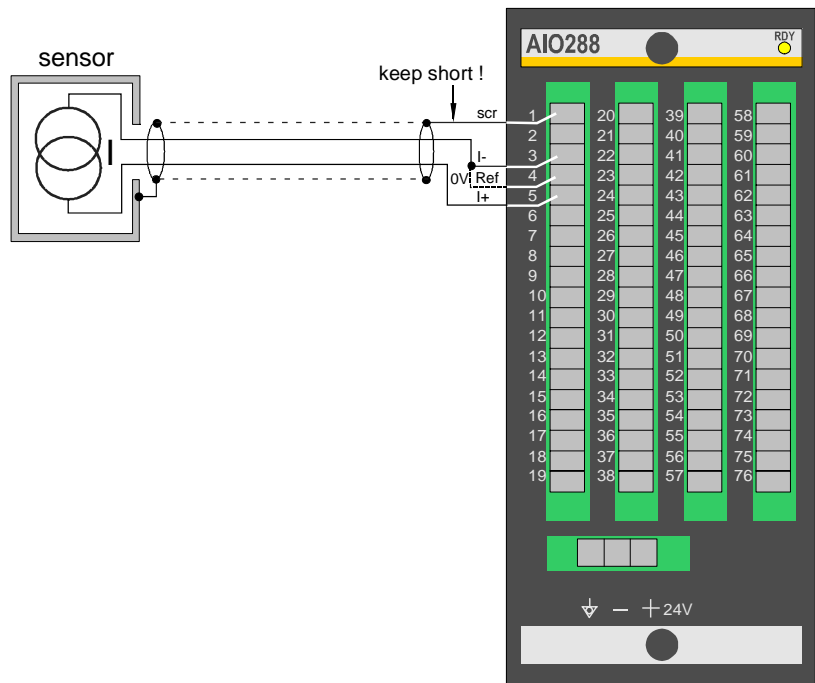
**remark:** When using galvanically separated sensors or floating potentials the clamps *U-* and *OVRef* must be connected.

### Single Ended



**remark:** When using galvanically separated sensors or floating potentials the clamps *U-* and *0VRef* must be connected.

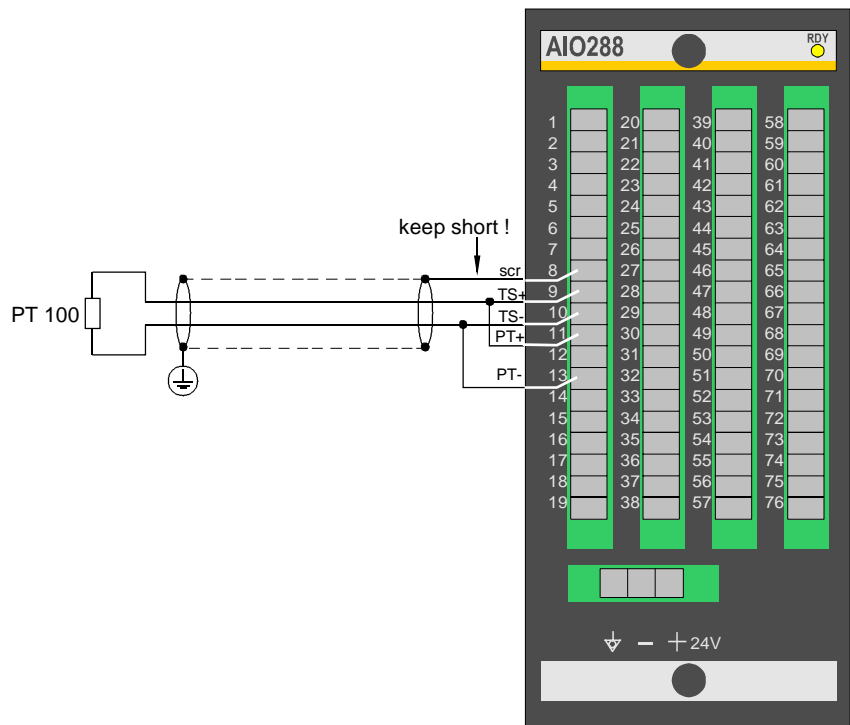
### Sensor with current output



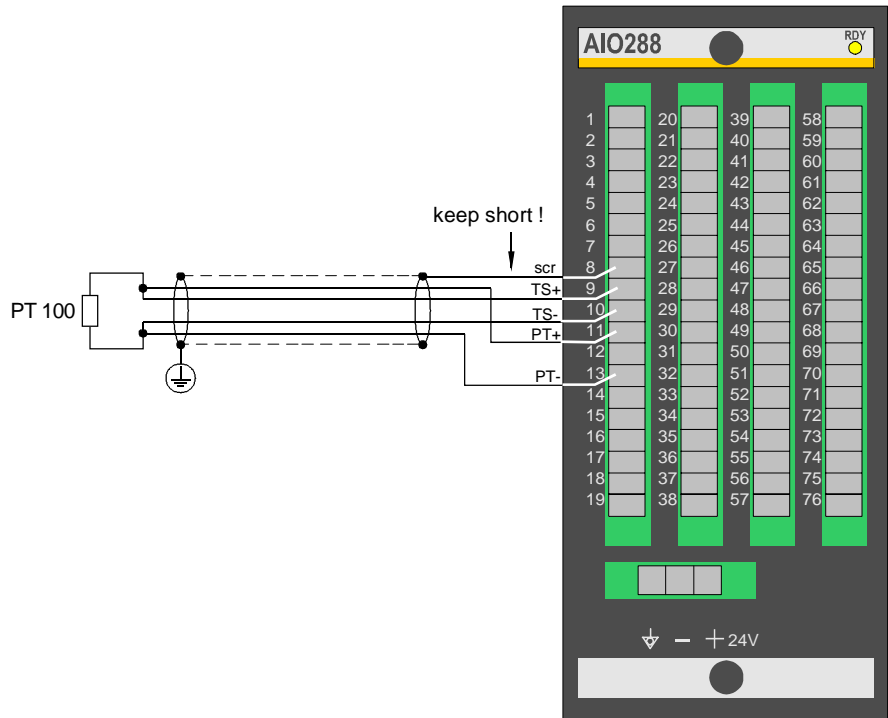
**remark:** When using galvanically separated sensors or floating potentials the clamps *U-* and *0VRef* must be connected.

# PT100 - Sensor

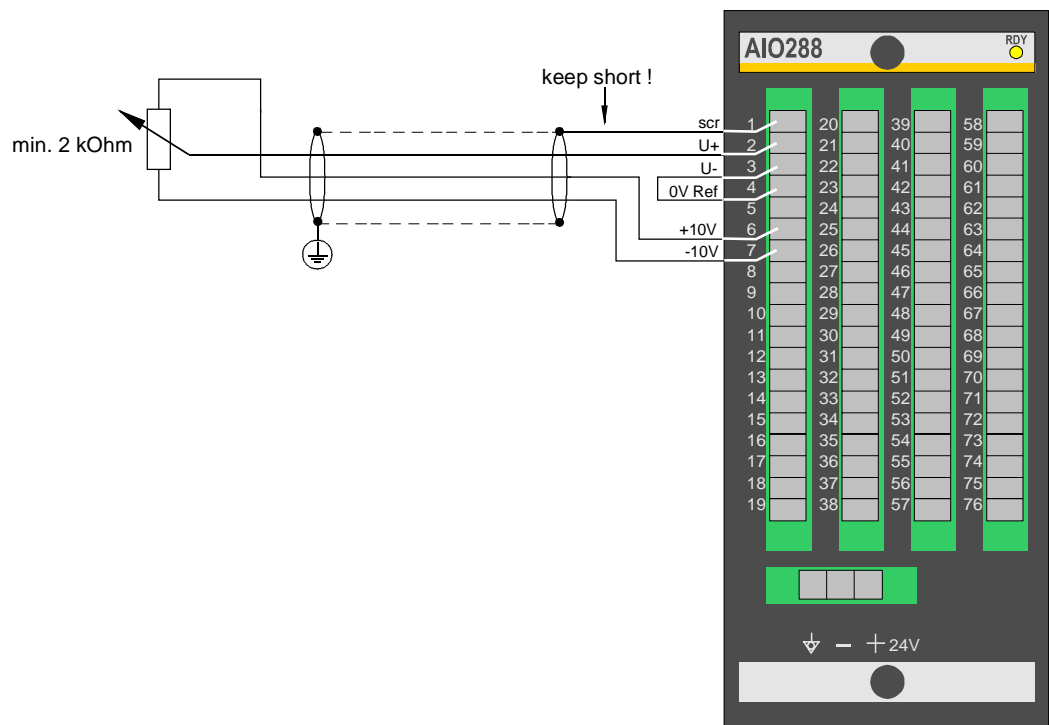
## 2 Wire Technology



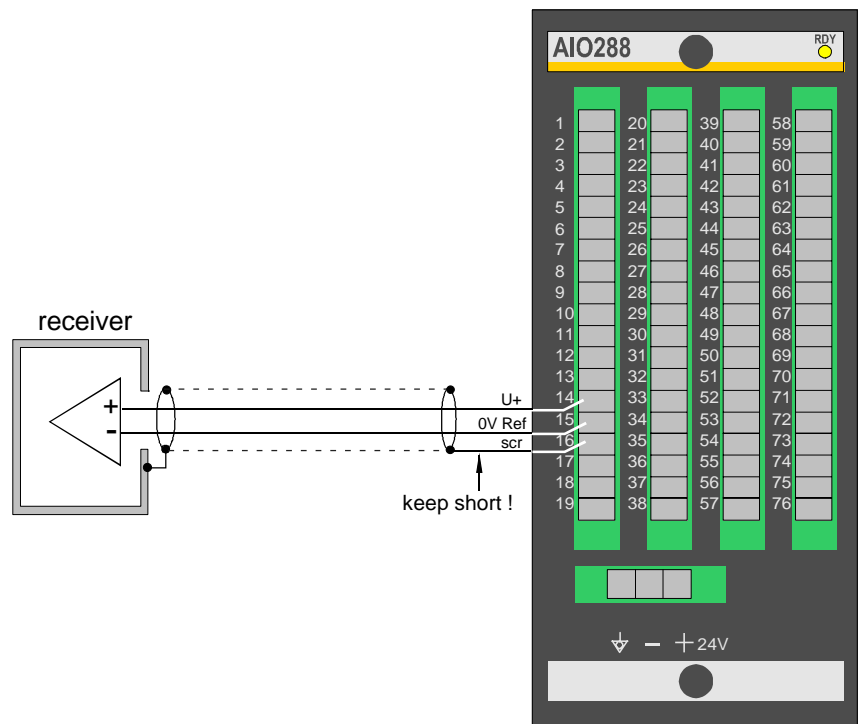
## 4 Wire Technology



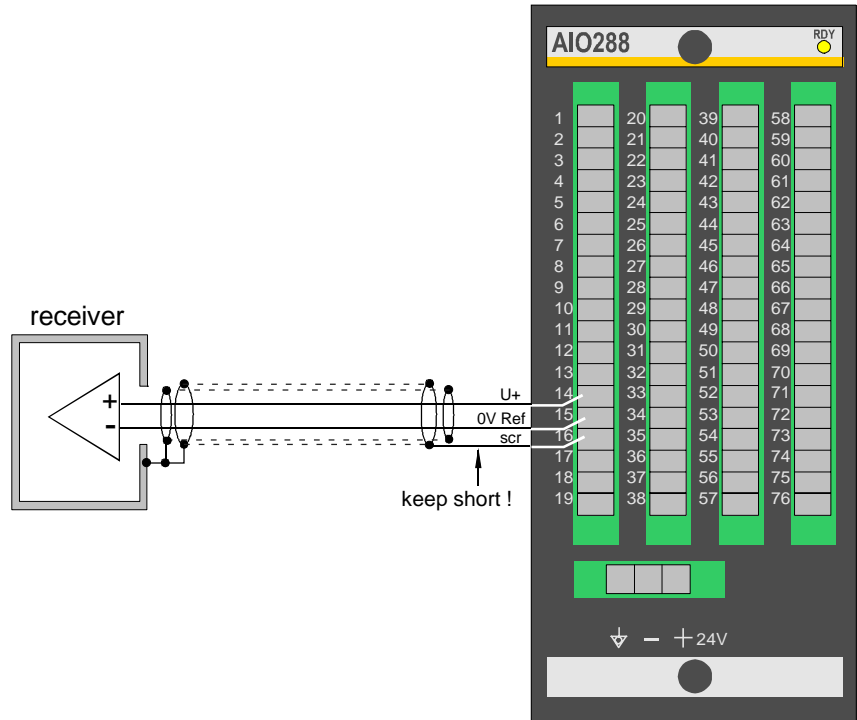
### Potentiometer



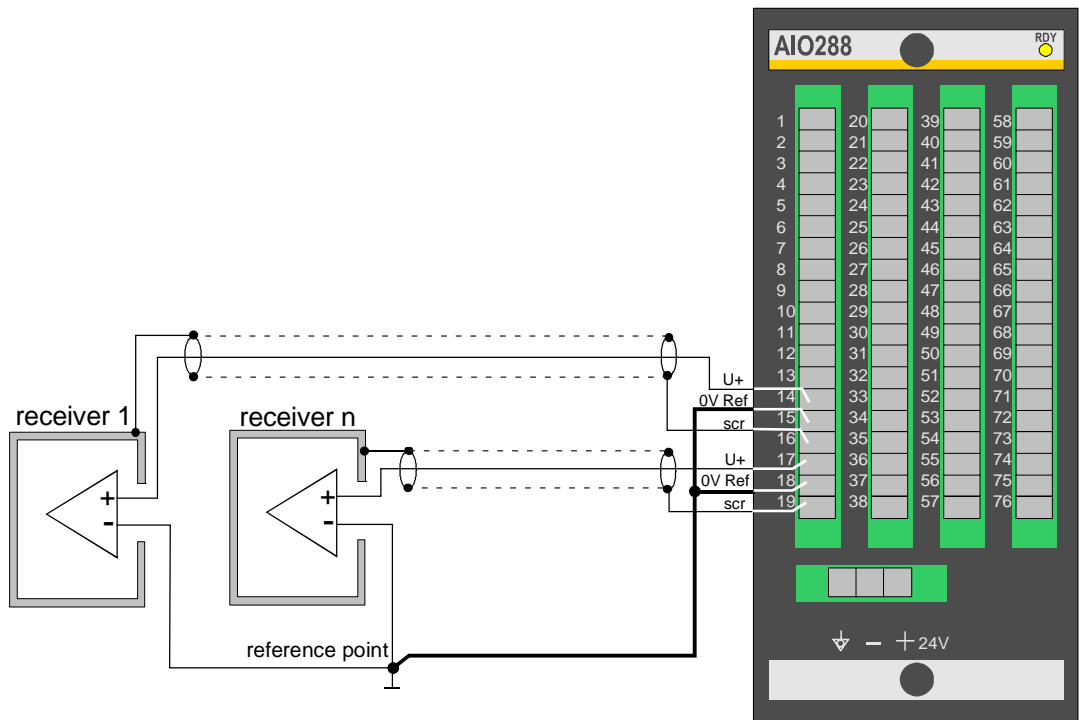
### Receiver with Voltage Input Differential



### Differential, Double Shielded

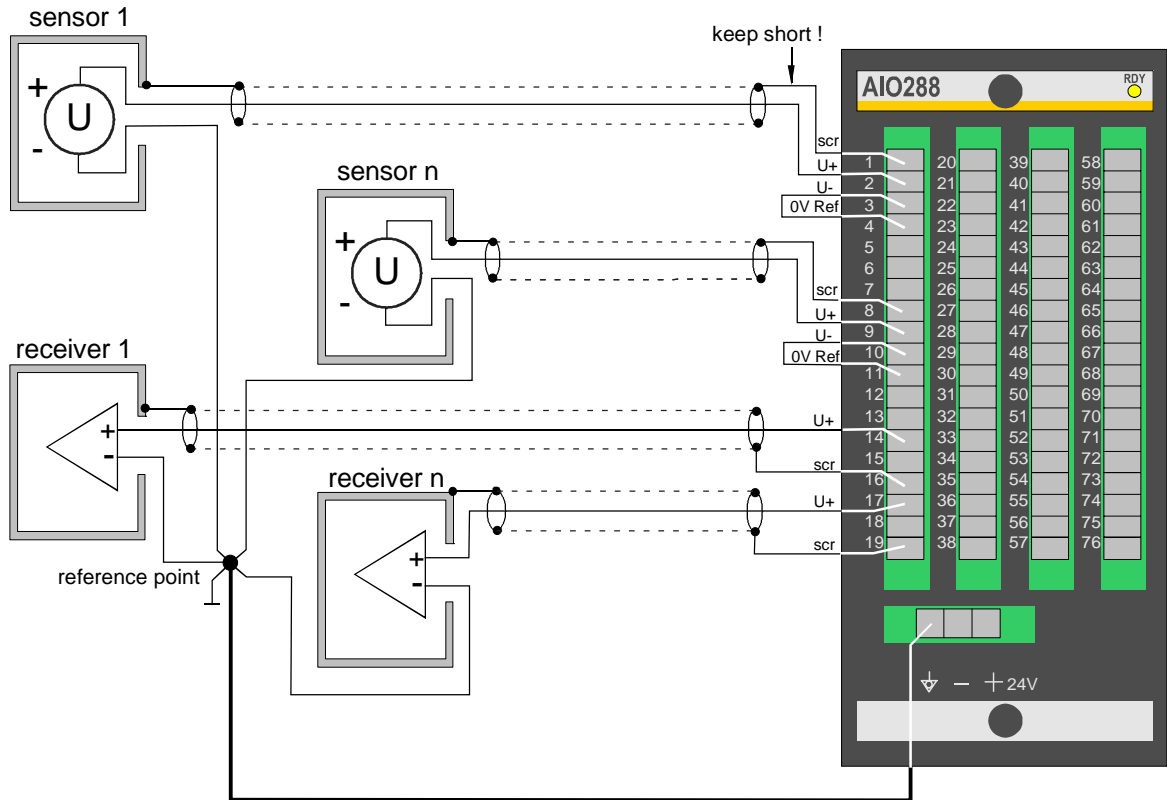


### Single Ended



## Receivers and Sensors with Voltage Inputs/Outputs

### Single Ended, with Reference to AGND



**remark:** All inputs and outputs must be wired in *single ended* mode if the AGND terminal is connected to one reference point.

Rittmeyer AG  
Grienbachstr. 39  
Postfach 2558  
CH-6302 Zug

Rittmeyer GmbH  
Postfach 1908  
DE-70709 Fellbach  
Raiffeisenplatz 6  
DE-70736 Fellbach

Rittmeyer Ges.m.b.H  
Walküregasse 11/2/1  
Postfach 73  
AT-1152 Wien

Rittmeyer Italiana s.r.l.  
Via Valbona 43  
IT-24010 Ponteranica (BG)

Rittmeyer S.A.  
Calle Julián Camarillo 26-3<sup>o</sup>  
Apartado 35145  
ES-28037 Madrid