Overview

Analog input/output modules

Input modules

Voltage values/ current values	Module ID	Page
±12.5 mV... 10 V ±20 mA or +4.... 20 mA	460-4 465-4	4/45 4/45
0... 1 V 0... 10 V 0... 20 mA or +4...20 mA	463-4	4/45
±1.25 V to ±10 V 0... 1.25 V to 0... 10 V +1... 5 V 0... 20 mA or 4... 20 mA ±20 mA	466-3	4/45

Output modules

Voltage values/ current values	Module ID	Page
±10 V... or 0... 20 mA ±10 V	470-UA 470-4UB	4/50 4/50
±1... 5 V ±4... 20 mA	470-4UC	4/50

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Analog input modules

Application

The analog input modules convert the analog signals from the process into digital values, which can be processed by the programmable controller.

Application of analog input modules:

- Process monitoring
- Measuring physical quantities, e.g. in mechanical engineering, process engineering, building services automation
- Control engineering

Design

Analog input modules with 16, 8 and 4 inputs are available. The modules require one slot.

Front connectors are used for terminating the signal cables. Modules and front connectors may be inserted and removed under power (except for the 466 input module).

Adhesive labels are supplied to identify modules and front connectors.

460 input module:

- Eight floating channels
- Sequential measured value acquisition by means of optovoltaic multiplexer
- Measuring range selection by means of measuring range modules
- Direct acquisition of thermocouple voltages
- Direct four-wire connection of resistance-type sensors, e.g. Pt 100
- Power supply from L+, L-
- Use in large plants/machines with high common-mode voltages
- For closed-loop control applications with time constant ranging from seconds to infinity

463 input module:

- Four individually isolated channels
- Simultaneous scanning of all channels within $16^2/_3$ or 20 ms (50 or 60 Hz)
- Measuring range selection via jumpers in the front connector
- Acquisition of transducer signals
- For fast, noise-immune measured value acquisition even under unfavourable potential conditions
- For closed-loop control applications where speed is a critical factor (time constants >20 ms)

Analog input modules (continued)

Design (continued)

465 input module:
- 16 non-floating channels
- Sequential measured value acquisition with semiconductor multiplexers
- Measuring range selection by means of measuring range modules
- Direct acquisition of thermocouple voltages
- Direct four-wire connection of resistance-type sensors, e.g. Pt 100
- Use in small-scale plants/machines where potential conditions are not a critical factor

Common features of the 460, 463 and 465 input modules:
- Integrating analog-digital conversion with a high degree of noise suppression at 50 (60) Hz and suppression of harmonics
- Enable input and input signals can be disabled
- The 460-4 input modules require two 498 measuring range modules
- The 465-4 input modules require two or four 498 measuring range modules, depending on whether up to 8 inputs or more than 8 inputs are used

466 input module:
- Eight differential or 16 individual channels (floating)
- Instantaneous value coding
- Measuring range selection through fixed wiring at the front connector
- For closed-loop control applications where speed is a critical factor (time constant >4 ms)

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Technical specifications

Analog input module	6ES5 460-4UA13	6ES5 465-4UA13[2)]	6ES5 463-4U.12
Number of inputs	**8** voltage/current inputs or **8** inputs for Pt 100 resistance thermometers	**16** voltage/current inputs or **8** inputs for Pt 100 resistance thermometers	**4** voltage/current inputs
Galvanic isolation	Yes	No	Yes
Input ranges (rated value)	± **12.5 mV** (for 460-4 only); ± **50 mV**; ± **500 mV**; **Pt 100**; ± **1 V**; ± **5 V**; ± **10 V**; ± **20 mA**; **+ 4 ... 20 mA** Input range can be selected for 4 channels at a time, using measuring range modules		**0 ... 1 V, 0 ... 10 V, 0 ... 20 mA + 4 ... 20 mA** for two-wire transducers and four-wire transducers
Input resistance in the individual ranges	12.5 mV: ≧ 10 MΩ 50 mV: ≧ 10 MΩ 500 mV: ≧ 10 MΩ	Pt 100: ≧ 10 MΩ 1 V: 90 kΩ; 2 ‰ 5 V: 50 kΩ 2 ‰	10 V: 50 kΩ; 2 ‰ 20 mA: 25 kΩ; 1 ‰ 4 ... 20 mA: 31.25 Ω; 1 ‰	1V: ≧ 10 MΩ; 10 V: 90 kΩ; 20 mA: 50 Ω 4 ... 20 ,A: 62.5 Ω;
Types of connection for signal sensors	Two-wire connection; four-wire connections for Pt 100			Two-wire connection
Digital representation of the input signal	12 bit plus sign or 13 bit two's complement (2048 units = rated value)			12 bit two's complement (1024 units = rated value)
Measuring principle	Integrating			Integrating
Conversion principle	Voltage-time conversion			Voltage-frequency conversion
Integration time (selectable for optimum noise suppression)	20 ms at 50 Hz 16 $^2/_3$ ms at 60 Hz			20 ms at 50 Hz 16 $^2/_3$ ms at 60 Hz
Encoding time per channel max.	60 ms at 50 Hz based on rated value 50 ms at 60 Hz based on rated value			20 ms at 50 Hz 16 $^2/_3$ ms at 60 Hz
Cycle time for 4 inputs	—	—		20 ms at 50 Hz 16 $^2/_3$ ms at 60 Hz
8 inputs	0.48 s at 50 Hz	0.48 s at 50 Hz		—
16 inputs	—	0.96 s at 50 Hz		—
Permissible voltage between inputs or between inputs and the central grounding point (destruction limit) max.	± 18 V or max. ± 75 V for 1 ms with a pulse repeat rate of 50 pulses/second			± 30 V or ± 75 V for 1 ms with a pulse repeat rate of 100 pulses/second
Permissible voltage between the reference potential of a non-floating sensor and the central grounding point max.	75 V DC/60 V AC	± 1 V		75 V DC/60 V AC

Analog input modules (continued)

Technical specifications (continued)

Analog input module	6ES5 460-4UA13	6ES5 465-4UA13[2]	6ES5 463-4U.12
Fault indication for			
• Overranging	At 200 % of rated value (4095 units)		At 150 % of rated value
• Wire breakage of sensor line	Can be designed for the range 50 mV, 500 mV and Pt 100		No
Noise suppression for f = n · (50/60 Hz ± 1 %) n = 1,2 ...			
• Common mode noise (V_p < 1 V) min.	100 dB	86 dB	80 dB
• Series mode noise max. (peak noise value < rated value of the range)	40 dB	40 dB	40 dB
Basic error limits[1] (at 20 °C)	12.5 mV: ± 2 ‰ Pt 100: ± 2 ‰ 10 V: ± 3.5 ‰ 50 mV: ± 2 ‰ 1 V: ± 3,5 ‰ 20 mA: ± 2.5 ‰ 500 mV: ± 1.5 ‰ 5 V: ± 3.5 ‰ 4 ... 20 mA: ± 2.5 ‰		1.1 ‰
Operational error limits[1] (at 0 °C to 60 °C; for one year)	12.5 mV: ± 6 ‰ Pt 100: ± 5 ‰ 10 V: ± 7.7 ‰ 50 mV: ± 5 ‰ 1 V: ± 7.7 ‰ 20 mA: ± 6.7 ‰ 500 mV: ± 4.5 ‰ 5 V: ± 7.7 ‰ 4 ... 20 mA: ± 6.7 ‰		3.7 ‰
Cable length (shielded) max.	200 m (656 ft); 50 m (164 ft) up to 50 mV	200 m (656 ft); 50 m (164 ft) up to 50 mV	200 m (656 ft)
Enable inputs (as with analog outputs)	+ 24 V	+ 24 V	+ 24 V
Supply voltage (as with analog outputs)	+ 24 V	+ 24 V	+ 24 V
Constant current source for Pt 100	2.5 mA	2.5 mA	—
Current consumption			
• Internal (at 5 V) typ.	0.13 A	0.15 A	0.2 A
• External (at 24 V) typ.	0.15 A	0.15 A	0.15 A
Power loss max.	3.5 W	1.5 W	5.0 W
Space requirements	1 slot		1 slot
Front connector	42-pin		42-pin
Weight approx.	0.4 kg (0.88 lb)		0.4 kg (0.88 lb)

Analog input module	6ES5 466-3LA11
Number of inputs	**8** differential inputs or **16** individual inputs (referred to ground) in 4 or 2 groups (selectable)
Galvanic isolation	Yes
Input ranges (rated values)	**0 ... 20 mA; 4 ... 20mA; ± 20 mA** **0 ... 1.25 V; 0 ... 2.5 V; 0 ... 5 V; 1 ... 5 V; 0 ... 10V** **± 1.25 V; ± 2.5 V; ± 5 V; ± 10 V;** } Selector switch lets you select these values for 4 channels separately
Input resistance in the individual ranges	Voltage measuring range: ≥ 10 MΩ Current measuring range: 125 Ω
Types of conn. for signal sensors	Two-wire connection
Digital repres. of the input signal	13 bit two's complement or 12 bit abs. value + sign or 12 bit binary
Measuring principle	Instantaneous value encoding
Conversion principle	Successive approximation
Encoding time per channel max.	250 µs
Cycle time for	
• 8 inputs max.	2 ms
• 16 inputs max.	4 ms
Permissible voltage between inputs or between inputs and central grounding point max.	± 30 V (static) or ± 75 V for 1 ms with a pulse repeat rate of 50 pulses/second
Permissible voltage between the reference potential of a non-floating sensor and the central grounding point max.	75 V DC/60 V AC

1) In accordance with DIN 43 745; referred to nominal measuring range (5 V supply from power supply chassis).
2) A filter (SIFI C, B84113-C-B30 or equivalent) is required in the 24 V DC load power supply for the module.

Analog input modules (continued)

Technical specifications (continued)

Analog input module	6ES5 466-3LA11 (continued)	
Fault indication for		
• Overranging	Yes (overflow bit)	
• Wire breakage of sensor line	No	
Noise suppression for f = n · (50/60 Hz ± 1 %); n = 1,2 ...		
• Common mode noise (V_p < 1 V) min	70 dB	
• Series mode noise (peak noise value < value of the range) min.	40 dB	
Basic error limits[1] (at 20 °C)	Voltage ranges (except 0 ... 1.25 V; ± 1.25 V): Current ranges and 0 ... 1.25 V; ± 1.25 V:	0.1 % 0.2 %
Operational error limits[1] (at 0 to 60 °C; for one year)	Voltage ranges (except 0 ... 1.25 V; ± 1.25 V): Current ranges and 0 ... 1.25 V; ± 1.25 V:	0.2 % 0.4 %
Cable length (shielded) max.	200 m (656 ft)	
Enable inputs (as with analog outputs)	—	
Supply voltage (as with analog outputs)	—	
Constant current source for Pt 100	—	
Current consumption		
• Internal (at 5 V) typ.	0.7 A	
• External (at 24 V) typ.	—	
Power loss max.	3.5 W	
Space requirements	1 slot	
Front connector	43-pin	
Weight approx.	0.4 kg (0.88 lb)	

1) In accordance with DIN 43 745; referred to nominal measuring range (5 V supply from power supply chassis).

Ordering data

	Order No.
460-4 analog input module 8 inputs, signal range set via measuring range module (two 498 measuring range modules are required); floating	**6ES5 460-4UA13**
465-4 analog input module 16 inputs (8 with Pt 100), signal range set via measuring range module (two or four 498 measuring range modules are required); non-floating	**6ES5 465-4UA13**
498 measuring range module for 460-4 and 465-4 analog input modules; four channels each	
±12.5 mV, ± 50 mV, ± 500 mV, Pt100	**6ES5 498-1AA11**
± 1 V	**6ES5 498-1AA21**
± 5 V	**6ES5 498-1AA61**
± 10 V	**6ES5 498-1AA31**
± 20 V	**6ES5 498-1AA41**
+ 4 ... 20 mA; for two-wire transducer	**6ES5 498-1AA51**
+ 4 ... 20 mA; for four-wire transducer	**6ES5 498-1AA71**

	Order No.
463-4 analog input module 4 inputs, floating	
For 50 Hz power systems	**6ES5 463-4UA12**
For 60 Hz power systems	**6ES5 463-4UB12**
466-3 analog input module 16 inputs, floating The operating instructions are included in the S5-135U/155U system manual (see page 4/155).	**6ES5 466-3LA11**
497 front connector for 460, 463, 465 analog input modules	
Crimp terminals, single-width, 42-pin	**6ES5 497-4UA12**
Crimp terminals, double-width, 42-pin	**6ES5 497-4UA22**
Screw terminals, single-width, 42-pin	**6ES5 497-4UB31**
Screw terminals, double-width, 42-pin	**6ES5 497-4UB12**
Front connector for 466 analog input module	
Crimp terminals, single-width, 43-pin	**6XX3 068**
Screw terminals, single-width, 43-pin	**6XX3 081**

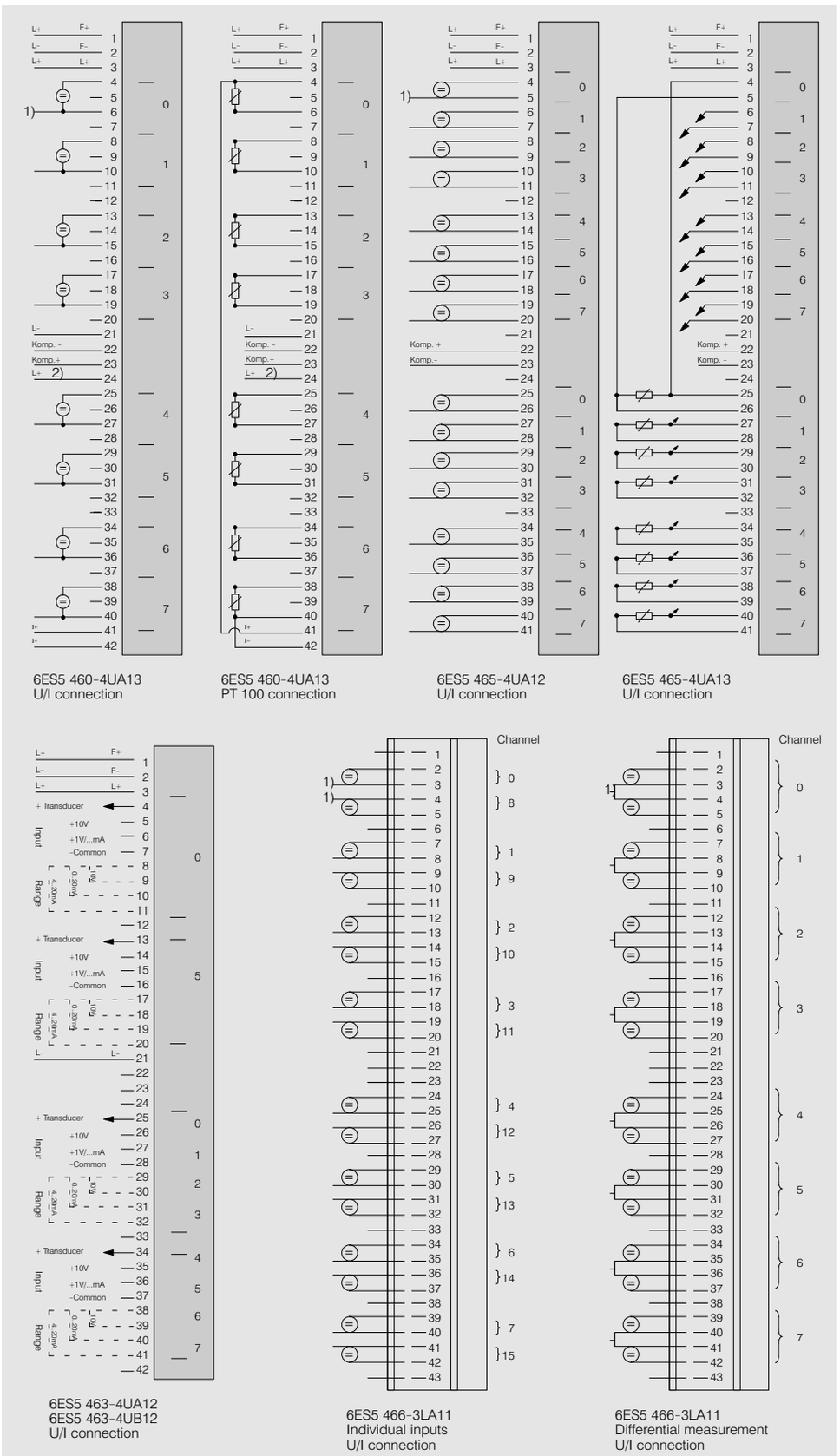

Fig. 4/26 Connection diagrams for analog input modules

1) Connection to the central grounding point of the system (see under technical specifications)
2) Only for disconnecting the test current if wire breakage monitoring is not activated

Analog output modules

Application

The analog output modules convert the digital values from the programmable controller into analog signals required by the process.

Design

Three analog output modules are available with eight outputs each and a range of output voltages. The modules require one slot.

Front connectors are used for terminating the signal cables. Modules and front connectors may be inserted and removed under power.

Adhesive labels are supplied for identifying modules and front connectors.

Principle of operation

Enaple input

The enable input can be used to disable the output of new values. The last output value is retained. The enable input can be deactivated by removing the respective jumper on the module.

Technical specifications

Number of outputs		**8** voltage and current outputs
Galvanic isolation		Yes (not between the outputs)
Output ranges		
(rated values)		
• 6ES5 470-4UA12		**± 10 V; 0 ... 20 mA**
• 6ES5 470-4UB12		**± 10 V**
• 6ES5 470-4UC12		**+ 1 ... 5 V; + 4 ... 20mA**
Load resistance		Purely ohmic
• For voltage outputs	min.	3.3 kΩ
• For current outputs	max.	300 Ω
Load connection		To the M_{analog} terminal
Digital representation of the output signal		12 bit two's complement (1024 units = rated value)
Permissible overload capability	approx.	25 % (up to 1280 units)
Conversion time		1 ms
Short-circuit protection		Yes
Short-circuit current	approx.	25 mA (for a voltage output)
Open-circuit voltage	max.	18 V (for a current output)
Voltage between the reference potential of the load (M_{analog} connection) and the casing	max.	60 V AC/75 V DC
Basic error limits[1] (at 20 °C)		± 2 ‰ ± 2 units
Operational error limits (0 to 60 °C; for one year)		± 6 ‰
Cable length (shielded)	max.	200 m (656 ft)

Enable input F		
Input voltage		
• Rated value		24 V DC
• Enable		+ 13 ... 33 V
• Disable		- 33 ... + 5 V
Input current (for enable)	typ. typ.	5 mA
Cable length (unshielded)	max.	200 m (656 ft)
Supply voltage V_{pos}		
• Rated value		24 V DC
• Ripple V_{pp} (referred to rated voltage)		15 %
• Permissible range (including ripple)		20 ... 30 V
• Value at t < 0.1 s	max.	36 V
Current consumption		
• Internal (at 5 V)	typ.	0.25 A
• External (at 24 V)	typ.	0.3 A
Space requirements		1 slot
Power loss	max. max.	9.0 W
Front connector		42-pin
Weight	approx.	0.4 kg (0.88 lb)

1) In accordance with DIN 43 745; referred to nominal measuring range (5 V supply from power supply chassis)
2) A filter (SIFI C, B84113-C-B30 or equivalent) is required in the 24 V DC load power supply for the module.

Analog output modules (continued)

Ordering data	Order No.		Order No.
470-4UA analog output module 8 outputs, ± 10 V, 0 ... 20 mA; floating	**6ES5 470-4UA13**	**497 front connector** Crimp terminals, single-width, 42-pin	**6ES5 497-4UA12**
470-4UB analog output module[2)] 8 outputs, ± 10 V, floating	**6ES5 470-4UB13**	Crimp terminals, double-width, 42-pin	**6ES5 497-4UA22**
470-4UC analog output module 8 outputs, + 1 ... 5 V, + 4 ... 20 mA; floating	**6ES5 470-4UC13**	Screw terminals, single-width, 42-pin	**6ES5 497-4UB31**
The operating instructions are included in the S5-135U/155U system manual (see page 4/155).		Screw terminals, double-width, 42-pin	**6ES5 497-4UB12**

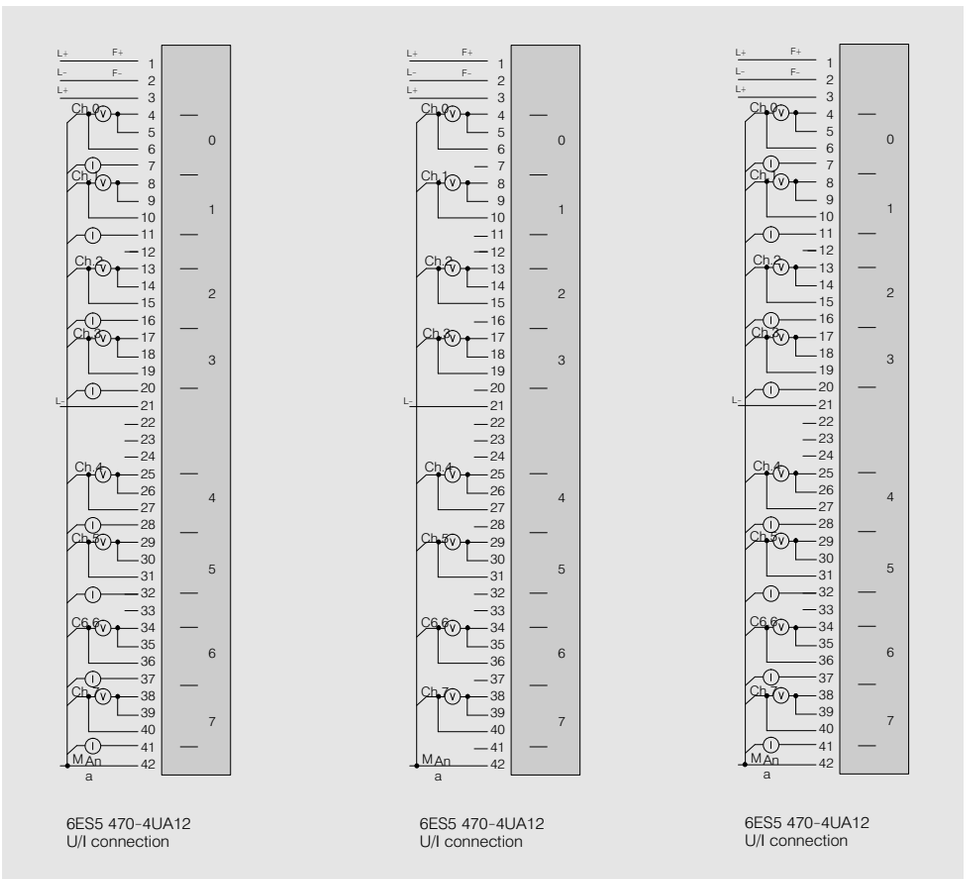

Fig. 4/27 Connection diagrams for analog output modules