MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Reference package for procurement and maintenance review

SIEMENS

6ES7144-5KD00-0BA0

FOUR-CHANNEL ANALOG INPUT MODULE

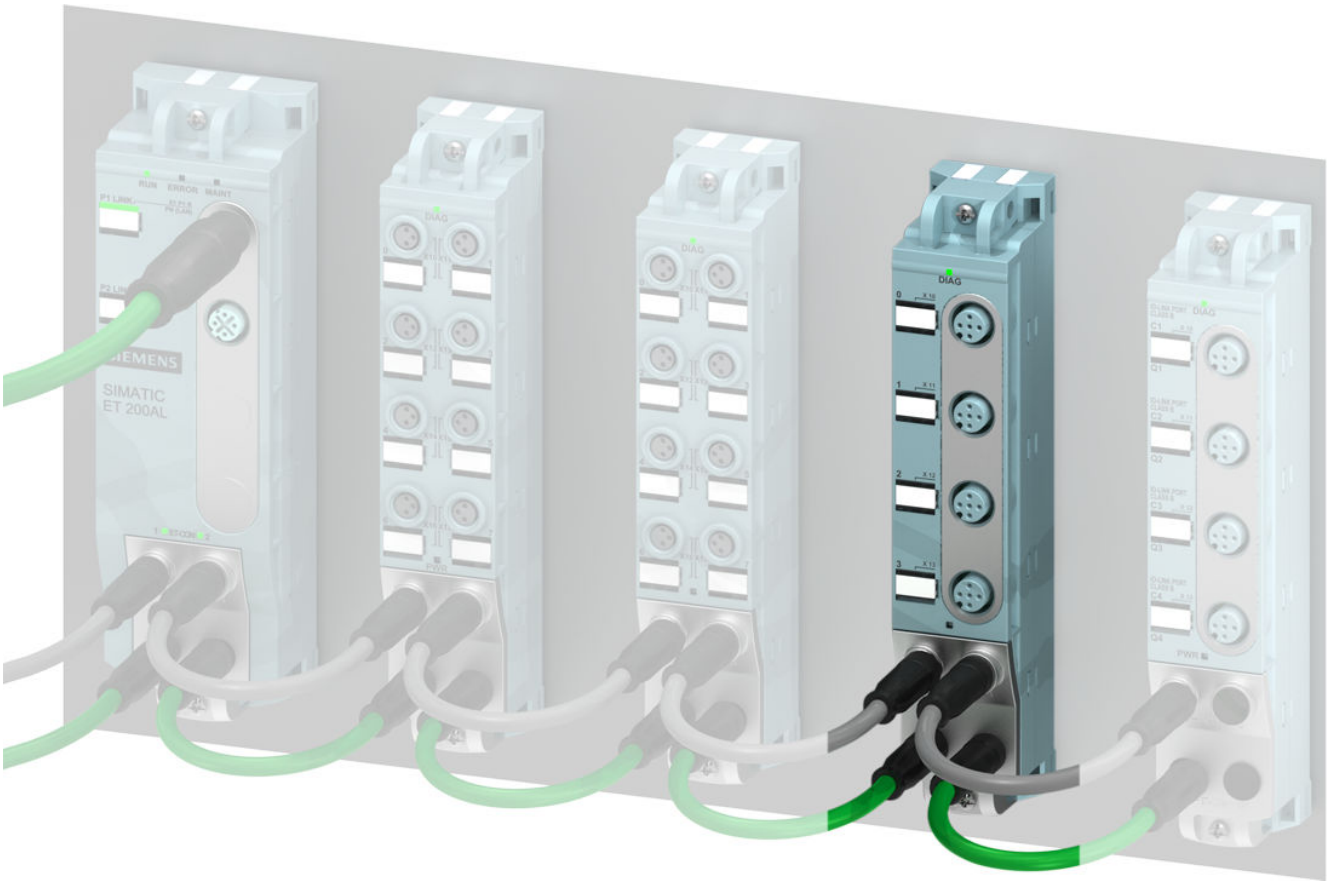
Used with the applicable SIMATIC ET 200AL configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: Siemens 6ES7144-5KD00-0BA0 official product data; applicable specification pages.



Edition 10/2024

SYSTEM MANUAL

SIMATIC

ET200AL

Analog input module AI 4xU/I/RTD 4xM12
6ES7144-5KD00-0BA0

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SIMATIC

ET 200AL
Analog input module
AI 4xU/I/RTD 4xM12
(6ES7144-5KD00-0BA0)

Equipment Manual

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Product overview

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3.1 Properties

Article number

6ES7144-5KD00-0BA0

View of the module

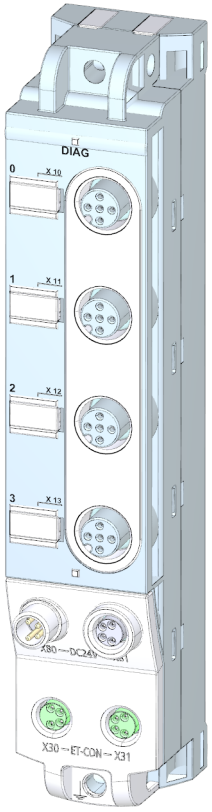


Figure 3-1 View of the analog input module AI 4xU/I/RTD 4xM12

Properties

The module has the following technical properties:

- 4 analog inputs
- M12 sockets for connection of sensors
- Measurement type can be set for each channel:
  - Voltage
  - Current (2-/4-wire transducers)
  - Resistance (2-/3-wire connection)
  - Resistance thermometer (RTD) (2-/3-wire connection)
- Resolution 16-bit
- Dimensions 30 x 159 mm
- Configurable diagnostics can be set for each channel
- Hardware interrupt on limit violation can be set per channel (two high and two low limits per channel)

The module supports the following functions:

- Firmware update
- Identification and maintenance data I&M0 to I&M3
- Value status (Quality Information)
- PROFIenergy

NOTE

Process values during startup

As long as no parameters have been received by the I/O module, the I/O module returns the process value $7FFF_H$.

Accessories

The following components are included in the module package:

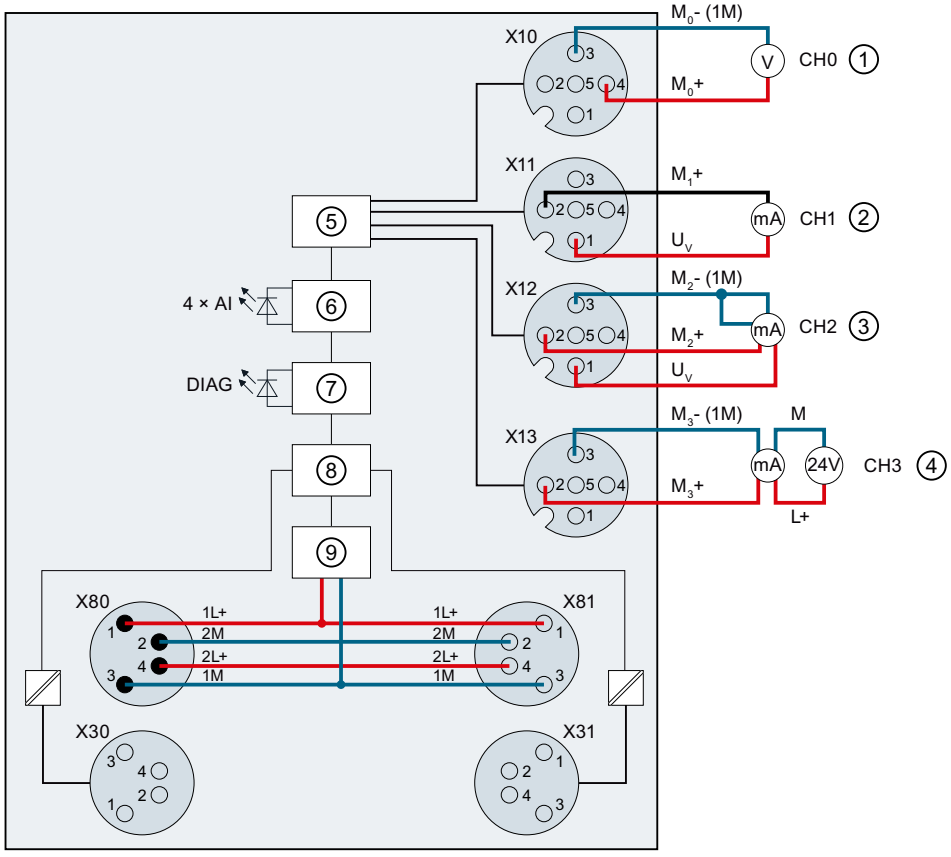
- Identification labels
- Spacers

Wiring

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4.1 Terminal and block diagram

The figure below shows an example of the pin assignment for voltage measurement and current measurement.



①	Voltage measurement	X30	Infeed of the ET-Connection
②	Current measurement (2 DMU)	X31	Loop-through of the ET-Connection
③	Current measurement (4 DMU, with internal power supply)	1L+	Supply voltage 1L+ (non-switched)
④	Current measurement (4 DMU, with external power supply)	1M	Ground 1M (non-switched)
⑤	Multiplexer	2L+	Load voltage 2L+ (switched)
⑥	Analog-to-digital converter (ADC)	2M	Ground 2M (switched)
⑦	Microcontroller	M_n+	Measuring input positive, channel n
⑧	ET-Connection interface	M_n-	Measuring input negative, channel n
⑨	Internal supply voltage	U_V	24 V encoder supply
X10 to X13	Channels 0 to 3	AI	LEDs channel status (0, 1, 2 and 3) (green)
X80	Infeed of supply voltages	DIAG	LED diagnostic status (red/green)
X81	Loop-through of supply voltages		

Figure 4-1 Terminal and block diagram for voltage and current measurement

4.2 Pin assignment

NOTE

Color coding

The sockets for ET-Connection and the power supply of the modules are color-coded. These colors correspond to the colors of the offered cables.

Pin assignment of the sockets for analog inputs

The tables below show the pin assignments of the four sockets for connection of the analog inputs.

Table 4-1 Pin assignment of the sockets for analog inputs (voltage measurement)

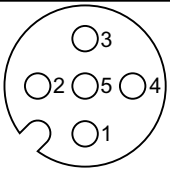
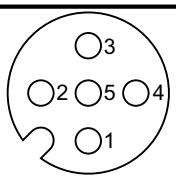
Pin	Assignment **X10 to X13 - sockets for analog inputs (voltage measurement)**	Front view of the sockets
1	24 V encoder supply $1U_S$ (derived from 1L+ non-switched)	
2	Reserved	
3	Encoder supply ground 1M	
4	Measuring input M_0+: Connector X10 Measuring input M_1+: Connector X11 Measuring input M_2+: Connector X12 Measuring input M_3+: Connector X13	
5	Functional earth FE	
Shield	Functional earth FE	

Table 4-2 Pin assignment of the sockets for analog inputs (current measurement)

Pin	Assignment **X10 to X13 sockets for analog inputs (current measurement)**	Front view of the sockets
1	24 V encoder supply $1U_S$ (derived from 1L+ non-switched)	
2	Measuring input M_0+: Connector X10 Measuring input M_1+: Connector X11 Measuring input M_2+: Connector X12 Measuring input M_3+: Connector X13	
3	Encoder supply ground 1M	
4	Reserved	
5	Functional earth FE	
Shield	Functional earth FE	

NOTICE

Short-circuit from encoder supply to measuring input

In the operating mode current measurement a short-circuit from the encoder supply to the measuring input can destroy the input channel.

Table 4-3 Pin assignment of the sockets for analog inputs (RTD/R 2-wire connection)

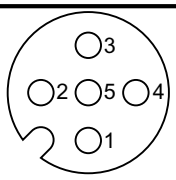
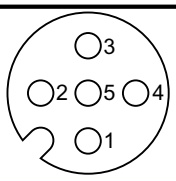
Pin	Assignment **X10 to X13 sockets for analog inputs (RTD/R 2-wire connection)**	Front view of the sockets
1	Measurement cable Ic_0+, M_0+: Connector X10 Measurement cable Ic_1+, M_1+: Connector X11 Measurement cable Ic_2+, M_2+: Connector X12 Measurement cable Ic_3+, M_3+: Connector X13	
2	Reserved	
3	Measurement cable Ic_0-, M_0-: Connector X10 Measurement cable Ic_1-, M_1-: Connector X11 Measurement cable Ic_2-, M_2-: Connector X12 Measurement cable Ic_3-, M_3-: Connector X13	
4	Reserved	
5	Functional earth FE	
Shield	Functional earth FE	

Table 4-4 Pin assignment of the sockets for analog inputs (RTD/R 3-wire connection)

Pin	Assignment **X10 to X13 sockets for analog inputs (RTD/R 3-wire connection)**	Front view of the sockets
1	Constant current cable Ic_0+: Connector X10 Constant current cable Ic_1+: Connector X11 Constant current cable Ic_2+: Connector X12 Constant current cable Ic_3+: Connector X13	
2	Reserved	

Pin	Assignment **X10 to X13 sockets for analog inputs (RTD/R 3-wire connection)**	Front view of the sockets
3	Measurement cable Ic_0-, M_0-: Connector X10 Measurement cable Ic_1-, M_1-: Connector X11 Measurement cable Ic_2-, M_2-: Connector X12 Measurement cable Ic_3-, M_3-: Connector X13	
4	Measuring input M_0+: Connector X10 Measuring input M_1+: Connector X11 Measuring input M_2+: Connector X12 Measuring input M_3+: Connector X13	
5	Functional earth FE	
Shield	Functional earth FE	

NOTICE

Incorrect connection of sensors at channel

If the measurement type current or voltage measurement is configured at the I/O module, a connected resistance thermometer could be destroyed.

NOTE

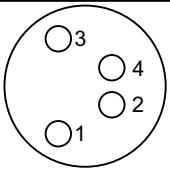
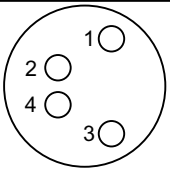
Coupler plug for RTD measurement

For RTD measurements, use a coupler plug with gold-plated contacts. Other materials can create contact resistance that can result in incorrect measured values.

Pin assignment of the sockets for ET-Connection

The table below shows the pin assignments of the 2 sockets for the connection of ET-Connection.

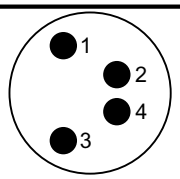
Table 4-5 Pin assignment for ET-Connection

Pin	Assignment		Assignment of the core color of the bus cable for ET-Connection	Front view of the sockets	
	X30 socket (ET-Connection IN)	X31 socket (ET-Connection OUT)		X30	X31
1	TXP	RXP	yellow		
2	RXP	TXP	white		
3	RXN	TXN	blue		
4	TXN	RXN	orange		
Shield	Functional earth FE		-		

Pin assignment of the connector for infeed of the supply voltage

The table below shows the pin assignment of the connector for infeed of the supply voltage.

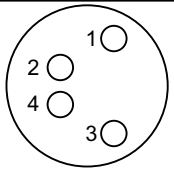
Table 4-6 Pin assignment of the supply voltage connector

Pin	Assignment X80 connector (POWER input)	Assignment of the core color of the power cable	Front view of the connector
1	Supply voltage 1L+ (non-switched)	brown	
2	Ground 2M (switched)	white	
3	Ground 1M (non-switched)	blue	
4	Load voltage 2L+ (switched)	black	

Pin assignment of the socket for loop-through of the supply voltage

The table below shows the pin assignment of the socket for loop-through of the supply voltage.

Table 4-7 Pin assignment of the supply voltage socket

Pin	Assignment X81 socket (POWER output)	Assignment of the core color of the power cable	Front view of the socket
1	Supply voltage 1L+ (non-switched)	brown	
2	Ground 2M (switched)	white	
3	Ground 1M (non-switched)	blue	
4	Load voltage 2L+ (switched)	black	

NOTICE

ET-Connection/supply voltage

Observe the correct wiring of the M8 sockets for ET-Connection and the supply voltage.

Mixing up the connector for ET-Connection and the connector for the supply voltage can destroy the module.

Technical specifications

7

Technical specifications of the AI 4xU/I/RTD 4xM12 analog input module

The following table shows the technical specifications as of the issue date. You can find a data sheet including daily updated technical specifications on the Internet (https://support.industry.siemens.com/cs/ww/en/pv/6ES7144-5KD00-0BA0/td?dl=en).

Article number	6ES7144-5KD00-0BA0
General information	
Product type designation	AI 4xU/I/RTD
HW functional status	FS07
Firmware version	V2.0.x
Product function	
• I&M data	Yes; I&M0 to I&M3
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	STEP 7 V13 SP1 or higher
• STEP 7 configurable/integrated from version	From V5.5 SP4 Hotfix 3
• PROFIBUS from GSD version/GSD revision	GSD as of Revision 5
• PROFINET from GSD version/GSD revision	GSDML V2.3.1
Supply voltage	
power supply according to NEC Class 2 required	No
Load voltage 1L+	
• Rated value (DC)	24 V
• permissible range, lower limit (DC)	20.4 V
• permissible range, upper limit (DC)	28.8 V
• Reverse polarity protection	Yes; against destruction
Input current	
Current consumption (rated value)	35 mA; without load
from load voltage 1L+ (unswitched voltage)	4 A; Maximum value
from load voltage 2L+, max.	4 A; Maximum value
Encoder supply	
Number of outputs	4
24 V encoder supply	
• Short-circuit protection	Yes; per channel, electronic
• Output current, max.	0.5 A; Per channel, total current of all channels max. 1 A

Article number	6ES7144-5KD00-0BA0
Power loss	
Power loss, typ.	1.5 W
Analog inputs	
Number of analog inputs	4
• For current measurement	4
• For voltage measurement	4
• For resistance/resistance thermometer measurement	4
permissible input voltage for voltage input (destruction limit), max.	30 V
permissible input current for current input (destruction limit), max.	50 mA
Cycle time (all channels), min.	8 ms
Technical unit for temperature measurement adjustable	Yes; Degrees Celsius / degrees Fahrenheit / Kelvin
Input ranges (rated values), voltages	
• 0 to +10 V	Yes
– Input resistance (0 to 10 V)	10 MΩ
• 1 V to 5 V	Yes
– Input resistance (1 V to 5 V)	10 MΩ
Input ranges (rated values), currents	
• 0 to 20 mA	Yes
– Input resistance (0 to 20 mA)	50 Ω
• 4 mA to 20 mA	Yes
– Input resistance (4 mA to 20 mA)	50 Ω
Input ranges (rated values), resistance thermometer	
• Ni 100	Yes; Standard/climate
– Input resistance (Ni 100)	10 MΩ
• Pt 100	Yes; Standard/climate
– Input resistance (Pt 100)	10 MΩ
Input ranges (rated values), resistors	
• 0 to 150 ohms	Yes
– Input resistance (0 to 150 ohms)	10 MΩ
• 0 to 300 ohms	Yes
– Input resistance (0 to 300 ohms)	10 MΩ
Cable length	
• shielded, max.	30 m
Analog value generation for the inputs	
Measurement principle	integrating

Article number	6ES7144-5KD00-0BA0
Integration and conversion time/resolution per channel	
• Resolution with overrange (bit including sign), max.	16 bit
• Integration time, parameterizable	Yes; channel by channel
• Integration time (ms)	0,3 / 16,7 / 20 / 60
• Interference voltage suppression for interference frequency f1 in Hz	3 600 / 60 / 50 / 16.7
• Conversion time (per channel)	2 / 18 / 21 / 61 ms
Smoothing of measured values	
• parameterizable	Yes
• Step: None	Yes; 1x cycle time
• Step: low	Yes; 4x cycle time
• Step: Medium	Yes; 16x cycle time
• Step: High	Yes; 32x cycle time
Encoder	
Connection of signal encoders	
• for voltage measurement	Yes
• for current measurement as 2-wire transducer	Yes
• for current measurement as 4-wire transducer	Yes
• for resistance measurement with two-wire connection	Yes
• for resistance measurement with three-wire connection	Yes
Errors/accuracies	
Linearity error (relative to input range), (+/-)	0.025 %
Temperature error (relative to input range), (+/-)	0.01 %/K
Crosstalk between the inputs, max.	-70 dB
Repeat accuracy in steady state at 25 °C (relative to input range), (+/-)	0.01 %
Operational error limit in overall temperature range	
• Voltage, relative to input range, (+/-)	0.35 %
• Current, relative to input range, (+/-)	0.45 %
• Resistance, relative to input range, (+/-)	0.25 %
• Resistance thermometer, relative to input range, (+/-)	0.25 %

Article number	6ES7144-5KD00-0BA0
Basic error limit (operational limit at 25 °C)	
• Voltage, relative to input range, (+/-)	0.25 %
• Current, relative to input range, (+/-)	0.25 %
• Resistance, relative to input range, (+/-)	0.15 %
• Resistance thermometer, relative to input range, (+/-)	0.15 %
Interference voltage suppression for f = n x (f1 +/- 0.5 %), f1 = interference frequency	
• Series mode interference (peak value of interference < rated value of input range), min.	40 dB
Interrupts/diagnostics/status information	
Alarms	
• Diagnostic alarm	Yes; Parameterizable
• Limit value alarm	Yes; Parameterizable
Diagnoses	
• Wire-break	Yes; at 4 mA to 20 mA and 1 V to 5 V
• Short-circuit	Yes; Encoder supply to M, channel by channel
• Overflow/underflow	Yes
Diagnostics indication LED	
• Channel status display	Yes; green LED
• for module diagnostics	Yes; green/red LED
Potential separation	
between the load voltages	Yes
Potential separation channels	
• between the channels	No
• between the channels and backplane bus	Yes
• between the channels and the power supply of the electronics	No
Isolation	
Isolation tested with	707 V DC (type test)
Degree and class of protection	
IP degree of protection	IP65/67
Standards, approvals, certificates	
Suitable for safety-related tripping of standard modules	Yes; From FS02

Article number	6ES7144-5KD00-0BA0
Highest safety class achievable for safety-related tripping of standard modules	
• Performance level according to ISO 13849-1	PL d
• Category according to ISO 13849-1	Cat. 3
• SIL acc. to IEC 62061	SIL 2
• remark on safety-oriented shutdown	https://support.industry.siemens.com/cs/de/en/view/39198-632
product functions / security / header	
signed firmware update	Yes
data integrity	Yes
Ambient conditions	
Ambient temperature during operation	
• min.	-30 °C
• max.	55 °C
Altitude during operation relating to sea level	
• Ambient air temperature-barometric pressure-altitude	Up to max. 5 000 m, at installation height > 2 000 m additional restrictions
connection method	
Design of electrical connection for the inputs and outputs	M12, 5-pole
Design of electrical connection for supply voltage	M8, 4-pole
ET-Connection	
• ET-Connection	M8, 4-pin, shielded
Dimensions	
Width	30 mm
Height	159 mm
Depth	40 mm
Weights	
Weight, approx.	168 g