SIEMENS

Product Information

SIMATIC S7-300

Analog Input Module SM 331; AI 8 x RTD x 24 Bit

New Analog Input Module Available

The S7-300 Analog Input Module SM 331; AI 8 x RTD x 24 Bit has been added to the S7-300 family. The order number for this module is 6ES7 331–7PF00–0AB0.

This product information includes details about the characteristics and technical specifications of analog input module SM 331; AI 8 x RTD x 24 Bit. Refer to the *S7-300 Installation and Hardware Manual* for more information about the S7-300 product family.

You will also learn:

- How to start up analog input module SM 331; AI 8 x RTD x 24 Bit
- The measuring ranges available for analog input module SM 331; AI 8 x RTD x 24 Bit
- How to configure analog input module SM 331; AI 8 x RTD x 24 Bit

Additional Assistance

For assistance in answering technical questions, for training on this product, or for ordering, contact your Siemens distributor or sales office.

2807946–0001

Characteristic Features and Technical Specifications of the Analog Input Module SM 331; AI 8 × RTD × 24 Bit

Order No. 6ES7 331–7PF00–0AB0

Characteristic Features

The analog input module SM 331; AI 8 × RTD × 24 Bit has the following characteristic features:

- 8 differential inputs for resistance thermometers (RTD) in 4 channel groups
- Measured-value resolution 23 Bit + sign (independent of integration time)
- Fast update mode for up to 4 channels
- Arbitrary RTD type selection per channel group
- Programmable diagnostics
- Programmable diagnostic interrupt
- Eight channels with limit monitoring
- Programmable limit interrupt
- Programmable end of cycle interrupt
- Galvanic isolation >500V to CPU

Terminal Connection Diagram

Figure 1 shows the terminal connection diagram and the 3–wire and 4–wire wiring diagrams for the SM331 AI8 x 24 Bit RTD Module for the analog.

The detailed technical specifications for this analog input module are on the following page.

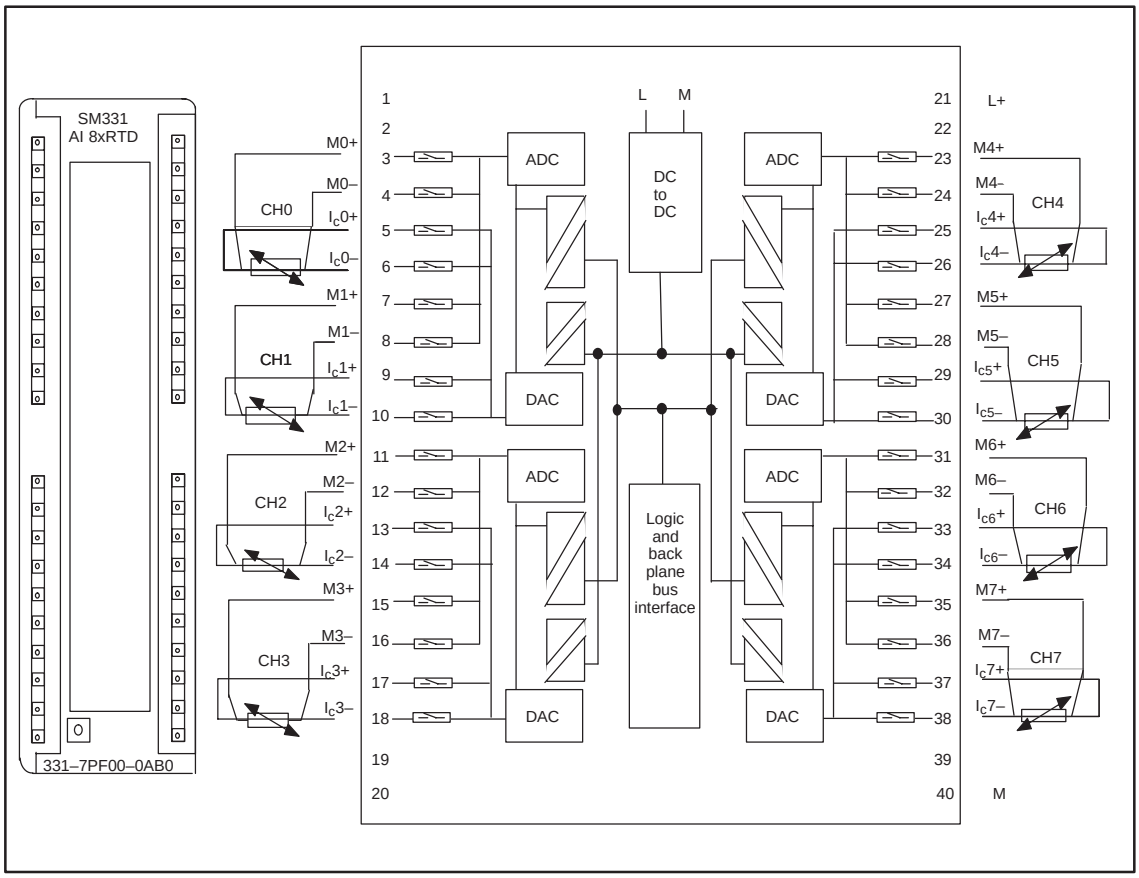

Figure 1 Connection Diagram of Analog Input Module SM 331; AI 8 x RTD x 24 Bit

Dimensions and Weight	
Dimensions W × H × D	40 × 125 × 120mm (1.56 × 4.88 × 4.68 in.)
Weight	approx. 272 g (9.6 oz.)
Module-Specific Data	
Number of inputs	8
Length of cable (shielded)	max. 200 m (218 yd.)
Voltage, Currents and Potentials	
Power rated voltage of the L+	24 VDC
• Reverse polarity protection	Yes
Galvanic isolation between bus, analog section, L+/M, and local ground.	Yes
Test Voltage	
• between bus, analog section, L+/M, and local ground.	500 VAC, 720 VDC
• between input groups	500 VAC, 720 VDC
Permissible common mode voltage	
• between inputs (U_{CM})	120 VAC
• between inputs and central ground	120 VAC
Current consumption	
• from back plane bus	max. 100 ma
• from power supply L+	max. 240 ma
Power losses of the module	max. 4.8 W

Analog Value Generation			
A/D Conversion Method	Sigma/Delta type		
Conversion time/module update/time/resolution			
Module Mode	8 Ch H/W Filter	8 Ch S/W Filter	4 Ch H/W Filter
• Programmable	Yes	Yes	Yes
• Conversion Time (ms)	85/Ch		10/Ch
Selected Frequency			
All channels at 50 Hz		30/ch	
All channels at 60 Hz		25/ch	
All channels at 400 Hz		8/ch	
• Module update time, (ms)	200		10
Selected Frequency			
All channels at 50 Hz		84	
All channels at 60 Hz		74	
All channels at 400 Hz		40	
• Module update time with wire-break enabled (ms)			170
• Resolution in bits + sign (incl. over-range)	23 bit + sign	23 bit + sign	23 bit + sign
• H/W Mode Noise Frequency Suppression (Hz)	50/60/ 400		50/60/ 400
• S/W Mode Noise Frequency Suppression (Hz)		50 60 400	

Noise Suppression and Error Limits	
Interference voltage suppression for F = n × (fl ± 1%), (f1 = parameterized interference frequency)	
• Common-mode noise (U_{cm} < 120 VAC)	> 100 dB
• Series-mode noise (peak value of noise + signal < nominal value of input range)	> 90 dB
Cross-talk between inputs	> 100 dB
Common-mode test voltage	
• between channels	120 VAC
• between channel and central grounding point	120 VAC
Operational limit (0 to 60° C)	
RTD Types Pt 100, Pt 200, Pt 500, Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000 Cu 10	± 1.0° C
Resistance Range (referred to input range) 150/300/600	± 0.1%
Basic error (operational limit at 25° C)	
RTD Types Pt 100, Pt 200, Pt 500, Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000 Cu 10	± 0.5° C
Resistance Range (referred to input range) 150/300/600	±0.05%
Temperature error (referred to input range)	±0.005%/K
Linearity error	
RTD Types Pt 100, Pt 200, Pt 500, Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000 Cu 10	± 0.2° C
Resistance Range (referred to input range) 150/300/600	±0.02%
Repeatability	
RTD Types Pt 100, Pt 200, Pt 500, Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000 Cu 10	± 0.1° C
Resistance Range (referred to input range) 150/300/600	±0.01%

Status, Interrupts, Diagnostics	
Interrupts	
• Limit interrupt	Programmable all channels
• Diagnostics interrupt	Programmable
Diagnostics functions	Programmable
• System fault display	Red LED (SF)
• Diagnostics information read-out	Possible

Sensor Selection Data	
Input ranges	
• Resistance Thermometer	Pt 100, Pt 200, Pt 500 Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000, Cu 10
• Resistance (ohms)	150, 300, 600
Measuring current for thermal resistors and open-circuit testing	Approx. 5mA
Permissible input voltage for voltage input	35 VDC continuous 75 VDC for max. 1 s (pulse duty factor 1:20)
Connection of the Sensor	
• With 4-conductor terminal	Yes
• With 3-conductor terminal	Yes
• With 2-conductor terminal	Yes (without line resistance correction)
Characteristics linearization	
• For thermal resistors	Pt100, Pt200, Pt500 Pt1000, Ni100, Ni120 Ni200, Ni500,Ni1000, Cu10 (standard and climatic range)

Starting Up the Analog Input Module SM 331; AI 8 × RTD × 24 Bit

Parameter Assignment

The analog input module SM 331; AI 8 × RTD × 24 Bit is set:

- With STEP 7 (see the *STEP 7 User Manual*) or
- In the user program by means of SFCs (see the *STEP 7 System and Standard Functions Reference Manual)*

Default Setting

The analog input module SM 331; AI 8 × RTD × 24 Bit has default settings for operating mode, measuring type, diagnostics, interrupts, etc., (see Table 1).

Table 1 Default Settings for the Analog Input Module SM 331; AI 8 × RTD × 24 Bit

Parameter	SM 331; AI 8 x RTD x 24 Bit		Parameter Type	Scope
	Value Range	Default Settings		
Enable				
Hardware interrupt when limit level is exceeded	Yes/No	No		
Hardware interrupt on end of cycle	Yes/No	No	Dynamic	Module
Diagnostics interrupts	Yes/No	No		
Trigger for process interrupt				
Upper limit value	32511 to –32512		Dynamic	Channel
Lower limit value	32511 to –32512	–		
Diagnostics				
Group diagnostics	Yes/No	No	Static	Group
Wire-break check	Yes/No	No		
Measurement				
Module Mode	8 Channel h/w filter 8 Channel s/w filter 4 Channel h/w filter	Yes No No	Dynamic	Module
Output Format	Celsius Fahrenheit	Celsius		Module
Interference Frequency (8 channel software mode only)	50 Hz 60 Hz 400 Hz	50 Hz		Group
Smoothing	None Weak Medium Strong	None		Group

Table 1 continued on next page.

(Table 1 Continued)

Parameter	Value Range	Default Settings		Parameter Type	Scope
Measuring Type	Measuring Range:	Alpha Type:	RTD-4W Pt 100 CI .003850	Dynamic	Group
1. Deactivated					
2. Resistance 4-W	150Ω 300Ω 600Ω				
3. Resistance 3-W	150Ω 300Ω 600Ω				
4. RTD 4-W	Pt 100Ω Cl. Pt 100Ω Std., Pt 200Ω Cl. Pt 200Ω Std., Pt 500Ω Cl. Pt 500Ω Std., Pt 1000Ω Cl. Pt 1000Ω Std.,	.003850 .003916 .003902 .003920 .003851			
5. RTD 4-W	Ni 100Ω Cl. Ni 100Ω Std., Ni 200Ω Cl. Ni 200Ω Std., Ni 500Ω Cl. Ni 500Ω Std., Ni 1000Ω Cl. Ni 1000Ω Std.,	.006180 .006720			
6. RTD 4-W	Cu 10Ω Cl. Cu 10Ω Std.	.004720			
7. RTD 3-W	Pt 100Ω Cl. Pt 100Ω Std., Pt 200Ω Cl. Pt 200Ω Std., Pt 500Ω Cl. Pt 500Ω Std., Pt 1000Ω Cl. Pt 1000Ω Std.,	.003850 .003916 .003902 .003920 .003851			
8. RTD 3-W	Ni 100Ω Cl. Ni 100Ω Std., Ni 200Ω Cl. Ni 200Ω Std., Ni 500Ω Cl. Ni 500Ω Std., Ni 1000Ω Cl. Ni 1000Ω Std.,	.006180 .006720			
9. RTD 3-W	Cu 10Ω Cl. Cu 10Ω Std.	.004720			

Channel Groups

The channels of the analog input module SM 331; AI 8 × RTD 24 × Bit are arranged in groups of two. You must assign the same parameters to both channels in each group.

Table 2 shows which channels of the analog input module SM 331; AI 8 × RTD × 24 Bit are configured as one channel group. You need the channel group numbers to set the parameters in the user program with an SFC. See Figure A–3 in Appendix A of the *S7-300 Installation and Hardware Manual* for more information.

Table 2 Assignment of Channels of the Analog Input Module SM 331; AI 8 × RTD × 24 Bit to Channel Groups

Channels ...	**...Form One Channel Group Each**
Channel 0	Channel group 0
Channel 1	
Channel 2	Channel group 1
Channel 3	
Channel 4	Channel group 2
Channel 5	
Channel 6	Channel group 3
Channel 7	

Operating Modes

The analog input module SM 331; AI 8 x RTD x 24 Bit operates in the following modes:

- 8 Channel Hardware Filtering
- 8 Channel Software Filtering
- 4 Channel Hardware Filtering

Channel Isolation

If you configure the analog input module SM 331; AI 8 x RTD x 24 Bit for four channels, with one channel connected to each group, the maximum isolation is 500 VAC. If you configure more than four channels, the common mode withstand voltage between two channels in a group is 120 VAC.

8 Channel Hardware Filtering Mode

Module Cycle Description

When operating in the 8 Channel Hardware Filtering Mode the analog input module SM331; AI 8 x RTD x 24 Bit switches between the two channels in each group. Since the module contains four analog–to–digital converters (ADC), all four ADCs convert simultaneously for channels 0, 2, 4 and 6. Upon completion of the even numbered channels, all four ADCs convert simultaneously for channels 1, 3, 5 and 7 the odd numbered channels (see Figure 2).

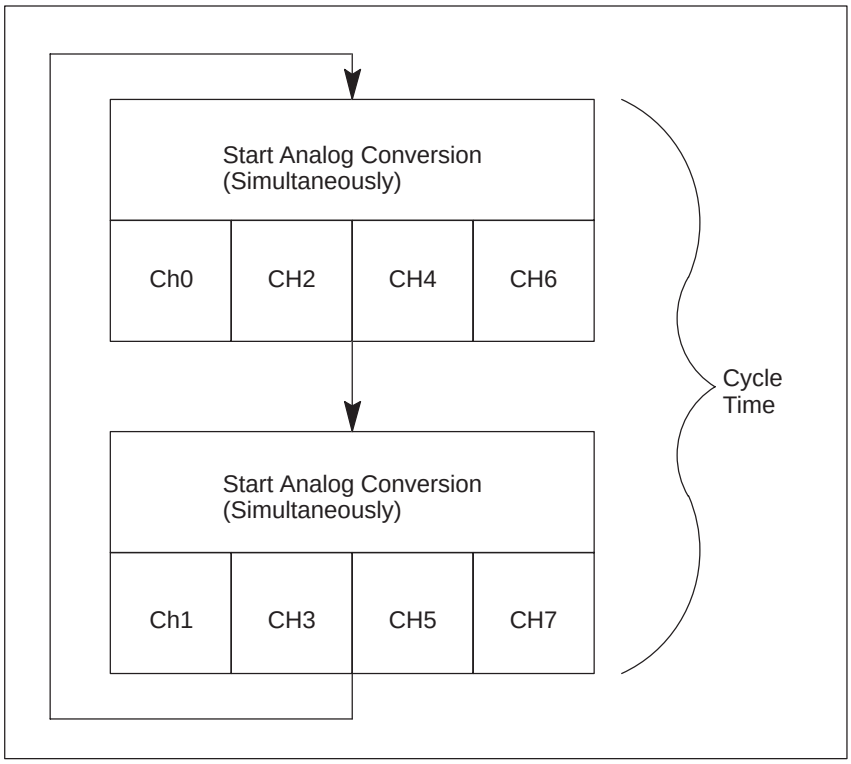

Figure 2 8 Channel Hardware Filtering Mode Cycle

Module Cycle Tine

When operating in the 8 Channel Hardware Filtering Mode the analog input module SM331; AI 8 x RTD x 24 Bit channel conversion time, including communication overhead, is 85 ms. The module must then switch to the opposite channel in the group using the opto–mos relays. The opto–mos relays require 12ms to switch and settle fully. Each channel requires 97 ms of time making the module cycle time equal to 194 ms.

8 Channel Software Filtering Mode

Module Cycle Description

When you operate in the 8 Channel Software Filtering Mode the analog input module SM331; AI 8 x RTD x 24 Bit switches between the two channels in each group. Since the module contains four analog–to–digital converters (ADC), all four ADCs convert simultaneously for channels 0, 2, 4 and 6. After the even numbered channels convert , all four ADCs convert simultaneously for channels 1, 3, 5 and 7.

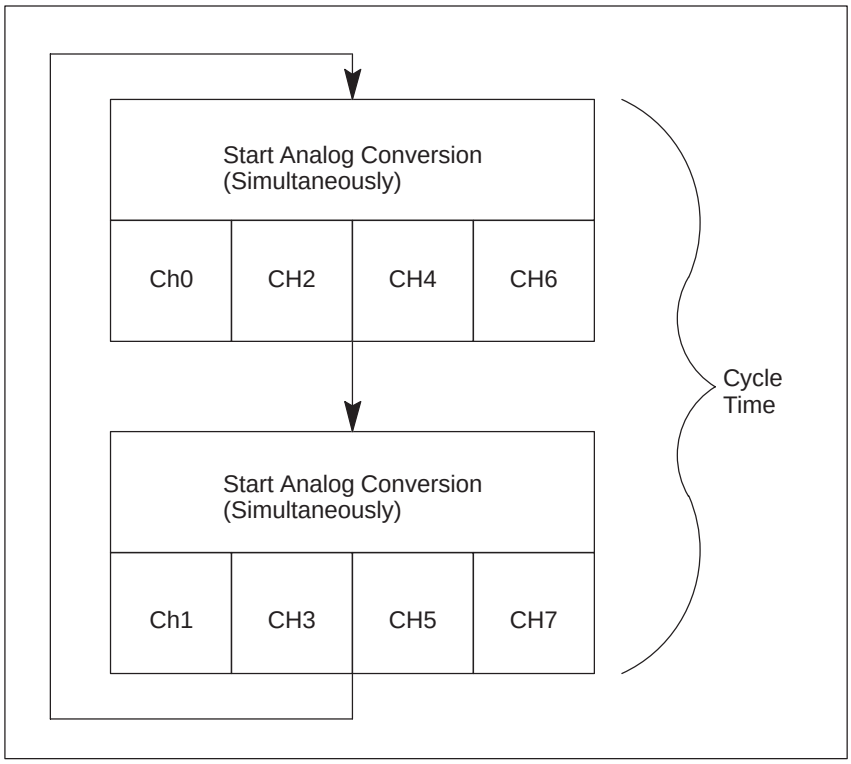

Figure 3 8 Channel Software Filtering Mode Cycle

Module Cycle Time

When operating in the 8 Channel Software Filtering Mode the analog input module SM331; AI 8 x RTD x 24 Bit, the channel conversion time is dependent of the interference frequency selected. If you select an interference frequency of 50 Hz, the channel conversion time, including communication overhead, is 30 ms. If you select an interference frequency of 60 Hz, the channel conversion time is 25 ms. If you select an interference frequency of 400 Hz, the channel conversion time reduces to 8 ms. Similar to the 8 Channel Hardware Filtering Mode, the module must then switch to the opposite channel in the group using the opto–mos relays with a settling time of 12 ms. Table 3 shows the module cycle time for a specific interference frequency .

Table 3 8 Channel Software Filteing Mode Cycle Times

Interference Frequency (Hz)	Channel Cycle Time (ms)	Module Cycle Time (for all Channels)
50	42	84
60	37	74
400	20	40

4 Channel Hardware Filtering Mode

Module Cycle Description

When you operate in the 4 Channel Hardware Filtering Mode, the analog input module SM331; AI 8 x RTD x 24 Bit does not switch between the channels in each group. Since the module contains four analog–to–digital converters (ADC), all four ADCs convert simultaneously for channels 0, 2, 4 and 6.

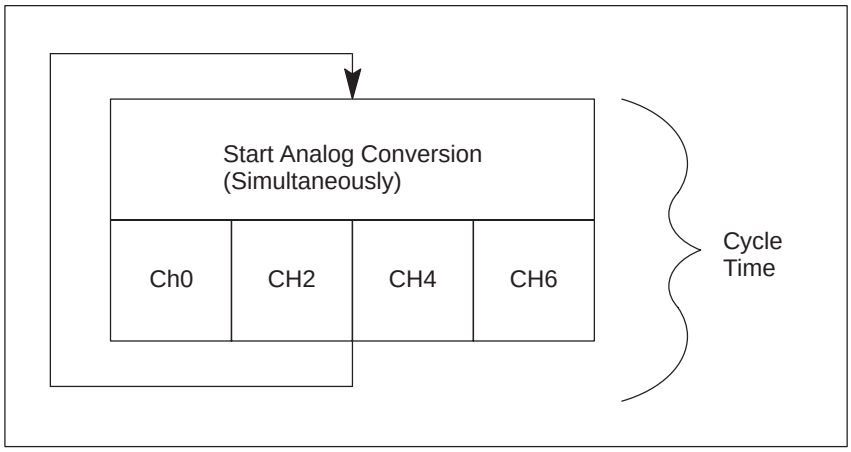

Figure 4 4 Channel Hardware Filtering Mode Cycle

Module Cycle Time

When operating in the 4 Channel Hardware Filtering Mode, the analog input module SM331; AI 8 x RTD x 24 Bit channel conversion time, including communication overhead is 10 ms. Since the module does not switch between the channels within the groups, the channel cycle time and the module cycle time are the same, 10ms.

Measuring Methods and Measuring Ranges of the Analog Input Module SM 331; AI 8 × RTD × 24 Bit

Measuring Methods

You can set the following measuring methods on the analog input module SM 331; AI 8 × RTD ×24 Bit:

- RTD 4–wire measurement
- RTD 3–wire measurement
- Resistance 4–wire measurement
- Resistance 3–wire measurement

Use the STEP 7 tool on the analog input module to make the necessary settings. See Section 4.3.4 of the *S7-300 Installation and Hardware Manual* for more information about these settings.

Measuring Ranges

Table 5 through table 11 lists the measuring ranges you can use with the analog input module. Use STEP 7 to select the desired measuring ranges.

Common Mode Voltage

The analog input module SM 331; AI 8 x RTD x 24 Bit can make measurements in the presence of AC or DC common mode voltage.

The AC and DC common mode voltage rejection is accomplished by the use of an instrumentation amplifier for the input stage. The relative measurement performed by the instrumentation amplifier rejects voltages < 120V RMS and < 120 VDC with a rejection ratio of > 100dB.

Wire-Break Check

The wire–break check is a module software function that is provided for all module modes. The process for detecting a wire–break is to reduce by half the excitation current for the given sensor and to verify that the resulting value is within nominal limits of the prior value measured. Since the wire–break value is not reported to the CPU, the module cycle time is doubled for the 8 Channel hardware and software filtering mode, regardless of the number of channels with wire-break enabled.

When operating in the 4 channel hardware filtering mode, the reduction in excitation current is performed once every three seconds, or once every 30 input channel scans. However, there is a break in the input data when performing wire–break detection. Since the reduction in excitation current basically is a step function to the module input, the ADCs digital filter requires 85ms to settle and report valid data. With a return to full excitation current, the total break in the input data is 170 ms

Measuring Ranges for RTD and Resistance Measurements

Table 4 shows all of the RTD and resistance measuring ranges for the SM331; AI 8 x RTD x 24 Bit module.

Table 4 Measuring Ranges for RTD and Resistance Measurements

Measuring Method Selected	Description	Measuring Range
RTD– 4-Wire/3-Wire	Table 6 through Table 11 shows the digitized analog values in the RTD measuring range.	Climatic– P 100, Pt 200, Pt 500, Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000, Cu 10 Standard– P 100, Pt 200, Pt 500, Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000, Cu 10
Resistance– 4-Wire/3-Wire	Table 5 shows the digitized analog values in the resistance measuring range.	150 300 600

Overflow, Underflow, and Process Alarm Limits

Overflow and Underflow diagnostic thresholds for some of the measuring ranges differ from those shown in Section 4.1.2, of the *S7-300 Installation and Hardware Manual.* Numerical methods in the module software for evaluating the process variables prevent values up to 32511 from being reported in some cases.

Process alarm limits should not be set at values higher than the minimum potential overflow or underflow threshold limits shown in Table 5 through Table 11.

Wiring Diagrams

Figure 5 shows the wiring diagrams for 4-wire and 3-wire sensor elements. When you use a 3–wire sensor , ensure you insert the jumper between M+ and I_c+. Incorrect wiring results in unpredictable module behavior.

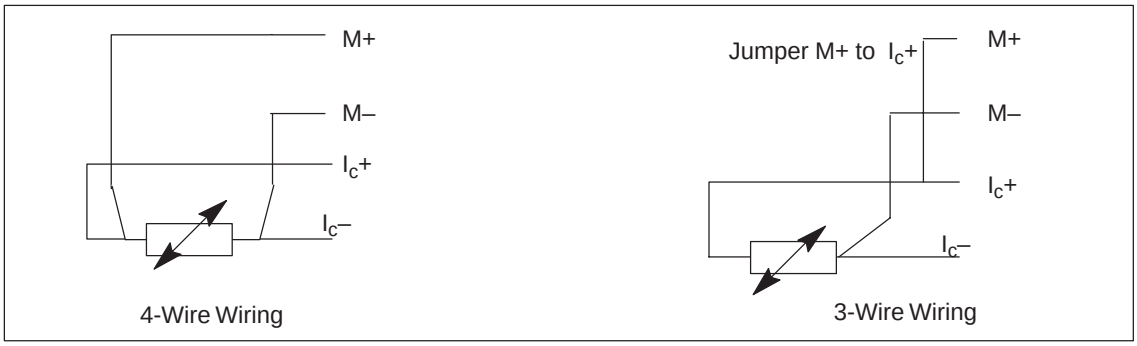

Figure 5 4-Wire and 3-Wire Wiring Diagram

Analog Value Representation of the Measuring Ranges of the Analog Input Module SM 331: AI 8 x RTD x 24 Bit

Introduction

The tables in this section contain the digitized analog values for the various measuring ranges of the analog input module. See table 5 through table 11.

How to Read the Measured-Value Tables

Since the binary representation for the analog values is always the same, these tables only contain the measured values and the units.

Resistance-Type Sensors Measuring Ranges

Table 5 shows the representation of the digitized measured value for resistance–type sensors with the measuring ranges 150 Ω, 300 Ω, and 600 Ω.

Table 5 Representation of the Digitized Measured Value of an Analog Input Module (Resistance-Type Sensors)

Measuring Range 150	Measuring Range 300	Measuring Range 600	System Word Units		Range
			Decimal	Hexadecimal	
>176.383	>352.767	>705.534	32767	7FFF	Overflow
176.383 . . 150.005	352.767 . . 300.011	705.534 . . 600.022	32511 . . 27649	7EFF . . 6C01	Overrange
150.000 112.500 . . 0.000	300.000 225.000 . . 0.000	600.000 450.000 . . 0.000	27648 20736 . . 0	6C00 5100 . . 0	Nominal Range
(negative values physically not possible)			–1 . .	FFFF . .	Underrange
–	–	–	32767	8000	Underflow

Standard Temperature Ranges

Table 6 shows the representation of the digitized measured value for the standard temperature range of the Pt 100, Pt 200, Pt 500 and Pt 1000 sensors.

Table 6 Standard Temperature Range for Pt 100, Pt 200, Pt 500, Pt 1000

Range	System Word Units		Standard Temperature Range Pt 100, Pt 200, Pt 500, Pt 1000 850 °C
	Decimal	Hexadecimal	
Overflow	32767	7FFF	>1000.0
Overrange	10000 . . 8501	2710 . . 2135	1000.0 . . 850.1
Nominal range	8500 . . –2000	2134 . . F830	850.0 . . –200.0
Underrange	–2001 . . –2430	F82F . . F682	–200.1 . . –243.0
Underflow	–32768	8000	<–243.0

Climate Temperature Ranges

Table 7 shows the representation of the digitized measured value for the climate temperature range of the Pt 100, Pt 200, Pt 500 and Pt 1000 sensors.

Table 7 Climate Temperature Range for Pt 100, Pt 200, Pt 500, Pt 1000

Range	System Word Units		Climate Temperature Range Pt 100, Pt 200, Pt 500, Pt 1000 130 °C
	Decimal	Hexadecimal	
Overflow	32767	7FFF	>155.00
Overrange	15500 . . 13001	3C8C . . 32C9	155.00 . . 130.01
Nominal range	13000 . . –12000	32C8 . . D120	130.00 . . –120.00
Underrange	–12001 . . –14500	D120 . . C75C	–120.01 . . –145.00
Underflow	–32768	8000	<–145.00

Standard Temperature Ranges

Table 8 shows the representation of the digitized measured value for the standard temperature range of the Ni 100, Ni 120, Ni 200, Ni 500 and Ni 1000 sensors.

Table 8 Standard Temperature Range for Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000

Range	System Word Units		Standard Temperature Range Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000 250 °C
	Decimal	Hexadecimal	
Overflow	32767	7FFF	>295.0
Overrange	2950 . . 2501	0B86 . . 09C5	295.0 . . 250.1
Nominal range	2500 . . –600	09C4 . . FDA8	250.0 . . –60.0
Underrange	–601 . . –1050	FDA7 . . FBE6	–60.1 . . –105.0
Underflow	–32768	8000	<–105.0

Climate Temperature Ranges

Table 9 shows the representation of the digitized measured value for the climate temperature range of the Ni 100, Ni 120, Ni 200, Ni 500 and Ni 1000 sensors.

Table 9 Climate Temperature Range for Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000

Range	System Word Units		Climate Temperature Range Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000 250 °C
	Decimal	Hexadecimal	
Overflow	32767	7FFF	>295.00
Overrange	29500 . . 25001	733C . . 61A9	295.00 . . 250.01
Nominal range	25000 . . –6000	61A8 . . E890	250.00 . . –60.00
Underrange	–6001 . . –10500	E88F . . D6FC	–60.01 . . –105.00
Underflow	–32768	8000	<–105.00

Standard Temperature Ranges

Table 10 shows the representation of the digitized measured value for the standard temperature range of the Cu 10 sensors.

Table 10 Standard Temperature Range for Cu 10

Range	System Word Units		Standard Temperature Range Cu 10 260 °C
	Decimal	Hexadecimal	
Overflow	32767	7FFF	>312.0
Overrange	3120 . . 2601	0C30 . . 0A29	312.0 . . 260.1
Nominal range	2600 . . –2000	0A28 . . F830	260.0 . . –200.0
Underrange	–2001 . . –2400	F82F . . F6A0	–200.1 . . –240.0
Underflow	–32768	8000	<–240.0

Climate Temperature Ranges

Table 11 shows the representation of the digitized measured value for the climate temperature range of the Cu 10 sensors.

Table 11 Climate Temperature Range for Cu 10

Range	System Word Units		Climate Temperature Range Cu 10 150 °C
	Decimal	Hexadecimal	
Overflow	32767	7FFF	>180.00
Overrange	18000 . . 15001	4650 . . 3A99	180.00 . . 150.01
Nominal range	15000 . . –5000	3A98 . . EC78	150.00 . . –50.00
Underrange	–5001 . . –6000	EC77 . . E890	–50.01 . . –60.00
Underflow	–32768	8000	<–60.00

Parameter Sets for Analog Input Module SM 331; AI 8 x RTD x 24 Bit

Parameter Assignment in the User Program

You have already set the parameters for the S7–300 module using STEP 7. You can use an SFC in the user program to change the AI 8 x RTD x 24 bit module dynamic parameters. You can also use an SFC in the user program to transfer the parameters from the CPU to the addressed module.

Parameters Stored in Data Records

The parameters for the AI 8 x RTD x 24 bit module are stored in three data records: records 0, 1 and 128.

Modifiable Parameters

You can change the parameters of record 1 and/or record 128 and pass them to the AI 8 x RTD x 24 bit module using SFC 55. This does not change the parameters set on the CPU. You cannot change the S7–300 parameters of record 0 in the user program.

The following section shows an overview of the parameters that are stored in records 0, 1, and 128 for the AI 8 x RTD x 24 bit module.

SFCs for Parameter Assignment

The following SFCs are available for assigning the parameters for the AI 8 x RTD x 24 bit module in the user program.

Table 12 SFCs for Assigning Module Parameters

SFC No.	Identifier	Application
55	WR_PARM	Transfer modifiable parameters (record 1 and 128) to the addressed signal module.
56	WR_DPARM	Transfer parameters (records 0, 1 or 128) from the CPU to the addressed signal module.
57	PARM_MOD	Transfer all parameters (records 0, 1, and 128) from the CPU to the addressed signal module.

Description of the Parameters

The following section contains all the modifiable parameters for the AI 8 x RTD x 24 bit module.

The parameters for the AI 8 x RTD x 24 bit module are described in this Product Information document and in the online help of STEP 7.

Parameters of Analog Input Module SM 331; AI 8 x RTD x 24 Bit

Parameters

Table 13 contains all the parameters that you can set for the Analog Input Module SM 331; AI 8 x RTD x 24 bit. The comparison shows:

- Parameters you can change using STEP 7.
- Parameters you can change using SFC 55 “WR_PARM”.

The parameters you set using STEP 7 can also be transferred to the module using SFCs 56 and 57.

Table 13 Parameters for the Analog Input Module SM 331; AI 8 x RTD x 24 bit

Parameter	Data Record No.	Configurable with...	
		...SFC S5	...Programming Device
Diagnostics: Group	0	No	Yes
Diagnostics: with wire-break	0	No	Yes
Limit value interrupt enable	1	Yes	Yes
Diagnostic interrupt enable	1	Yes	Yes
End of cycle interrupt enable	1	Yes	Yes
Measurement units	1	Yes	Yes
Module Mode	128	Yes	Yes
Interference frequency suppression	128	Yes	Yes
Measurement type	128	Yes	Yes
Measurement range	128	Yes	Yes
Measurement range alpha	128	Yes	Yes
Measurement smoothing	128	Yes	Yes
Upper limit value	128	Yes	Yes
Lower limit value	128	Yes	Yes
Note: Before you can enable the diagnostic interrupt in record 1 in the user program, you must first enable the diagnostics in record 0 with STEP 7.			

Structure of Data Record 1

Figure 6 shows the structure of data record 1 for the parameters of the Analog Input Module SM 331; AI 8 x RTD x 24 bit.

You can activate a parameter by setting the corresponding bit in byte 0 to “1”.

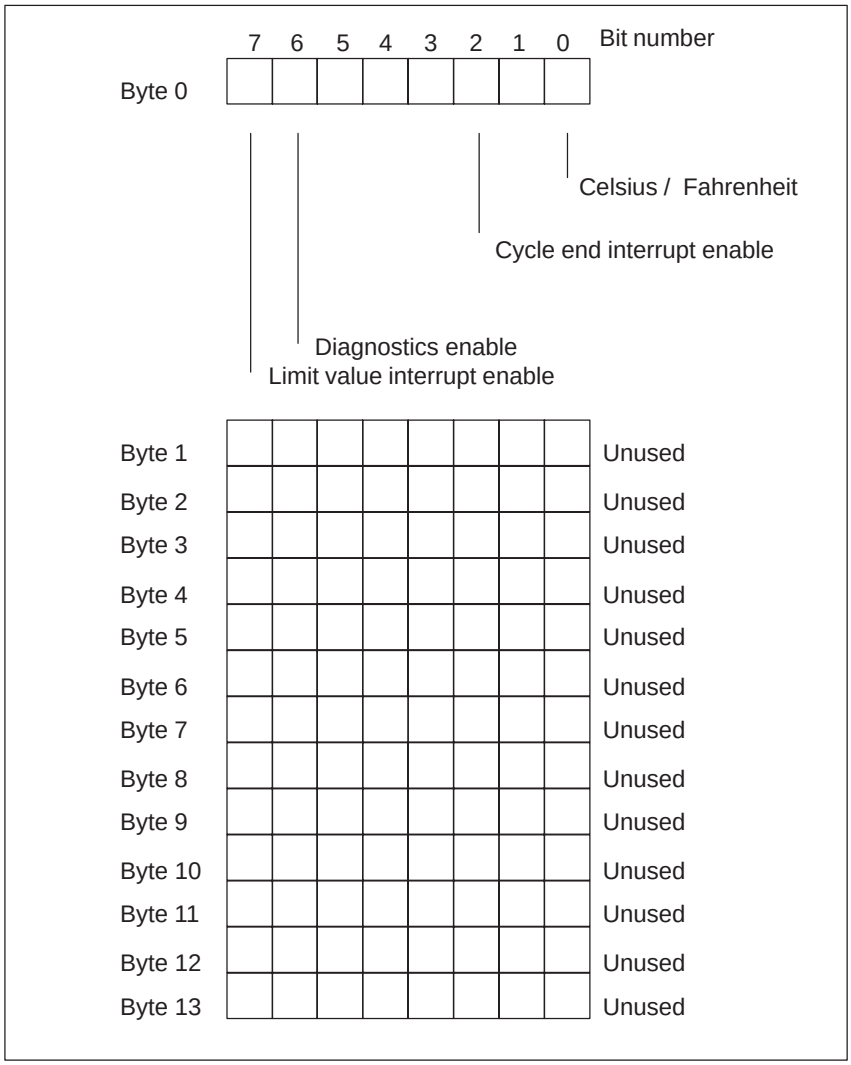

Figure 6 Data Record 1 for Parameters of the Analog Input Module SM 331; AI 8 x RTD x 24 bit

Structure of Data Record 128

Figure 7 shows the structure of data record 128 for the parameters of the Analog Input Module SM 331; AI 8 x RTD x 24 bit.

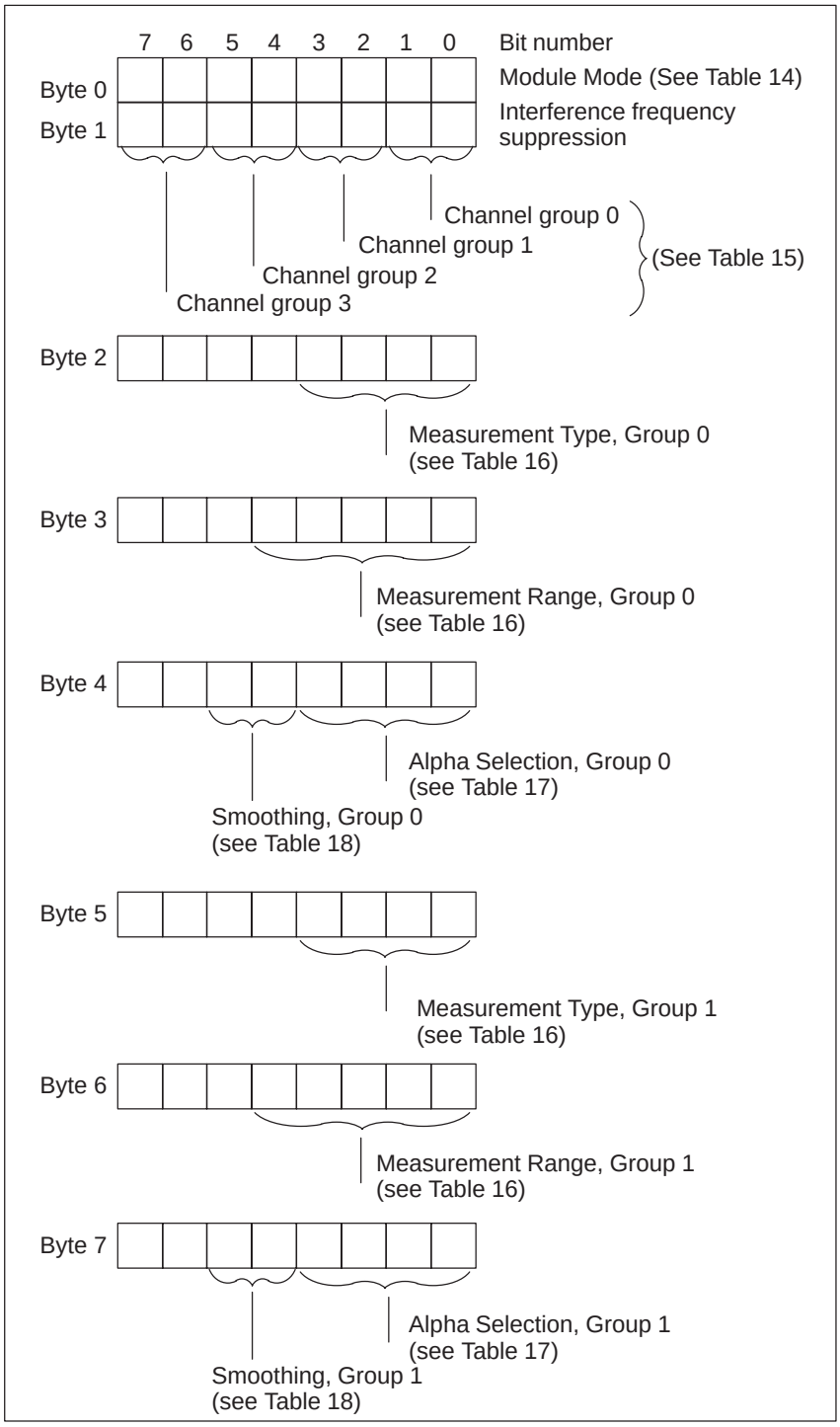

Figure 7 Data Record 128 for Parameters of the Analog Input Module SM 331; AI 8 x RTD x 24 bit

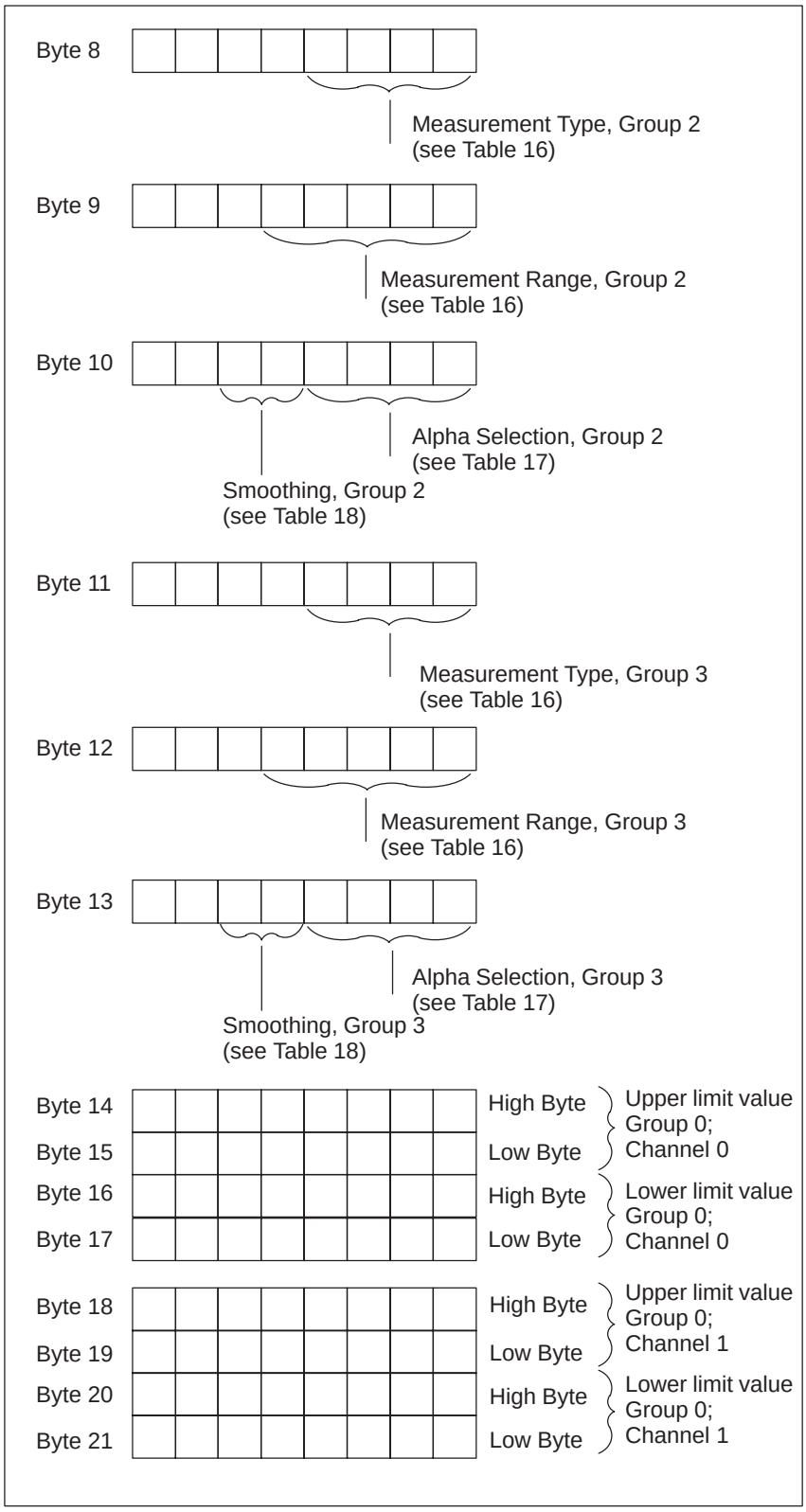

Figure 6 Data Record 128 for Parameters of the Analog Input Module SM 331; AI 8 x RTD x 24 bit (continued)

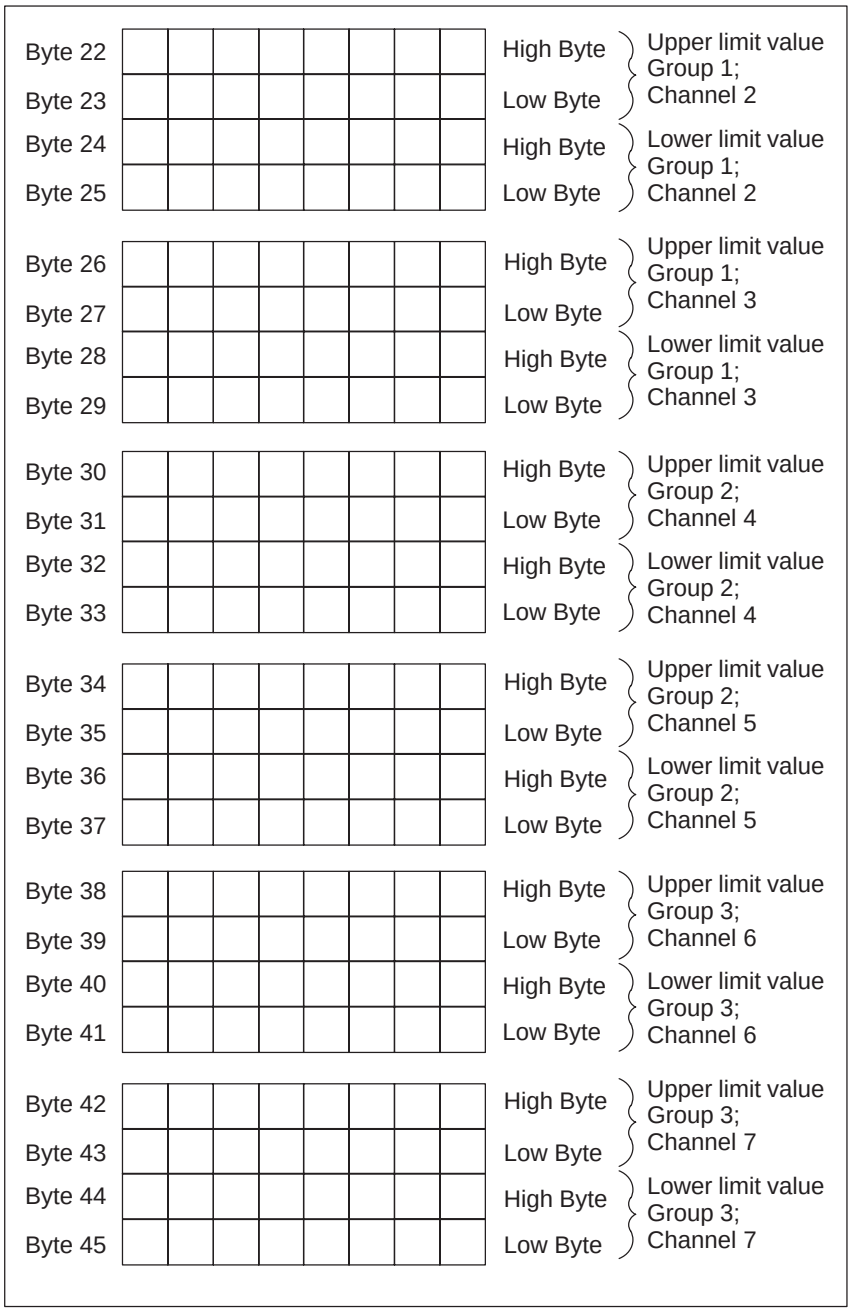

Figure 6 Data Record 128 for Parameters of the Analog Input Module SM 331; AI 8 x RTD x 24 bit (continued)

The representation of the limit values matches the analog value representation. Observe the range limits when setting the limit values.

Module Mode

Table 14 contains the codes for the various module operating modes that you enter in byte 0 of data record 128 (see Figure 7).

Table 14 Codes for the module modes of the Analog Input Module SM 331; AI 8 x RTD x 24 bit

Module Mode	Code
8 Channel Hardware Filtering	2#00000000
8 Channel Software Filtering	2#00000001
4 Channel Hardware Filtering	2#00000010

Interference Frequency Suppression

Table 15 contains the codes for the various frequencies that you enter in record 128 (see Figure 7). Note that the 50 Hz, 60 Hz, and 400 Hz selections are for the 8 Channel Software Filtering module mode only. The 50/60/400 Hz selection is for the 8 Channel and 4 Channel Hardware Filtering module modes only.

Table 15 Codes for the Interference Frequency Suppression of Analog Input Module SM 331; AI 8 x RTD x 24 bit

Interference Frequency Suppression	Code
400 Hz	2#00
60 Hz	2#01
50 Hz	2#10
50/60/400 Hz	2#11

Measurement Type and Measurement Range

Table 16 contains all the measuring ranges for the Analog Input Module SM 331; AI 8 x RTD x 24 bit. Table x also shows the codes for the measurement types and the measuring range. You must enter these codes, according to the measuring range desired, in the appropriate bytes of data record 128 (see Figure 7).

Table 16 Codes for the Measuring Ranges of the Analog Input Module SM 331: AI 8 x RTD x 24 Bit

Measurement Type	Code	Measurement Range	Code
Deactivated	2#0000	Deactivated	2#0000
Resistor 4-Wire Connection	2#0100	150 Ω 300 Ω 600 Ω	2#0010 2#0100 2#0110
Resistor 3-Wire Connection	2#0101	150 Ω 300 Ω 600 Ω	2#0010 2#0100 2#0110
Resistance-Type Thermometer + linearization 4-Wire Connection	2#1000	Pt 100 Climate Range Ni 100 Climate Range Pt 100 Standard Range Ni 100 Standard Range Pt 500 Standard Range Pt 1000 Standard Range Ni 1000 Standard Range Pt 200 Climate Range Pt 500 Climate Range Pt 1000 Climate Range Ni 1000 Climate Range Pt 200 Standard Range Ni 120 Standard Range Ni 120 Climate Range Cu 10 Climate Range Cu 10 Standard Range Ni 200 Standard Range Ni 200 Climate Range Ni 500 Standard Range Ni 500 Climate Range	2#00000000 2#00000001 2#00000010 2#00000011 2#00000100 2#00000101 2#00000110 2#00000111 2#00001000 2#00001001 2#00001010 2#00001011 2#00001100 2#00001101 2#00001110 2#00001111 2#00010000 2#00010001 2#00010010 2#00010011
Resistance-Type Thermometer + linearization 3-Wire Connection	2#1001	Pt 100 Climate Range Ni 100 Climate Range Pt 100 Standard Range Ni 100 Standard Range Pt 500 Standard Range Pt 1000 Standard Range Ni 1000 Standard Range Pt 200 Climate Range Pt 500 Climate Range Pt 1000 Climate Range Ni 1000 Climate Range Pt 200 Standard Range Ni 120 Standard Range Ni 120 Climate Range Cu 10 Climate Range Cu 10 Standard Range Ni 200 Standard Range Ni 200 Climate Range Ni 500 Standard Range Ni 500 Climate Range	2#00000000 2#00000001 2#00000010 2#00000011 2#00000100 2#00000101 2#00000110 2#00000111 2#00001000 2#00001001 2#00001010 2#00001011 2#00001100 2#00001101 2#00001110 2#00001111 2#00010000 2#00010001 2#00010010 2#00010011

Resistance-type Thermometer Alpha Selection

Table 17 contains all the alpha selections for the resistance–type thermometer measuring range of the Analog Input Module SM 331; AI 8 x RTD x 24 bit. You must enter these codes, according to the measuring range desired, in the appropriate bytes of data record 128 (see Figure 7).

Table 17 Codes for the Alpha Selection of the Analog Input Module SM 331; AI 8 RTD x 24 Bit

Alpha Selection	Code
Pt 0.003850 Ω/Ω/°C	2#0000
Pt 0.003916 Ω/Ω/°C	2#0001
Pt 0.003902 Ω/Ω/°C	2#0010
Pt 0.003920 Ω/Ω/°C	2#0011
Pt 0.00385055 Ω/Ω/°C	2#0100
Ni 0.006180 Ω/Ω/°C	2#1000
Ni 0.006720 Ω/Ω/°C	2#1001
Cu 0.00427 Ω/Ω/°C	2#1100

Input Smoothing Selection

Table 18 contains all the smoothing selections for the Analog Input Module SM 331; AI 8 x RTD x 24 bit. You must enter these codes, according to the measuring range desired, in the appropriate bytes of data record 128 (see Figure 7).

Table 18 Codes for the Smoothing Selection of the Analog Input Module SM 331; AI 8 RTD x 24 Bit

Smoothing Selection	Code
None	2#00
Weak	2#01
Medium	2#10
Strong	2#11