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ET 200S distributed I/O 2AO U HS analog electronic module (6ES7135-4FB52-0AB0)

Manual

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Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.


If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

 WARNING
This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Preface

Purpose of the manual

This manual supplements the *ET 200S Distributed I/O System* Operating Instructions. General functions for the ET 200S are described in the *ET 200S Distributed I/O System* Operating Instructions.

The information in this document along with the operating instructions enables you to commission the ET 200S.

Basic knowledge requirements

To understand these operating instructions you should have general knowledge of automation engineering.

Scope of the manual

This manual applies to this ET 200S module. It describes the components that are valid at the time of publication.

Recycling and disposal

Thanks to the fact that it is low in contaminants, this ET 200S module is recyclable. For environmentally compliant recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste.

Additional support

If you have any questions relating to the products described in these operating instructions, and do not find the answers in this document, please contact your local Siemens representative.

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The portal to our technical documentation for the various SIMATIC products and systems is available at:

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The online catalog and ordering system are available at:

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Training center

We offer courses to help you get started with the ET 200S and the SIMATIC S7 automation system. Please contact your regional training center or the central training center in D -90327, Nuremberg, Germany.

Phone: +49 (911) 895-3200.

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- Information about on-site services, repairs, spare parts. Lots more can be found on our "Services" pages.

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Properties

1.1 2AO U HS analog electronic module (6ES7135-4FB52-0AB0)

Properties

- 2 outputs for voltage output
- Output range:
 - ± 5 V, resolution 15 bit + sign
 - ± 10 V, resolution 15 bits + sign
 - 1 to 5 V, resolution 14 bits
- Isolated from the load voltage L+
- Supports isochrone mode
 - Minimum possible time for the isochronous DP cycle (T_{DPmin}): 250 μ s
 - Minimum possible conversion time of the output modules: (T_{WA}): 100 μ s
- Firmware update of electronic module is possible.

General terminal assignment

Note

Terminals A4, A8, A3, and A7 are only available at specified terminal modules.

Terminal assignment for 2AO U HS (6ES7135-4FB52-0AB0)				
Terminal	Assignment	Terminal	Assignment	Notes
1	QV ₀	5	QV ₁	<ul style="list-style-type: none"> • QV_n: Analog output voltage, Channel n • S_{n+}: Sensor cable positive, Channel n • S_{n-}: Sensor cable negative, Channel n • M_{ana}: Ground of the module • AUX1: Protective-conductor terminal or voltage bus (freely usable up to 230 VAC)
2	S ₀₊	6	S ₁₊	
3	M _{ana}	7	M _{ana}	
4	S ₀₋	8	S ₁₋	
A4	AUX1	A8	AUX1	
A3	AUX1	A7	AUX1	

Usable terminal modules

Usable terminal modules for 2AO U HS (6ES7135-4FB52-0AB0)		
TM-E15C26-A1 (6ES7193-4CA50-0AA0)	TM-E15C24-01 (6ES7193-4CB30-0AA0)	← Spring terminal
TM-E15S26-A1 (6ES7193-4CA40-0AA0)	TM-E15S24-01 (6ES7193-4CB20-0AA0)	← Screw-type terminal
TM-E15N26-A1 (6ES7193-4CA80-0AA0)	TM-E15N24-01 (6ES7193-4CB70-0AA0)	← Fast Connect
<p style="text-align: center;">Wiring examples</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>2-wire</p> </div> <div style="text-align: center;"> <p>4-wire</p> </div> </div>		

Block diagram

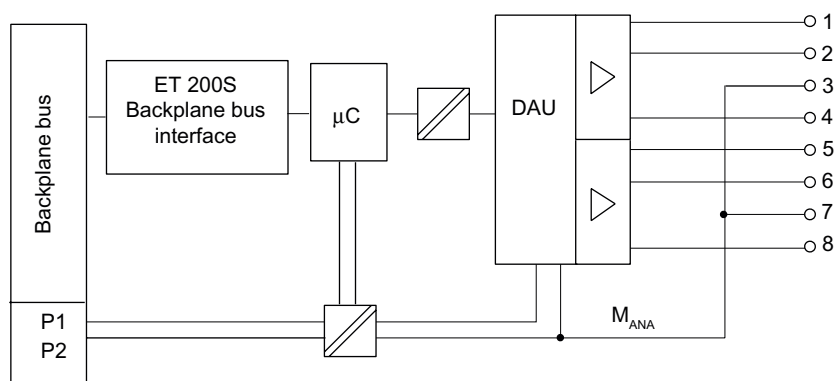


Figure 1-1 Block diagram of the 2AO U HS

Technical specifications for 2AO U HS (6ES7135-4FB52-0AB0)

Dimensions and weight	
Width (mm)	15
Weight	Approx. 40 g
Module-specific data	
Supports isochrone mode	Yes
Supports I&M functions	Yes
Number of outputs	2
Cable length	
• Shielded	Max. 200 m Max. 20 m for $T_{WA} = 100 \mu s$
Parameter length	7 bytes
Address space	4 bytes
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Electrical isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels	No
Permissible potential difference	
• Between MANA and the central grounding point (U_{iso})	75 VDC / 60 VAC
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 130 mA
Power loss of the module	Typically 2.2 W
Status, interrupts, diagnostics	
Diagnostics function	
• Group error display	Red "SF" LED
• Diagnostic information readable	Supported
Substitute values can be applied	Yes, assignable

Properties

1.1 2AO U HS analog electronic module (6ES7135-4FB52-0AB0)

Analog value generation	
Resolution (including sign)	± 5 V/15 bit + sign ± 10 V/15 bits + sign 1 to 5 V/14 bits
Conversion time in µs (per channel)	Max. 20 µs
Cycle time in ms (per module)	0.25 ms
Settling time ¹	
• For resistive load	0.05 ms
• For capacitive load	0.05 ms
• For inductive load	0.05 ms
Interference suppression, error limits	
Crosstalk between the outputs	> 60 dB
Operational limit (in the entire temperature range, with reference to the output range)	± 0,2 %
Basic error limit (operational limit at 25 °C with reference to output range)	± 0,1 %
Temperature error (with reference to the output range)	± 0.01 %/K
Linearity error (with reference to the output range)	± 0,03 %
Repeatability (in steady state at 25°C with reference to output range)	± 0,03 %
Output ripple; bandwidth 0 to 50 kHz (relative to output range)	± 0,02 %
Actuator selection data	
Output range (rated value)	± 5 V ± 10 V 1 to 5 V
Load impedance (in the nominal range of the output) at voltage outputs, capacitive load • At voltage outputs	Min. 1.0 kΩ/ 1 µF Max. 0.1 µF for TWA 100 µs
Voltage output • Short-circuit protection • Short-circuit current	Yes approx. 25 mA
Destruction limit against voltages/currents applied from outside	
• Voltage at the outputs to M _{ANA}	Max. 15 V/ 5 hours
• Current	Max. DC 30 mA
Connection of actuators • Voltage output 2-conductor connection 4-conductor connection	Possible, without compensation of the cable resistances Possible
¹ at a max. load of 1 kΩ/ 100 nF and a max. cable length of 20 m	

Firmware update (as of revision level 03)

To add functions and for troubleshooting, it is possible to load firmware updates to the operating system memory of the electronic module using STEP 7 HW Config.

Note

When you launch the firmware update, the old firmware is deleted. If the firmware update is interrupted or canceled, the electronic module will no longer be capable of functioning. Restart the firmware update and wait until it has completed successfully.

Note

If the ET 200S is operated in conjunction with an S7-300 CPU with PROFIBUS DP interface or an ET 200S Interface Module IM151-3 PN HIGH SPEED, a station failure of the ET 200S can occur during the firmware update.

I&M functions and firmware update

The interface modules identified in the table below (as of order number) can be used to read and write I&M data from the module and for the firmware update.

Interface module	as of order number
IM151-1 HIGH FEATURE	6ES7151-1BA02-0AB0
IM151-3 PN	6ES7151-3AA22-0AB0
IM151-3 PN HIGH FEATURE	6ES7151-3BA22-0AB0
IM151-3 PN FO	6ES7151-3BB22-0AB0
IM151-7 CPU	6ES7151-7AA20-0AB0

Parameters

2.1 Parameters

Parameters for the 2AO U HS analog electronic module

Table 2-1 Parameters for the 2AO U HS analog electronic module

Parameters	Range of values	Default setting	Applicability
Group diagnostics (parameter assignment error, internal error)	<ul style="list-style-type: none"> Disable Enable 	Disable	Module
Diagnostics: short-circuit to M ¹	<ul style="list-style-type: none"> Disable Enable 	Disable	Channel
Reaction to CPU/Master STOP	<ul style="list-style-type: none"> Output has no current or voltage Substitute a value Keep last value 	Output has no current or voltage	Module
Type/range of output	<ul style="list-style-type: none"> Deactivated ± 5 V ± 10 V 1 to 5 V 	± 10 V	Channel
Substitute value	To 65535 (value range must be within the nominal range)	<ul style="list-style-type: none"> ± 5 V: 0 V ± 10 V: 0 V 1 to 5 V: 1 V 	Channel
¹ No diagnostic detection between -0.296 V and +0.296 V			

Note

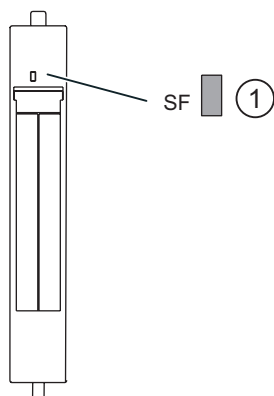
If you deactivate a channel of the electronic module, you do not gain any advantages in terms of speed due to the measuring procedure.

Diagnostics

3.1 LED displays on analog electronic modules

Analog electronic modules

LED displays on analog electronic modules:



① Batch error (red)

Status and error displays by means of LEDs on analog electronic modules

The table below shows the status and error displays on the analog electronic modules.

Event (LED)	Cause	Remedy
SF		
values	No configuration or incorrect module plugged in. No load voltage present. There is a diagnostic message.	Check the parameter assignment. Check the load voltage. Evaluate the diagnostics.

3.2 Channel-related diagnostics - error types

Analog output module error types

Table 3-1 Error types

Error type		Meaning	Remedy
31 _D	11111: Channel temporarily unavailable	The firmware is being updated. Channel 0 applies to the entire module. The module does not output any values during this time.	---
16 _D	10000: Parameter assignment error	Module cannot utilize the parameters for the channel: Inserted module does not match the configuration. Incorrect parameter assignment.	Correct the configuration (align actual and preset configuration). Correct the parameter assignment (wire break diagnostics assigned only for the allowed measuring ranges).
9 _D	01001: Error	Internal module error has occurred (diagnostic message on channel 0 applies to the whole module).	Replace the module.
1 _D	00001: short-circuit	Short circuit of the actuator supply.	Correct the process wiring.

Analog value representation

4.1 Introduction

Electronic modules with analog outputs

With the electronic modules with analog outputs, digital values set by a controller can be converted to a corresponding analog signal (current) in an analog output module and used to control suitable actuators (setpoint input for speed controllers, temperature controllers and similar).

4.2 Analog value representation for measuring range with SIMATIC S7

Analog value representation

With the same nominal range, the digitized analog value is the same for input and output values. Analog values are represented in two's complement.

The following table shows the analog value representation for the analog electronic modules.

Table 4-1 Analog value representation (SIMATIC S7 format)

Resolution	Analog value															
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Significance of the bits	S	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Sign

The sign (S) of the analog value is always in bit number 15:

- "0" → +
- "1" → -

4.3 Output ranges for 2AO U HS

Analog values

The following table shows the representation of the binary analog values and the corresponding decimal and hexadecimal representation of the units of the analog values.

The table below shows the 11, 12, 13, 14, and 15 bit resolutions + sign. Each analog value is entered left aligned in the ACCU. The bits marked with "x" are set to "0".

Table 4-2 Analog values (SIMATIC S7 format)

Resolution in bits	Units		Analog value	
	Decimal	Hexadecimal	High byte	Low byte
11+S	16	10 _H	S 0 0 0 0 0 0 0	0 0 0 1 x x x x
12+S	8	8 _H	S 0 0 0 0 0 0 0	0 0 0 0 1 x x x
13+S	4	4 _H	S 0 0 0 0 0 0 0	0 0 0 0 0 1 x x
14+S	2	4 _H	S 0 0 0 0 0 0 0	0 0 0 0 0 0 1 x
15 + sign	1	1 _H	S 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

4.3 Output ranges for 2AO U HS

Output ranges for voltage and current: ± 5 V , ± 10 V

Table 4-3 SIMATIC S7 format: Output range ± 5 V, ± 10 V

Output range ± 5 V	Output range ± 10 V	Units		Range
		Decimal	Hexadecimal	
0	0	> 32511	> 7EFF _H	Overflow
5.8800	11.7589	32511	7EFF _H	Overrange
:	:	:	:	
5.0002	10.0004	27649	6C01 _H	
5.0000	10.0000	27648	6C00 _H	Nominal range
3.7500	7.5000	20736	5100 _H	
:	:	:	:	
- 3.7500	- 7.5000	-20736	AF00 _H	
- 5.0000	- 10.0000	-27648	9400 _H	
- 5.0002	- 10.0004	-27649	93FF _H	Underrange
:	:	:	:	
- 5.8800	- 11.7589	-32512	8100 _H	
0	0	< -32512	< 8100 _H	Underflow

Output ranges for voltage and current: 1 to 5 V

Table 4-4 SIMATIC S7 format: Output ranges 1 to 5 V

Output range 1 to 5 V	Units		Range
	Decimal	Hexadecimal	
0	> 32511	> 7EFF _H	Overflow
5.7000	32511	7EFF _H	Overrange
:	:	:	
5.0002	27649	6C01 _H	Nominal range
5.0000	27648	6C00 _H	
:	:	:	
1.0000	0	0 _H	Underrange
0.9998	-1	FFFF _H	
:	:	:	
0	-6912	E500 _H	Underflow
0	< -6913	< E4FF _H	

4.4 Effect on analog value representation

4.4.1 Influence of the supply voltage and the operating state on analog output values

The output values of the analog modules are dependent on the supply voltage for electronics/sensors and on the operating state of the PLC (CPU of the DP master). The table below shows this dependency.

Table 4-5 Dependence of the analog output values on the operating state of the PLC (CPU of the DP master) and the supply voltage L+

Operating state of the PLC (CPU of the DP master)		Supply voltage L+ on ET 200S (power module)	Output value of the electronic module with analog outputs
POWER ON	RUN	L+ present	PLC values Until first value output: <ul style="list-style-type: none"> After startup, a signal of 0 mA or 0 V is output. Dependent on the "CPU/ Master STOP" parameter.
		L+ missing	-
POWER ON	STOP	L+ present	Dependent on the "CPU/ Master STOP" parameter.
		L+ missing	-
POWER OFF	-	L+ present	Dependent on the "CPU/ Master STOP" parameter.
		L+ missing	-

4.4.2 Influence of the value range on the 2AO U HS analog output

The response of the electronic modules with analog outputs depends on the part of the value range in which the input values are located. The table below shows this dependency.

Table 4-6 Behavior of the analog modules, depending on the location of the analog input value in the range of values

Output value is in ...	Input value in SIMATIC S5/S7 format
Nominal range	Value from DP master
Overrange/underrange	Value from DP master
Overflow	0-signal
Underflow	0-signal
Prior to parameter assignment, or incorrect parameter assignment	0-signal

4.4.3 Effect on the change rate of the output signals

Factors

The following factors influence the change rate of the output signals:

- Length, impedance, and capacitance of the cable
- Input impedance and capacitance of the actuators

See also

2AO U HS analog electronic module (6ES7135-4FB52-0AB0) (Page 7)

Connecting

5.1 Connecting analog outputs

Introduction

This chapter describes the factors to consider when connecting the analog outputs.

Cables for analog signals

You should use shielded and twisted-pair cables for the analog signals. This reduces the effect of interference. You should ground the shield of the analog cables at both ends of the cables. If there are differences in potential between the ends of the cable, an equipotential bonding current flows over the shield, which can interfere with the analog signals. In this case, you should only ground the shield at one end of the cable.

Analog output modules

In the case of the analog output modules there is generally galvanic isolation

- Between logic and backplane bus.
- Between the load voltage and M_{ANA} .

Note

Ensure that this potential difference U_{ISO} does not exceed the permitted value. If there is a possibility of exceeding the permitted value, make a connection between terminal M_{ANA} and the central grounding point.

5.2 Using the shield connection

Rules

To prevent interference we recommend the following with the analog electronic modules:

- Use shielded wires to the sensors and actuators.
- Lay out the wire shields on the shield connection.
- Connect the shield connection with low impedance to the ground bus.

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