

AMIKON TECHNICAL DOCUMENTATION

Installation Instructions

Siemens 6ES7138-4DB03-0AB0

ET 200S SSI Interface

INTERFACE	ENCODER WIDTH	SIGNALS	LOAD SUPPLY
1 SSI encoder	13 to 25 bits	RS422	24 V DC

For qualified personnel only. Isolate the equipment and follow the complete manufacturer and site safety procedures. This reference does not replace the approved project design or the full installation manual.

01

PREPARATION AND WIRING CHECKS

- Verify the 4DB03 identity, the selected standard or Fast catalog entry and the installed IM 151 capability.
- Use the applicable TM-E15S24-01 or TM-E15S26-A1 terminal diagram; the original drawing retains a compatible 4DB02 label.
- Maintain SSI data/clock polarity and shield both twisted-pair connections at both ends; observe the rate-specific cable limits.
- Keep the total encoder supply within 500 mA and match width, parity, coding and monoflop timing to the actual encoder.
- Restore the correct process-data mapping, check diagnostics, and reload comparison values or retrigger latching when station parameters are reassigned.

02

ORIGINAL WIRING REFERENCE

Original source PDF pages 238, 2, 7, 231, 232, 233, 237, 239, 240, 241, 242, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263. The following pages retain the original Siemens drawings and printed page numbers.

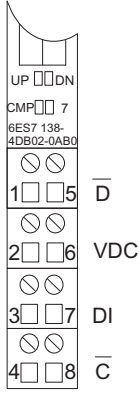
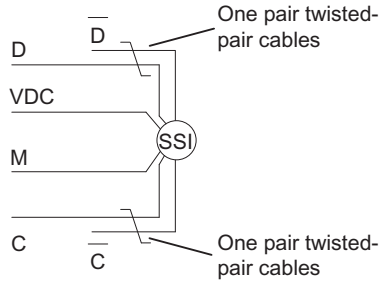
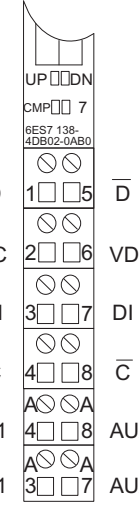
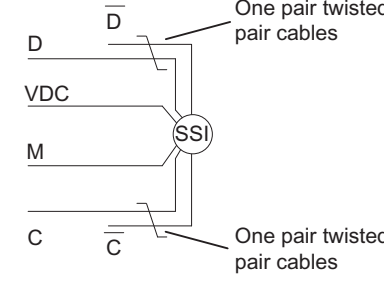
Source: Siemens 06/2010, A5E00124867-07. Original wiring and safety pages follow.

4.4 Terminal Assignment Diagram

Terminal Assignment

You will find the terminal assignment for the 1SSI in the table below.

Table 4- 1 Terminal Assignment of the 1SSI

View	Terminal Assignment	Remarks
 UP ☐ ☐ DN CMP ☐ ☐ 7 6ES7 138-4DB02-0AB0 D 1 ☐ 5 $\bar{D}$ VDC 2 ☐ 6 VDC M 3 ☐ 7 DI C 4 ☐ 8 $\bar{C}$	TM-E15S24-01 and EM 1SSI  One pair twisted-pair cables One pair twisted-pair cables	Terminals 1 to 8: 1/5: Data from the SSI encoder ¹ 2/6: Power supply for absolute encoder and switch ² 3: Chassis ground 7: Digital input latch function 4/8: SSI clock (clock wire) ¹
 UP ☐ ☐ DN CMP ☐ ☐ 7 6ES7 138-4DB02-0AB0 D 1 ☐ 5 $\bar{D}$ VDC 2 ☐ 6 VDC M 3 ☐ 7 DI C 4 ☐ 8 $\bar{C}$ AUX1 4 ☐ 8 AUX1 AUX1 3 ☐ 7 AUX1	TM-E15S26-A1 and EM 1SSI  One pair twisted-pair cables One pair twisted-pair cables	

¹ It is essential that you maintain the correct polarity when wiring the encoder. If you do not, an absolute encoder error is reported. Signals according to RS422

² Short circuit-proof, maximum 0.5 A.

Legal information

Warning notice system

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 product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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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.

Preface

How this Manual Is Structured...

This manual is supplementary to the *ET 200S Distributed I/O System* operating instructions.

The ET 200S Distributed I/O System

(<http://support.automation.siemens.com/WW/view/en/1144348>) operating instructions provide comprehensive information pertaining to the hardware configuration, installation, wiring, commissioning, diagnostics and technical specifications of the ET 200S distributed I/O system.

This manual provides a description of functions and the technical specifications of the ET 200S modules for technological functions: 1Count24V, 1Count5V, 1SSI and 2PULSE.

How to Find Your Way Around

At the beginning of each section you will find a **Product Overview**, which lists the features and applications of the module described. You will also find the order number of the module and the name and release of the software required. For the current GSD file, go to:

- <http://www.automation.siemens.com/csi/gsd>

In each section you will then find a section with the heading **Brief Instructions on Commissioning**. These brief instructions tell you in a series of short steps how to install and configure the module, how to integrate it in your use program, and how to test it in your user program.

Index

The index contains keywords that come up in the manual.

Standards and approvals

For information about standards and approvals, refer to the section "General technical specifications" in the ET 200S Distributed I/O System

(<http://support.automation.siemens.com/WW/view/en/1144348>) operating instructions.

Recycling and disposal

The ET 200S 1Count24V, ET 200S 1Count5V, ET 200S 1SSI and ET 200S 2PULSE modules can be recycled due to the non-toxic materials from which they are assembled. For environmentally sustainable recycling and disposal of your old device, contact a certified disposal service for electronic scrap.

1SSI

4.1 Product Overview

Order Number

6ES7 138-4DB03-0AB0

Compatibility

The 1SSI with order number 6ES7 138-DB03-0AB0 replaces the 1SSI with the following order numbers:

- 6ES7 138-4DB02-0AB0
- 6ES7 138-4DB01-0AB0
- 6ES7 138-4DB00-0AB0

and is fully compatible.

Features

- The 1SSI is an interface between an absolute encoder (SSI) and the higher-level controller. You edit the cyclically recorded encoder value in your controller program.
- Can be operated using terminal modules TM-E15S24-01 and TM-E15S26-A1
- Isochronous mode
- Normalization of the encoder value (that is, discounting of adjusted, irrelevant bits in the encoder value).
- Reversal of the direction of rotation to adjust the direction of movement of the absolute encoder to the axis.
- Latch function for freezing the current encoder value (only possible in standard mode).
- Comparison function between the current encoder value and loadable comparison values (only possible in standard mode).
- Type of encoder value recording can be selected:
 - Free-wheeling
 - Synchronous to the update rate
 - Isochronously
- Fast mode can be selected; with rapid encoder value detection and compressed functionality (cannot be used with the IM 151 with the order number 6ES7 151-1AA00-0AB0).
- Maximum encoder sampling rate (e.g., for ultrasonic encoders) is taken into account in isochronous mode
- Sign of life in isochronous mode
- Parity check of encoder value can be performed
- Gray/dual converter

Supported Encoder Types

The following encoder types are supported:

- Absolute encoder (SSI) with 13 bits
To
- Absolute encoder (SSI) with 25 bits

Note

The predecessor modules only support absolute encoders (SSI) that have widths of 13 bits, 21 bits and 25 bits.

Firmware update ¹

To add functions and for troubleshooting, you can load firmware updates to the operating system memory of the 1SSI using STEP 7 HW Config.

Note

When you start the firmware update, the old firmware is deleted. If the firmware update is interrupted or canceled for any reason, the 1SSI will no longer function correctly as a result. Restart the firmware update and wait until it has completed successfully.

Identification Data ¹

- Hardware release status
- Serial number

See also ET 200S Distributed I/O operating instructions (<http://support.automation.siemens.com/WW/view/en/1144348>), "Identification data" section.

¹ The function is only available if the used interface module supports the required system services.

Configuration

You can use either of the following to configure the 1SSI:

- STEP 7 V5.4 SP2 and later, or with the HSP (hardware support package, available online) STEP 7 V5.3 SP2 and later.
- A GSD file (<http://www.automation.siemens.com/csi/gsd>)

4.2 Isochronous Mode

Note

For basic information on isochronous mode, refer to the Isochronous mode (<http://support.automation.siemens.com/WW/view/en/15218045>) function manual.

Hardware Requirements

You will require the following for the 1SSI in isochronous mode:

- A CPU that supports isochronous mode
- PROFIBUS master or PROFINET controller that supports the constant bus cycle time
- An IM 151 that supports isochronous mode

Features

Depending on the system parameter assignment, the 1SSI works in either non-isochronous or isochronous mode.

In isochronous mode, the data communication between the master and 1SSI is isochronous to the bus cycle.

In isochronous mode, all bytes of the feedback interface are consistent.

If isochronous mode fails, the feedback interface is not updated. In the user program, this can be detected with the sign of life in the feedback interface.

4.4 Terminal Assignment Diagram

Wiring Rules

The cables (terminals 1 and 5 and terminals 4 and 8) must be shielded, twisted-pair cables. The shield must be supported at both ends. To do this, use the shield contact (see the ET 200S Distributed I/O System (<http://support.automation.siemens.com/WW/view/en/1144348>) operating instructions).

4.5 Configuring standard mode and fast mode

Introduction

In order to take full advantage of the functionality of the 1SSI for the application in question, choose between fast mode and standard mode, depending on your automation task.

Areas of Application	Mode
• Closed-loop control applications such as position controls with path position as actual value • Fast encoder value detection	Fast
• Monitoring or detecting of position points • Length measurement, edge detection, synchronization with workpieces	Standard

Configuring Standard Mode and Fast Mode

Standard Mode	Fast Mode
Parameters are assigned to the various modes. You will find the parameter lists in the descriptions of the modes.	
You can integrate the 1SSI in your project in two different ways. Decide whether you want to work with the GSD file or with STEP 7 using HW Config .	

Configuring 1SSI with STEP 7 using HW Config (in isochronous and non-isochronous mode)	
Select an entry from the hardware catalog that corresponds to the functionality you want.	
For standard mode, select the 1SSI entry with the number 6ES7 138-4DB03-0AB0 in the infotext.	For fast mode, select the 1SSI fast mode entry with the number 6ES7 138-4DB03-0AB0 Fast in the infotext.
Drag the entry to the slot at which you have installed your 1SSI.	
Select the parameters.	

Configuring 1SSI with the GSD file (only in non-isochronous mode)	
Select an entry in the GSD file that corresponds to the functionality you want.	
Select 6ES7 138-4DB03-0AB0 1SSI for standard mode.	Select 6ES7 138-4DB03-0AB0 1SSI Fast for fast mode.
Select the parameters.	

4.6 Functions of the 1SSI

4.6.1 Overview of 1SSI functions

Operating Principle

The 1SSI records the signals of the connected position encoder cyclically and forwards them, depending on the parameter assignment, to the feedback interface by means of the following functions:

- Encoder value detection
- Gray/binary converter
- Normalization
- Direction reversal
- Comparator (only in standard mode)
- Latch function (only in standard mode)
- Error detection
- Sign of life

The 1SSI uses the "ready for operation" feedback bit to indicate that the functions are executable and the displayed encoder value is valid.

4.6.2 Encoder Value Detection

Description

The absolute encoder transfers its encoder values in message frames to the 1SSI. The transmission of message frames is initiated by the 1SSI. The following alternatives are available for encoder value detection:

- Free-wheeling encoder value detection
- Synchronous encoder value detection
- Isochronous encoder value detection

You can set free-wheeling or synchronous encoder value detection in HW Config with the "Detection" parameter. This parameter only works in non-isochronous mode.

The detection of the encoder value will be isochronous when the 1SSI is in isochronous mode. In this case, the "Detection" parameter is not evaluated.

The following table shows these connections:

Table 4- 2 Encoder Value Detection

Mode	"Detection" Parameter	Encoder value detection
Non-isochronous mode	Free-wheeling	Free-wheeling encoder value detection
	Synchronous	Synchronous encoder value detection
Isochronous mode	- (irrelevant)	Isochronous encoder value detection

Free-Wheeling Encoder Value Detection

With free-wheeling encoder value detection, you obtain maximum accuracy with the latch function.

The 1SSI initiates the transmission of a message frame each time the assigned monoflop time elapses.

The 1SSI processes the detected encoder value asynchronously to these free-wheeling message frames in the cycle of the update rate.

This results in encoder values of various ages with the free-wheeling detection of encoder values. The difference between maximum and minimum age is the jitter.

Synchronous Encoder Value Detection

With synchronous encoder value detection, you obtain maximum accuracy with encoder value detection.

The 1SSI initiates the transmission of a message frame in the cycle of its update rate.

The 1SSI processes the transmitted encoder value synchronously to its update rate.

Isochronous Encoder Value Detection

Isochronous encoder value detection is carried out automatically when the equidistant bus cycle is activated in the DP master system and the DP slave is synchronized to the bus cycle.

The 1SSI initiates the transmission of a message frame in every bus cycle at time T_i , as long as the configured maximum encoder sampling rate does not result in a reduction.

The 1SSI processes the transmitted encoder value isochronously to the bus cycle.

4.6.3 Gray/Binary Converter

Description

When Gray is set, the encoder value supplied by the absolute encoder in gray code is converted to binary code. When Binary is set, the supplied encoder value is not converted.

NOTICE
If you selected the Gray setting, the 1SSI always converts the total encoder value (13 to 25 bits). Preceding special bits thus influence the encoder value and trailing bits can under some circumstances be corrupted.

4.6.4 Transmitted Encoder Value and Standardization

Description

The transmitted encoder value contains the encoder position of the absolute value encoder. Depending on the encoder that is used, other bits that are located before and after the encoder position are transmitted in addition to the encoder position.

So that the 1SSI can determine the encoder position, specify the following:

- Encoder type
- Number of trailing bits
- Total steps of the absolute encoder

With normalization, you specify the representation of the encoder value in the feedback interface.

- With "Normalization On", you specify that trailing, irrelevant bits in the encoder value are to be discounted (see the following example).
- With "Normalization Off", you specify that trailing bits are retained and are available for evaluation.

4.6.8 Error Detection in Standard Mode

Description

The absolute value encoder and sensor supply short circuit errors must be acknowledged. They have been detected by the 1SSI and are indicated at the feedback interface. Channel-specific diagnostics are performed if you have enabled group diagnostics in your configuration (see device manual of the interface module used).

The parameter assignment error bit is acknowledged by means of correct parameter assignment.

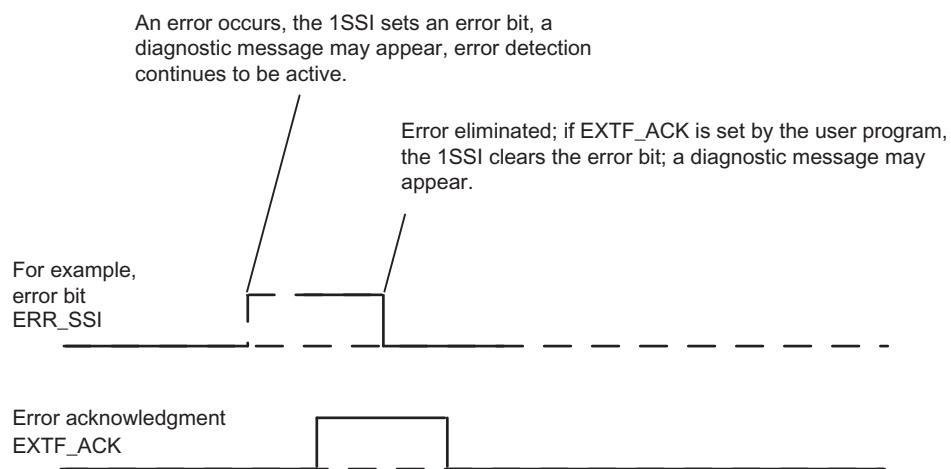


Figure 4-4 Error Acknowledgment

In the case of constant error acknowledgement (`EXT_F_ACK = 1`) or in CPU/master STOP mode, the 1SSI reports the errors as soon as they are detected and clears the errors as soon as they are eliminated.

4.6.9 Error Detection in Fast Mode

Description

The absolute value encoder and sensor supply short circuit errors have been detected by the 1SSI and are indicated at the feedback interface. Channel-specific diagnostics are performed if you have enabled group diagnostics in your configuration (see device manual of the interface module used).

The parameter assignment error bit is acknowledged by means of correct parameter assignment.

As soon as the absolute value encoder and sensor supply short circuit errors are no longer detected by the 1SSI, the error display at the feedback interface is cleared, and in certain cases the channel-specific diagnosis reports an error-free condition.

4.7 Behavior at CPU/master STOP

Description

The 1SSI detects the CPU/master STOP. The reaction to this is to stop the active operation.

Exiting the CPU/master STOP status

Without reassigning the parameters of the ET 200 station	• The feedback interface of the 1SSI remains current.
With reassignment of the parameters of the ET 200 station	• You must reload the comparison values. • The latch function has to be triggered with a new edge on the digital input DI.

Reassigning Parameters of the ET 200S Station

Reconfiguration of the ET 200S station is carried out by your CPU/master at:

- POWER ON of the CPU/master
- Upon power on of the IM 151
- After failure of the bus transmission
- Upon loading changed parameters or configuration of the ET 200S station to the CPU/master

4.8 Setting parameters for the 1SSI

Overview

You set the parameters for the 1SSI by means of the GSD file for the ET 200S or using the STEP 7 parameter assignment software. It is not possible to reassign the parameters by means of the user program.

Depending on the mode that you selected, either of the following parameter sets from your parameter assignment appear in the parameter assignment software:

- All parameters (standard mode), or
- A portion of the parameters (fast mode)

You can enter the following parameters (the default appears in bold):

Parameters	Value Range	Note
Group diagnostics	Disable /enable	Enabling parameter
Detection	Free-wheeling /synchronous	This parameter is irrelevant in isochronous mode and is not evaluated.
Encoder type ¹	No encoder/ SSI 13-bit / ... / SSI 25-bit	No encoder: The encoder input is switched off.
Gray/binary converter ¹	Gray /binary	Code supplied by the encoder
Transmission rate ^{1 3}	125 kHz / 250 kHz / 500 kHz / 1 MHz / 1.5 MHz / 2 MHz	Note that the transmission rate affects the accuracy and up-to-dateness of the encoder values.
Monoflop time ^{1 2 3}	16 µs / 32 µs / 48 µs / 64 µs	The specification of the monoflop time is relevant for free-wheeling encoder value detection. See the vendor's technical specifications.
Parity	None , odd, even	An assigned parity bit is included in the "Encoder Type" parameter. If a 25-bit encoder is assigned parity, then 26 bits are read from the encoder. The bit following the LSB (least significant bit) is evaluated as a parity bit. A parity error is reported by means of the following feedback interfaces: • EXT_F in fast mode • ERR_SSI in standard mode
Normalization	Off /on	–
Number of trailing bits ¹	0 to 15	The number of trailing bits must be specified.
Direction reversal	Off /on	–

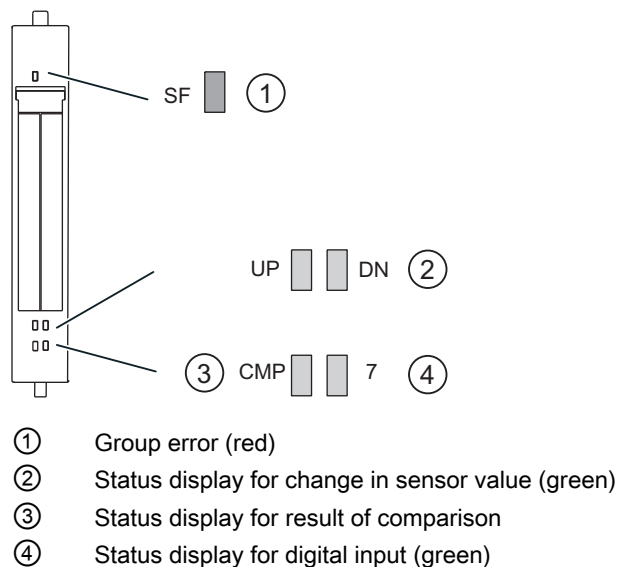
Parameters	Value Range	Note
Total steps of the absolute encoder ¹	- Encoder type 13 bits: 16 to 8192 - Encoder type 14 bits: 16 to 16384 - Encoder type 15 bits: 16 to 32768 - Encoder type 16 bits: 16 to 65536 - Encoder type 17 bits: 16 to 131072 - Encoder type 18 bits: 16 to 262144 - Encoder type 19 bits: 16 to 524288 - Encoder type 20 bits: 16 to 1048576 - Encoder type 21 bits: 16 to 2097152 - Encoder type 22 bits: 16 to 4194304 - Encoder type 23 bits: 16 to 8388608 - Encoder type 24 bits: 16 to 16777216 - Encoder type 25 bits: 16 to 33554432	If you find "Total steps - highword" and "Total steps - lowword" in your parameter assignment software instead of "Total steps", the following definition applies: $Total\ steps = total\ steps\ lowword + total\ steps\ highword \times 2^{16}$
Latch: Encoder value	Not active / With rising edge DI / With falling edge DI / With both edges DI	This parameter is available in the parameter assignment software in standard mode only. Not active: The encoder value cannot be frozen.
Comparator 1	Not active / In the up direction / In the down direction / In both directions	This parameter is available in the parameter assignment software in standard mode only. Not active: The comparator is switched off.
Comparator 2	Not active / In the up direction / In the down direction / In both directions	This parameter is available in the parameter assignment software in standard mode only. Not active: The comparator is switched off.
Sign of life	Off , On	This parameter is only active in isochronous mode. When sign of life is on, the sign-of-life bit is toggled, i.e., the last sent value is inverted, each time an encoder value is read in in isochronous mode. If a reduction is assigned in the "Encoder Sampling Rate" parameter, the value is toggled only if an encoder value was actually read in. You can find the sign-of-life bit in the feedback interface in: - Byte 4/bit 7 (standard mode) - Byte 0/bit 7 (fast mode)

Parameters	Value Range	Note
Encoder sampling rate	No limitation , 0.1 kHz to 6.3 kHz (in 0.1-kHz steps)	Any encoder sampling rate to be taken into account is set here. This parameter is only active in isochronous mode. It enables the use of slower encoders (such as ultrasound encoders) even in a fast processing cycle. An integer reduction n is calculated using the set frequency. In this case, the encoder is read in again only every nth clock cycle. Example: Processing cycle 500 μs Encoder sampling rate: 1.2 kHz (approximately every 833 μs) --> reduction $n = 2$, i.e., the encoder is read in again only every 2nd processing cycle, i.e., every ms.
¹ See the technical specifications of the absolute encoder. ² The monoflop time is the time between 2 SSI frames. The assigned monoflop time must be greater than the monoflop time of the absolute encoder (refer to the technical specifications of the manufacturer). ³ The following limitation applies to the monoflop time of the absolute encoder: (1/transmission rate) < monoflop time of absolute encoder < 64 μs		

4.9 Diagnostics

4.9.1 Diagnostics using the LED display

LED display on the 1SSI



Status and error displays by means of LEDs on the 1SSI

The table below shows the status and error displays on the 1SSI.

Event (LEDs)					Cause	Remedy
SF	UP	DN	CMP	7		
On					No parameter assignment. There is a diagnostic message.	Check the parameter assignment. Evaluate the diagnostics data.
	On				At value change from smaller to larger sensor values (including zero-crossing)	
		On			At value change from larger to smaller sensor values (including zero-crossing)	
			On		Set for comparison result CMP 1	
				On	DI (latch) is activated.	

4.9.2 Error types

For information on the structure of the channel-related diagnostics, refer to the manual on the interface module used in your ET 200S station.

1SSI error types

The following table shows the error types on the 1SSI.

Error class		Meaning	Remedy
1D	00001: Short circuit	Short circuit of the supply to the absolute encoder.	Correct the process wiring.
9D	01001: Error	Internal module error occurred. Load voltage from the power module is too low.	Replace the module. Correct the process wiring. Check the load voltage.
16D	10000: Parameter assignment error	Parameters have not been assigned to the module.	Correct the parameter assignment.
26D	11010: External error	Start/Stop bit error (error absolute encoder): Wire break in the sensor cable, or sensor cable is not connected. Sensor type, transmission rate, and monoflop time do not correspond to the sensor connected; programmable sensors do not correspond to the settings on the 1SSI electronic module. Sensor is defective or there are faults.	Replace the sensor; correct the process wiring. Correct the parameter assignment.

4.10 Control and Feedback Interfaces in Standard Mode

Note

For the 1SSI, the following data of the control and feedback interface are consistent:

Byte 0 to 3

Byte 4 to 7

Use the access or addressing mode for data consistency over the entire control and feedback interface on your master (only for configuration using the GSD file).

Description

The two tables show the assignment of the control interface (outputs) and the feedback interface (inputs):

Table 4- 3 Assignment of the Feedback Interface (Inputs)

Address	Assignment
Bytes 0 to 3	Encoder value double word (bit 31 set, encoder value frozen)
Byte 4	Bit 7: Reserved = 0 or sign of life LZ Bit 6: Ready for operation RDY Bit 5: Parameter assignment error ERR_PARA Bit 4: Absolute encoder error ERR_SSI Bit 3: Encoder supply short circuit ERR_24V Bit 2: Status DI STS_DI Bit 1: Status DN STS_DN Bit 0: Status UP STS_UP
Byte 5	Bit 7: Reserved = 0 Bit 6: Reserved = 0 Bit 5: Reserved = 0 Bit 4: Reserved = 0 Bit 3: Comparison value 2 reached, CMP2 Bit 2: Comparison value 1 reached, CMP Bit 1: Load function error, ERR_LOAD Bit 0: Load function running, STS_LOAD
Bytes 6 to 7	Reserved = 0

Table 4- 4 Assignment of the Control Interface (Outputs)

Address	Assignment
Bytes 0 to 3	Comparison value 1 or 2 (double word)
Byte 4	Bit 7: Error acknowledgment EXTf_ACK Bit 6: Acknowledgment of latch function LATCH_ACK Bit 5: Reserved = 0 Bit 4: Reserved = 0 Bit 3: Reserved = 0 Bit 2: Reserved = 0 Bit 1: Load comparison value 2, CMP_VAL2 Bit 0: Load comparison value 1, CMP_VAL1
Byte 5	Reserved = 0
Bytes 6 to 7	Reserved = 0

Notes on the Control and Feedback Bits

Bits	Notes
CMP	Comparison result of comparator 1
CMP2	Comparison result of comparator 2
CMP_VAL1	Load comparison value 1
CMP_VAL2	Load comparison value 2
ERR_24V	The encoder supply is short circuited. ERR_24V is reset when the short circuit is eliminated and acknowledged with the EXTf_ACK control bit.
ERR_LOAD	Error while loading the comparison values because both control bits CMP_VAL1 and CMP_VAL2 are set.
ERR_PARA	Incorrect parameter assignment for the ET 200S station. Cause: Total steps of the absolute encoder are not in the range of values for the type of encoder. The parameter bit is cleared when a correct parameter assignment is transmitted.
ERR_SSI	The 1SSI detects an absolute encoder error if the message frames at the SSI interface are faulty. Causes: No encoder connected; wire break in the encoder cable; over voltage of encoder supply; type of encoder, transmission rate, parity error, monoflop time do not correspond to the connected encoder; programmable encoders do not correspond to the settings on the 1SSI; encoder is defective or faults exist. ERR_SSI is reset when the cause of the error is eliminated and acknowledged with the EXTf_ACK control bit.
EXTf_ACK	Error acknowledgement for the absolute encoder ERR_SSI and encoder supply short circuit ERR_24V errors
LATCH_ACK	Acknowledgement for latch function
LZ	This parameter is only active in isochronous mode. When sign of life is on, the sign-of-life bit is toggled, i.e., the last sent value is inverted, each time an encoder value is read in in isochronous mode. If a reduction is assigned in the "Encoder Sampling Rate" parameter, the value is toggled only if an encoder value was actually read in.
STS_DI	The bit displays the status of the digital input DI.
STS_DN	Status direction down; for encoder value change from larger to smaller encoder positions (including zero crossover)
STS_LOAD	Feedback bit for CMP_VAL1 and CMP_VAL2. The 1SSI uses this bit to indicate that a comparison value is loaded.

Bits	Notes
STS_UP	Status direction down; for encoder value change from larger to smaller encoder positions (including zero crossover)
RDY	The parameter assignment of the 1SSI is correct, and the module is executing its functions. The displayed feedback is valid. For the absolute value encoder error, ERR_SSI is also set.

Access to the Control and Feedback Interface in STEP 7 Programming

	Configuring with STEP 7 using the GSD file ¹⁾ (Hardware catalog\PROFIBUS-DP\ Additional FIELD DEVICES\ET 200S)	Configuring with STEP 7 using HW Config (Hardware catalog\PROFIBUS-DP\ ET 200S)
Feedback interface	Read with SFC 14 "DPRD_DAT"	Load command, e.g. L PID
Control interface	Write with SFC 15 "DPWR_DAT"	Transfer command, e.g. T PQD
¹ Load and transfer commands are also possible with CPU 3xxC, CPU 318-2 (as of V3.0), CPU 4xx (as of V3.0) and WinLC RTX (PC CPU).		

4.11 Feedback Interface in Fast Mode

Description

Refer to the table below for the assignment of the feedback interface (inputs):

Table 4- 5 Assignment of the Feedback Interface (Inputs)

Address	Assignment
Bytes 0 to 3	Bit 31: Reserved = 0 or sign of life LZ Bit 30: Ready for operation (feedback is valid) RDY Bit 29: Parameter assignment error ERR_PARA; Bit 28: Group error absolute encoder or encoder supply short circuit EXTf Bit 27: Status DI STS_DI Bit 26: Status DN STS_DN Bit 25: Status UP STS_UP Bytes 0 to 24: Encoder value

Notes on the Feedback Bits

Bits	Notes
ERR_PARA	Incorrect parameter assignment for the ET 200S station. Cause: Total steps of the absolute encoder are not in the range of values for the type of encoder. The parameter bit is cleared when a correct parameter assignment is transmitted.
EXTf	Group error absolute encoder or encoder supply short circuit Causes: The encoder supply is short circuited or No encoder connected; wire break in the encoder cable; type of encoder, transmission rate, monoflop time do not correspond to the connected encoder; programmable encoders do not correspond to the settings on the 1SSI; encoder is defective or faults or parity errors exist. EXTf is reset when the causes of the errors are eliminated.
LZ	This parameter is only active in isochronous mode. When sign of life is on, the sign-of-life bit is toggled, i.e., the last sent value is inverted, each time an encoder value is read in in isochronous mode. If a reduction is assigned in the "Encoder Sampling Rate" parameter, the value is toggled only if an encoder value was actually read in.
STS_DI	The bit displays the status of the digital input DI.
STS_DN	Status direction down; for encoder value change from larger to smaller encoder positions (including zero crossover)
STS_UP	Status direction down; for encoder value change from larger to smaller encoder positions (including zero crossover)
RDY	The parameter assignment of the 1SSI is correct, and the module is executing its functions. The displayed feedback is valid. For the absolute value encoder error, ERR_SSI is also set.

Access to the Feedback Interface in STEP 7 Programming

	Configuring with STEP 7 using the GSD File	Configuring with STEP 7 using HW Config
Feedback interface	Read with SFC 14 "DPRD_DAT"	Load command (e.g. L PID)

4.12 Technical Specifications

Overview

General technical specifications	
Dimensions and Weight	
Dimensions W x H x D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Voltages, Currents, Potentials	
Rated load voltage L+ • Reverse polarity protection	24 VDC Yes
Galvanic isolation • Between backplane bus and SSI function • Between SSI function and load voltage L+	Yes No
Encoder supply • Output voltage • Output current	L+ (-0.8 V) Max. 500 mA (Total current at terminals 2 and 6), short-circuit proof
Current consumption • From the backplane bus • From load voltage L+ (no load)	max. 10 mA max. 40 mA
Power dissipation of the module	1.0 W
SSI Module Encoder Input	
Position feedback	Absolute
Differential signals for SSI data and SSI clock	According to RS422
Data transmission rate and wire length with absolute encoders (twisted pair and shielded) *)	• 125 kHz max. 320 m • 250 kHz max. 160 m • 500 kHz max. 60 m • 1 MHz max. 20 m • 1.5 MHz max. 10 m • 2 MHz max. 8 m
Digital Input	
Input voltage	0 signal: -30 ... 5 V 1 signal: 11 ... 30 V
Input current	0 signal: ≤2 mA (quiescent current) 1 signal: 9 mA (typically)
Input delay	0 > 1: max. 300 μs 1 > 0: max. 300 μs
Connection of a two-wire BERO type 2	Possible
Shielded cable length	50 m
Status, Interrupts, Diagnostics	

General technical specifications						
Interrupts						
Status display for digital input DI	LED 7 (green)					
Status display of first comparator CMP	CMP LED (green)					
Encoder value change Up	UP LED (green)					
Encoder value change Down	DN LED (green)					
Group error	SF LED (red)					
Encoder Value Inaccuracy in Non-Isochronous Mode						
Free-wheeling encoder value detection						
- Maximum age - Standard mode - Fast mode	(2 × frame transfer rate) + monoflop time + 1 μs (2 × frame transfer rate) + monoflop time + 700 μs					
- Jitter - Standard mode - Fast mode	Frame runtime + Monoflop time Frame runtime + Monoflop time					
Synchronous encoder value detection						
- Age - Standard mode - Fast mode	Frame runtime + 1 ms Frame transfer rate + 700 μs					
Isochronous encoder value detection						
Age in standard mode and fast mode	Encoder value at time T _i of the current bus cycle					
Latch Value Inaccuracy in Non-Isochronous Mode						
Free-wheeling encoder value detection						
Jitter in standard mode and fast mode	Frame runtime + Monoflop time					
Synchronous encoder value detection						
- Jitter - Standard mode - Fast mode	1 ms 700 μs					
Isochronous encoder value detection						
Jitter in standard mode and fast mode	Frame runtime + Monoflop time					
Frame runtime of the encoders (for selected encoder widths without parity bit)						
	13 bits	14 bits	16 bits	21 bits	24 bits	25 bits
• 125 kHz	112 μs	120 μs	136 μs	176 μs	200 μs	208 μs
• 250 kHz	56 μs	60 μs	68 μs	88 μs	100 μs	104 μs
• 500 kHz	28 μs	30 μs	34 μs	44 μs	50 μs	52 μs
• 1 MHz	14 μs	15 μs	17 μs	22 μs	25 μs	26 μs
• 1.5 MHz	9 μs	10 μs	11 μs	15 μs	17 μs	17 μs
• 2 MHz	7 μs	8 μs	9 μs	11 μs	13 μs	13 μs
Monoflop time ¹	16 μs / 32 μs / 48 μs / 64 μs					

General technical specifications		
Response Times in Non-Isochronous Mode		
Update rate of the 1SSI		
- In standard mode - In fast mode		1 ms
		700 μ s
Isochronous Times for the Module		
In standard mode	TCI	125 μ s + Frame runtime (in μ s)
	TCO	125 μ s
	T _{oi} Min	0 μ s
	T _{DP} Min	400 μ s + Frame runtime if frame runtime > 100 μ s
		500 μ s if frame runtime $\leq$ 100 μ s
In fast mode	TCI	70 μ s + Frame runtime (in μ s)
	TCO	0 μ s
	T _{oi} Min	0 μ s
	T _{DP} Min	210 μ s + Frame runtime if frame runtime > 40 μ s
		250 μ s if frame runtime $\leq$ 40 μ s

¹ The following restriction applies to the monoflop time of the absolute encoder:
 $(1/\text{transmission rate}) < \text{monoflop time of the absolute encoder} < 64 \mu\text{s}$

^{*)} As long as the encoder in use does not require a shorter line length.