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Siemens S7 HMI

5.30 Siemens S7 HMI

5.30.1 General Information

Communication between TesiMod operating terminals and Siemens S7-300/400 controllers are based on the S7 MPI communication protocol.
In this case, the Siemens HMI adapter is used to physically connect the operating terminal. The adapter converts the MPI protocol to a 3964R-based protocol.
This allows the operating terminal to be connected to the controllers with a simple RS232 interface.

The operating terminal is capable of addressing up to four given MPI bus addresses, meaning four connections can be established.
With the 3964R protocol, the operating terminal acts as a master.

5.30.2 Protocol Parameters

The communication interface parameters - with exception of the baud rate parameter - can not be modified:
Baud rate: **9600**, 19200, 38400

The default value is printed in **bold**.

5.30.2.1 Parameter Delay until Connection Setup

This parameter specifies the time the operating terminal waits before starting communication.
Permitted values are in the range of 5 s to 255 s.
The default value is 5 s.

The value for the waiting time must be increased, depending on the number of stations on the MPI bus.

5.30.2.2 Parameter MPI - Address of Terminal

The MPI address is used to specify the station number of the operating terminal.
Permitted values are in the range of 3 to 126.
The default value is 3.

Modifications to the operating terminal's MPI address can still be made when the operating terminal is already in operation. This is done using the system variable **ComSlaveNr**. The operating terminal must be rebooted after specifying a new MPI address during runtime.
This system variable can be set up in the Setup Mask or any other I/O mask of the user description.
If this system variable is integrated into the Setup Mask, the operating terminal is automatically rebooted once the Setup Mask is exited after having modified the MPI address.
If this system variable is integrated into any other I/O mask, it will be necessary to switch the operating terminal off and back on.

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5.30.2.3 Parameter Highest MPI - Address for MPI Bus

All stations on the MPI bus must be aware of the highest MPI address in order to ensure proper communication.
Permitted values are **15**, 31, 63, 126.
The default value is 15, however, this value must be checked and corrected, if necessary.

5.30.2.4 Parameter Connections

As already mentioned above, the operating terminal allows up to four communication connections to be established.

The connection possibilities are defined in a table. Connections can be established to all modules offering communication capability and CPUs on the MPI bus network.

The following can be specified in the table:

- MPI Address The address of the controller to connect to.
- Segment ID Identifies the subnet in a S7-300/400 controller.
- Slot Slot number of the communication module which the connection is to be established with.
- Rack Number Number of the rack that contains the communication module.

Connection	MPI Address	Segment ID	Slot Number	Rack Number
1	2	1	0	0
2	0	1	0	0
3	0	1	0	0
4	0	1	0	0

Table 5.30.1: Connections

5.30.3 Data Types

The following data types are available for direct user access.
The characters xxx identify values that depend on the controller or its memory area.

Type	Description	From	To	DB Type	From	To	Access
Z	Counter	0	xxx				Read-Only
T	Timer	0	xxx				Read-Only
E	Input Bit	0.0	xxx.7				
EB	Input Byte	0	xxx				
EW	Input Word	0	xxx				
ED	Input Double Word	0	xxx				
A	Output Bit	0.0	xxx.7				
AB	Output Byte	0	xxx				
AW	Output Word	0	xxx				
AD	Output Double Word	0	xxx				
M	Flag Bit	0.0	xxx.7				
MB	Flag Byte	0	xxx				
MW	Flag Word	0	xxx				
MD	Flag Double Word	0	xxx				
DB	Data Block (Bit)	1	255	DBX	0.0	8191.7	
DB	Data Block (Byte)			DBB	0	8191	
DB	Data Block (Word)			DBW	0	8190	
DB	Data Block (Double Word)			DBD	0	8188	

Table 5.30.2: Data types

5.30.3.1 Data Type Orientation

a) Alphanumerical Texts
Are stored in the memory byte for byte in ascending address order.

b) Counter
A distinction is made between variables which have been assigned a counter address and variables which have been assigned another PLC address.
Counter address
When accessing counter addresses, the count value is interpreted in binary format and the control bits

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of the counter are masked out. Counter addresses should therefore be accessed in the **read-mode** only to prevent control bits from being erased.
The count value is interpreted in BCD-code. This allows this value to be transferred, within the PLC program, to the counter by means of the accumulator. This service should be used for indirect write operations of count starting values since the data are provided in a Siemens conforming format.

c) Timer
Timer functions consist of a time value and a time base. The terminal operates with imaginary unsigned 4-byte variables, even though the data stored in the PLC comprise only 2 bytes.
When reading from timers, the time value and time base are converted to a terminal-internal unsigned 4-byte number which represents the time value to the time base of 0.01 seconds.
Example: When using a time base of 10 (resolution is 1.0 second) and a time value of 999, the value 99900 is represented or edited in the terminal. This value can be scaled to other value ranges by specifying a factor and divisor within the variable definition.
When writing timer variables to the PLC, the terminal-internal unsigned 4-byte number is converted to the time value and the smallest possible time base setting.
In addition, a distinction is made between variables which have been assigned a timer address and variables which have been assigned another PLC address.

Timer address
When accessing timer addresses, the time value is interpreted in binary format. This service should be used in the read-mode only to prevent timer control bits from being erased.

All other addresses
The time value is interpreted in BCD-code. This service should be used for indirect write operations of time starting values since the values are provided in the Siemens conforming format.

d) Floating Point Numbers
The data are interpreted in IEEE floating point format.

e) Binary Variables with a Length of 1, 2 or 4 Bytes
Data with a length of 2 bytes are interpreted in the PLC-conforming byte order for words.
Data with a length of 4 bytes are interpreted in the PLC-conforming byte order for long words.

5.30.4 Poll Area

The poll area must reside in the flag area or in a data block and, in both cases, be defined as a byte or word access (MB, MW, DBB, DBW).

Example: Word-structured poll area starting at MW10

Word Address	Reference	High Byte	Low Byte
Word Address + 0	MW10	Write Coordination Byte	Reserved
Word Address + 1	MW11	Message Channel High Byte	Message Channel Low Byte
Word Address + 2	MW12	Function Keys LED 1 to 4	Function Keys LED 5 to 8
Word Address + 3	MW13	Function Keys LED 9 to 12	Function Keys LED 13 to 16
Word Address + 4	MW14	Function Keys LED 17 to 20	Function Keys LED 21 to 24
Word Address + 5	MW15	Function Keys LED 25 to 28	Function Keys LED 29 to 32

Table 5.30-3: Word-structured poll area

5.30.5 Parallel Message System

The area for the parallel messages must reside in the flag area or in a data block and, in both cases, be defined as a byte or word access (MB, MW, DBB, DBW).

Example:

Word Address	Reference	High Byte	Low Byte
Word Address + 0	MW20	Messages 0 to 7	Messages 8 to 15
Word Address + 1	MW21	Messages 16 to 23	Messages 24 to 31
Word Address + 2	MW22	Messages 32 to 39	Messages 40 to 47

Table 5.30-4: Word-structured message system

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5.30.6 Physical Interfacing

Pin	Designation	Function
1	nc	not connected
2	RD	Receive Data
3	TD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground
6	nc	not connected
7	RTS	Request To Send
8	CTS	Clear To Send
9	nc	not connected

Table 5.30-5: Pin assignment X2 RS232

Pin	Designation	Function
1	Shield	Shielding
6	TD	Transmit Data
18	RD	Receive Data
17	RTS	Request To Send
15	CTS	Clear To Send
25	SGND	Signal Ground
20	DTR	Data Terminal Ready

Table 5.30-6: Pin assignment universal interface SER1 RS232

Pin	Designation	Function
1	Shield	Shielding
2	T(A)	Transmit Data, Channel A
3	R(A)	Receive Data, Channel A
4	RTS(A)	Request To Send, Channel A
5	CTS(A)	Clear To Send, Channel A
6	nc	not connected
7	nc	not connected
8	SG	Signal Ground
9	T(B)	Transmit Data, Channel B
10	R(B)	Receive Data, Channel B
11	RTS(B)	Request To Send, Channel B
12	CTS(B)	Clear To Send, Channel B
13	nc	not connected
14	nc	not connected
15	nc	not connected

Table 5.30-7: Pin assignment X2 RS485



The Siemens handling and wiring guidelines must be observed when connecting an operating terminal to the MPI bus.

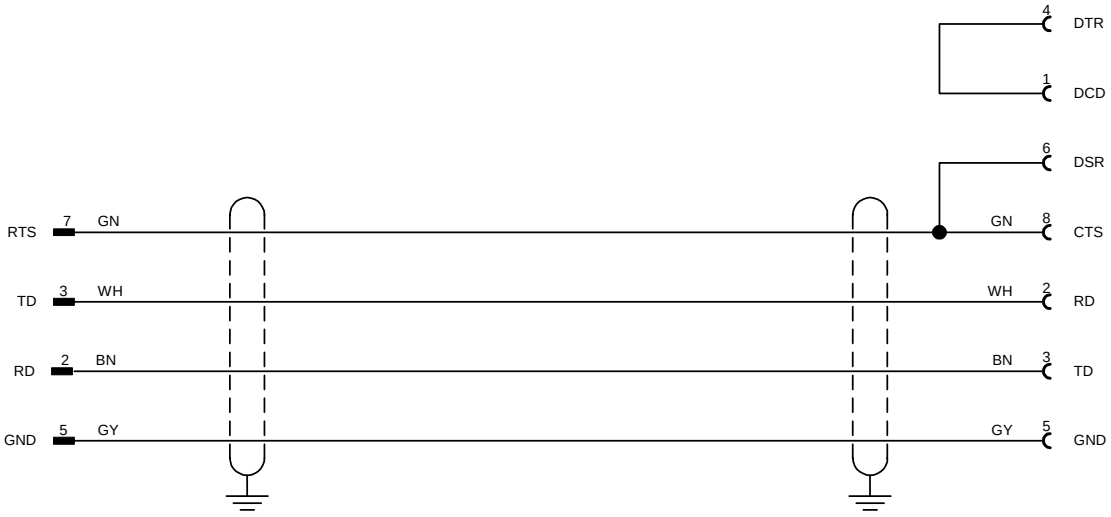
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5.30.6.1 Connecting Cable RS232 - HMI Adapter

The following wiring diagram does not apply to terminals with universal interface.

TesiMod
Operating Terminal

Siemens S7
HMI Adapter



D-Subminiature
Male Connector
9-pin

D-Subminiature
Female Connector
9-pin

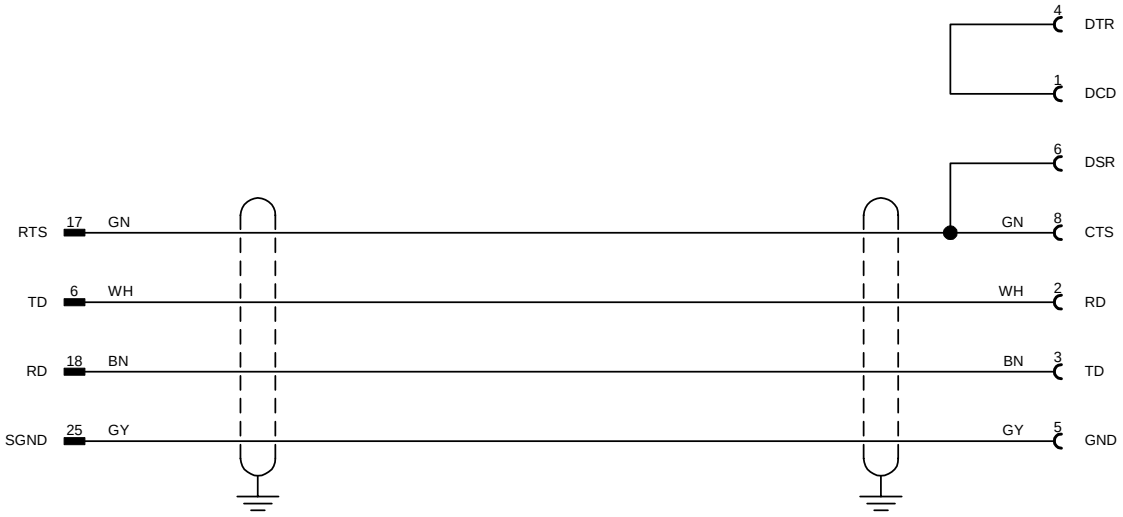
The shield is connected to the metallic housing at both ends.

5.30.6.2 Connecting Cable Universal Interface SER1 RS232 - HMI Adapter

The following wiring diagram applies to terminals with universal interface only.

TesiMod
Operating Terminal

Siemens S7
HMI Adapter



D-Subminiature
Male Connector
25-pin

D-Subminiature
Female Connector
9-pin

The shield is connected to the metallic housing at both ends.

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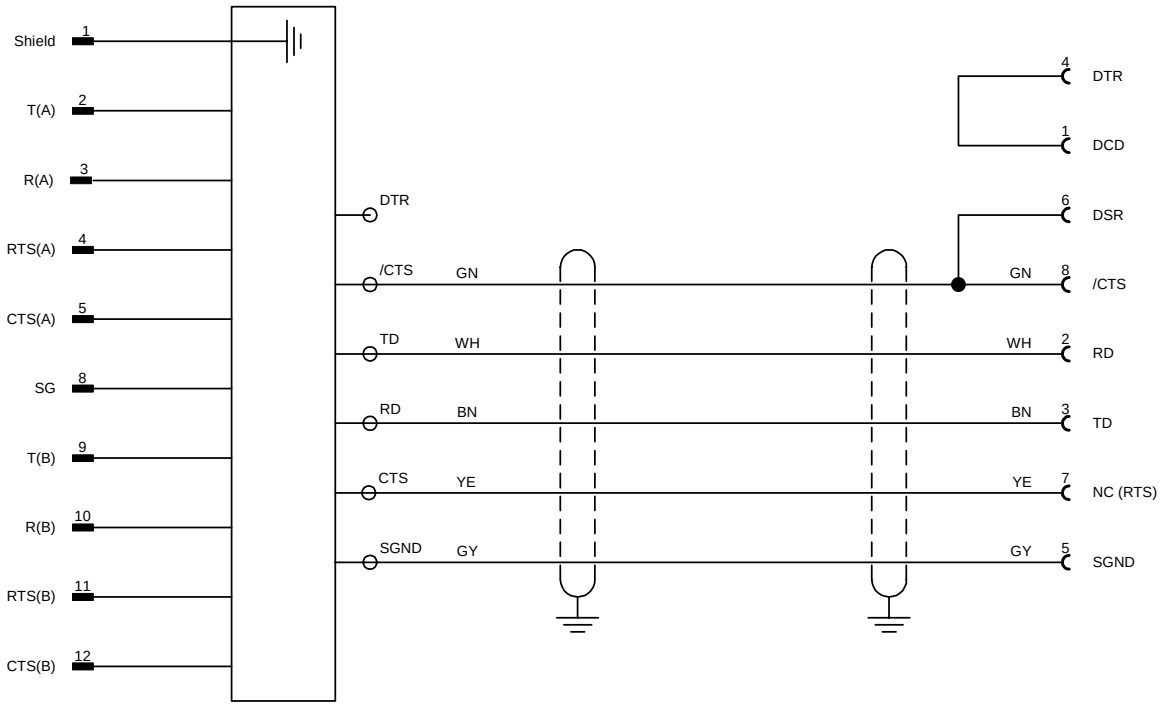
5.30.6.3 Connecting Cable RS485 - HMI Adapter

All TesiMod operating terminals with a 15-pin RS485 interface can be connected to the HMI adapter by way of a converter cable.

The following wiring diagram does not apply to terminals with universal interface.

TesiMod
Operating Terminal BT

Siemens S7
HMI Adapter



D-Subminiature
Male Connector
15-pin

D-Subminiature
Female Connector
9-pin

The shield is connected to the metallic housing at both ends.

5.30.7 Error Messages

Code	1	E_SLAVE_NOT_READY	Slave currently not ready
	2	E_PROTOKOL	Sequence of packets
	3	E_FRAME	Protocol frame error
	4	E_TIMEOUT	Timeout error
	5	E_CRC_BCC	CRC error
	6	E_PARITY	Parity error
	7	E_SEND_ABORT	Send process aborted
	8	R_REC_ABORT	Receive process aborted
	9	E_BUF_SIZE	Insufficient cyclic buffer
	10	E_NO_DEFINE	No cyclic data defined
	12	E_DEFINE	Cyclic data already defined
	15	E_NO_PROTOCOL	Selected protocol is not supported
	16	E_OVERRUN	Receive buffer overrun
	40	E_SYS_ADDRESS	Undefined system variable
	50	E_3964R_PROTOKOL	Error at 3964R level
	Subcode		
	50	E_QUITTUNG_OPEN	
	51	E_QUITTUNG_DATA	
	52	E_NO_RESPONSE	
	55	E_TIMEOUT_OPEN_QUIT	
	56	E_TIMEOUT_DATA_QUIT	
	57	E_TIMEOUT_RESPONSE_OPEN	
	58	E_TIMEOUT_RESPONSE_DATA	
Code	60	E_RESET	Return code in header on RESET
	70	E_START_TOOL	Return code in header on START
	80	E_CONNECT	Return code in header on CONNECT
	81	E_CONNECT_1	Return code in data section on CONNECT
	82	E_CONNECT_2	Return code in data section on CONNECT
	83	E_CONNECT_3	Return code in data section on CONNECT
	84	E_CONNECT_4	Return code in data section on CONNECT

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90	E_DISCONNECT	Return code in header on DISCONNECT
100	E_BAUDRATE	Return code in header on BAUDRATE
110	E_MB_WRITE_RESP	Return code upon write operation to flag bit
111	E_A_WRITE_RESP	Return code upon write operation to outputs
112	E_E_WRITE_RESP	Return code upon write operation to inputs
113	E_M_WRITE_RESP	Return code upon write operation to flag
114	E_T_WRITE_RESP	Return code upon write operation to timer
115	E_Z_WRITE_RESP	Return code upon write operation to counter
116	E_DB_WRITE_RESP	Return code upon write operation to data block
117	E_A_READ_FOR_WRITE_RESP	Return code upon write operation to output bit
118	E_E_READ_FOR_WRITE_RESP	Return code upon write operation to input bit
119	E_DB_READ_FOR_WRITE_RESP	Return code upon write operation to DB bit
120	E_MB_READ_RESP	Return code upon read operation from flag bit
121	E_A_READ_RESP	Return code upon read operation from output
122	E_E_READ_RESP	Return code upon read operation from input
123	E_M_READ_RESP	Return code upon read operation from flag
124	E_T_READ_RESP	Return code upon read operation from timer
125	E_Z_READ_RESP	Return code upon read operation from counter
126	E_DB_READ_RESP	Return code upon read operation from data block

Subcodes for codes 60 to 126

Subcode		
000	NO_ERROR	Nowhere an error found

257	ERR_COMLINKNOTAVAILABLE1	Communication connection not available
266	ERR_NEGATIVEACKNOWLEDGE	Negative acknowledge / timeout error
268	ERR_DATANOTEXISTORLOCK	Data does not exist or is locked
512	ERR_XX .. Unknown error	
513	ERR_WRONGINTERFACE	Wrong interface specified
514	ERR_TOOMANYINTERFACES	Too many interfaces
515	ERR_TBALREADYINIT	Toolbox already initialized
516	ERR_ALREADYCONNECTED	Toolbox already initialized with another connection
517	ERR_BADTOOLBOX	Toolbox not initialized
518	ERR_CANTSETHANDLE	Handle can not be set
519	ERR_DATASEGNOTLOCKED	Data segment is not locked
521	ERR_DATAFIELDINCORRECT	Data field incorrect
770	ERR_BLOCKTOSMALL	Block size too small
771	ERR_BOCKBOUNDARYEXC	Block limits exceeded
787	ERR_ST_BAUDRATE	Wrong MPI baud rate selected
788	ERR_ST_HSA	Highest MPI address is wrong
789	ERR_ST_TS	Address already exists
794	ERR_ST_UNPLUGGED	not connected to MPI network
795	ERR_ST_SYNI	---
800	ERR_HARDWARE1	Hardware error
897	ERR_HARDWARE2	Hardware error
16385	ERR_UNKNOWNCONNECTION	Communication link unknown
16386	ERR_COMLINKNOTAVAILABLE2	Communication link not available
16387	ERR_MPIJUSTESTABLISHING	MPI communication in progress
16388	ERR_MPIBROKEN	MPI connection down
2048	ERR_TOOLBOXBUSY	Toolbox is busy
32769	ERR_NOTALLOWEDINMODE	Not permitted in this mode
33025	ERR_HARDWARE3	Hardware error
33027	ERR_OBJECTCANTBEACCESSED	Access to object not permitted
33028	ERR_CONTEXTNOTSUPPORTED	Context not supported
33029	ERR_ADDRESSNOTVALID	Address invalid
33030	ERR_DATATYPENOTSUPPORTED	Data type not supported
33031	ERR_DATATYPENOTCONSISTENCE	Data type not consistent
33034	ERR_OBJECTNOTEXISTS	Object does not exist

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33537	ERR_NOMEMORYINCPU	Not enough memory on CPU
33796	ERR_SERIOUS	Serious error
34048	ERR_WRONGPDUSIZE	Wrong PDU size
34562	ERR_ADDRESSNOTVALID2	Address not valid
53761	ERR_SYNTAXBLOCKNAME	Syntax error: block name
53762	ERR_SYNTAXFUNCPARAMETER	Syntax error: function parameter
53763	ERR_SYNTAXBLOCKTYPE	Syntax error: block type
53764	ERR_NOBLOCKLINKED	No linked data block in CPU
53765	ERR_OBJECTALREADYEXIST1	Object already exists
53766	ERR_OBJECTALREADYEXIST2	Object already exists
53767	ERR_BLOCKINEPROM	Data block in EPROM
53769	ERR_BLOCKMISSING	Block does not exist
53774	ERR_NOBLOCKAVAILABLE	No block available
53776	ERR_BOCKNUMBERTOLARGE	Block number too large
53825	ERR_LEVELTOLESS	Protection level too low
54278	ERR_INFOMISSING	Information does not exist
55298	ERR_JOBDOESNOTEXIST	This job does not exist
61185	ERR_WRONGID2	Wrong ID2, cyclic job handle
65487	ERR_INVALIDPARAMETER	API function called with an invalid parameter
65501		Invalid baud rate
65502	ERR_3964R_FRAMING	Framing error, violation of the asynchronous character frame
65503	ERR_3964R_PARITY	Parity error
65504	ERR_3964R_OVERRUN	Overrun, too many characters received
65505	ERR_3964R_NOISE	Transportation errors (e.g.: parity)
65506	ERR_3964R_NOACK	Telegram did not receive any acknowledge
65507	ERR_3964R_COLLISION	Collision with a remote partner of higher priority
65508	ERR_3964R_RECEIVING	Device in receiving mode
65509	ERR_3964R_NOCONNECT	Maximum number of connection requests exceeded
65510	ERR_V24_NOTSUPP	Function not supported in the current mode of operation
65511	ERR_V24_BADMODE	Mode is not supported
65512	ERR_V24_HANDLE	Port handle not valid

65513	ERR_V24_HARDW	Hardware does not support this function
65514	ERR_V24_NOSLOT	Port table full
65515	ERR_V24_TIMEOUT	Timeout during write operation
65516	ERR_V24_OUTRNG	Value out of range
65517	ERR_V24_CLOSED	Port not open
65518	ERR_V24_NOMEM	Buffer can not be allocated
65519	ERR_V24_DEVICE	Device not installed
65520	ERR_V24_INUSE	Device already open
65533	ERR_UNKNOWNFUNKTION	Unknown function
65534	ERR_UNKNOWNERROR	Unknown error
65535	ERR_TIMEOUT	Timeout, check RS232 interface

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