HE-65
SLIN-BUS

Technical Information
Interface Description

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Italics and **bold** type are used for the title of a document or to emphasize text passages.

Passages written in `Courier` show text which is visible on the screen / display as well as software menu selections.

"< >" refers to keys on your computer keyboard (e.g. <RETURN>).

Note

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Revision History

Note:
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Revision	Date

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1 Introduction

The SLIN field bus is used for the networking of up to 8 absolute encoder. The communication between master and slave is controlled according to a declaration designated in the protocol. In this case, it gives only one master. As transmission medium serves a symmetric two-wire data line (difference signals). The electric data of the interface correspond standard RS-485.

The RS-485 interface of the TR absolute encoder are galvanically separate. So it is given a high immunity to faults against electromagnetic influences.

The protocol is optimized for a fast cycle time. For this reason, a variable telegram length and a high active data part was selected.

General technical data:

- bus interface in accordance with RS-485
- bus interface galvanically isolated
- linear bus structure
- twisted, shielded two-wire data line as medium
- maximum length 1200m, reasonably however to 600m
- up to 8 encoders on the bus, identity is set by jumpers in the connector
- standard transmission rate 115,2 kBd
- transmission rates following in addition are practicable: 9,6 kBd, 19,2 kBd and 345,594 kBd
- bus access: master / slave principle
- variable telegram length
- asynchronous and half-duplex data transfer
- UART character format in accordance with IEC FT1.2
- Data check: parity and checksum

2 Physical characteristics

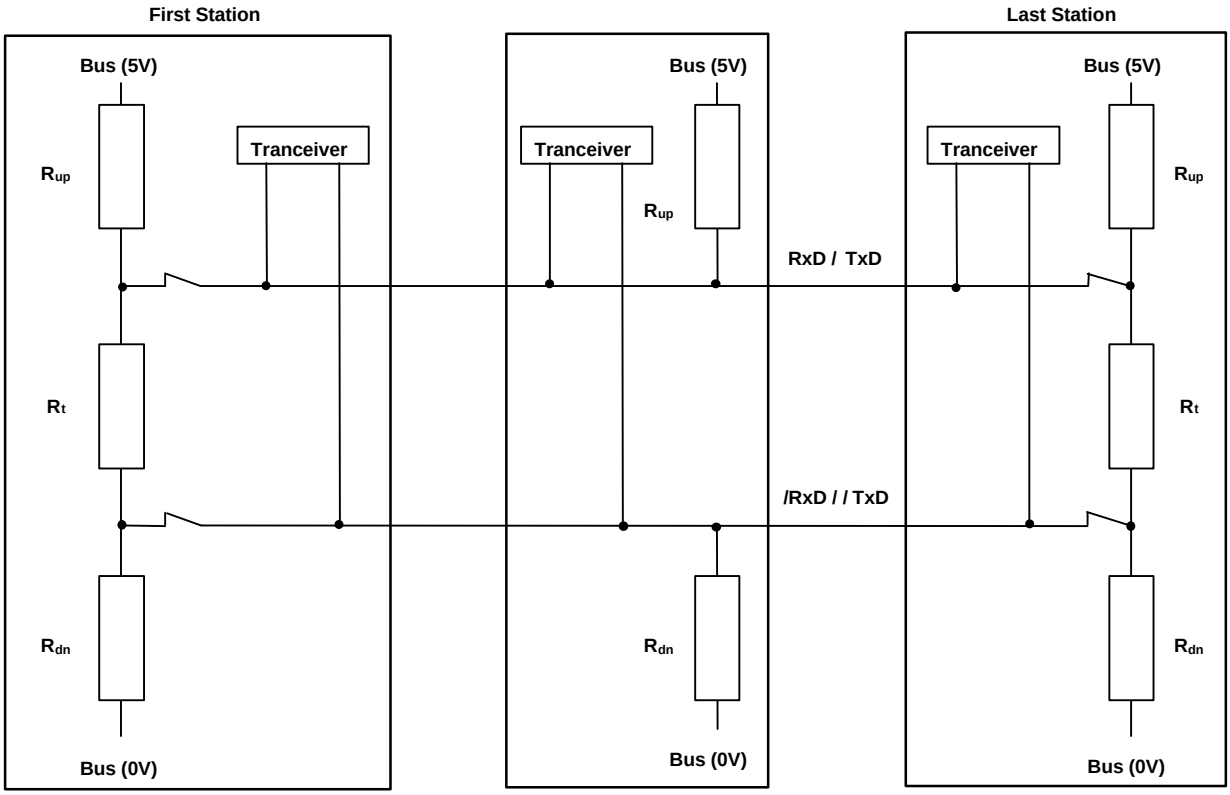
The electric characteristics of the RS-485 interface pre-sets the bus topology. Only a linear bus structure is practicable. From the master the cable is linked to encoder 1, to encoder 2 ... and to the encoder n.

The maximum spatial expansion depends on the environment, the quality and shielding of the used cable and the transmission rate. A length to be achieved purely is 1200m.

3 Bus termination

At the physical ends of the bus cable, the signal lines must (Receive-Transmit and /Receive-/Transmit) be terminated with a resistor of the size of the line surge impedance (approx. 120 Ω). In addition, the line "Receive-Transmit" with "Bus (+5V)" and the line "/Receive-/Transmit" with "Bus (0V-level)" of each encoder is connected (pull-up resistor Rup and pull-down resistor Rdn) with a resistor (approx. 4,7 kΩ). Before start up the bus system it is to be considered, that the bus termination resistors of all encoders are switched correct. At the first and the last station the terminating resistors must be switched on. At all other stations the terminating resistors must be switched off. The bus termination resistor is not dependent from the station address.

Bus termination in a SLIN absolute encoder line



4 Potential compensation between the data reference potentials

Between the stations the data reference potential "Bus (0 V-level)" of the RS-485 interface driver may not exceed +/- 2V (Common mode). A cable with at least a supplementary line is to be used if this can not be guaranteed for a potential compensation. This potential compensation line must be connected via a 100 Ω resistor with every station.

A exclusive use of the galvanically isolated TR absolute encoder as slave, this problem can not occur.

5 Addressing of the encoders

The addressing of the absolute encoders occurs via a coding, usually in the SUB-D connector or generally via cable jumpers:

Inputs

Ident 0.....encoder address 2^0, jumper to GND
Ident 1.....encoder address 2^1, jumper to GND
Ident 2.....encoder address 2^2, jumper to GND

6 The SLIN-Protocol

The physical bus can always be used by a station for a specific time only. Therefore, the temporal sequence of use the bus must be regulated by a bus access control. Therefore the SLIN protocol coordinates the bus access according to the master/slave principle. Every bus activity of the passive stations (encoder) is started by the master (PLC, PC) with a control word.

Control word:

1 start bit
3 bits for identity of the encoder
1 control bit (low)
3 reserved bits (low)
1 control bit (high)
1 parity bit (even)
1 stop bit

The slave is entitled only by this requirement to transmitting its response telegram. The response of the encoder occurs within a defined time window of 0,1 - 0,4 ms.
The response consists again of the 11 bits of the UART character with the first 7 data bits:

1 start bit
7 data bits
1 control bit (low), which is indicate, that it is sent a data word
1 parity bit (even)
1 stop bit

These data words are sent in sequence until no relevant data are present. After this the encoder sends the final word with its identity:

1 start bit
3 bits for identity of the encoder
1 bit reserve
3 bits checksum
1 control bit (high)
1 parity bit (even)
1 stop bit

Example:
13-bit encoder, 8 relevant data bits: 0 0000 1001 1010b
At first the lowest 7 bits and then the residual 6 bits of data are sent. The residual bit is filled with 0. At last the final word is sent.
In the case of the same encoder but only with 6 bits of relevant data:
0 0000 0011 1010b
It is sent only one data word and then directly the final word.

7 Checksum

For generate the checksum, the ADDC command of an 8 bit µC (8051- derivate) is used. In the sample program indicated below, this command in the programming language C was imitated.

```
carry = 0;          // carry is needed to simulate "8-bit -add-with-carry"
for(x = 1;x <= 4; x++)
{
        c2=c2 + b[x] + carry;
        if(c2 > 0xFF)     carry = 1;
        else              carry = 0;
}
checksum = c2 & 0x70h
```

This checksum can also be generated in a simplified manner as follows in a PLC:

- the lowest byte = b[1], the most significant byte = b[4].
- sum c1 = b[1] + b[2] + b[3]
- check whether a carry has occurred into the ninth bit
- if a carry has occurred: C2 = c1 + b[4] + 1
- no carry: C2 = c1 + b[4]

Checksum = c2 AND 0111 0000b