Rexroth Inline DALI Terminal

R911332218
Edition 01

R-IB IL DALI-PAC

DALI Master

06/2011

1 Description

The terminal is designed for use within an Inline station.

It is a DALI master and is used to control lights with DALI ballasts according to IEC 60929. As defined in the DALI standard, up to 64 ballasts (EBs) can be addressed individually.

A DALI bus supply is also required in order to operate a DALI system with this terminal. An R-IB IL DALI/PWR-PAC terminal or a suitable external power supply unit is required for this.

Features

- DALI master without integrated DALI bus supply
- Safe electrical isolation of the DALI bus
- DALI bus protected against accidental connection of the mains voltage (up to 250 V AC)
- Terminal can be used as an extension of an Inline terminal and supplied by its integrated power supply unit
- Alternatively, direct DALI bus supply using a suitable power supply unit
- Communication via process data
- Diagnostic, transmit and receive indicator

For further information on the Rexroth Inline system, please refer to the application description of the Rexroth Inline system (see "Documentation" on page 2).

Make sure you always use the latest documentation.

It can be downloaded at www.boschrexroth.com.

2 Ordering Data

DALI terminal

Description	Type	MNR	Pcs. / Pkt.
Rexroth Inline-DALI terminal; complete with accessories (connector and labeling field)	R IB IL DALI-PAC	R911172213	1

For additional ordering data (accessories), please refer to the product catalog at www.boschrexroth.com.

Documentation

Description	Type	MNR	Pcs. / Pkt.
"Automation Terminals of the Rexroth Inline Product Range" application description	DOK-CONTRL-ILSYS-INS***-AW..-EN-P	R911317021	1
"Configuring and Installing the Rexroth Inline Product Range for INTERBUS" application description	DOK-CONTRL-ILSYS-PRO***-AW..-EN-P	R911317023	1
DALI documentation	See www.dali-ag.org		

3 Technical Data

General data	
Housing dimensions (width x height x depth)	12.2 mm x 120 mm x 72 mm
Weight	60 g (with connectors)
Operating mode	Process data mode with 2 words
Ambient temperature (operation)	-25°C to +55°C
Ambient temperature (storage/transport)	-25°C to +85°C
Permissible humidity (operation/storage/transport)	75% on average, 85% occasionally (no condensation)
Permissible air pressure (operation)	80 kPa to 106 kPa (up to 2000 m above sea level)
Permissible air pressure (storage/transport)	70 kPa to 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20 according to IEC 60529
Connection data	
Designation	Inline connector
Connection method	Spring-cage connection
Conductor cross section	0.08 mm^2 to 1.5 mm^2 (solid or stranded), 28 - 16 AWG
Interfaces	
Local bus	
Connection	Via data routing
Transmission speed	500 kbps
DALI (general)	
Transmission speed	1200 bps
Protective equipment	Bus protected up to 250 V AC, maximum
DALI when supplied by R-IB IL DALI/PWR-PAC (via potential jumpers)	
Bus voltage	14 V, typical
Short-circuit output current	≤ 250 mA
Maximum bus load	128 mA Observe the derating of the R-IB IL DALI/PWR-PAC terminal.
Power consumption	
Communications power U_L	7.5 V DC
Current consumption at U_L	≤ 38 mA

Power dissipation

Formula to calculate the power dissipation of the terminal

$P_{EL} = P_{BUS} + P_{DRV}$

$P_{BUS} = 0.27$ W

$P_{DRVmax} = 0.56$ W + I_{DALI} x (I_{DALI} x 3.85 Ω + 0.47 V)

$P_{DRV\_ICS} = 0.37$ W + I_{DALI} x (I_{DALI} x 4.7 Ω + 0.58 V)

Where:

P_EL	Total power dissipation in the terminal
P_{BUS}	Power dissipation through bus operation
P_{DRV}	Power dissipation through the DALI bus driver, depends on the bus load and activity on the DALI bus (idle, transmitting, receiving)
P_{DRV_ICS}	Typical power dissipation through the DALI bus driver when operating the DALIterminal on bus controllers from the Inline Control Server (ICS) range
I_{DALI}	DALI bus load at the R IB IL DALI-PAC terminal; 2 mA, typical per DALI slave

Protective equipment

Surge voltage on DALI bus	275 V varistor
Short circuit on DALI bus	Electronic fuse, no time limit

Electrical isolation/isolation of the voltage areas

Common potentials

DALI supply voltage U_{DALI} and DALI bus have the same potential.

Separate potentials in the R IB IL DALI-PAC terminal

Test distance	Test voltage
7.5 V supply (bus logic)/DALI bus	2500 V AC, 50 Hz, 1 min
Routine test	1200 V AC, 50 Hz, 1 min

Error messages to the higher-level control or computer system

I/O error message in the event of DALI bus voltage failure or short circuit of the DALI bus

Approvals

For the latest approvals, please visit www.boschrexroth.com.

4 Internal Basic Circuit Diagram

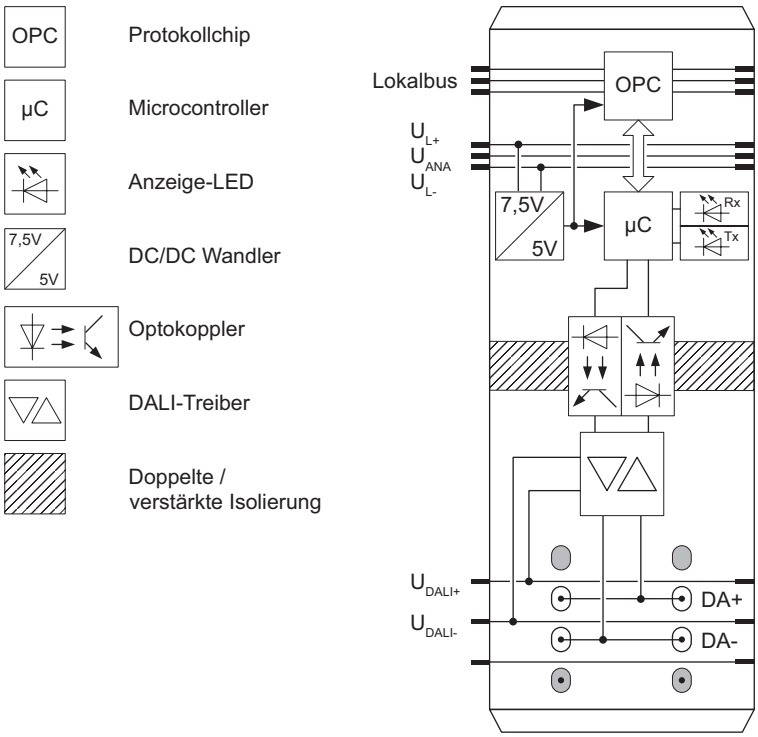

Fig. 1 Internal basic circuit diagram

Other symbols used are explained in the application description for the Rexroth Inline system (see "Documentation" on page 2).

5 Local Diagnostic and Status Indicators and Terminal Point Assignment

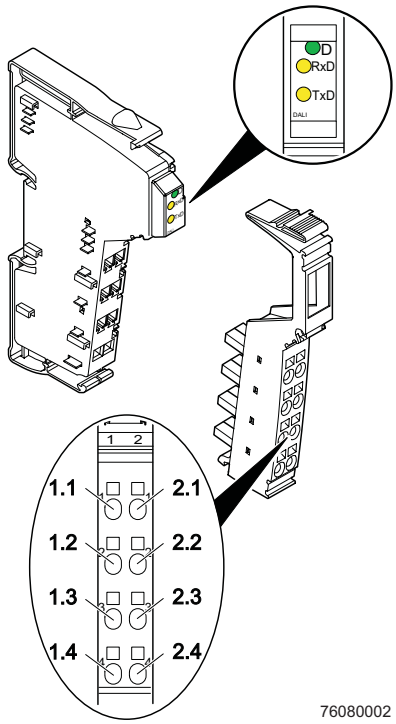

Fig. 2 Terminal with appropriate connector

5.1 Local Diagnostic and Status Indicators

Des.	Color	Meaning
D	Green	Diagnostics
RxD	Yellow	Terminal is receiving data from the DALI bus
TxD	Yellow	Terminal is transmitting data to the DALI bus

Function identification

Orange

5.2 Terminal Point Assignment

Terminal point	Signal	Assignment
1.1, 2.1	**–**	Not used
1.2, 2.2	**DA+**	DALI bus (positive)
1.3, 2.3	**DA-**	DALI bus (negative)
1.4, 2.4	**–**	Not used

CAUTION

Terminal points not used by the terminal must not be wired.
Terminal points 2.2 and 2.3 are not available on the device itself. They are connected to terminal points 1.2 and 1.3 inside the connector.

6 Connection Notes

The voltage drop between the transmitter and receiver on the DALI bus cable must not exceed 2 V at 250 mA. The table below contains recommended values for wiring. The maximum cable length between two bus devices should not exceed 300 m.

Cable length	Minimum cross section
< 100 m	0.5 mm^2
100 m to 150 m	0.75 mm^2
> 150 m	1.5 mm^2

Special bus cables (twisted or shielded) are not required. Serial and star network topologies or a combination of both can be used. Ring structures should be avoided.

DALI interface insulation in the ballasts of lights only meets the requirements of basic insulation. SELV (safety-extra low voltage) is therefore not ensured on the DALI bus despite the safe isolation of the R IB IL DALI-PAC terminal.

7 Connection Example

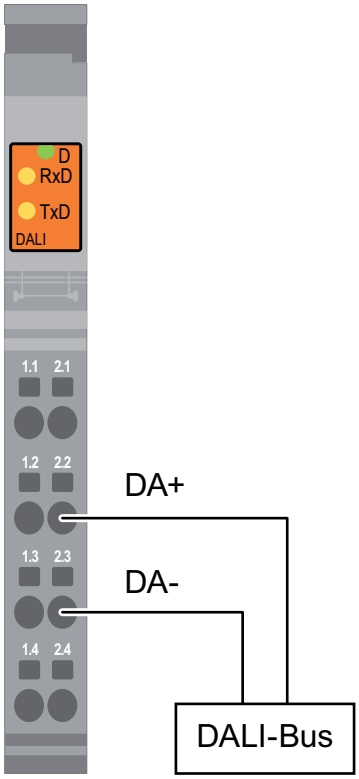

Fig. 3 Connection example

The R IB IL DALI-PAC terminal is usually used as an extension terminal to an R-IB IL DALI/PWR-PAC terminal.
Up to three extension terminals can be supplied by an R-IB IL DALI/PWR-PAC terminal.

Alternatively, the DALI bus supply can also be provided directly via the DALI bus, e.g., using a suitable power supply unit or other DALI bus devices with integrated supply.

The following conditions must be met on the DALI bus:

- 9.5 V to 22.5 V DC supply voltage with a minimum load capacity of 135 mA (for full configuration with 64 ballasts)
- Total short-circuit current of ≤ 250 mA, the response time must be less than 10 µs

The DALI bus supply must only be provided via the potential jumpers U_{DALI} on the side (by an R-IB IL DALI/PWR-PAC terminal) or directly via the DALI bus.

When using an external DALI bus supply, ensure correct polarity when connecting to the R IB IL DALI-PAC terminal. The terminal must be isolated on both sides by an R-IB IL DOR LV-SET-PAC disconnect terminal set.

8 Typical Station Structure

8.1 Supply Through the R-IB IL DALI/PWR-PAC Terminal

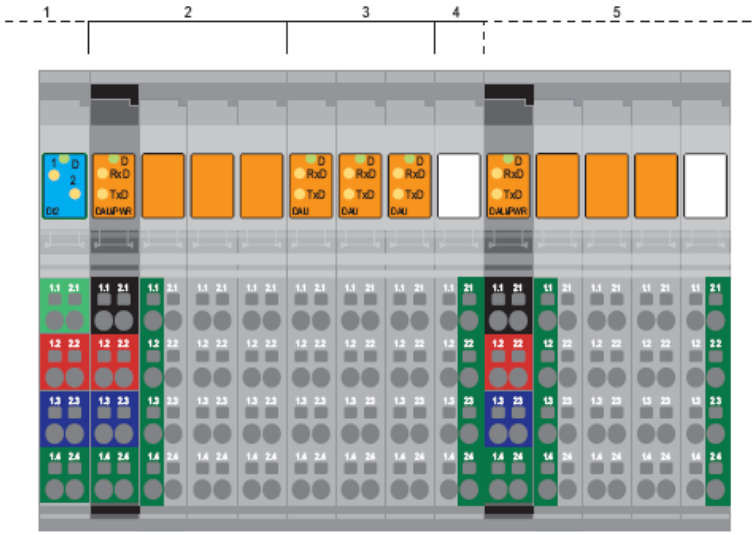

Fig. 4 Typical station structure with several DALI terminals

Fig. 4 shows a typical station structure when using several DALI terminals. The station consists of the following sections:

1 24 V segment

2 R-IB IL DALI/PWR-PAC terminal.
The DALI bus supply is supplied from the preceding 24 V segment via the potential jumpers (U_M) on the side. U_M and GND of connector 1 remain unwired.

3 Up to three R IB IL DALI-PAC extension terminals. The DALI bus supply of these DALI masters is provided by the preceding R-IB IL DALI/PWR-PAC terminal via the potential jumpers U_{DALI}.

4 Distance terminal as the end terminal for the DALI segment. This distance terminal is supplied as standard with the R-IB IL DALI/PWR-PAC terminal. It must always be used to ensure correct termination of the DALI segment – regardless of how many DALI extension terminals (0 to 3) are used in this DALI segment.

5 Next DALI segment starting with an R-IB IL DALI/PWR-PAC terminal, no DALI extension terminals in the example.
As this terminal is not preceded by a 24 V segment (i.e., 24V DC is not supplied via the potential jumpers U_M), the DALI bus supply must be supplied via connections 1.2 and 1.3 (or 2.2 and 2.3) of connector 1. The required 24 V DC supply can be tapped from section 2, e.g., at connector 1 (connections 1.2 and 1.3 or 2.2 and 2.3) (observe maximum permissible currents). This DALI segment must also be terminated by a distance terminal used as the end terminal.

CAUTION

Every DALI segment must be terminated by the end terminal supplied. Otherwise, under certain circumstances the electrical isolation between U_M/U_S and the DALI bus may be compromised.

CAUTION

The DALI busses in section 2 and 3 in Fig. 4 are not electrically isolated from one another. Usually this does not present a problem. However, if such isolation is required, the R-IB IL DALI/PWR-PAC terminals must not be extended by R IB IL DALI-PAC terminals (and used to supply them).

However, the DALI busses in sections 2 and 3 are electrically isolated from the DALI bus in section 5, even in the event that all sections are supplied from the same 24 V DC supply (U_M).

8.2 External Supply

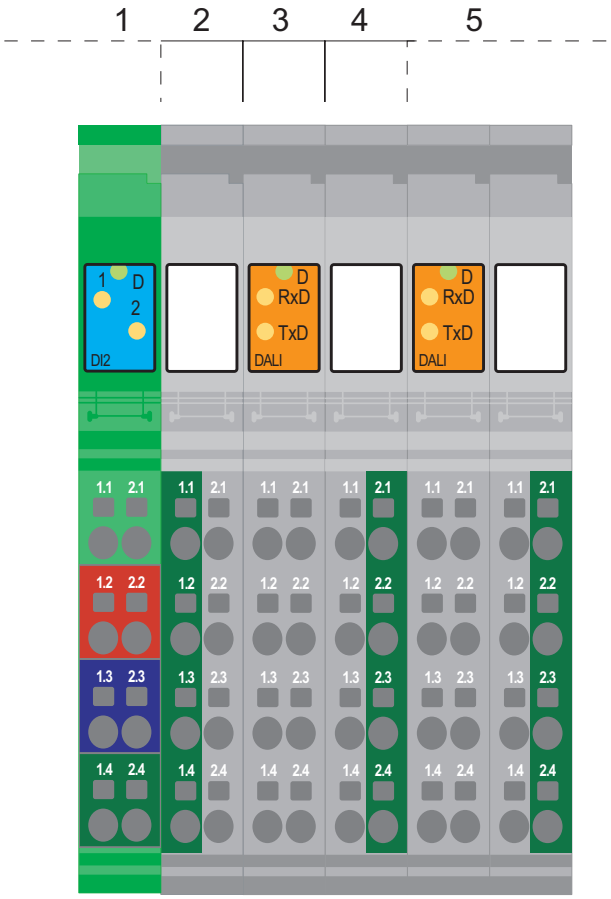

Fig. 5 *Station structure when using an external DALI bus supply*

Fig. 5 shows the station structure when using external DALI power supply units. Power is supplied by connecting directly to the DALI bus, e.g., at the DALI terminal (observe polarity). The station consists of the following sections:

1 24 V segment

2 R-IB IL DOR LV SET-PAC distance terminal

3 R IB IL DALI-PAC terminal

4 R-IB IL DOR LV SET-PAC distance terminal

5 Next DALI terminal with disconnect terminal

If the DALI terminals follow a 230 V segment, the same structure applies in principle. However, the first disconnect terminal is then considered the end terminal for the 230 V segment.

CAUTION

Isolate every DALI terminal that is supplied via an external power supply unit on both sides using an R-IB IL DOR LV SET-PAC distance terminal set (set contains two disconnect terminals). Otherwise, impermissible connections can occur due to the potential jumpers U_{DALI} on the side.
As the DALI terminal is polarity-dependent, ensure correct polarity when connecting the external power supply unit.

9 Programming Data/ Configuration Data

9.1 Local Bus (INTERBUS)

ID code	BF_{hex} (191_{dec})
Length code	02_{hex}
Input address area	2 words
Output address area	2 words
Parameter channel (PCP)	0 words
Register length (bus)	2 words

9.2 Other Bus Systems

For the programming data/configuration data of other bus systems, please refer to the corresponding electronic device data sheet (e.g., GSD, EDS).

10 Process Data

10.1 Process Data Output Word OUT0

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	TB	Command			0	0	0	0	0	0	0	0

Bit 10 to bit 8: Command

Bit			Command	Description
10	9	8		
0	0	0	Idle	DALI bus in the idle state
0	0	1	Send	Send DALI command
0	1	0	Repeat	Send DALI command again (50 ms)
0	1	1	Reserved	
1	0	0		
1	0	1		
1	1	0		
1	1	1		

Bit 11: TB (Toggle Bit)

This bit is used when commands with the same command field are to be sent consecutively.

10.2 Process Data Output Word OUT1

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Address byte								S = 0: Data byte S = 1: Command byte							
Y	A	A	A	A	A	A	S								

10.3 Process Data Input Word IN0

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EB	K	AW	F	TB	Command			Response							

10.4 Process Data Input Word IN1

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Address byte								S = 0: Data byte S = 1: Command byte							
Y	A	A	A	A	A	A	S								

The input words mirror the output words. Possible differences for IN 0:

- **EB** indicates an I/O error (DALI supply failure, short circuit on the DALI bus or error in the driver circuitry)
- **K** is set if an unsupported command has been received via Inline (no action on the DALI bus)
- **AW** (response) is set if a valid response has been received from the ballast; only then is the response field to be evaluated (otherwise as for OUT 0)
- **F** is set if an invalid response has been received from the ballast (e.g., fault on the DALI bus)

11 Function Description

The terminal checks incoming process data words for changes to the command byte (high byte of OUT 0). The toggle bit is typically inverted by the application of the bus master on every new DALI transaction.

In OUT 1, the terminal transmits the DALI command to be sent to the DALI bus. The data word in OUT 1 is therefore not interpreted in any way by the terminal.

The terminal starts sending OUT 1 to the DALI bus if:

- A change in the command byte has been detected
- The command byte contains a valid "Send" or "Repeat" command
- The DALI bus is in the idle state (previous transmission with the DALI bus completed successfully)

The terminal then waits around 10 ms for a response from the DALI slave and receives it, if present.

Finally, the terminal copies process data words OUT0/1 to process data words IN0/1 and modifies status bits EB, K, AW, and F as well as the response byte accordingly. This acknowledgment indicates that the terminal is ready for the next command.

If a valid DALI response has been received, the terminal waits around a further 10 ms after receiving the response (DALI bus pause). As acknowledgment, the AW bit is then set in process data word IN0, and the response is copied to the low byte of IN0.

The "Repeat" command is used to send the DALI command twice in intervals of 50 ms (start of first transmission - start of second transmission). The command is processed in the same way as the "Send" command. Certain DALI commands have to be sent twice in order to be completed correctly. This can be achieved using the "Repeat" command – independently of the bus cycles of the local bus.

DOK-CONTRL-ILDALI *****-DA01-EN-P

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