

Rexroth Inline DALI Terminal With Supply Option

R911332216
Edition 01

R-IB IL DALI/PWR-PAC

DALI Master
Integrated DALI Bus Supply

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.

The terminal requires a 24 V DC supply for the integrated DALI bus supply. This can be provided via the potential jumper U_M or supplied via connector 1.

Features

- DALI master with integrated DALI bus supply
- Designed for single master operation
- Safe electrical isolation of the DALI bus
- DALI bus protected against accidental connection of the mains voltage (up to 250 V AC)
- Can be extended by up to three R-IB IL DALI-PAC terminals
- 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 with supply option; complete with accessories (end terminal, connectors, and labeling fields)	R-IB IL DALI/PWR-PAC	R911172212	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 Product Range for IN-TERBUS" 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)	48.8 mm x 120 mm x 72 mm
Weight	235 g (complete with connectors and end terminal); 190 g (with connectors, without end terminal)
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 (solid/stranded)	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

Bus voltage	14 V, typical
Short-circuit output current	≤ 250 mA
Maximum bus load	128 mA Observe derating when using DALI extension terminals.
Transmission speed	1200 bps
Protective equipment	Bus protected up to 250 V AC, maximum

Power consumption

Communications power U_L	7.5 V DC
Current consumption at Current consumption at U_L	≤ 38 mA
Main voltage U_M	24 V DC
Current consumption at U_M	$I_M \approx 0.86 \times \Sigma I_{DALI}$ Where ΣI_{DALI} : Total DALI bus load including all DALI extension terminals

Power dissipation**Formula to calculate the power dissipation of the terminal**

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

$$P_{BUS} = 0.27 \text{ W}$$

$$P_{DRV_{max}} = 0.56 \text{ W} + I_{DALI1} \times (I_{DALI1} \times 3.85 \Omega + 0.47 \text{ V})$$

$$P_{DRV_ICS} = 0.37 \text{ W} + I_{DALI1} \times (I_{DALI1} \times 4.7 \Omega + 0.58 \text{ V})$$

$$P_{SUPPLY} = \Sigma I_{DALI} \times 3.6 \text{ V}$$

$$\Sigma I_{DALI} = I_{DALI1} + I_{DALI2} + I_{DALI3} + I_{DALI4}$$

$$\Sigma I_{DALI} \approx N \times 2 \text{ mA}$$

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 DALI terminal on bus controllers from the Inline Control Server (ICS) range

P_{SUPPLY} Power dissipation through the DALI power supply

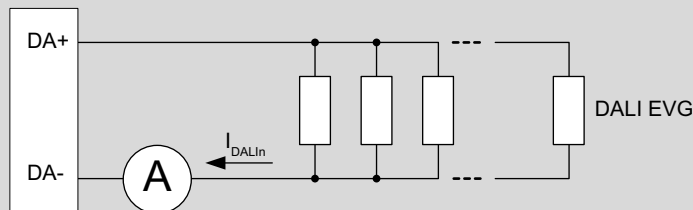
I_{DALIn} DALI bus load of the individual terminals

I_{DALI1} DALI bus load at the R-IB IL DALI/PWR-PAC terminal

ΣI_{DALI} Load of the DALI supply including all extension terminals

N Total number of all R-IB IL DALI/PWR-PAC terminals and their ballasts supplied by up to three extension terminals
 $0 \leq N \leq 256$

The above approximation of the DALI bus load ΣI_{DALI} is based on the maximum value of 2 mA per ballast as defined in the standard. For precise values, use the manufacturer's information for the ballasts or take your own measurements.



The total load is the sum of all measured currents I_{DALIn} at the R-IB IL DALI/PWR-PAC terminal and all R-IB IL DALI-PAC extension terminals that are connected to it.

Limitation of simultaneity, derating**Permissible total current ΣI_{DALI} depending on the ambient temperature T_{amb}**

T_{amb}	ΣI_{DALI}	Number of ballasts (example)
Up to 45°C	≤ 512 mA	4 x 64
Up to 50°C	≤ 400 mA	3 x 64
Up to 55°C	≤ 330 mA	3 x 55

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**

24 V main voltage U_M and GND have the same potential. FE is a separate potential area.

Separate potentials in the R-IB IL DALI/PWR-PAC terminal**Test distance**

7.5 V supply (bus logic)/24 V supply (I/O) and FE

7.5 V supply (bus logic)/DALI bus

Routine test

24 V supply (I/O) and FE/ DALIbus

Routine test

Test voltage

500 V AC, 50 Hz, 1 min.

2500 V AC, 50 Hz, 1 min

1200 V AC, 50 Hz, 1 min

2500 V AC, 50 Hz, 1 min

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

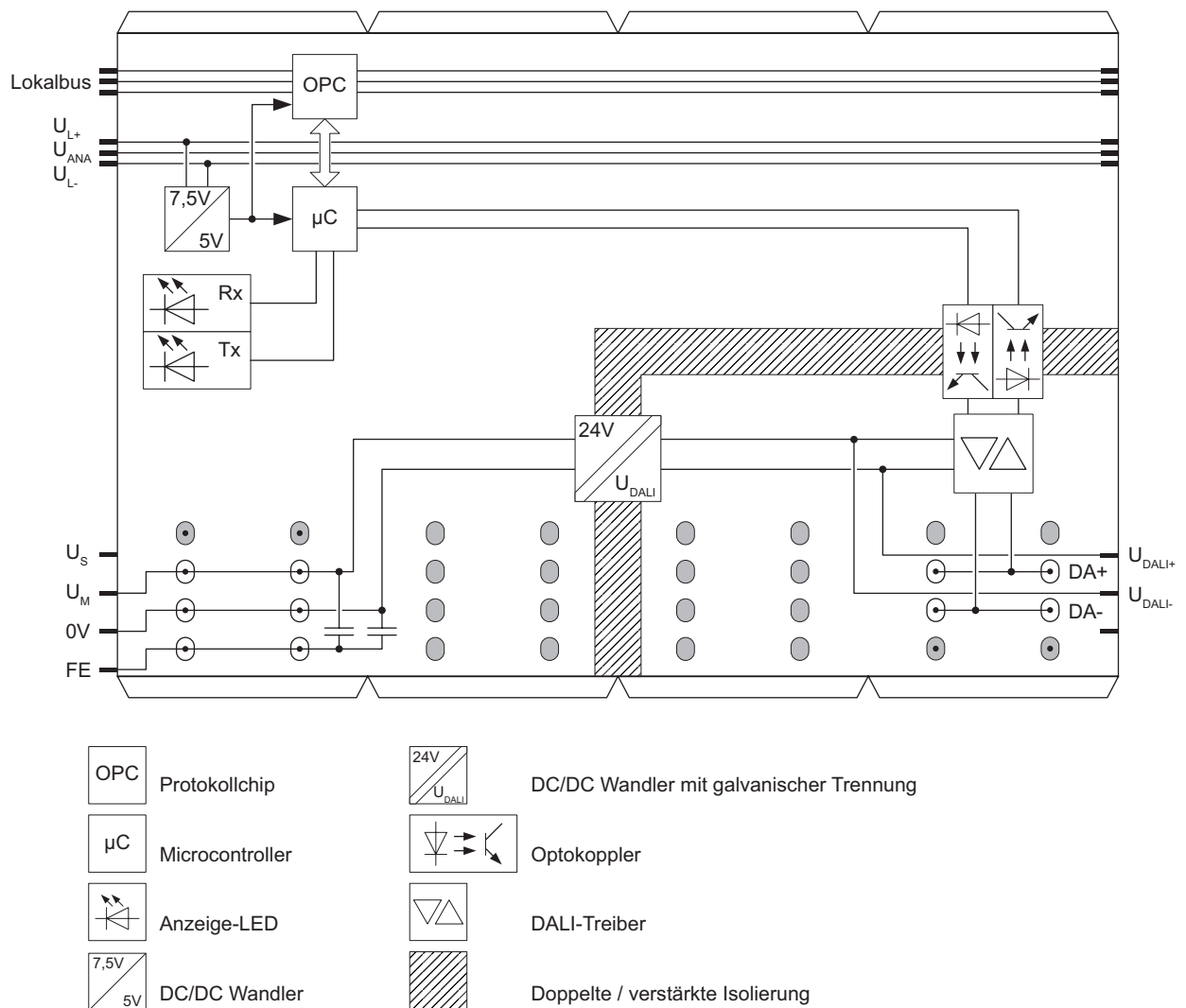


Fig. 1 Internal basic circuit diagram



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

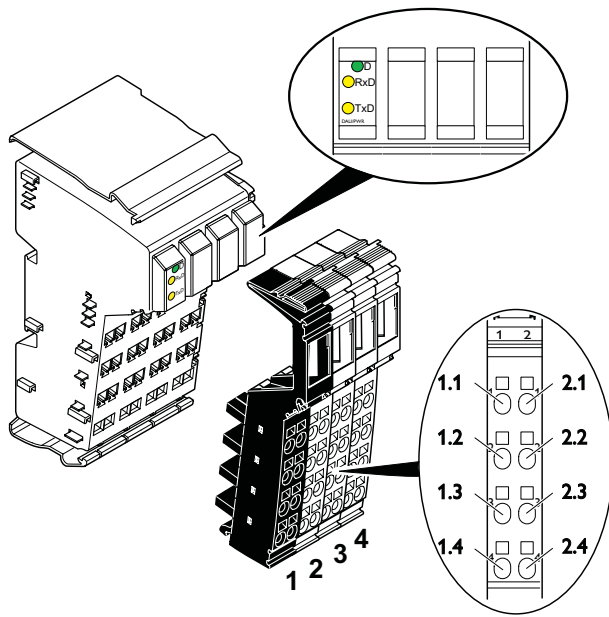


Fig. 2 Terminal with appropriate connectors

76070002

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

Terminal point assignment

Plug connector	Terminal point	Signal	Assignment
1	1.1, 2.1	–	Not used
	1.2, 2.2	U_M	+24 V supply voltage, internally connected to the potential jumper U_M
	1.3, 2.3	GND	24 V supply voltage ground
	1.4, 2.4	FE	Functional earth ground, internally connected to potential jumper FE
2	Not used		
3	Not used		
4	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 1.2, 1.3, 2.2, and 2.3 of connector 1 are connected internally with a capacitor to FE (see Fig. 1).



CAUTION

The DALI bus supply must **only** be provided via the potential jumpers U_M on the side **or** via connector 1.

For example, if the R-IB IL DALI/PWR-PAC terminal is directly preceded by a 24 V segment, the supply is already provided via the potential jumpers. Supply via connector 1 is then **not permitted** (see also "Typical Station Structure" on page 8).

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/PWR-PAC terminal.



The R-IB IL DALI/PWR-PAC terminal is not suitable for use if the DALI bus is supplied externally, e.g., by other bus devices. In this case, the R-IB IL DALI-PAC terminal should be used.

7 Connection Example

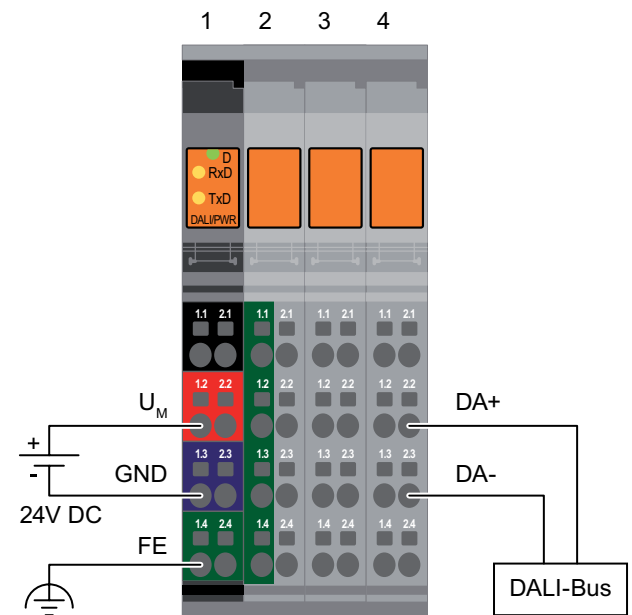


Fig. 3 Connection example



The supply must only be provided via the potential jumpers U_M on the side or via connector 1.

For example, if the R-IB IL DALI/PWR-PAC terminal is directly preceded by a 24 V segment, the supply is already provided via the potential jumpers. Supply via connector 1 is then not permitted.

8 Typical Station Structure

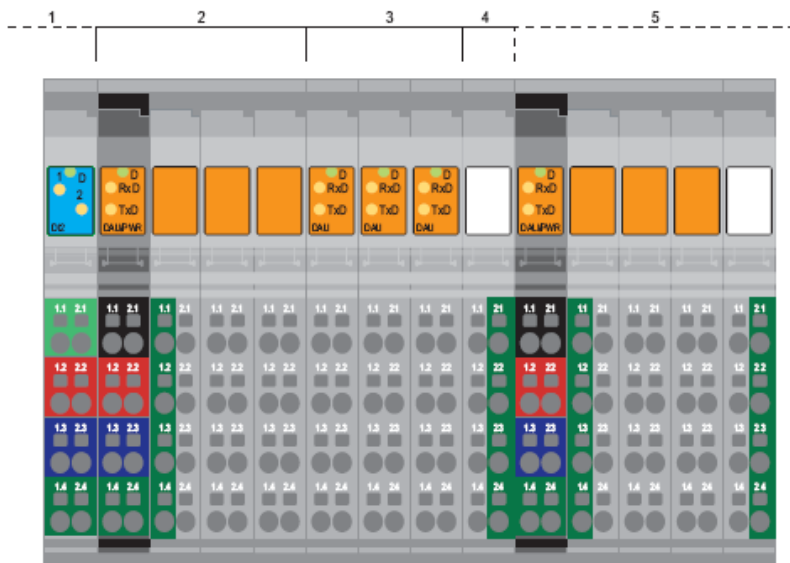


Fig. 4 Typical station structure with several DALI terminals

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 is supplied from the preceding 24 V segment via the potential jumpers (U_M) on the side. U_M and GND of connector 1 are not connected.
- 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., 24 V 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).

9 Programming Data/ Configuration Data

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

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

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	0	0

Bit 15 to bit 8: Command

Bit			Com- mand	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.

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								

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									

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 IN 1, and the response is copied to the low byte of IN 1.

The "Repeat" command is used to send the DALI command twice in intervals of 50ms (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
PWR-DA01-EN-P

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