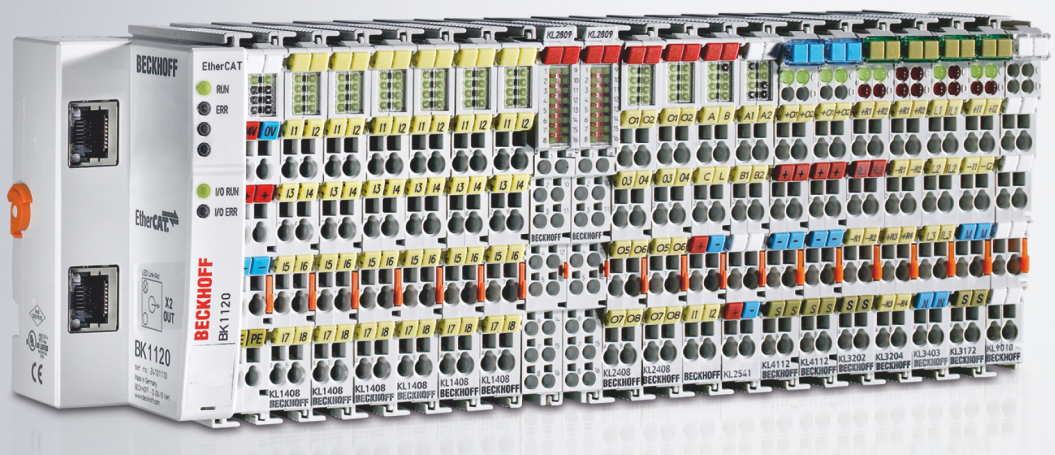
BECKHOFF New Automation Technology

Documentation | EN

KL6811/KS6811

DALI/DSI Master Terminals with integrated power supply



2022-09-22 | Version: 2.1.0

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1 Foreword

1.1 Notes on the documentation

Intended audience

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning these components.
It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement.

No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

Trademarks

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Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents: EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702 with corresponding applications or registrations in various other countries.

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1.2 Safety instructions

Safety regulations

Please note the following safety instructions and explanations!
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Description of instructions

In this documentation the following instructions are used.
These instructions must be read carefully and followed without fail!

⚠ DANGER

Serious risk of injury!

Failure to follow this safety instruction directly endangers the life and health of persons.

⚠ WARNING

Risk of injury!

Failure to follow this safety instruction endangers the life and health of persons.

⚠ CAUTION

Personal injuries!

Failure to follow this safety instruction can lead to injuries to persons.

NOTE

Damage to environment/equipment or data loss

Failure to follow this instruction can lead to environmental damage, equipment damage or data loss.

Tip or pointer

This symbol indicates information that contributes to better understanding.

1.3 Documentation issue status

Version	Comment
2.1.0	• Chapter *Technical data* updated • Ex markings added to technical data • Chapter *Instructions for ESD protection* added • Chapter *Disposal* added • Chapter *Beckhoff Identification Code (BIC)* added • Links to TwinCAT libraries updated • Document structure updated
2.0.0	• Migration
1.4.0	• Register description corrected • Technical data updated • Introduction and annex updated
1.3.0	• Screenshots for KS2000 configuration software updated • Technical data updated
1.2.2	• Mounting rail installation updated • Basic function principles updated
1.2.1	• LED descriptions updated • Product overview restructured
1.2	• Parameterization description for KL6811 and DALI devices with KS2000 configuration software expanded • Status byte descriptions expanded • Technical data updated • Register description corrected
1.1	• Parameterization description for KL6811 and DALI devices with KS2000 configuration software added • Description of DALI commands expanded • Examples for register communication added
1.0	• Description of LEDs and pin assignment expanded • Information on further reading and the standard added • English translation available
0.2	Technical data updated
0.1	First preliminary version

Firmware and hardware versions

Documentation Version	KL6811, KS6811	
	Firmware	Hardware
2.1.0	2H	11
2.0.0	2H	11
1.4.0	2H	10
1.3.0	2F	07
1.2.2	1J	04
1.2.1	1J	04
1.2	1J	03
1.1	1G	03
1.0		01
0.2		01
0.1		01

The firmware and hardware versions (delivery state) can be taken from the serial number printed on the side of the terminal.

Syntax of the serial number

Structure of the serial number: WW YY FF HH	Example with serial number 35 04 1B 01:
WW - week of production (calendar week)	35 - week of production 35
YY - year of production	04 - year of production 2004
FF - firmware version	1B - firmware version 1B
HH - hardware version	01 - hardware version 01

2 Product overview

2.1 Introduction

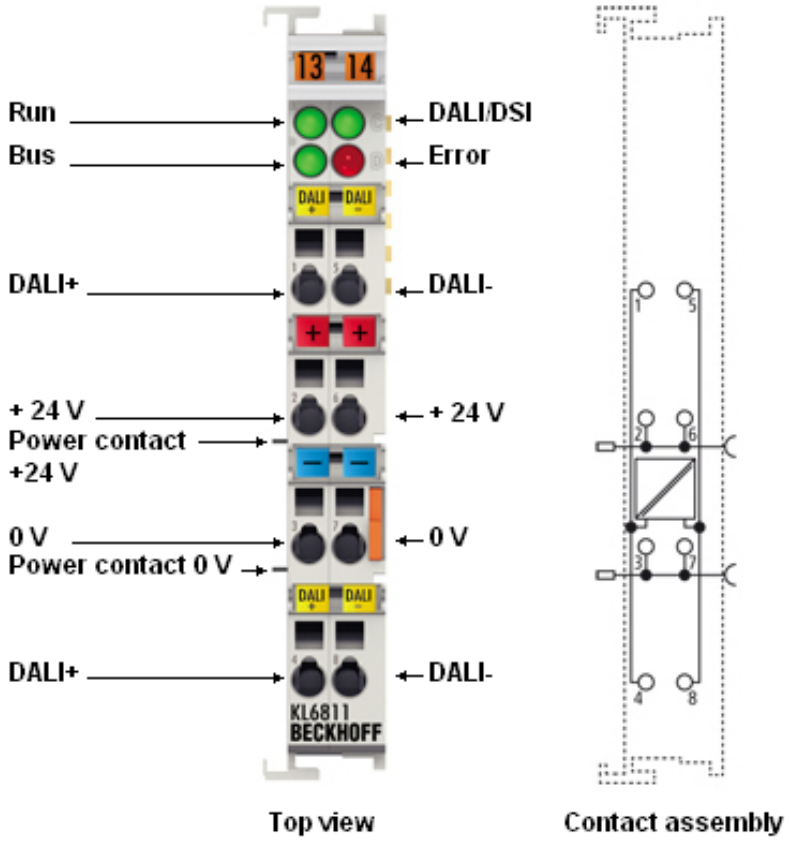


Fig. 1: KL6811 – DALI/DSI Master Terminal

The KL6811/KS6811 enables the connection of up to 64 DALI devices [▶ 11]. The KS2000 configuration software facilitates parameterization via a PC. The PC is directly coupled with the Bus Coupler via an RS232 interface or via the fieldbus. The KL6811/KS6811 features an integrated power supply unit (24 V_{DC}) with electrically isolated output voltage. No further components are required for operation of the DALI devices. The KL6811/KS6811 operates fieldbus independent.

The KL6811/KS6811 can also be operated as a DSI master [▶ 11].

2.2 Technical data

Technical data	KL6811	KS6811
Data transfer channels	1	
DALI devices / groups	maximum 64 / maximum 16	
Bit width in the K-bus I/O	2 x 8 bit user data, 1 x 8 bit control/status	
Bit width in the input process image	1 data word, 1 status byte	
Bit width in the output process image	1 data word, 1 control byte	
Configuration	with KS2000 configuration software via - Bus Coupler and configuration cable - Fieldbus	
Power supply for electronic	via the K-bus	
Current consumption from K-bus	typically 55 mA	
Current consumption from the power contacts	typically 30 mA + load	
Short-circuit strength	yes, automatic re-starting	
Input voltage	24 V_{DC} (-15%/+ 20%)	
Isolation voltage	DALI bus / K-Bus: permanent 1500 V_{AC} DALI bus / power contacts: permanent 1500 V_{AC} K-Bus / power contacts: permanent 500 V_{AC}	
DALI / DSI	standards-conform, open-circuit voltage 11.5 ... 15 V_{DC}	
Max. high/low level	current 130 mA / 250 mA	
Pluggable wiring	no	yes
Weight	approx. 80 g	
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm	
Mounting [▶ 13]	on 35 mm mounting rail conforms to EN 60715	
Power loss	0.5 W + power dissipation caused by the connected DALI devices	
Permissible ambient temperature range during operation	0°C ... + 55°C	
Permissible ambient temperature range during storage	-25°C ... + 85°C	
Permissible relative humidity	95%, no condensation	
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27	
EMC immunity/emission	conforms to EN 61000-6-2 / EN 61000-6-4	
Protection class	IP20	
Installation position	variable	
Approvals/markings*	CE, UKCA, cULus, EAC, ATEX [▶ 21]	

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

*) Real applicable approvals/markings see type plate on the side (product marking).

2.3 Basic function principles

Coupling to price-sensitive actuators in a controller system is a challenge for a universal gateway. A building's illumination is typically implemented through a large number of devices. The price of a lamp, and therefore of the connection to a control system, is thus of great significance.

DALI

The **D**igital **A**ddressable **L**ighting **I**nterface (DALI) is a simple bus system for building automation that transmits the signals for the digital operation of lighting devices. The lamp, sensor, button and switching elements are wired in parallel, and are linked through the controller. Other actuators, such as heating control valves or the motors for operating blinds are increasingly being put under digital control.

DALI offers the following advantages:

- an inexpensive interface with simple installation
- fully digital switching of lamps and similar equipment.
- all main manufacturers of ballasts support DALI

The KL6811 DALI Master Terminal from Beckhoff closes the gap between lighting controller and lamp and enables the connection of up to 64 DALI devices (DALI devices). The KL6811 is integrated into the BECKHOFF Bus Terminal system as a normal Bus Terminal and is therefore fieldbus independent. The higher-level Bus Coupler transfers the data from the DALI master terminal to the controller. The DALI power supply unit integrated in the KL6811 supplies the DALI bus. No further components are required for the operation of the DALI line.

During the start-up phase, the KL6811 searches for connected DALI devices and supports the user during commissioning of the system. The KS2000 [▶ 23] configuration software can be used to parameterize the DALI master terminal from a PC. The parameterization takes place via the fieldbus or via a RS232 interface, which are connected to the configuration interface of the higher-level Bus Coupler.

DSI

The KL6811 can also be operated as a DSI master. The Digital Serial interface (DSI) is an even simpler bus system for lighting control. The DSI master sends digital light intensity values serially to the DSI devices. The brightness of the devices can be set between 1% and 100%. The assignment of the brightness to the control values is logarithmic, so that a human observer sees a uniform increase in brightness when the control values are increased linearly. The devices can be switched to dark by setting the control value to 0, without having to switch off the mains voltage.

3 Mounting and wiring

3.1 Instructions for ESD protection

NOTE

Destruction of the devices by electrostatic discharge possible!

The devices contain components at risk from electrostatic discharge caused by improper handling.

- Please ensure you are electrostatically discharged and avoid touching the contacts of the device directly.
- Avoid contact with highly insulating materials (synthetic fibers, plastic film etc.).
- Surroundings (working place, packaging and personnel) should by grounded probably, when handling with the devices.
- Each assembly must be terminated at the right hand end with a KL9010 bus end terminal, to ensure the protection class and ESD protection.

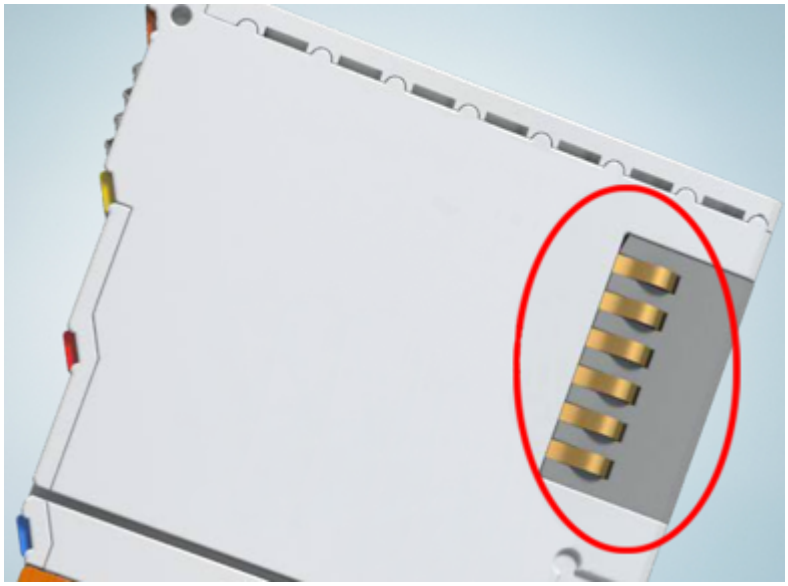


Fig. 2: Spring contacts of the Beckhoff I/O components

3.2 Installation on mounting rails

⚠ WARNING

Risk of electric shock and damage of device!

Bring the bus terminal system into a safe, powered down state before starting installation, disassembly or wiring of the bus terminals!

Assembly

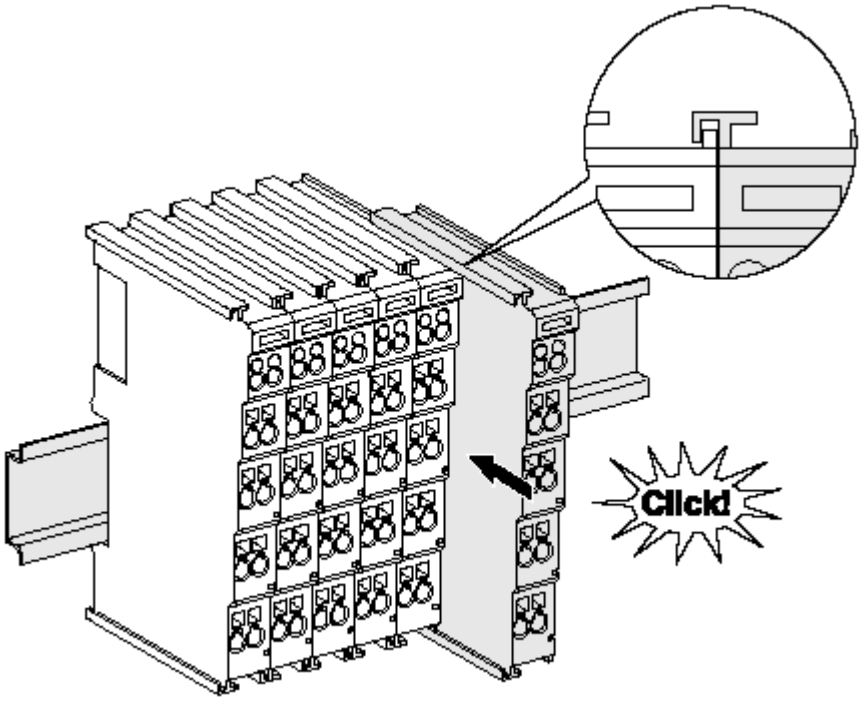


Fig. 3: Attaching on mounting rail

The bus coupler and bus terminals are attached to commercially available 35 mm mounting rails (DIN rails according to EN 60715) by applying slight pressure:

1. First attach the fieldbus coupler to the mounting rail.
2. The bus terminals are now attached on the right-hand side of the fieldbus coupler. Join the components with tongue and groove and push the terminals against the mounting rail, until the lock clicks onto the mounting rail.
   If the terminals are clipped onto the mounting rail first and then pushed together without tongue and groove, the connection will not be operational! When correctly assembled, no significant gap should be visible between the housings.

Fixing of mounting rails

The locking mechanism of the terminals and couplers extends to the profile of the mounting rail. At the installation, the locking mechanism of the components must not come into conflict with the fixing bolts of the mounting rail. To mount the mounting rails with a height of 7.5 mm under the terminals and couplers, you should use flat mounting connections (e.g. countersunk screws or blind rivets).

Disassembly

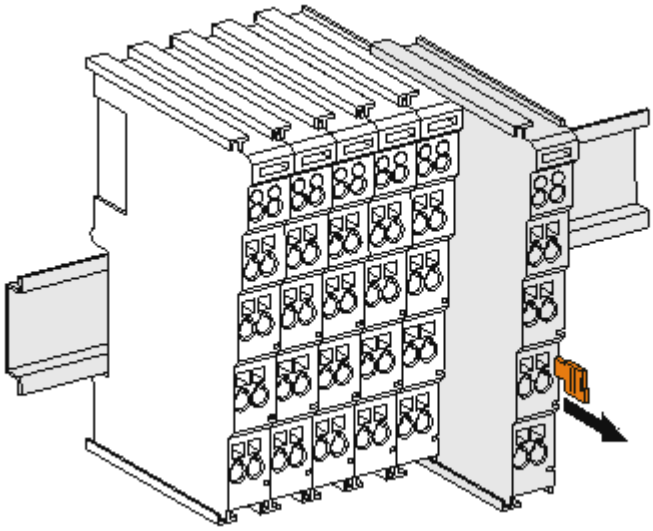


Fig. 4: Disassembling of terminal

Each terminal is secured by a lock on the mounting rail, which must be released for disassembly:

1. Pull the terminal by its orange-colored lugs approximately 1 cm away from the mounting rail. In doing so for this terminal the mounting rail lock is released automatically and you can pull the terminal out of the bus terminal block easily without excessive force.
2. Grasp the released terminal with thumb and index finger simultaneous at the upper and lower grooved housing surfaces and pull the terminal out of the bus terminal block.

Connections within a bus terminal block

The electric connections between the Bus Coupler and the Bus Terminals are automatically realized by joining the components:

- The six spring contacts of the K-Bus/E-Bus deal with the transfer of the data and the supply of the Bus Terminal electronics.
- The power contacts deal with the supply for the field electronics and thus represent a supply rail within the bus terminal block. The power contacts are supplied via terminals on the Bus Coupler (up to 24 V) or for higher voltages via power feed terminals.

Power Contacts

During the design of a bus terminal block, the pin assignment of the individual Bus Terminals must be taken account of, since some types (e.g. analog Bus Terminals or digital 4-channel Bus Terminals) do not or not fully loop through the power contacts. Power Feed Terminals (KL91xx, KL92xx or EL91xx, EL92xx) interrupt the power contacts and thus represent the start of a new supply rail.

PE power contact

The power contact labeled PE can be used as a protective earth. For safety reasons this contact mates first when plugging together, and can ground short-circuit currents of up to 125 A.

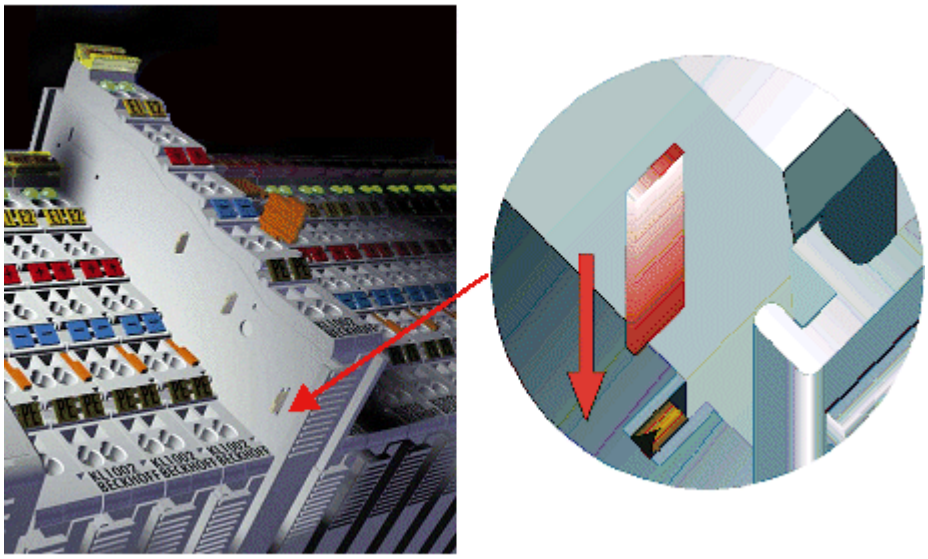


Fig. 5: Power contact on left side

NOTE

Possible damage of the device

Note that, for reasons of electromagnetic compatibility, the PE contacts are capacitatively coupled to the mounting rail. This may lead to incorrect results during insulation testing or to damage on the terminal (e.g. disruptive discharge to the PE line during insulation testing of a consumer with a nominal voltage of 230 V). For insulation testing, disconnect the PE supply line at the Bus Coupler or the Power Feed Terminal! In order to decouple further feed points for testing, these Power Feed Terminals can be released and pulled at least 10 mm from the group of terminals.

⚠ WARNING

Risk of electric shock!

The PE power contact must not be used for other potentials!

3.3 Disposal

Products marked with a crossed-out wheeled bin shall not be discarded with the normal waste stream. The device is considered as waste electrical and electronic equipment. The national regulations for the disposal of waste electrical and electronic equipment must be observed.

3.4 Connection

3.4.1 Connection system

⚠ WARNING

Risk of electric shock and damage of device!

Bring the bus terminal system into a safe, powered down state before starting installation, disassembly or wiring of the bus terminals!

Overview

The bus terminal system offers different connection options for optimum adaptation to the respective application:

- The terminals of ELxxxx and KLxxxx series with standard wiring include electronics and connection level in a single enclosure.
- The terminals of ESxxxx and KSxxxx series feature a pluggable connection level and enable steady wiring while replacing.
- The High Density Terminals (HD Terminals) include electronics and connection level in a single enclosure and have advanced packaging density.

Standard wiring (ELxxxx / KLxxxx)

Fig. 6: Standard wiring

The terminals of ELxxxx and KLxxxx series have been tried and tested for years.
They feature integrated screwless spring force technology for fast and simple assembly.

Pluggable wiring (ESxxxx / KSxxxx)

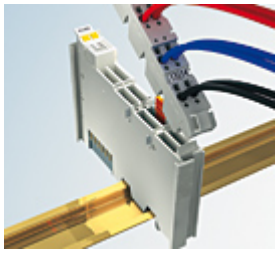


Fig. 7: Pluggable wiring

The terminals of ESxxxx and KSxxxx series feature a pluggable connection level.
The assembly and wiring procedure is the same as for the ELxxxx and KLxxxx series.
The pluggable connection level enables the complete wiring to be removed as a plug connector from the top of the housing for servicing.
The lower section can be removed from the terminal block by pulling the unlocking tab.
Insert the new component and plug in the connector with the wiring. This reduces the installation time and eliminates the risk of wires being mixed up.

The familiar dimensions of the terminal only had to be changed slightly. The new connector adds about 3 mm. The maximum height of the terminal remains unchanged.

A tab for strain relief of the cable simplifies assembly in many applications and prevents tangling of individual connection wires when the connector is removed.

Conductor cross sections between 0.08 mm² and 2.5 mm² can continue to be used with the proven spring force technology.

The overview and nomenclature of the product names for ESxxxx and KSxxxx series has been retained as known from ELxxxx and KLxxxx series.

High Density Terminals (HD Terminals)

Fig. 8: High Density Terminals

The terminals from these series with 16 terminal points are distinguished by a particularly compact design, as the packaging density is twice as large as that of the standard 12 mm bus terminals. Massive conductors and conductors with a wire end sleeve can be inserted directly into the spring loaded terminal point without tools.

Wiring HD Terminals

The High Density Terminals of the ELx8xx and KLx8xx series doesn't support pluggable wiring.

Ultrasonically “bonded” (ultrasonically welded) conductors

Ultrasonically “bonded” conductors

It is also possible to connect the Standard and High Density Terminals with ultrasonically “bonded” (ultrasonically welded) conductors. In this case, please note the tables concerning the wire-size width [▶ 18]!

3.4.2 Wiring

⚠ WARNING

Risk of electric shock and damage of device!

Bring the bus terminal system into a safe, powered down state before starting installation, disassembly or wiring of the bus terminals!

Terminals for standard wiring ELxxxx/KLxxxx and for pluggable wiring ESxxxx/KSxxxx

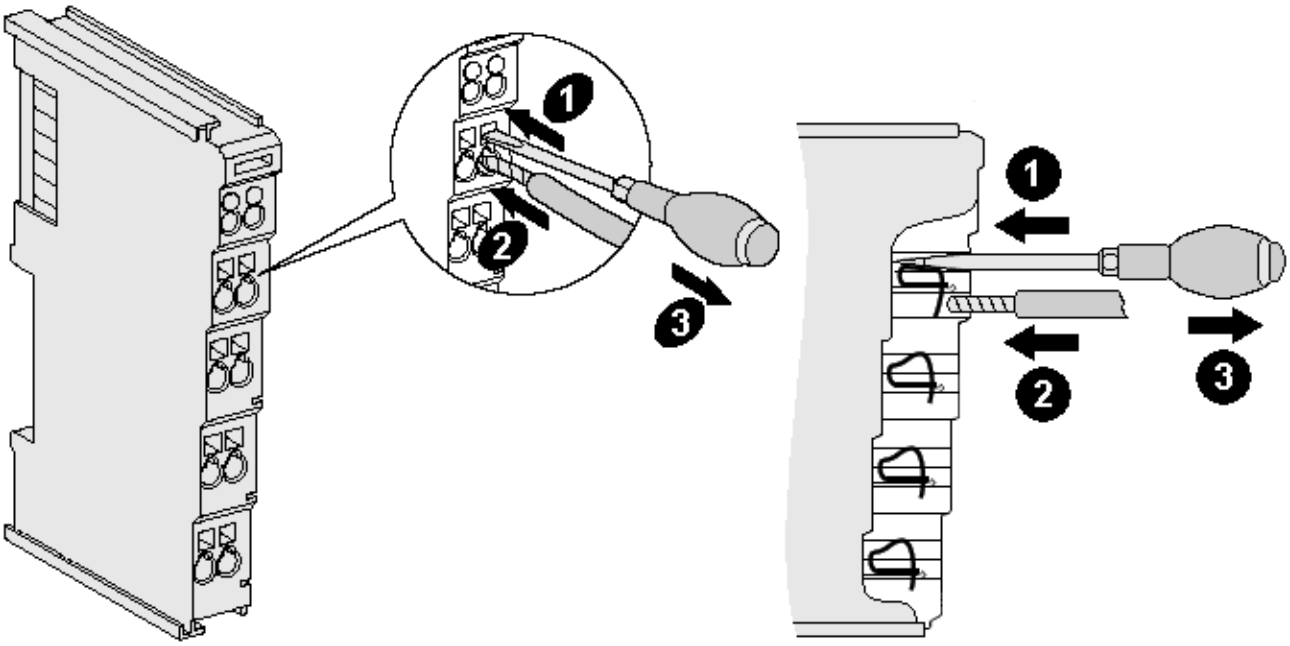


Fig. 9: Connecting a cable on a terminal point

Up to eight terminal points enable the connection of solid or finely stranded cables to the bus terminal. The terminal points are implemented in spring force technology. Connect the cables as follows:

1. Open a terminal point by pushing a screwdriver straight against the stop into the square opening above the terminal point. Do not turn the screwdriver or move it alternately (don't toggle).
2. The wire can now be inserted into the round terminal opening without any force.
3. The terminal point closes automatically when the pressure is released, holding the wire securely and permanently.

See the following table for the suitable wire size width.

Terminal housing	ELxxxx, KLxxxx	ESxxxx, KSxxxx
Wire size width (single core wires)	0.08 ... 2.5 mm²	0.08 ... 2.5 mm²
Wire size width (fine-wire conductors)	0.08 ... 2.5 mm²	0.08 ... 2.5 mm²
Wire size width (conductors with a wire end sleeve)	0.14 ... 1.5 mm²	0.14 ... 1.5 mm²
Wire stripping length	8 ... 9 mm	9 ... 10 mm

High Density Terminals (HD Terminals [▶ 17]) with 16 terminal points

The conductors of the HD Terminals are connected without tools for single-wire conductors using the direct plug-in technique, i.e. after stripping the wire is simply plugged into the terminal point. The cables are released, as usual, using the contact release with the aid of a screwdriver. See the following table for the suitable wire size width.

Terminal housing	High Density Housing
Wire size width (single core wires)	0.08 ... 1.5 mm²
Wire size width (fine-wire conductors)	0.25 ... 1.5 mm²
Wire size width (conductors with a wire end sleeve)	0.14 ... 0.75 mm²
Wire size width (ultrasonically “bonded" conductors)	only 1.5 mm² (see notice [▶ 17])
Wire stripping length	8 ... 9 mm

3.4.3 Shielding

Shielding

Encoder, analog sensors and actors should always be connected with shielded, twisted paired wires.

3.4.4 Contact assignment

⚠ WARNING

Risk of injury through electric shock and damage to the device!

Bring the Bus Terminals system into a safe, de-energized state before starting mounting, disassembly or wiring of the Bus Terminals.

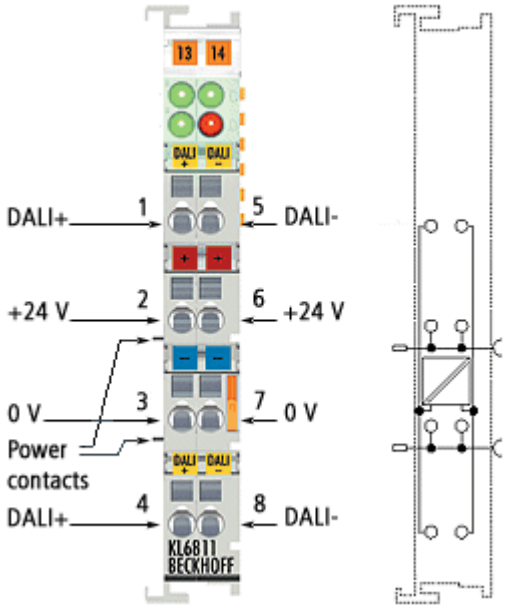


Fig. 10: KL6811 - Contact assignment

Contact assignment

Terminal point	No.	Connection for
DALI +	1	DALI/DSI control cable (internally connected to terminal point no. 4)
+24 V	2	Power contact +24 V
0 V	3	Power contact 0 V
DALI +	4	DALI/DSI control cable (internally connected to terminal point no. 1)
DALI -	5	DALI/DSI control cable (internally connected to terminal point no. 8)
+24 V	6	Power contact +24 V
0 V	7	Power contact 0 V
DALI -	8	DALI/DSI control cable (internally connected to terminal point no. 5)

NOTE

No mains voltage at the power contacts

The terminal points for the power contacts (+24 V, 0 V) must not be connected to 230 V mains voltage under any circumstances, since this would destroy the KL6811.

Contacts for the DALI control cable (DALI+, DALI-) and mains voltage

If the contacts for the DALI control line (DALI+, DALI-) are accidentally connected to 230 V mains voltage, the KL6811 is not destroyed, but switches off.

Line lengths in DALI mode

The DALI bus can be configured in a line or star topology, or in a mix of the two. The maximum cable length must not exceed 300 m!

Cable length	Wire cross section
up to 100 m	minimum 0.5 mm^2
up to 150 m	minimum 0.75 mm^2
up to 300 m	minimum 1.5 mm^2

Further important boundary conditions derived from IEC 62386:

- The DALI cables must not be terminated with resistors.
- The maximum voltage drop between the sender and the receiver must not exceed 2 V.
- If the maximum cable length is utilized, it is not advisable to lay DALI in combination with the power cable.

3.5 LED indicators

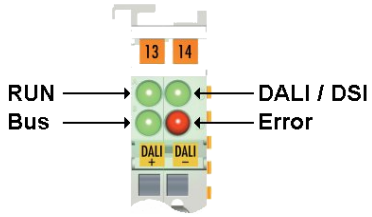


Fig. 11: KL6811 - LEDs

LED	No.	Meaning	
RUN	A	on	Data transmission on the K-bus
Bus	B	flashing	Activity: Data transfer on the DALI/DSI bus
		on	No power supply (24 V_{DC}) for the power contacts
DALI / DSI	C	on	Operating mode: DALI mode
		off	Operating mode: DSI mode
Error	D	on	in DALI mode: Overload of the internal DALI power supply in DSI mode: DSI feedback

3.6 ATEX - Special conditions (standard temperature range)

⚠ WARNING

Observe the special conditions for the intended use of Beckhoff fieldbus components with standard temperature range in potentially explosive areas (directive 2014/34/EU)!

- The certified components are to be installed in a suitable housing that guarantees a protection class of at least IP54 in accordance with EN 60079-15! The environmental conditions during use are thereby to be taken into account!
- For dust (only the fieldbus components of certificate no. KEMA 10ATEX0075 X Issue 9): The equipment shall be installed in a suitable enclosure providing a degree of protection of IP54 according to EN 60079-31 for group IIIA or IIIB and IP6X for group IIIC, taking into account the environmental conditions under which the equipment is used!
- If the temperatures during rated operation are higher than 70°C at the feed-in points of cables, lines or pipes, or higher than 80°C at the wire branching points, then cables must be selected whose temperature data correspond to the actual measured temperature values!
- Observe the permissible ambient temperature range of 0 to 55°C for the use of Beckhoff fieldbus components standard temperature range in potentially explosive areas!
- Measures must be taken to protect against the rated operating voltage being exceeded by more than 40% due to short-term interference voltages!
- The individual terminals may only be unplugged or removed from the Bus Terminal system if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- The fuses of the KL92xx/EL92xx power feed terminals may only be exchanged if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- Address selectors and ID switches may only be adjusted if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!

Standards

The fundamental health and safety requirements are fulfilled by compliance with the following standards:

- EN 60079-0:2012+A11:2013
- EN 60079-15:2010
- EN 60079-31:2013 (only for certificate no. KEMA 10ATEX0075 X Issue 9)

Marking

The Beckhoff fieldbus components with standard temperature range certified according to the ATEX directive for potentially explosive areas bear one of the following markings:

II 3G KEMA 10ATEX0075 X Ex nA IIC T4 Gc Ta: 0 … +55°C

II 3D KEMA 10ATEX0075 X Ex tc IIIC T135°C Dc Ta: 0 ... +55°C
(only for fieldbus components of certificate no. KEMA 10ATEX0075 X Issue 9)

or

II 3G KEMA 10ATEX0075 X Ex nA nC IIC T4 Gc Ta: 0 … +55°C

II 3D KEMA 10ATEX0075 X Ex tc IIIC T135°C Dc Ta: 0 ... +55°C
(only for fieldbus components of certificate no. KEMA 10ATEX0075 X Issue 9)

3.7 Continuative documentation for ATEX and IECEx

NOTE	
	**Continuative documentation about explosion protection according to ATEX and IECEx** Pay also attention to the continuative documentation **Ex. Protection for Terminal Systems** Notes on the use of the Beckhoff terminal systems in hazardous areas according to ATEX and IECEx, that is available for download within the download area of your product on the Beckhoff homepage www.beckhoff.com!

4 Configuration software KS2000

4.1 KS2000 - Introduction

The KS2000 configuration software permits configuration, commissioning and parameterization of bus couplers, of the affiliated bus terminals and of Fieldbus Box Modules. The connection between bus coupler / Fieldbus Box Module and the PC is established by means of the serial configuration cable or the fieldbus.

Fig. 12: KS2000 configuration software

Configuration

You can configure the Fieldbus stations with the Configuration Software KS2000 offline. That means, setting up a terminal station with all settings on the couplers and terminals resp. the Fieldbus Box Modules can be prepared before the commissioning phase. Later on, this configuration can be transferred to the terminal station in the commissioning phase by means of a download. For documentation purposes, you are provided with the breakdown of the terminal station, a parts list of modules used and a list of the parameters you have modified. After an upload, existing fieldbus stations are at your disposal for further editing.

Parameterization

KS2000 offers simple access to the parameters of a fieldbus station: specific high-level dialogs are available for all bus couplers, all intelligent bus terminals and Fieldbus Box modules with the aid of which settings can be modified easily. Alternatively, you have full access to all internal registers of the bus couplers and intelligent terminals. Refer to the register description for the meanings of the registers.

Commissioning

The KS2000 software facilitates commissioning of machine components or their fieldbus stations: Configured settings can be transferred to the fieldbus modules by means of a download. After a *login* to the terminal station, it is possible to define settings in couplers, terminals and Fieldbus Box modules directly *online*. The same high-level dialogs and register access are available for this purpose as in the configuration phase.

The KS2000 offers access to the process images of the bus couplers and Fieldbus Box modules.

- Thus, the coupler's input and output images can be observed by monitoring.
- Process values can be specified in the output image for commissioning of the output modules.

All possibilities in the *online mode* can be used in parallel with the actual fieldbus mode of the terminal station. The fieldbus protocol always has the higher priority in this case.

4.2 KL6811 configuration

Connect the configuration interface of your fieldbus coupler with the serial interface of your PC via the configuration cable and start the *KS2000* configuration software.

Click on the *Login* button. The configuration software will now load the information for the connected fieldbus station.
In the example shown, this is

- a BK9000 Bus Coupler for Ethernet
- a KL1xx2 digital input terminal
- a KL6811 DALI Master Terminal
- a KL9010 bus end terminal

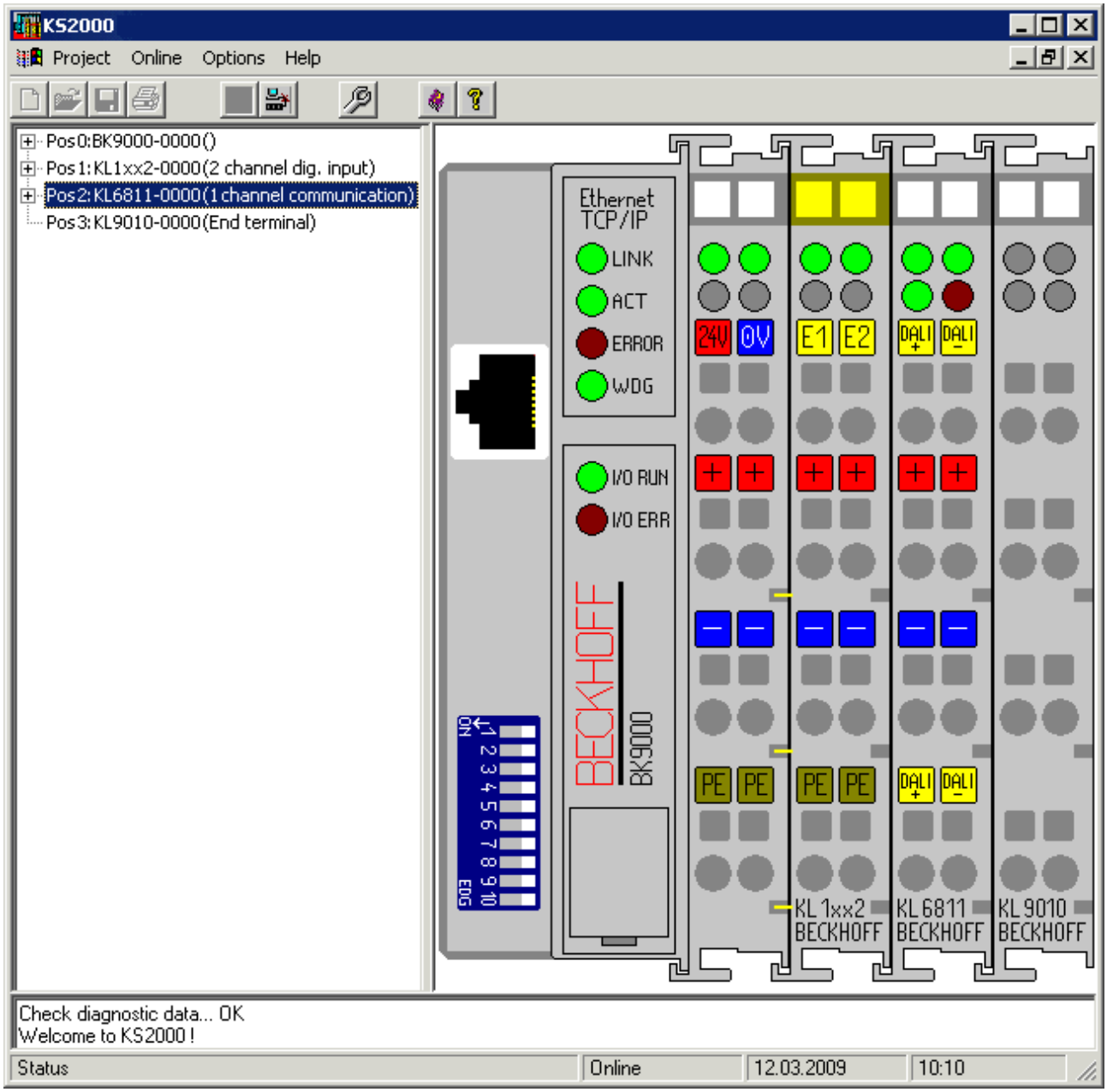


Fig. 13: Display of the fieldbus station in KS2000

The left-hand KS2000 window displays the terminals of the fieldbus station in a tree structure.
The right-hand KS2000 window contains a graphic display of the fieldbus station terminals.

In the tree structure of the left-hand window, click on the plus-sign next to the terminal whose parameters you wish to change (item 2 in the example).

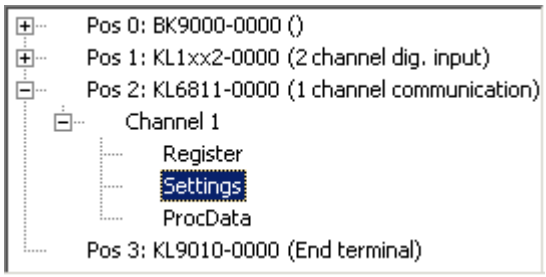


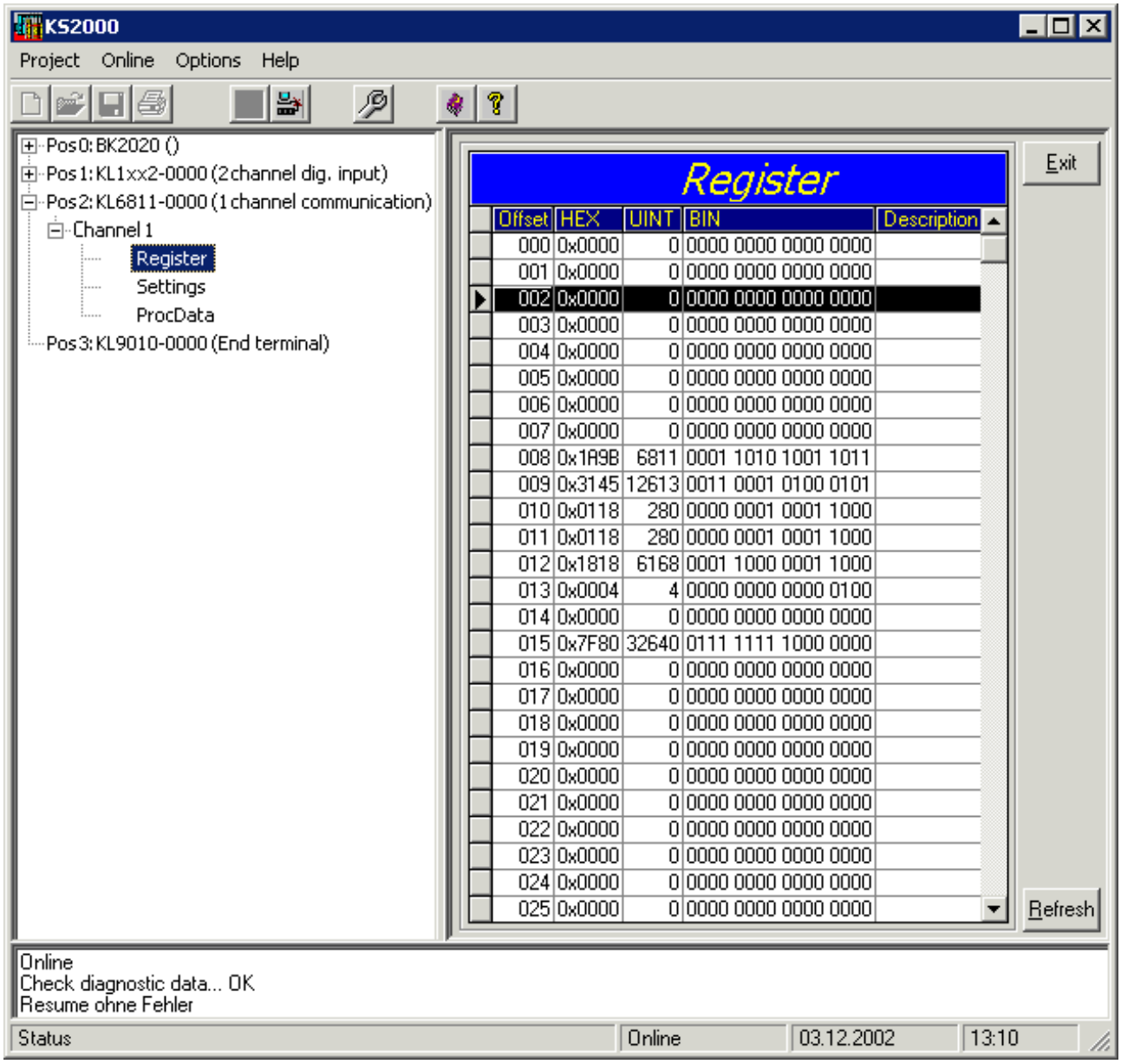
Fig. 14: KS2000 tree branches for channel 1 of the KL6811

For the KL6811, the branches *Register*, *Settings* and *ProcData* are displayed:

- Register [▶ 27] enables direct access to the KL6811 registers.
- Under Settings [▶ 28] you find dialog boxes for parameterizing the KL6811.
- ProcData displays the KL6811 process data.

4.3 Register

You can access the registers of the KL6811 directly under *Register*. The meaning of the register is explained in the register overview [▶ 48].



Offset	HEX	UINT	BIN	Description
000	0x0000	0	0000 0000 0000 0000	
001	0x0000	0	0000 0000 0000 0000	
002	0x0000	0	0000 0000 0000 0000	
003	0x0000	0	0000 0000 0000 0000	
004	0x0000	0	0000 0000 0000 0000	
005	0x0000	0	0000 0000 0000 0000	
006	0x0000	0	0000 0000 0000 0000	
007	0x0000	0	0000 0000 0000 0000	
008	0x1A9B	6811	0001 1010 1001 1011	
009	0x3145	12613	0011 0001 0100 0101	
010	0x0118	280	0000 0001 0001 1000	
011	0x0118	280	0000 0001 0001 1000	
012	0x1818	6168	0001 1000 0001 1000	
013	0x0004	4	0000 0000 0000 0100	
014	0x0000	0	0000 0000 0000 0000	
015	0x7F80	32640	0111 1111 1000 0000	
016	0x0000	0	0000 0000 0000 0000	
017	0x0000	0	0000 0000 0000 0000	
018	0x0000	0	0000 0000 0000 0000	
019	0x0000	0	0000 0000 0000 0000	
020	0x0000	0	0000 0000 0000 0000	
021	0x0000	0	0000 0000 0000 0000	
022	0x0000	0	0000 0000 0000 0000	
023	0x0000	0	0000 0000 0000 0000	
024	0x0000	0	0000 0000 0000 0000	
025	0x0000	0	0000 0000 0000 0000	

Fig. 15: Register view in KS2000

4.4 Settings

Under *Settings* you will find the dialog masks for parameterization of the KL6811 and of the DALI/DSI devices connected to it.

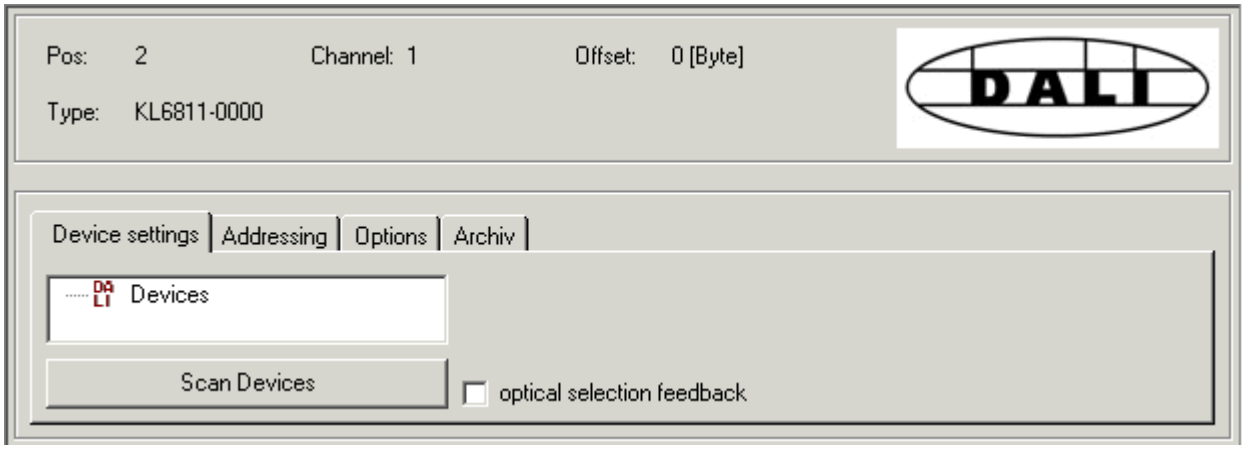


Fig. 16: KS2000 - parameterization of the KL6811 and the DALI/DSI devices

Device settings

You can change the settings of the DALI/DSI devices [▶ 28]on this tab.

Addressing

You can carry out the addressing of the DALI devices [▶ 37]on this tab.

Options

You can specify a number of options for the KL6811 [▶ 41] on this tab.

4.4.1 Setting up the DALI/DSI devices

Click the *Scan devices* button so that the KL6811 reads in the connected DALI/DSI devices. In this example, 6 DALI devices are shown.

Sending DALI commands

Click on *Devices*.

Commands to multiple DALI devices

Address type

In DALI operation [▶ 41]you can use this mask to send a command to

- all the connected DALI devices (collective call/broadcast),
- a group of DALI devices (group), or
- to one specific DALI device (short address).

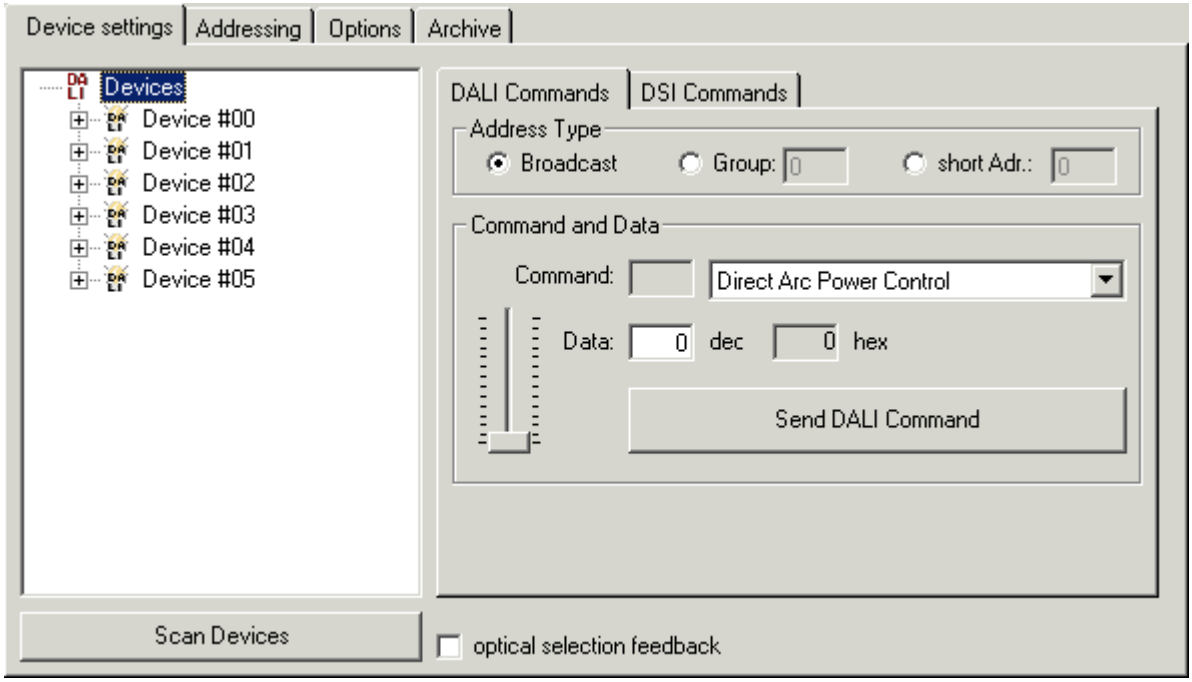


Fig. 17: KS2000 - parameterization of the DALI/DSI devices - address-type

Command and data

Direct control of the lamp power

The first command in this menu is supported by means of an intensity slider:

- set the intensity slider to the desired value or
- enter a value into the *Data* field

and click the *Send DALI command* button. The KL6811 sends this value as a direct DALI command [▶ 55] for the lamp power to all the selected DALI devices.

Further commands

The command number is shown in decimal format for all other commands. They are described under this number in the section covering indirect DALI commands [▶ 55] for lamp power.

Settings for the individual DALI devices

Four dialog masks are available to control every recognized DALI device:

- Lighting control/query [▶ 30] (click directly on *Device #xx*)
- Variables [▶ 33]
- Groups [▶ 36]
- Scenes [▶ 36]

Visual selection feedback

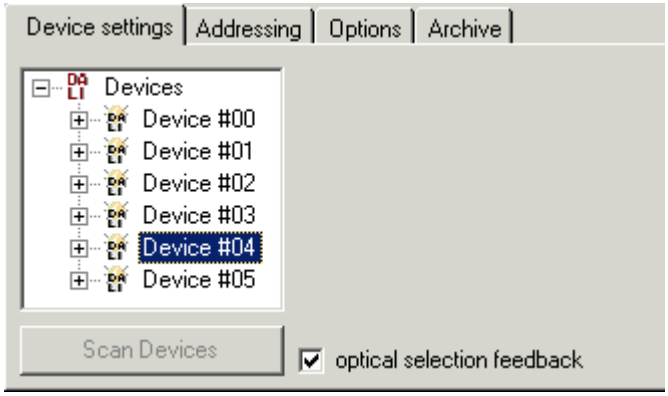


Fig. 18: KS2000 - parameterization of the DALI/DSI devices - visual selection feedback

If the option *visual selection feedback* is enabled, the selected device (in the example device #04) sets its current lamp power value to the parameterized maximum value.

Sending DSI commands

In DSI operation [▶ 41] you can use this mask to send the same light intensity to all the connected DSI devices:

- set the intensity slider to the desired value or
- enter a value into the *Data* field

and click the *Send DSI command* button. The KL6811 sends this value to all the connected DSI devices.

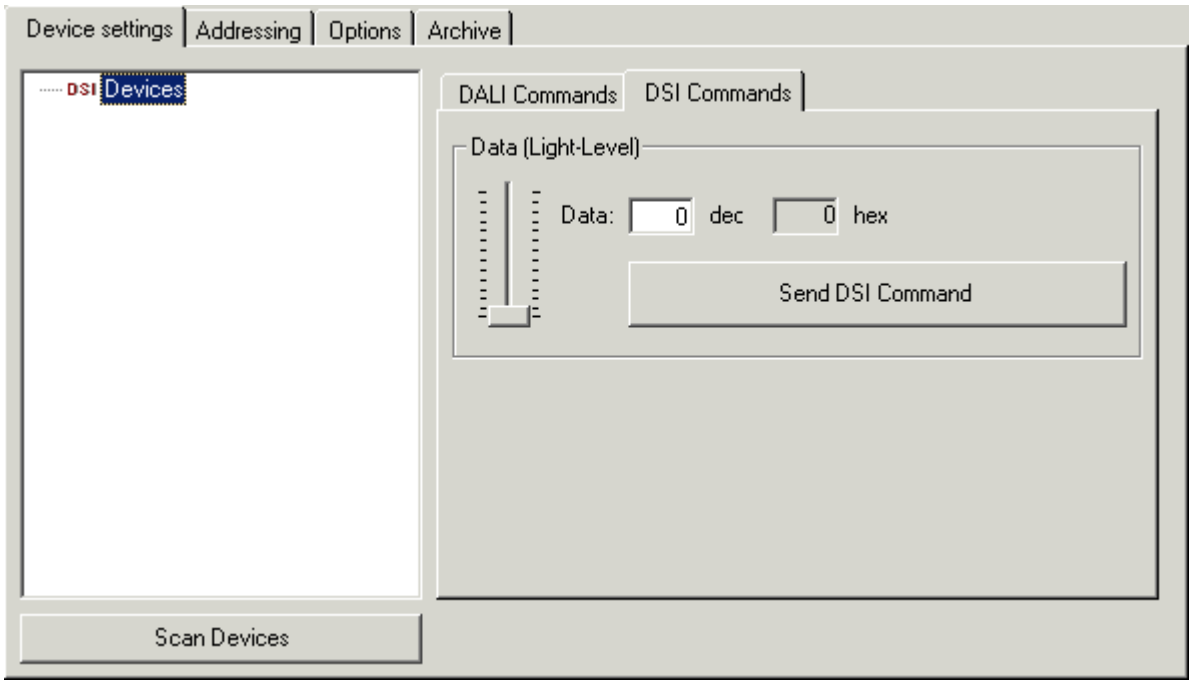


Fig. 19: KS2000 - parameterization of the DALI/DSI devices - sending of DSI commands

4.4.1.1 Lighting control / query

Click on the device number (in this example, *Device #00*). A dialog mask appears with areas for direct lamp control, indirect lamp control and query.

Direct light control (control via direct DALI commands [▶ 55] for lamp power)

Sets the lamp intensity to the specified value.

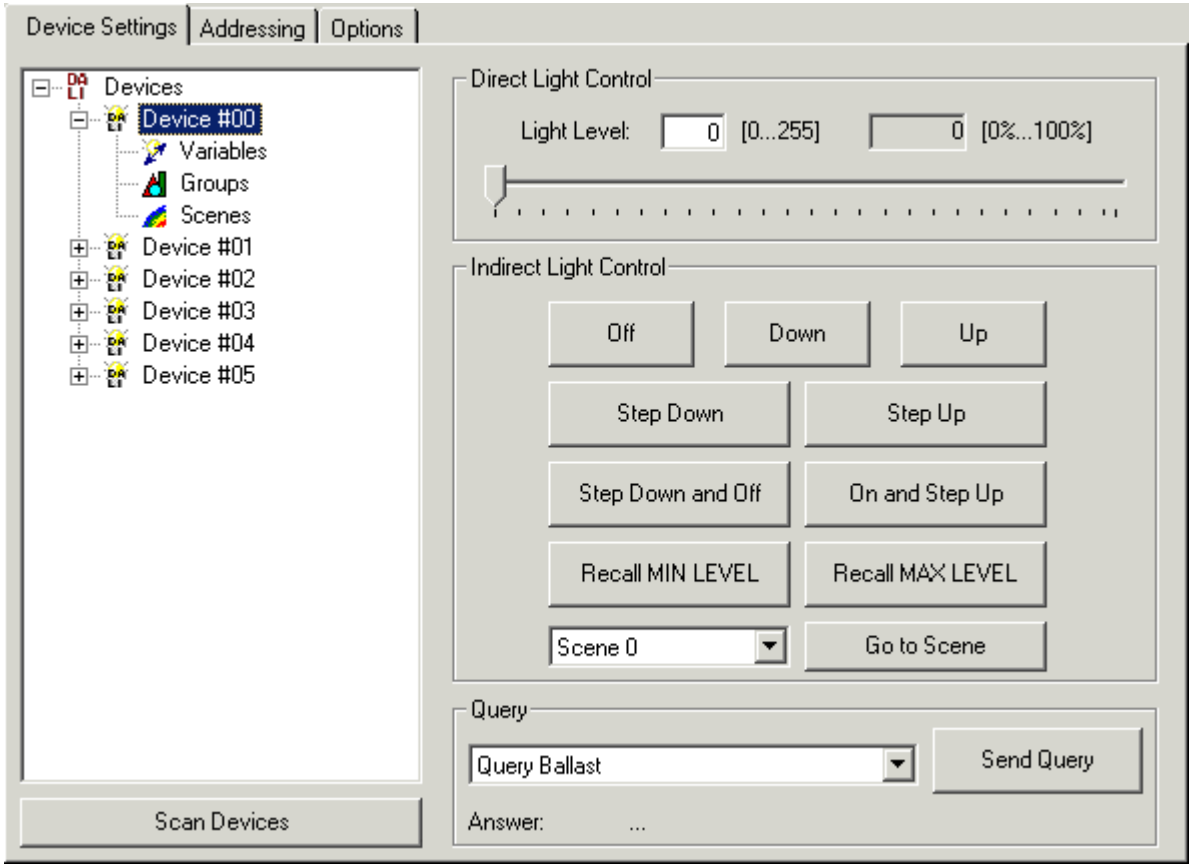


Fig. 20: KS2000 - parameterization of the DALI/DSI devices - lighting control / queries

Indirect light control (control via the indirect DALI commands [▶ 55] for lamp power)

Buttons that send an associated DALI command to the selected device are available for the main functions.

Switching off

Switches off the lamp connected to the DALI device without fading (sends DALI command 0 [▶ 55]$_{dec}$).

Down

Dims the DALI device over a period of 200 ms using the selected fade rate [▶ 34] (sends DALI command 2 [▶ 55]$_{dec}$)

Up

Brightens the DALI device over a period of 200 ms using the selected fade rate [▶ 34] (sends DALI command 1 [▶ 55]$_{dec}$)

Step Down

Lowers the current lamp power value by one graduation without fading (sends DALI command 4 [▶ 55]$_{dec}$), assuming the lamp has not already been set to its parameterized minimum (MIN) value. If the lamp has already been set to its MIN value, it is not changed, and remains switched on. The minimum value can be parameterized on the Variables [▶ 33] tab.

Step Up

Sets the current lamp power value one graduation higher without fading (sends DALI command 3 [▶ 55]$_{dec}$), unless it is already switched on. If the lamp is switched off, it is not switched on.

Step Down and off

Sets the current lamp power value one step lower without fading (sends DALI command 7 [▶ 55]$_{dec}$). If the lamp is already set to its parameterized minimum (MIN) value, it is switched off. The MIN value can be parameterized on the Variables [▶ 33] tab.

On and Step Up

Sets the current lamp power value one step higher without fading (DALI command 8 [▶ 55]$_{dec}$). If the lamp is switched off, it is switched on and is set to its parameterized minimum (MIN) value. The MIN value can be parameterized on the Variables [▶ 33] tab.

Recall MIN LEVEL

Sets the lamp power value to the parameterized minimum (sends DALI command 6 [▶ 55]$_{dec}$). If the lamp was switched off, it is switched on.

Recall MAX LEVEL

Sets the lamp power value to the parameterized maximum (sends DALI command 5 [▶ 55]$_{dec}$). If the lamp was switched off, it is switched on.

Go to Scene

- Select a scene.
- Click the Go to scene button.

Sets the DALI device's lamp power value to the level parameterized for the selected scene (sends a DALI command between 16 and 31 [▶ 55]$_{dec}$). This value can be parameterized on the Scenes [▶ 36] tab.

Queries

This dialog allows you to inquire about information regarding the status of the DALI device:

- Select the desired query.
- Click the *Send query* button.

Query ballast

Asks whether the DALI device is ready for data exchange (DALI command 145 [▶ 57]dec).

Query lamp failure

Asks whether the DALI device has a lamp problem (DALI command 146 [▶ 57]$_{dec}$).

Query lamp power supply switched on

Asks whether the power supply to the DALI device has been switched on (DALI command 147 [▶ 57]$_{dec}$).

Query limit value error

Asks whether a limit value error has occurred on the DALI device (DALI command 148 [▶ 57]$_{dec}$).

Query reset status

Asks whether the DALI device is in the reset state (DALI command 149 [▶ 57]$_{dec}$).

Query missing short address

Asks whether the DALI device is missing the short address (DALI command 150 [▶ 57]$_{dec}$).

Query DTR contents

Reads the content of the Data Transfer Register (DTR) from the DALI device (DALI command 152 [▶ 57]$_{dec}$).

Query device type

Reads the type of the DALI device (DALI command 153 [▶ 57]$_{dec}$). The following device types exist:
0: Standard device
1: Device for emergency lighting
2: Device for HID lamps
3: Device for dimming bulbs
5 to 255 are reserved for future device types. You may find further information in the DIN EN 60929 [▶ 58] standard.

Query power supply fault

Asks whether a fault in the power supply has occurred at the DALI device (DALI command 155 [▶ 57]$_{dec}$).

4.4.1.2 Variables

The intelligence in the DALI system is not 100% centralized. This means that a large number of settings and light values are stored in the form of variables in the ballasts.
Click on *Variables*. A dialog mask in which you can inspect and edit the variables for the selected DALI device appears.

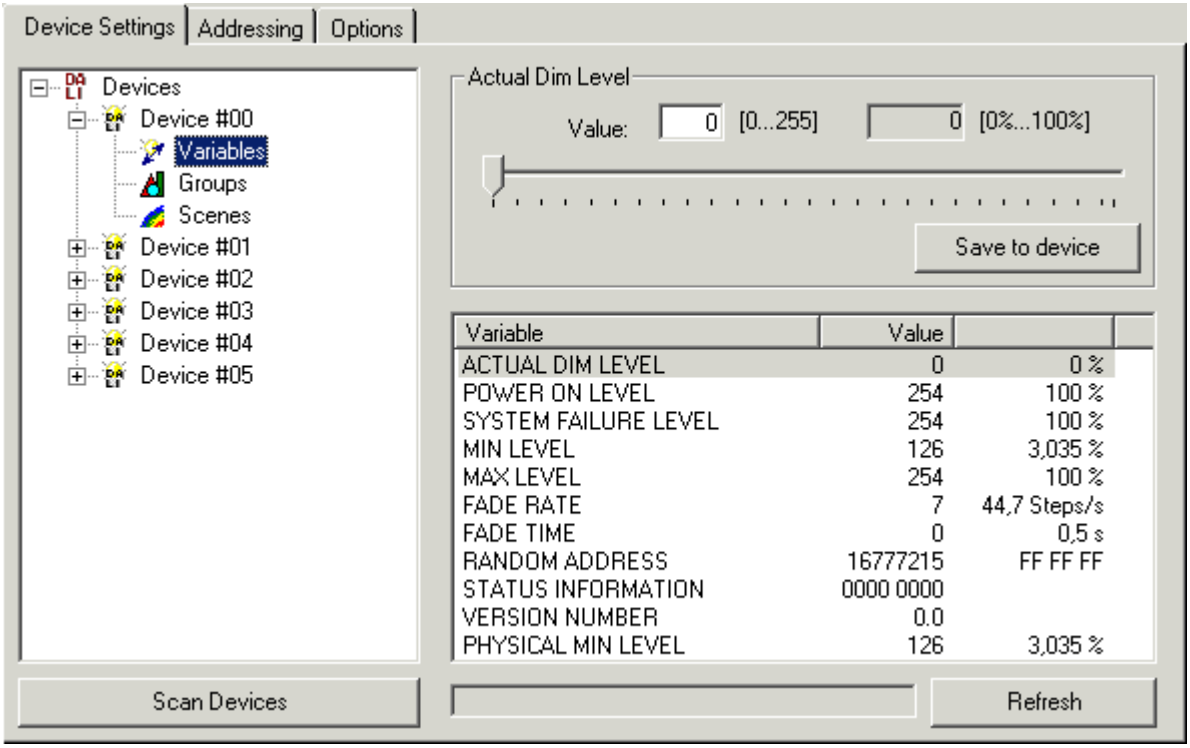


Fig. 21: KS2000 - parameterization of the DALI/DSI devices - variables

Actual dim level

This variable contains the power currently applying to the lamp.

Power ON level

This variable specifies the lamp power that the DALI device is to adopt after the power supply has been switched on, if the DALI bus is already under power and is idle.

System failure level

This variable specifies the lamp power that the DALI device is to adopt in the event of a system error.

MIN level

You specify the minimum lamp power that the DALI device is to adopt here, so that the illuminance does not fall below a level that you want. The MIN value cannot be less than the smallest physically possible value [▶ 35]specified by the manufacturer of the DALI device.

MAX level

You specify the maximum lamp power that the DALI device is to adopt here, so that the illuminance does not exceed a level that you want.

Fade rate

Enter the velocity in steps per second (step/s), with which the DALI device dims for 200 ms when the commands Brighter [▶ 31] (DALI command 1 [▶ 55]$_{dec}$) or Darker [▶ 31] (DALI command 2 [▶ 55]$_{dec}$) are issued. The absolute fade rate is not entered directly, but it is calculated according to the following formula:

$$T = \frac{506}{\sqrt{2^n}}$$

T = absolute fade rate

n = value that is stored in the *Fade rate* variable

The following values result:

n	absolute fade rate
0	Not permitted
1	357.796 steps/s
2	253.000 steps/s
3	178.898 steps/s
4	126.500 steps/s
5	89.449 steps/s
6	63.250 steps/s
7	44.725 steps/s
8	31.625 steps/s
9	22.362 steps/s
10	15.813 steps/s
11	11.181 steps/s
12	7.906 steps/s
13	5.591 steps/s
14	3.953 steps/s
15	2.795 steps/s

Fade time

Enter here the time in seconds that the DALI device is to take to change the brightness when, for instance, changing a scene, or to execute direct DALI commands for lamp power. This time is independent of the size of the change, so that all the lamps complete their change over the same period. In the case of a lamp that is switched off, the pre-heating and ignition time is not included in the fade time.
The absolute fade time is not entered directly, but it is calculated according to the following formula:

$$T = \frac{1}{2}\sqrt{2^n}$$

T = absolute fade time

n = value that is stored in the *Fade time* variable

The following values result:

n	absolute fade time
0	< 0.707 s
1	0.707 s
2	1.000 s
3	1.414 s
4	2.000 s
5	2.828 s
6	4.000 s
7	5.657 s
8	8.000 s
9	11.314 s
10	16.000 s
11	22.627 s
12	32.000 s
13	45.255 s
14	64.000 s
15	90.510 s

Direct address

This variable contains the DALI device's short address. A valid short address lies in the range between 0_{dec} and 63_{dec}. If 255_{dec} is written into the variable, the short address is deleted.

Status information

This variable can only be read. It contains the DALI device's status byte. The bits in the status byte have the following significance:

Bit	Name		Meaning
7	Power supply fault	0_{bin}	No
6	Missing short address	0_{bin}	No
5	Reset status	0_{bin}	No
4	Fading done	0_{bin}	Fading has been completed
		1_{bin}	Fading in progress
3	Limit value error	0_{bin}	The most recently requested lamp power value was between the MIN and MAX values, or was OFF.
2	Lamp power	0_{bin}	OFF
		1_{bin}	ON
1	Lamp failure	0_{bin}	OK
0	Status of the DALI device	0_{bin}	OK

Version number

Displays the DALI device's version number. This variable is entered by the device manufacturer, and can only be read!

Physical minimum level

Indicates the lowest physically possible lamp power that the DALI device can adopt. This variable is entered by the device manufacturer, and can only be read!

4.4.1.3 Groups

Click on *Groups*. The dialog mask for assigning the DALI device to a group appears.

In this dialog you can add each DALI device to up to 16 groups. If a DALI device receives a command associated with a group number for which the device has been parameterized, it will execute the command.

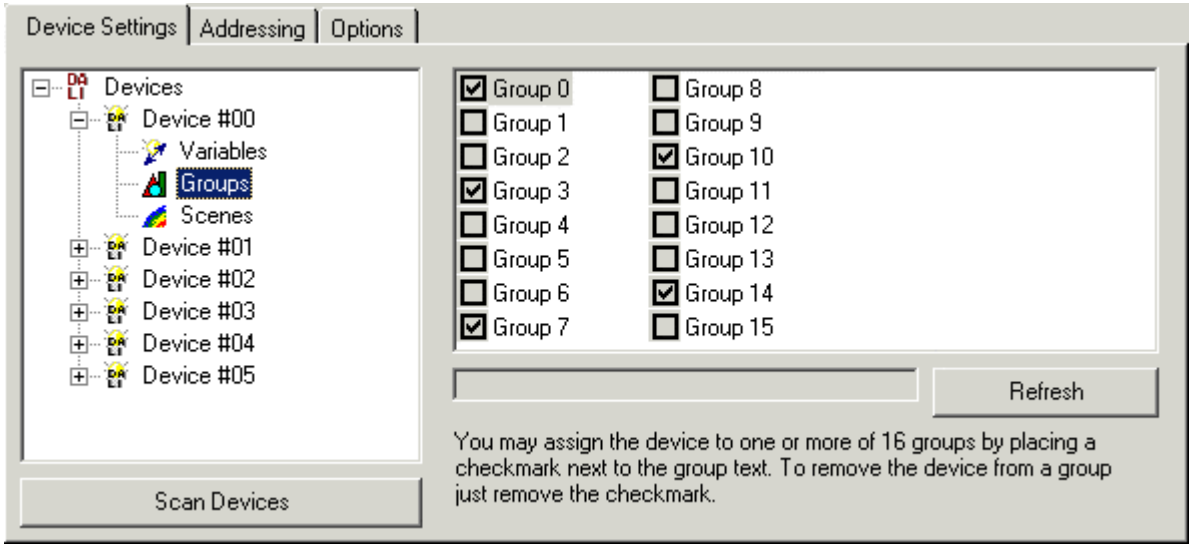


Fig. 22: KS2000 - parameterization of the DALI/DSI devices - groups

4.4.1.4 Scenes

The light intensities for 16 different scenes can be stored at each DALI device through this mask. If a DALI device receives a scene number for which it has been parameterized (e.g. in the context of a broadcast), it will set the intensity specified for this scene. If the value 255 (mask) is specified for this scene, the DALI device retains its previous value.

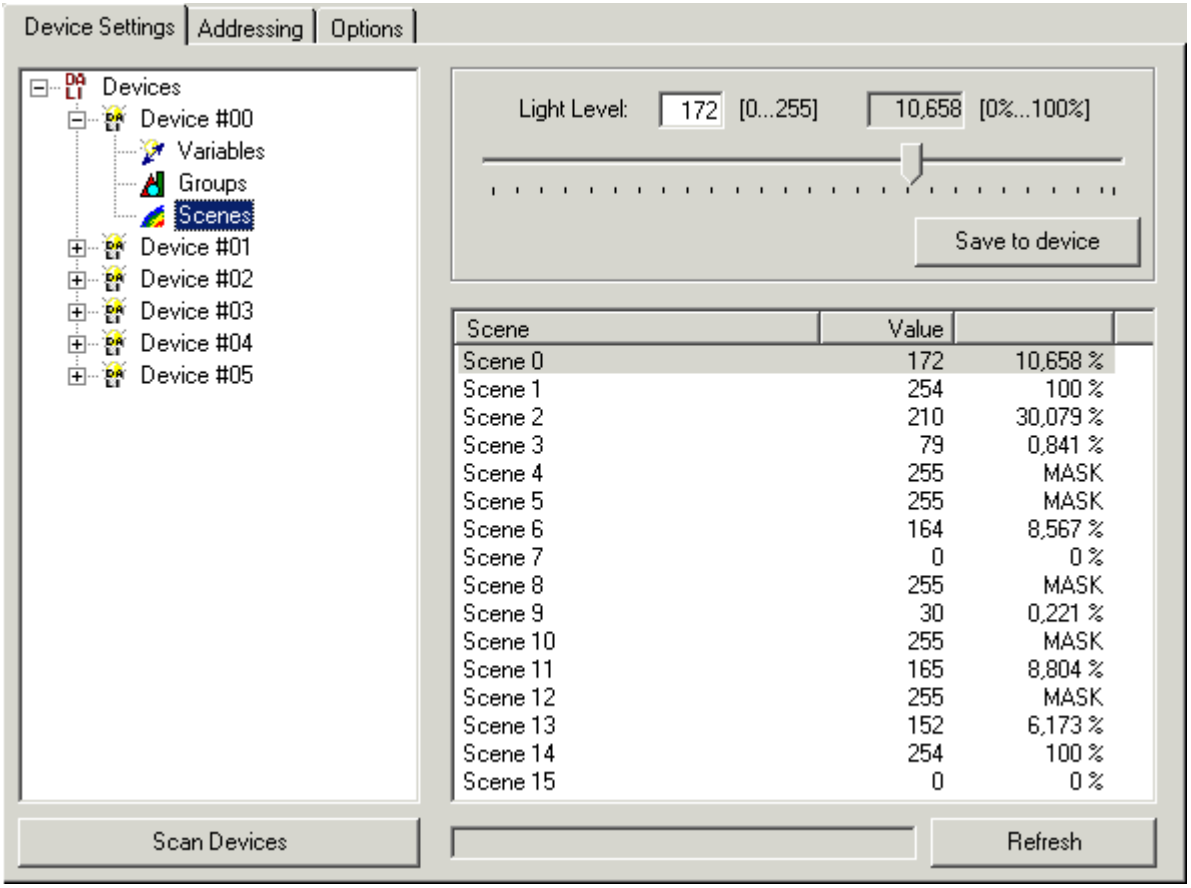


Fig. 23: KS2000 - parameterization of the DALI/DSI devices - scenes

4.4.2 Addressing the DALI devices

Physical selection

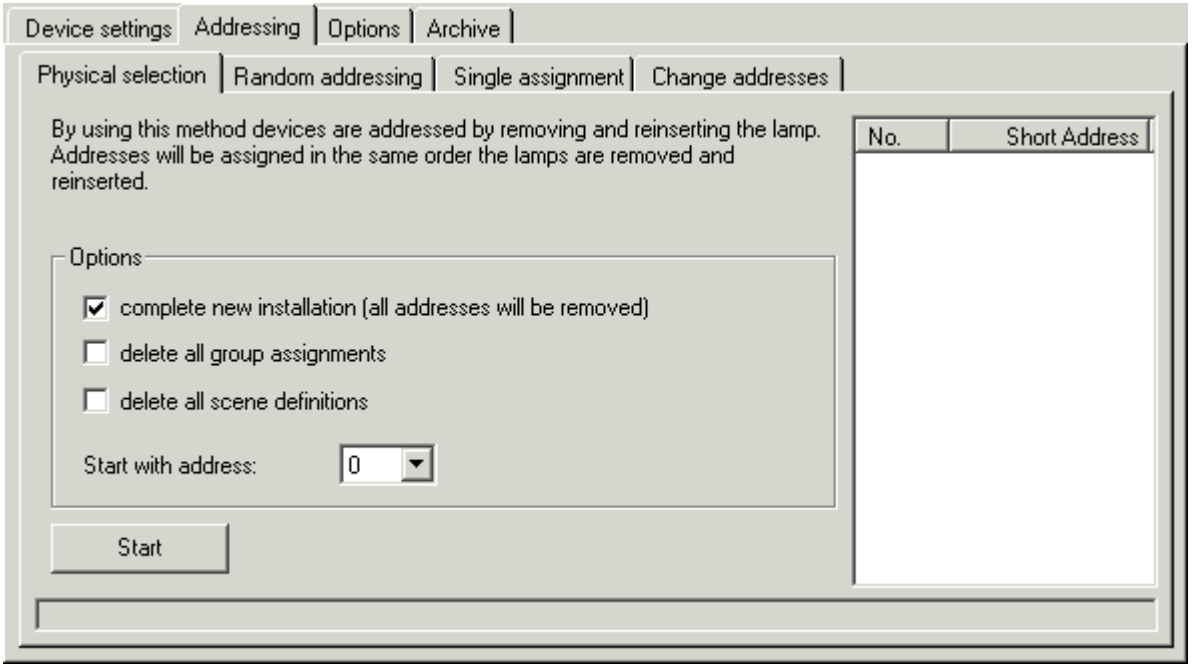


Fig. 24: KS2000 - addressing of the DALI device - physical selection

Do not interrupt the addressing process

The addressing procedure must not be interrupted by other DALI commands. Make sure of this by, for instance, interrupting your PLC program or the K-Bus cycle before starting the addressing.

Sequence of actions for physical addressing

1. Click the *Start* button in order to begin the addressing procedure.

Addresses

If you have selected *Complete new installation*, all previous addresses will be deleted. Otherwise you can add further devices to the existing addressing scheme. If you have not selected *Delete all group assignments*, the assignment of addresses to groups is retained. Bear this in mind when re-assign in the addresses!

2. The following instruction now appears in the status line:
   Wait for a device to be selected. Remove the lamp!
3. After the lamp has been removed, the instruction that appears in the status line is as follows:
   The device was addressed. Add the lamp again!
   After reinserting the lamp, it flashes three times in order to indicate that the address assignment has been successful.
   The newly addressed device is now shown in the list of short addresses.
4. Repeat Point 2 and Point 3 for every DALI device that is to be re-addressed.
5. When you have assigned all the addresses, complete the addressing procedure by clicking the *Cancel* button.

The newly addressed devices will be shown in the list of short addresses:

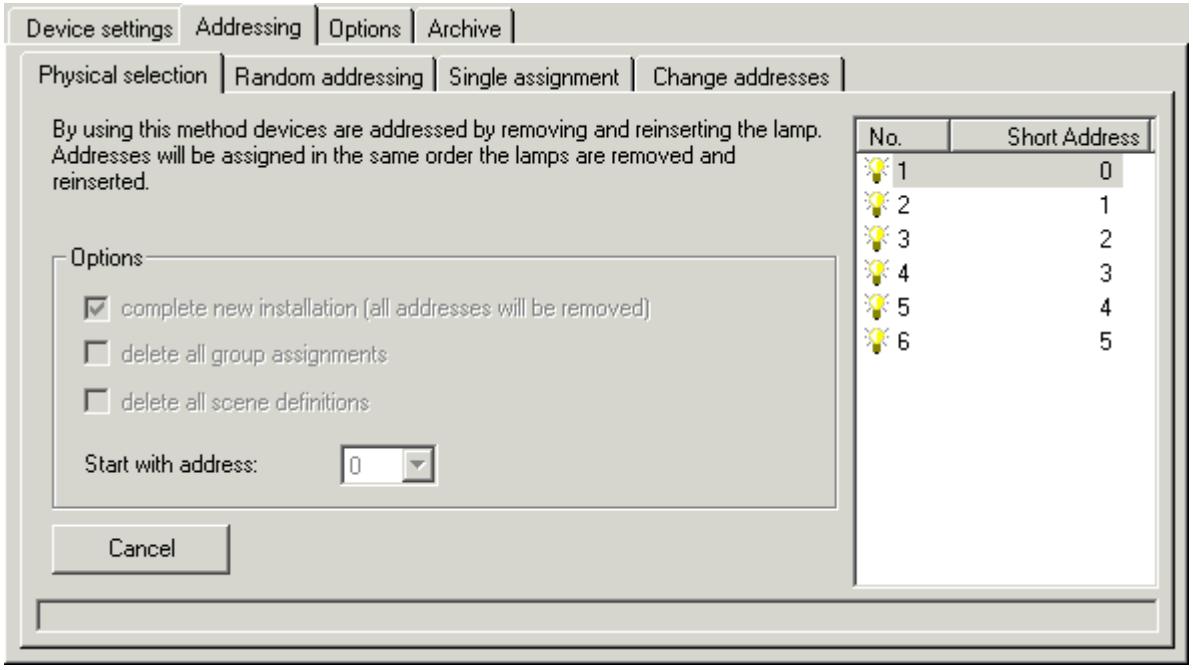


Fig. 25: KS2000 - addressing of the DALI device - displaying the physical addressing

Random addressing

With this method, addresses are assigned randomly.

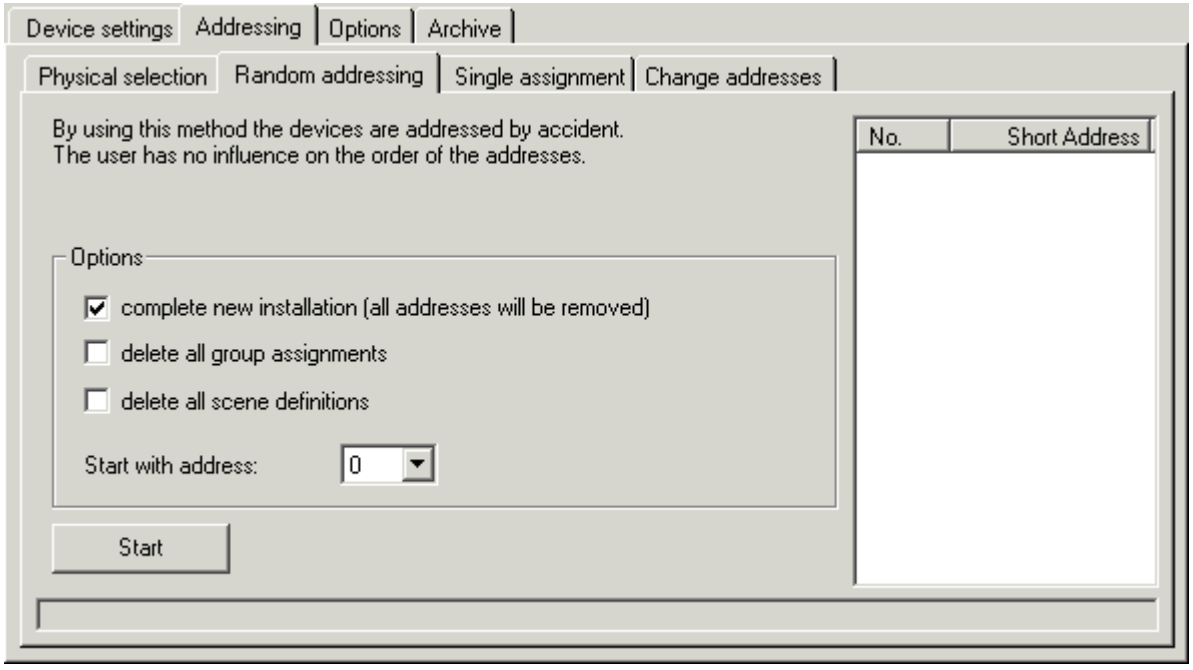


Fig. 26: KS2000 - addressing of the DALI device - random addressing

The operator has no influence on the order of the address assignment. The order can, however, be modified retrospectively via the *Modify addresses* tab.

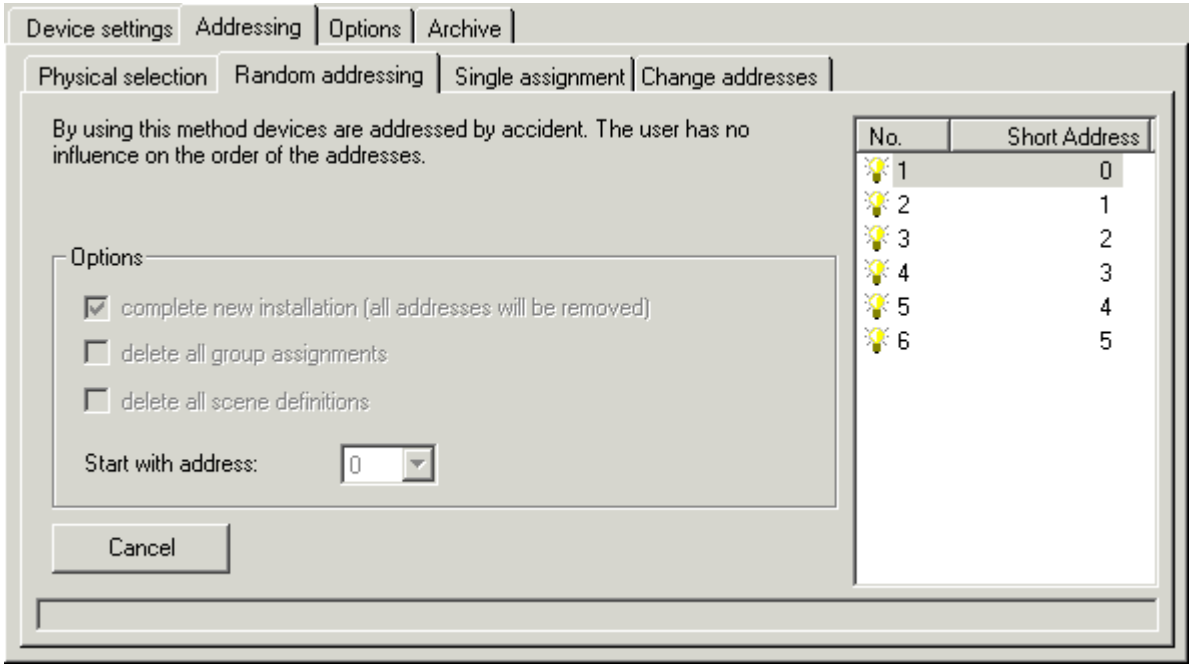


Fig. 27: KS2000 - addressing the DALI devices - displaying the randomly assigned addresses

Single assignment

With this method, all DALI devices connected to the KL6811 are assigned the same new address. In practice, only the one DALI device, which is to be assigned this address, will therefore be connected, before the *Start* button is pressed.

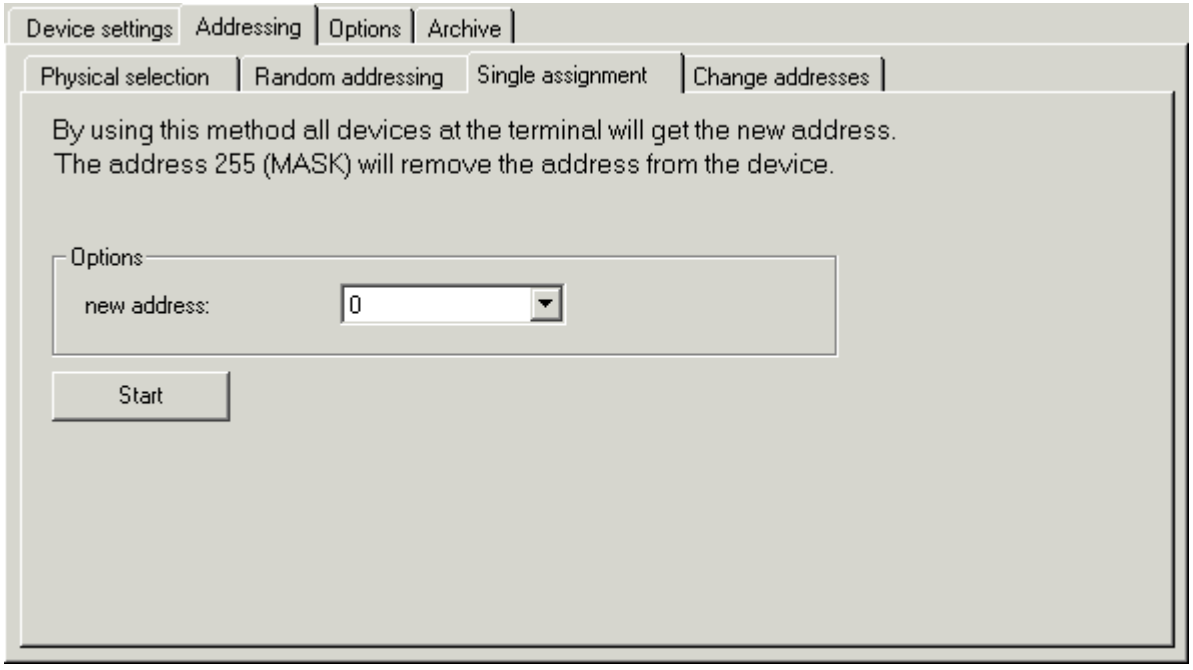


Fig. 28: KS2000 - addressing of the DALI devices - single assignment

Modify addresses

In the list on the right select the device, whose address you want to change. Via the *New Address* selection box you can select a new address for the selected device.

Once you have selected all new addresses, click on *Start* to allocate the addresses to the devices.

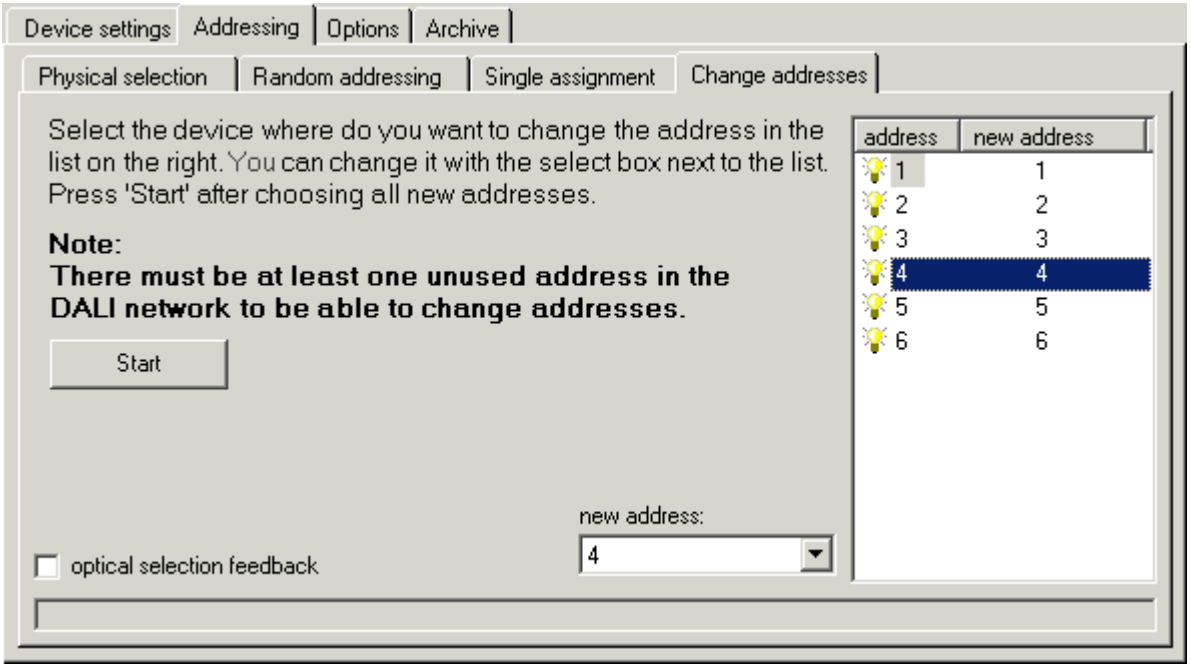


Fig. 29: KS2000 - addressing of the DALI devices - Modify addresses

Visual selection feedback

If the option *visual selection feedback* is enabled, the selected device (in the example device #04) sets its current lamp power value to the parameterized maximum value.

4.4.3 Options

This mask allows you to specify a variety of options for the KL6811.

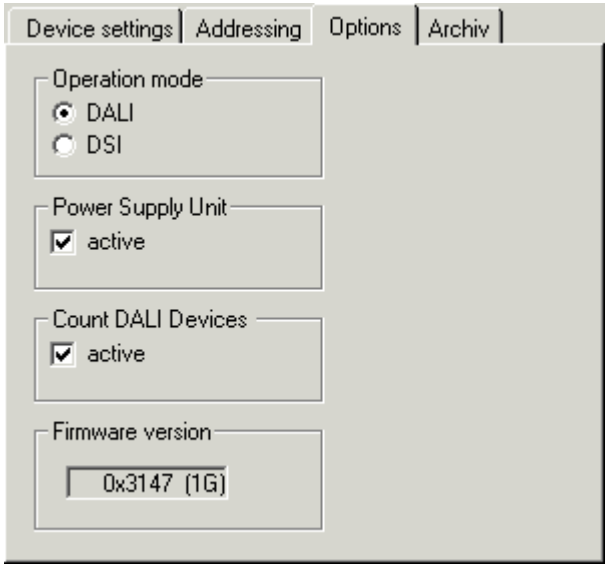


Fig. 30: KS2000 - Options for the KL6811

Operating mode (R32.12-15 [▶ 50])

You can specify the KL6811 operating mode here:

- DALI: The KL6811 operates as a DALI [▶ 11] master
- DSI: The KL6811 operates as a DSI [▶ 11] master

Power supply unit (R32.3 [▶ 50])

You can switch off the DALI/DSI power supply unit here.

Count DALI devices (R32.4 [▶ 50])

Here you can disable the counting of the DALI devices after the KL6811 startup.

Firmware version (R9 [▶ 49])

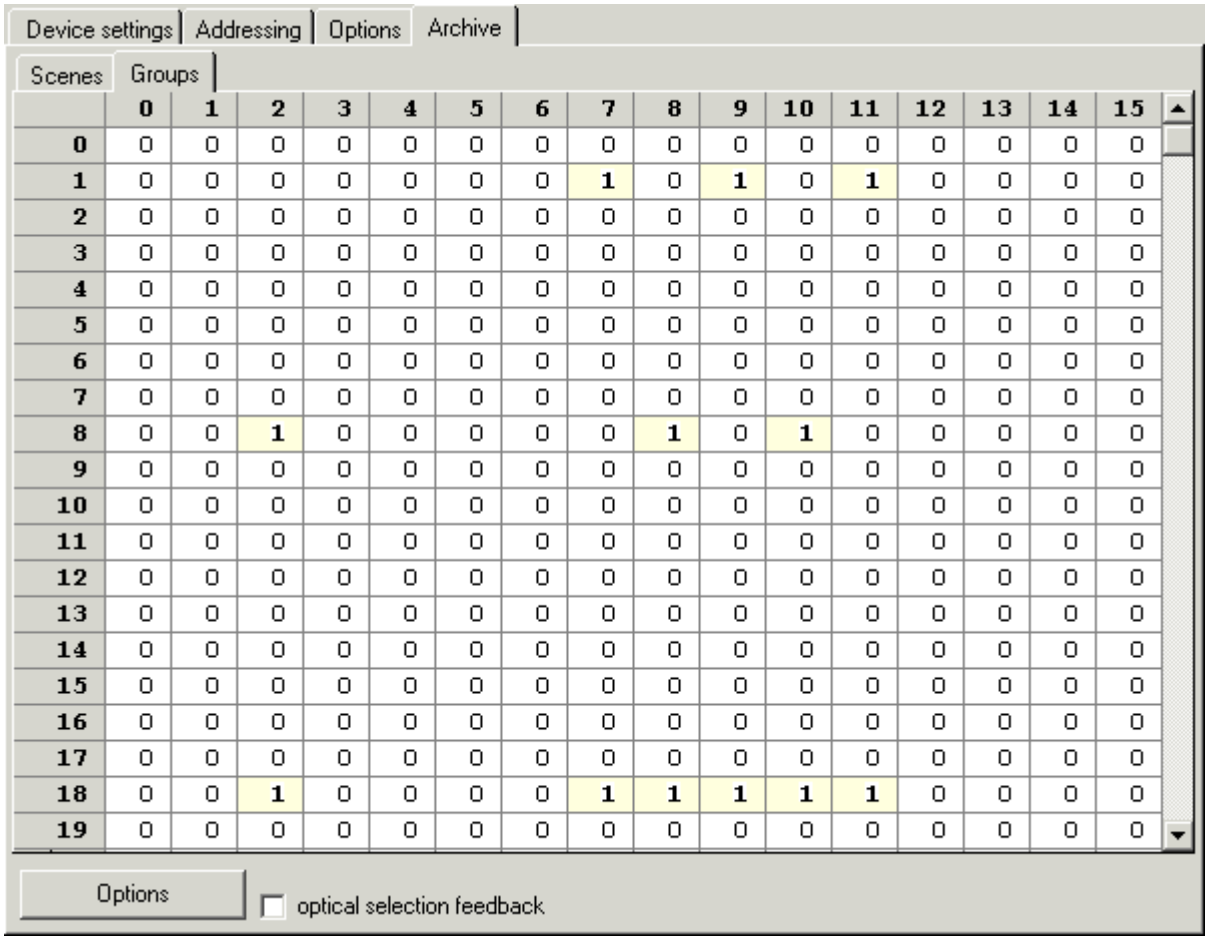
Displays the firmware version of the KL6811 .

4.4.4 Archive

These masks provide clearly arranged tables to facilitate the following tasks for DALI devices connected to the KL6811:

- specify association with 16 groups;
- specify the light values for 16 scenes.

4.4.4.1 Groups



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	1	0	0	0	0	1	1	1	1	1	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fig. 31: KS2000 - archive - groups

Here you specify the association for up to 16 groups (listed horizontally) for up to 64 DALI devices (listed vertically).

The following entries are valid:

- 1: DALI device belongs to a group
- 0: DALI device does not belong to a group

In the example shown,

- DALI device 1 is assigned to groups 7, 9 and 11;
- DALI device 8 is assigned to groups 2, 8 and 10;
- DALI device 18 is assigned to groups 2, 7, 8, 9, 10 and 11;

Visual selection feedback

If the option *visual selection feedback* is enabled and you click on a group number, the brightness of all DALI devices of this group is set to maximum.
This also requires *Online Monitoring* to be enabled under Options in the KS2000, and the I/O Run LED on the Bus Coupler must be on.

Options

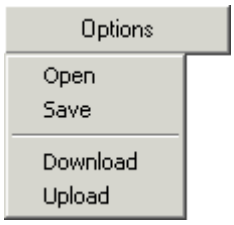


Fig. 32: Options

Open

Opens a configuration stored on the hard disk of the PC (*.xml).

Save

Saves the configuration in a file (*.xml) on the hard disk of the PC.

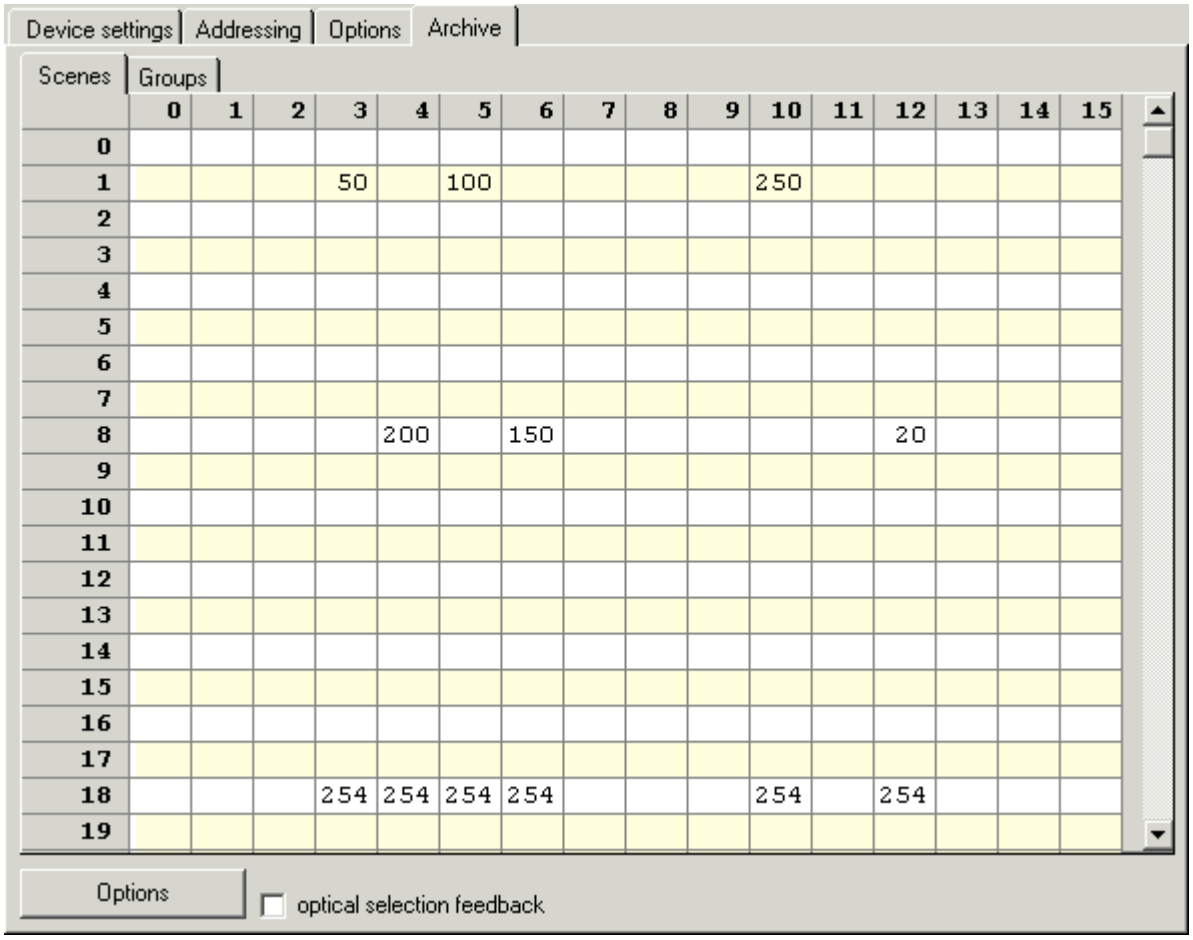
Download

Saves the configuration in the connected DALI devices.

Upload

Loads the configuration from the connected DALI devices.

4.4.4.2 Scenes



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0																
1				50		100					250					
2																
3																
4																
5																
6																
7																
8					200		150						20			
9																
10																
11																
12																
13																
14																
15																
16																
17																
18				254	254	254	254				254		254			
19																

Fig. 33: KS2000 - archive - scenes

Here you specify the light values for up to 16 scenes (listed horizontally) for up to 64 DALI devices (listed vertically).

The following entries are valid:

- 0 to 254: light values (0: off, 254: maximum brightness)
- 255: Mask (on changing to the new scene, the device retains its existing value).

In the example shown, for

- DALI device 1 the light value 50 is assigned for scene 3, the light value 100 for scene 5, and the light value 250 for scene 10;
- DALI device 8 the light value 200 is assigned for scene 4, the light value 150 for scene 6, and the light value 20 for scene 12;
- DALI device 18 the light value 254 is assigned for scenes 3, 4, 5, 6, 10 and 12.

Visual selection feedback

If the option *visual selection feedback* is enabled and you click in the scene column, all DALI devices for this scene are assigned the light values entered in this column.
This also requires *Online Monitoring* to be enabled under Options in the KS2000, and the I/O Run LED on the Bus Coupler must be on.

4.5 Process data

The process data is represented graphically under *ProcData*.

5 Access from the user program

5.1 Process image

In the process image, the KL6811 is represented with 3 bytes of input and output data. These are organized as follows:

Byte offset (without word alignment*)	Byte offset (with word alignment*)	Format	Input data	Output data
0	0	Byte	Status byte (SB)	Control byte (CB)
1	2	Word	DataIN	DataOUT

*) Word alignment: The Bus Coupler places values on even byte addresses

5.1.1 Process data words in DALI mode

Process output word (DataOUT)

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Name	Y	Address bits (A)						S	Command (X)							

Key

Bit	Name	Description	
15	Y	0_{bin}	Address bits 9 to 14 contain a DALI short address.
		1_{bin}	Address bits 9 to 14 contain a DALI group address or a DALI collective call.
14 to 9	Address bits (A)	0_{bin}	DALI short address, DALI group address or DALI collective call
8	Selection bit (S)	0_{bin}	Bits 0 to 7 contain a lamp power value.
		1_{bin}	Bits 0 to 7 contain a DALI command.
7 to 0	Command (X)	Lamp power value or DALI command*	

*) A list of DALI commands can be found in Chapter DALI commands [▶ 55].

Commands received by the DALI devices

Please note that DALI devices can only receive commands once their load side is supplied with power (230 V), since the PIC (single-chip micro-controller) of a DALI device is typically supplied via the load voltage.

Process input word (DataIN)

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Name	reserved							OK	Parameter							

Key

Bit	Name	Description	
15 to 9	-	reserved	
8	OK	0_{bin}	Bits 0 to 7 do not contain valid data
		1_{bin}	Bits 0 to 7 contain the valid response of a DALI device
7 to 0	Parameter	Response of a DALI device	

5.1.2 Process data words in DSI mode

Process output word (DataOUT)

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Name	reserved								DSI dimming value							

Key

Bit	Name	Description
15 to 8	-	reserved
7 to 0	DSI dimming value	Here you can specify the 8-bit dimming value for all DSI devices.

Process input word (DataIN)

In DSI mode, the process input word has no function.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Name	reserved															

5.2 Control and status byte

5.2.1 Process data mode

Control byte in process data mode

The control byte (CB) is located in the output image, and is transmitted from the controller to the KL6811.

Bit	CB.7	CB.6	CB.5	CB.4	CB.3	CB.2	CB.1	CB.0
Name	RegAccess	R/W	-	-	-	-	RepeatASC	Toggle

Key

Bit	Name	Description	
CB.7	RegAccess	0_{bin}	Register communication off (process data mode)
CB.6	R/W	0_{bin}	Read access
CB.5 to CB.2	-	reserved	
CB.1	RepeatASC	0_{bin}	The KL6811 does not repeat the application-related expansion commands [▶ 57] (224_{dec}-255_{dec}) not.
		1_{bin}	The KL6811 also repeats the application-related expansion commands [▶ 57] (224_{dec}-255_{dec}).
CB.0	Toggle	With each edge change of the toggle bit, the KL6811 sends a DALI or DSI telegram. The telegrams can be transmitted at intervals of 25 ms, i.e. within 100 ms the KL6811 can send a maximum of 4 telegrams. Depending on the content (with or without return channel), the duration of a DALI telegram cycle is between 25 and 43.34 ms. The end of a DALI telegram cycle is indicated by an edge of the toggle bit in the status byte (SB.0 [▶ 46]).	

Status byte in process data mode

The status byte (SB) is located in the input image, and is transmitted from KL6811 to the controller.

Bit	SB.7	SB.6	SB.5	SB.4	SB.3	SB.2	SB.1	SB.0
Name	RegAccess	Error	-	-	-	BC Collision	FC Collision	Toggle

Key

Bit	Name	Description	
SB.7	RegAccess	0_{bin}	Acknowledgement for process data mode
SB.6	Error	0_{bin}	No error
		1_{bin}	Error: • In DALI mode if the internal DALI power supply unit of the KL6811 is used: overload of the internal DALI power supply unit of the KL6811 (bus under-voltage) • In DSI mode: error message from one (or several) of the DSI devices
SB.5 to SB.3	-	reserved	
SB.2	BC Collision (only in DALI mode)	0_{bin}	no collision
		1_{bin}	DALI collision detected on the backward channel: during the transfer of a DALI telegram, a collision with the send data of another DALI device was detected. The bit SB.2 is reset with the next edge of the bit SB.0, unless another DALI collision has occurred.
SB.1	FC Collision (only in DALI mode)	0_{bin}	no collision
		1_{bin}	DALI collision detected on the forward channel: during the transfer of a DALI telegram, a collision with the send data of another DALI master was detected. The bit SB.1 is reset with the next edge of the bit SB.0, unless another DALI collision has occurred.
SB.0	Toggle	An edge of SB.0 is the acknowledgement for the end of the telegram cycle initiated with the toggle bit of the control byte (CB.0 [▶ 46]). The telegram was sent via the DALI/DSI bus. In DALI mode, the collision bit (SB.1) provides information about any collisions that may have occurred.	

5.2.2 Register communication

Control byte for register communication

The control byte (CB) is located in the output image, and is transmitted from the controller to the KL6811.

Bit	CB.7	CB.6	CB.5	CB.4	CB.3	CB.2	CB.1	CB.0
Name	RegAccess	R/W	Reg. no.					

Key

Bit	Name	Description	
CB.7	RegAccess	1_{bin}	Register communication switched on
CB.6	R/W	0_{bin}	Read access
		1_{bin}	Write access
CB.5 to CB.0	Reg. no.	Register number: Enter the number of the register [▶ 48] that you want to - read with input data word 0 here. - write to with output data word 0.	

⚠ CAUTION

Invalid process data during register communication!

It is not possible to access the data registers during register communication! Process data that may still be displayed is not valid!

Status byte for register communication

The status byte (SB) is located in the input image, and is transmitted from KL6811 to the controller.

Bit	SB.7	SB.6	SB.5	SB.4	SB.3	SB.2	SB.1	SB.0
Name	RegAccess	R	Reg. no.					

Key

Bit	Name	Description	
SB.7	RegAccess	1_{bin}	Acknowledgement for register access
SB.6	R	0_{bin}	Read access
SB.5 to SB.0	Reg. no.	Number of the register that was read or written.	

5.3 Register overview

Register	Comment	Default value		R/W	Memory
R0	reserved	-	-	-	-
R1 [▶ 49]	DALI Device Counter	-	-	R	RAM
R2 to R5	reserved	-	-	-	-
R6 [▶ 49]	Diagnostic register	-	-	R	RAM
R7 [▶ 49]	Command register	0x0000	0_{dec}	R/W	RAM
R8 [▶ 49]	Terminal description	0x1A9B	6811_{dec}	R	ROM
R9 [▶ 49]	Firmware version	e.g. 0x3143	e.g. 12611_{dec}	R	ROM
R10 [▶ 49]	Multiplex shift register	0x0118	280_{dec}	R	ROM
R11 [▶ 49]	Signal channels	0x0118	280_{dec}	R	ROM
R12 [▶ 49]	Minimum data length	0x1818	6168_{dec}	R	ROM
R13 [▶ 49]	Data structure	0x0000	0_{dec}	R	ROM
R14	reserved	-	-	-	-
R15 [▶ 49]	Alignment register	-	-	R/W	RAM
R16 [▶ 49]	Hardware version	e.g. 0x0000	e.g. 0_{dec}	R/W	SEEROM/RAM
R17 to R30	reserved	-	-	-	-
R31 [▶ 49]	Code word register	0x0000	0_{dec}	R/W	RAM
R32 [▶ 50]	Feature register	0x0000	0_{dec}	R/W	SEEROM/RAM
R33 to R63	reserved	-	-	-	-

5.4 Register description

R1: DALI Device Counter

After the startup of the KL6811, the number of DALI devices found is stored here. This function can be disabled with bit 4 of the feature register (R32.4 [▶ 50]).

R6: Diagnostic register

In a later firmware version, the diagnostic register will be used to provide diagnostic information about the state of the DALI master terminal.

R7: Command register

This register can be used to transfer commands to the DALI master terminal.

R8: Terminal description

Register R8 contains the terminal identifier in hexadecimal coding: 0x1A9B (6811_{dec})

R9: Firmware version

Register R9 contains the firmware revision level of the terminal in hexadecimal coding, e. g. 0x3144 (12612_{dec}).

R10: Shift register length

0x0118

R11: Number of signal channels

0x0118

R12: Minimum data length

0x1818

R13: Data type

Register R13 contains the data type of the Bus Terminal. 0x0004 represents a special function.

R15: Alignment register

R16: Hardware version number

Register R16 contains the hardware revision level of the terminal in hexadecimal coding, e.g. 0x0000 (0_{dec}).

User register

The user registers of the terminal can be written by the user program in order to change the characteristics of the terminal at run-time.

R31: Code word register

- If you write values into the user registers without previously having entered the user code word (0x1235) in the code word register, these values are only stored in the RAM registers, but not in the EPROM registers and are therefore lost if the terminal is restarted.
- If you write values into the user registers and have previously entered the user code word (0x1235) in the code word register, these values are stored in the RAM registers and in the EPROM registers and are therefore retained if the terminal is restarted.

The code word is reset if the terminal is restarted.

R32: Feature register

The feature register specifies the terminal's operating mode.

Bit	Feature	Value	Explanation	Default
R32.15 R32.14 R32.13 R32.12	Operation mode	0000_{bin}	DALI	0000_{bin}
		0001_{bin}	DSI	
		further	reserved	
R32.11	-	-	reserved	0_{bin}
...	...	...	...	...
R32.5	-	-	reserved	0_{bin}
R32.4	Disable counting of DALI devices	0_{bin}	The DALI devices are not counted after the KL6811 startup.	0_{bin}
		1_{bin}	After the KL6811 startup, the DALI devices are counted, and the result is stored in register 1 (R1 [▶ 49]).	
R32.3	Deactivation of the internal DALI power supply unit	0_{bin}	Supply of the DALI bus via the internal power supply unit of the KL6811.	0_{bin}
		1_{bin}	Internal DALI power supply unit deactivated: an external DALI power supply unit is required.	
R32.2	-	-	reserved	0_{bin}
R32.1	-	-	reserved	0_{bin}
R32.0	-	-	reserved	0_{bin}

5.5 Examples of Register Communication

The numbering of the bytes in the examples corresponds to the display without word alignment.

5.5.1 Example 1: Reading the firmware version from register 9

Output Data

Byte 0: Control byte	Byte 1: DataOUT1, high byte	Byte 2: DataOUT1, low byte
0x89 (1000 1001_{bin})	0xXX	0xXX

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 not set means: reading the register.
- Bits 0.5 to 0.0 specify the register number 9 with 00 1001_{bin}.
- The output data word (byte 1 and byte 2) has no meaning during read access. To change a register, write the required value into the output word.

Input Data (answer of the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0x89	0x33	0x41

Explanation:

- The terminal returns the value of the control byte as a receipt in the status byte.

- The terminal returns the firmware version 0x3341 in the input data word (byte 1 and byte 2). This is to be interpreted as an ASCII code:
  - ASCII code 0x33 represents the digit 3
  - ASCII code 0x41 represents the letter A
    The firmware version is thus 3A.

5.5.2 Example 2: Writing to an user register

Code word

In normal mode all user registers are read-only with the exception of Register 31. In order to deactivate this write protection you must write the code word (0x1235) into Register 31. If a value other than 0x1235 is written into Register 31, write protection is reactivated. Please note that changes to a register only become effective after restarting the terminal (power-off/power-on).

I. Write the code word (0x1235) into register 31.

Output Data

Byte 0: Control byte	Byte 1: DataOUT1, high byte	Byte 2: DataOUT1, low byte
0xDF (1101 1111_{bin})	0x12	0x35

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 set means: writing to the register.
- Bits 0.5 to 0.0 specify the register number 31 with 01 1111_{bin}.
- The output data word (byte 1 and byte 2) contains the code word (0x1235) for deactivating write protection.

Input Data (answer of the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0x9F (1001 1111_{bin})	0xXX	0xXX

Explanation:

- The terminal returns a value as a receipt in the status byte that differs only in bit 0.6 from the value of the control byte.
- The input data word (byte 1 and byte 2) is of no importance after the write access. Any values still displayed are invalid!

II. Read Register 31 (check the set code word)

Output Data

Byte 0: Control byte	Byte 1: DataOUT1, high byte	Byte 2: DataOUT1, low byte
0x9F (1001 1111_{bin})	0xXX	0xXX

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 not set means: reading the register.
- Bits 0.5 to 0.0 specify the register number 31 with 01 1111_{bin}.
- The output data word (byte 1 and byte 2) has no meaning during read access.

Input Data (answer of the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0x9F (1001 1111_{bin})	0x12	0x35

Explanation:

- The terminal returns the value of the control byte as a receipt in the status byte.
- The terminal returns the current value of the code word register in the input data word (byte 1 and byte 2).

III. Write to Register 32 (change contents of the feature register)

Output data

Byte 0: Control byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0xE0 (1110 0000_{bin})	0x00	0x02

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 set means: writing to the register.
- Bits 0.5 to 0.0 indicate register number 32 with 10 0000_{bin}.
- The output data word (byte 1 and byte 2) contains the new value for the feature register.

⚠ CAUTION

Observe the register description!

The value of 0x0002 given here is just an example!
The bits of the feature register change the properties of the terminal and have a different meaning, depending on the type of terminal. Refer to the description of the feature register of your terminal (chapter *Register description*) regarding the meaning of the individual bits before changing the values.

Input data (response from the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0xA0 (1010 0000_{bin})	0xXX	0xXX

Explanation:

- The terminal returns a value as a receipt in the status byte that differs only in bit 0.6 from the value of the control byte.
- The input data word (byte 1 and byte 2) is of no importance after the write access. Any values still displayed are invalid!

IV. Read register 32 (check changed feature register)

Output Data

Byte 0: Control byte	Byte 1: DataOUT1, high byte	Byte 2: DataOUT1, low byte
0xA0 (1010 0000_{bin})	0xXX	0xXX

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 not set means: reading the register.
- Bits 0.5 to 0.0 indicate register number 32 with 10 0000_{bin}.
- The output data word (byte 1 and byte 2) has no meaning during read access.

Input Data (answer of the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0xA0 (1010 0000_{bin})	0x00	0x02

Explanation:

- The terminal returns the value of the control byte as a receipt in the status byte.
- The terminal returns the current value of the feature register in the input data word (byte 1 and byte 2).

V. Write register 31 (reset code word)

Output Data

Byte 0: Control byte	Byte 1: DataOUT1, high byte	Byte 2: DataOUT1, low byte
0xDF (1101 1111_{bin})	0x00	0x00

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 set means: writing to the register.
- Bits 0.5 to 0.0 specify the register number 31 with 01 1111_{bin}.
- The output data word (byte 1 and byte 2) contains 0x0000 for reactivating write protection.

Input Data (answer of the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0x9F (1001 1111_{bin})	0xXX	0xXX

Explanation:

- The terminal returns a value as a receipt in the status byte that differs only in bit 0.6 from the value of the control byte.
- The input data word (byte 1 and byte 2) is of no importance after the write access. Any values still displayed are invalid!

6 Programming

6.1 TwinCAT libraries

See software documentation in the Beckhoff Information System.

TwinCAT 2: TwinCAT 2 | PLC Lib: TcDALIV2

TwinCAT 3: TwinCAT 3 | PLC Lib: Tc2_DALI

7 Appendix

7.1 DALI commands

In accordance with the DIN EN 60929 [▶ 58] standard, addresses and commands are transmitted as numbers with a length of two bytes.

These commands take the form YAAA AAAS xxxx xxxx. Each letter here stands for one bit.

- Y: type of address
  0_{bin}: Short address
  1_{bin}: group address or collective call
- A: significant address bit
- S: selection bit (specifies the significance of the following eight bits):
  0_{bin}: the 8 xxxx xxxx bits contain a value for direct control of the lamp power
  1_{bin}: The 8 xxxx xxxx bits contain a command number.

x: a bit in the lamp power or in the command number

Direct DALI commands for lamp power

These commands take the form YAAA AAA**0** xxxx xxxx.

xxxx xxxx: the value representing the lamp power is transmitted in these 8 bits. It is calculated according to this formula:

$$P_{Value} = 10^{\left(\frac{Value - 1}{253/3}\right)} \cdot \frac{P_{100\%}}{1000}$$

253 values from 1_{dec} to 254_{dec} are available for transmission in accordance with this formula.

There are also 2 direct DALI commands with special meanings:

Command	Command no.	Description	Answer
00_{hex}	0_{dec}	The DALI device dims using the current fade time down to the parameterized MIN value, and then switches off.	-
FF_{hex}	254_{dec}	Mask (no change): this value is ignored in what follows, and is therefore not loaded into memory.	-

Indirect DALI commands for lamp power

These commands take the form YAAA AAA**1** xxxx xxxx.

xxxx xxxx: These 8 bits transfer the command number. The available command numbers are listed and explained in the following tables in hexadecimal and decimal formats.

Command	Command no.	Description	Answer
00_{hex}	0_{dec}	Switch off lamp immediately (without fading).	-
01_{hex}	1_{dec}	Turn brighter for 200 ms with selected step speed.	-
02_{hex}	2_{dec}	Turn darker for 200 ms with selected step speed.	-
03_{hex}	3_{dec}	Increase the current lamp power value by one step (without fading). If the lamp is switched off, it is not switched on.	-
04_{hex}	4_{dec}	Reduce the current lamp power value by one step (without fading), if the lamp is not already at its parameterized minimum value. If the lamp is already at its minimum value, it is not changed and remains switched on.	-
05_{hex}	5_{dec}	Set the current lamp power value to the parameterized maximum value. If the lamp is switched off, it is switched on.	-
06_{hex}	6_{dec}	Set the current lamp power value to the parameterized minimum value. If the lamp was switched off, it is switched on.	-
07_{hex}	7_{dec}	Reduce the current lamp power value by one step (without fading). If the lamp is already at its minimum value, it is switched off.	-
08_{hex}	8_{dec}	Increase the current lamp power value by one step (without fading). If the lamp was switched off, it is switched on and set to its parameterized minimum value.	-
09_{hex} ... $0F_{hex}$	9_{dec} ... 15_{dec}	reserved	-
$1n_{hex}$ (n: 0_{hex} ... F_{hex})	16_{dec} ... 31_{dec}	Set the lamp power value to the value stored for the specified scene (n).	-

Configuration commands

Command	Command no.	Description	Answer
20_{hex}	**32_{dec}**	Reset all parameters to the delivery state.	-
21_{hex}	**33_{dec}**	Save the current brightness value in the DTR (data transfer register).	-
22_{hex}... 29_{hex}	**34_{dec}... 41_{dec}**	reserved	-
$2A_{hex}$	**42_{dec}**	Save the current DTR value as maximum lamp power value.	-
$2B_{hex}$	**43_{dec}**	Save the current DTR value as minimum lamp power value.	-
$2C_{hex}$	**44_{dec}**	Save the current DTR value as fault condition lamp power value.	-
$2D_{hec}$	**45_{dec}**	Save the current DTR value as switch-on lamp power value.	-
$2E_{hex}$	**46_{dec}**	Save the current DTR value as step time [▶ 34].	-
$2F_{hex}$	**47_{dec}**	Save the current DTR value as step speed [▶ 34].	-
30_{hex} ... $3F_{hex}$	**48_{dec} ... 63_{dec}**	reserved	-
$4n_{hex}$ (n: 0_{hex} ... F_{hex})	**64_{dec} ... 79_{dec}**	Save the current DTR value as selected scene (n).	-
$5n_{hex}$ (n: 0_{hex} ... F_{hex})	**80_{dec} ... 95_{dec}**	Delete the selected scene (n) from the DALI device.	-
$6n_{hex}$ (n: 0_{hex} ... F_{hex})	**96_{dec} ... 111_{dec}**	Add the DALI device to the selected group (n).	-
$7n_{hex}$ (n: 0_{hex} ... F_{hex})	**112_{dec} ... 127_{dec}**	Delete the DALI device from the selected group (n).	-
80_{hex}	**128_{dec}**	Save the current DTR value as short address.	-
81_{hex} ... $8F_{hex}$	129_{dec} ... 143_{dec}	reserved	-
90_{hex}	144_{dec}	Return the state (XX) of the DALI device.	XX
91_{hex}	145_{dec}	Check whether the DALI device is working.	yes/no
92_{hex}	146_{dec}	Check whether a lamp has failed.	yes/no
93_{hex}	147_{dec}	Check whether the power supply of the lamp is switched on.	yes/no
94_{hex}	148_{dec}	Check whether the device has received an invalid value.	yes/no
95_{hex}	149_{dec}	Check whether the DALI device is in reset state.	yes/no
96_{hex}	150_{dec}	Check whether the DALI device is missing a short address.	yes/no
97_{hex}	151_{dec}	Return the version number (XX).	XX
98_{hex}	152_{dec}	Return the content (XX) of the DTR.	XX
99_{hex}	153_{dec}	Return the devices type (XX).	XX
$9A_{hex}$	154_{dec}	Return the physical minimum (XX).	XX
$9B_{hex}$	155_{dec}	Check whether there is a supply error at the DALI device.	yes/no
$9C_{hex}$ ... $9F_{hex}$	156_{dec} ... 159_{dec}	reserved	-
$A0_{hex}$	160_{dec}	Return the current lamp power value (XX).	XX
$A1_{hex}$	161_{dec}	Returns the maximum permitted lamp power value (XX).	XX
$A2_{hex}$	162_{dec}	Returns the minimum permitted lamp power value (XX).	XX
$A3_{hex}$	163_{dec}	Returns the switch-on lamp power value (XX).	XX
$A4_{hex}$	164_{dec}	Returns the fault condition lamp power value (XX).	XX
$A5_{hex}$	165_{dec}	Returns the step speed [▶ 34] (X) and the step speed [▶ 34] (Y).	XY
$A6_{hex}$ ... AF_{hex}	166_{dec} ... 175_{dec}	reserved	-
Bn_{hex} (n: 0_{hex} ... F_{hex})	176_{dec} ... 191_{dec}	Returns the lamp power value (XX) for the specified scene (n).	XX
$C0_{hex}$	192_{dec}	Returns a bit pattern, which indicates which group (0-7) the DALI device belongs to.	XX
$C1_{hex}$	193_{dec}	Returns a bit pattern, which indicates which group (8-15) the DALI device belongs to.	XX
$C2_{hex}$	194_{dec}	Returns the upper bits of the optional address (HH).	HH
$C3_{hex}$	195_{dec}	Returns the middle bits of the optional address (MM).	MM
$C4_{hex}$	196_{dec}	Returns the lower bits of the optional address (LL).	LL
$C5_{hex}$ ... DF_{hex}	197_{dec} ... 223_{dec}	reserved	-
$E0_{hex}$ ... FF_{hex}	224_{dec} ... 255_{dec}	Query of the application-related extended commands.	

Repetition of DALI commands

- The DALI master terminal KL6811 automatically repeats the commands 32_{dec} to 128_{dec}, 258_{dec} and 259_{dec} (shown in bold) in order to save you having to call them again in the user program.
- The DALI master terminal KL6811 also repeats the commands 224_{dec} to 255_{dec}, if this option is enabled with bit 1 of the control byte (CB.1).

Special commands

You may find the special commands and further information in the DIN EN 60929 [▶ 58] standard.

7.2 Bibliography

Books

- DALI manual published by DALI AG (DALI Activity Group, see http://www.dali-ag.org).

Standards

- DIN EN 60929: Standard for AC-supplied electronic ballasts for tubular fluorescent lamps (IEC 60929), Annex E.

7.3 Support and Service

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