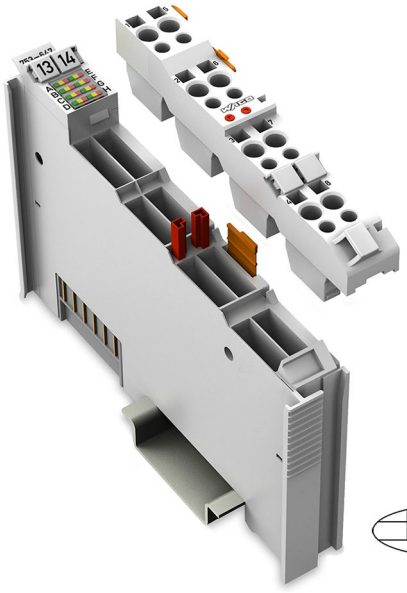
WAGO TECHDOCS

Manual

WAGO I/O System 750/753



DALI 2 certified

753-647

DALI Multi-Master

Version 1.4.5

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Every conceivable measure has been taken to ensure the accuracy and completeness of this documentation. However, as errors can never be fully excluded, we always appreciate any information or suggestions for improving the documentation.

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We wish to point out that the software and hardware terms as well as the trademarks of companies used and/or mentioned in the present manual are generally protected by trademark or patent.

WAGO is a registered trademark of WAGO Verwaltungsgesellschaft mbH.

Table of Contents

1 Notes about this Documentation

Note

Always retain this documentation!
This documentation is part of the product. Therefore, retain the documentation during the entire service life of the product. Pass on the documentation to any subsequent user. In addition, ensure that any supplement to this documentation is included, if necessary.

1.1 Validity of this Documentation

This documentation is only applicable to the I/O module 753-647 (DALI Multi-Master).

The I/O module 753-647 shall only be installed and operated according to the instructions in this manual and in the manual for the used fieldbus coupler or controller.

NOTICE

Consider power layout of the WAGO I/O System 750!
In addition to these operating instructions, you will also need the manual for the used fieldbus coupler or controller, which can be downloaded at www.wago.com. There, you can obtain important information including information on electrical isolation, system power and supply specifications.

1.2 Revision History

Table 1: Revision History

Document version	Device version		Change
	Hardware	Firmware	
1.0.0	01	01	First edition
1.1.0	01	01	Editorial revision: adjustments for WAGO DALI Configurator 2
1.2.0	01	01	Editorial revision
1.3.0	02	04	HW update, FW update, adjustments for WAGO DALI Configurator 3
1.4.0	03	20	“DALI-2 ready”; adjustments for WAGO DALI Configurator 3.1
1.4.2	03	20	Editorial supplement: Notes on DALI-1 compatibility
1.4.3	03	20	Editorial supplement in section “Construction Site Function”
1.4.4	03	20	Editorial revision
1.4.5	03	20	Editorial revision, reference to external power supply updated

1.3 Copyright

1.4 Symbols

⚠ DANGER

Personal Injury!
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ DANGER

Personal Injury Caused by Electric Current!
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Personal Injury!
Indicates a moderate-risk, potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Personal Injury!
Indicates a low-risk, potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Damage to Property!
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

NOTICE

Damage to Property Caused by Electrostatic Discharge (ESD)!
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

Note

Important Note!
Indicates a potential malfunction which, if not avoided, however, will not result in damage to property.

Information

Additional Information:
Refers to additional information which is not an integral part of this documentation (e.g., the Internet).

1.5 Number Notation

Table 2: Number Notation

Number Code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C notation
Binary	'100' '0110.0100'	In quotation marks, nibble separated with dots (.)

1.6 Font Conventions

Table 3: Font Conventions

Font Type	Indicates
italic	Names of paths and data files are marked in italic-type. e.g.: *C:\Program Files\WAGO Software*
Menu	Menu items are marked in bold letters. e.g.: **Save**
>	A greater-than sign between two names means the selection of a menu item from a menu. e.g.: **File** > **New**
Input	Designation of input or optional fields are marked in bold letters, e.g.: **Start of measurement range**
“Value”	Input or selective values are marked in inverted commas. e.g.: Enter the value “4 mA” under **Start of measurement range**.
[Button]	Pushbuttons in dialog boxes are marked with bold letters in square brackets. e.g.: **[Input]**
[Key]	Keys are marked with bold letters in square brackets. e.g.: **[F5]**

2 Important Notes

This section includes an overall summary of the most important safety requirements and notes that are mentioned in each individual section. To protect your health and prevent damage to devices as well, it is imperative to read and carefully follow the safety guidelines.

2.1 Legal Bases

2.1.1 Subject to Changes

WAGO GmbH & Co. KG reserves the right to provide for any alterations or modifications. WAGO GmbH & Co. KG owns all rights arising from the granting of patents or from the legal protection of utility patents. Third-party products are always mentioned without any reference to patent rights. Thus, the existence of such rights cannot be excluded.

2.1.2 Personnel Qualifications

All sequences implemented on WAGO I/O System 750 devices may only be carried out by electrical specialists with sufficient knowledge in automation. The specialists must be familiar with the current norms and guidelines for the devices and automated environments.

All changes to the coupler or controller should always be carried out by qualified personnel with sufficient skills in PLC programming.

2.1.3 Use of the 750 Series in Compliance with Underlying Provisions

Fieldbus couplers, controllers and I/O modules found in the modular WAGO I/O System 750 receive digital and analog signals from sensors and transmit them to actuators or higher-level control systems. Using controllers, the signals can also be (pre-) processed.

The devices fulfill the requirements of protection type IP20 and are designed for use in dry interior spaces. There is protection against finger injury and solid impurities ≥ 12.5 mm diameter is assured; protection against water damage is not ensured.
The devices represent open-type devices. They may only be installed in enclosures (tool-secured enclosures or operating rooms) which fulfil the listed requirements specified in the safety instructions in chapter “Safety Advice (Precautions)”. Use without additional protective measures in environments within which dust, corrosive fumes, gases or ionized radiation can occur is considered improper use.

Operating the WAGO I/O System 750 devices in home applications without further measures is only permitted if they meet the emission limits (emissions of

interference) according to EN 61000-6-3. You will find the relevant information in the section “Device Description” > “Standards and Guidelines” in the manual for the used device.

Appropriate housing (per 2014/34/EU) is required when operating the WAGO I/O System 750 in hazardous environments. Please observe the installation regulations! Please note that a prototype test certificate must be obtained that confirms the correct installation of the system in a housing or switch cabinet.

The implementation of safety functions such as EMERGENCY STOP or safety door monitoring must only be performed by the F I/O modules within the modular WAGO I/O System 750. Only these safe F I/O modules ensure functional safety in accordance with the latest international standards. WAGO's interference-free output modules can be controlled by the safety function.

2.1.4 Technical Condition of Specified Devices

The devices to be supplied ex works are equipped with hardware and software configurations, which meet the individual application requirements. These modules contain no parts that can be serviced or repaired by the user. The following actions will result in the exclusion of liability on the part of WAGO GmbH & Co. KG:

- Repairs,
- Changes to the hardware or software that are not described in the operating instructions,
- Improper use of the components.

Further details are given in the contractual agreements. Please send your request for modified and new hardware or software configurations directly to WAGO GmbH & Co. KG.

2.1.4.1 Disposal

2.1.4.1.1 Electrical and Electronic Equipment

Electrical and electronic equipment may not be disposed of with household waste. This also applies to products without this symbol.

Electrical and electronic equipment contain materials and substances that can be harmful to the environment and health. Electrical and electronic equipment must be disposed of properly after use.
WEEE 2012/19/EU applies throughout Europe. Directives and laws may vary nationally.

Environmentally friendly disposal benefits health and protects the environment from harmful substances in electrical and electronic equipment.

- Observe national and local regulations for the disposal of electrical and electronic equipment.
- Clear any data stored on the electrical and electronic equipment.
- Remove any added battery or memory card in the electrical and electronic equipment.
- Have the electrical and electronic equipment sent to your local collection point.

Improper disposal of electrical and electronic equipment can be harmful to the environment and human health.

2.1.4.1.2 Packaging

Packaging contains materials that can be reused.
PPWD 94/62/EU and 2004/12/EU packaging guidelines apply throughout Europe. Directives and laws may vary nationally.

Environmentally friendly disposal of the packaging protects the environment and allows sustainable and efficient use of resources.

- Observe national and local regulations for the disposal of packaging.
- Dispose of packaging of all types that allows a high level of recovery, reuse and recycling.

Improper disposal of packaging can be harmful to the environment and wastes valuable resources.

2.2 Safety Advice (Precautions)

For installing and operating purposes of the relevant device to your system the following safety precautions shall be observed:

DANGER

Do not work on devices while energized!
All power sources to the device shall be switched off prior to performing any installation, repair or maintenance work.

DANGER

Dangerous voltages – follow assembly sequence!
If there is a fault, dangerous voltages may be present on the DALI bus. The DALI Multi-Master Module must not be placed directly to the left of an I/O module that works with SELV and has power jumper contacts (e.g., Supply Module 750-624). Otherwise, safe disconnect cannot be ensured. If necessary, put a spacer module (Item No. 750-616) between the DALI Multi-Master Module and such an I/O module to ensure safe disconnection.

DANGER

Install the device only in appropriate housings, cabinets or in electrical operation rooms!
The WAGO-I/O-SYSTEM 750 and its components are an open system. As such, install the system and its components exclusively in appropriate housings, cabinets or in electrical operation rooms. Allow access to such equipment and fixtures to authorized, qualified staff only by means of specific keys or tools.

DANGER

Dangerous voltages – restrict access
Since the DALI bus is only isolated from power supply with basic insulation, it cannot be ruled out that dangerous voltages are present on the DALI bus in the event of a fault. In accordance with EN 61010-2-201, this communication interface must be restricted as inaccessible.

DANGER

Ensure a standard connection!
To minimize any hazardous situations resulting in personal injury or to avoid failures in your system, the data and power supply lines shall be installed according to standards, with careful attention given to ensuring the correct terminal assignment. Always adhere to the EMC directives applicable to your application.

NOTICE

Ensure proper contact with the DIN-rail!
Proper electrical contact between the DIN-rail and device is necessary to maintain the EMC characteristics and function of the device.

NOTICE

Replace defective or damaged devices!
Replace defective or damaged device/module (e.g., in the event of deformed contacts).

NOTICE

Protect the components against materials having seeping and insulating properties!
The components are not resistant to materials having seeping and insulating properties such as: aerosols, silicones and triglycerides (found in some hand creams). If you cannot exclude that such materials will appear in the component environment, then install the components in an enclosure being resistant to the above-mentioned materials. Clean tools and materials are imperative for handling devices/modules.

NOTICE

Clean only with permitted materials!
Clean housing and soiled contacts with propanol.

NOTICE

Do not use any contact spray!
Do not use any contact spray. The spray may impair contact area functionality in connection with contamination.

NOTICE

Do not reverse the polarity of connection lines!
Avoid reverse polarity of data and power supply lines, as this may damage the devices involved.

NOTICE

Avoid electrostatic discharge!

The devices are equipped with electronic components that may be destroyed by electrostatic discharge when touched. Please observe the safety precautions against electrostatic discharge per DIN EN 61340-5-1/-3. When handling the devices, please ensure that environmental factors (personnel, work space and packaging) are properly grounded.

2.3 Requirements

Table 4: Required Hardware of the WAGO I/O System

Component	Reference source (item number)
Fieldbus controller/PLC WAGO I/O System 750, e. g. ETHERNET PLC or PFC200 Controller	 WAGO (750-891) WAGO (750-8212)
DALI Multi-Master Module	WAGO (753-647)
End Module	WAGO (750-600)
Current supply for the indirect supply of the DALI Bus participants via the DALI Multi-Master Module (753-647), e. g.: DALI Multi-Master DC/DC Converter or Current supply	 WAGO (753-620) WAGO (787-2857)

2.4 Compatibility List

The following controllers are compatible with the DALI_647_02.lib and/or DALI_647_04.lib libraries:

Table 5: Controller Compatibility List

Item No.	Name	From FW	*_02.lib	*_04.lib	*_PFC_04.lib	e!COCKPIT
750-819	PFC LON	09	x			
750-829	PFC BACnet MS/TP	07	x	x		
750-830	PFC BACnet/IP	05	x			
750-831	PFC BACnet/IP	07	x	x		
750-833	PFC PROFIBUS	17	x			
750-837	PFC CANopen	17	x			
750-838	PFC CANopen	17	x			
750-841	PFC ETHERNET	21	x			
750-842	PFC ETHERNET	19	x			
750-849	PFC KNX IP	05	x			
750-852	PFC ETHERNET	09	x	x		
750-871	PFC ETHERNET	09	x			
750-872	PFC ETHERNET	05	x			
750-873	PFC ETHERNET	05	x			
750-880	PFC ETHERNET	09	x	x		
750-881	PFC ETHERNET	09	x	x		
750-882	PFC ETHERNET	09	x	x		
750-884	PFC ETHERNET	09	x	x		
750-885	PFC ETHERNET	09	x	x		
750-889	PFC KNX IP	07	x	x		
750-810x	PFC100 ETHERNET	08				x
750-820x	PFC200 ETHERNET	08			x	x
750-821x	PFC200 ETHERNET	11			x	x
758-874	I/O-IPC	09	x	x		
758-875	I/O-IPC	09	x	x		
758-876	I/O-IPC	09	x	x		

3 Device Description

3.1 Device-Specific Safety Information

DANGER

Dangerous voltages – follow assembly sequence!
If there is a fault, dangerous voltages may be present on the DALI bus. The DALI Multi-Master Module must not be placed directly to the left of an I/O module that works with SELV and has power jumper contacts (e.g., Supply Module 750-624). Otherwise, safe disconnect cannot be ensured. If necessary, put a spacer module (Item No. 750-616) between the DALI Multi-Master Module and such an I/O module to ensure safe disconnection.

Note

Required accessories: Power supply unit for indirect power supply via the DALI Multi-Master Module (753-647), Item No.: 753-620 or 787-2857!
Please note that a suitable power supply is required for the network slaves via the DALI Multi-Master Module, such as the power supply unit for the DALI Multi-Master Module (753-647), Item No.: 787-2857, or the DALI Multi-Master DC/DC Converter (753-620).
These power supplies do not provide direct power to the DALI bus, but only indirect power supply via the DALI Multi-Master Module. They ensure electrical isolation for this between the DALI bus and the I/O module required for the installation of 230 V electrical loads.

NOTICE

Destruction of DALI subscribers due to misuse of the WAGO power supply (787-2857)!
Please note that the power supply by WAGO (Item No.: 787-2857) may only be connected to the DALI Multi-Master Module (753-647). The power supply for the DALI bus is provided indirectly via the DALI Multi-Master Module. A direction connect to the DALI bus can result in the destruction of the attached DALI slaves. Therefore, never connect the WAGO Power Supply (787-12857) to a DALI network directly without a DALI Multi-Master Module (753-647) connected between the power supply and the network.

NOTICE

No reverse voltage protection!
The module is not protected against incorrect connection of the connecting leads.

Note

Perform configuration using the WAGO DALI Configurator!
You must use the WAGO DALI Configurator for configuration of the DALI Multi-Master Module (753-647) and the DALI Line.
You can download the WAGO DALI Configurator as a stand-alone tool from the WAGO Internet site at:
www.wago.com

Information

More information about the WAGO DALI Configurator!
A detailed description of the WAGO DALI Configurator is given in the manual for the configurator.
You can download this manual free of charge from the WAGO Internet site at:
www.wago.com

Note

Limit the PLC cycle time to a maximum of 60 ms
For communication with the DALI Configurator, the DALI function blocks in the PLC program must be run through at least every 60 ms.

3.2 Abbreviations and Terms

Table 6: Abbreviations and Terms Used in this Manual

Abbreviation/ Term	Explanation
Control Device	IEC term for the DALI (Multi)-Master (also, active sensors)
Control Gear	IEC term for passive electronic ballast (actuators)
DALI	“Digital Addressable Lighting Interface” (protocol for lighting control)
ECG	Electronic control gear (ballast unit)
PI	Process image of I/O module
PAA	I/O module output process data
PAE	I/O module input process data

Information

More definitions of terms given in the glossary.
Further, detailed explanations and definitions of technical terms used in this manual are given in alphabetical order in the section “Glossary.”

3.3 General Description

The DALI Multi-Master Module is used to connect a DALI network (DALI Line) to a WAGO fieldbus node with PLCs and 750/753 Series I/O modules.

This module is used in applications for digital control of lighting actuators, such as control gear (electronic ballasts) in building automation and for evaluation of DALI sensors.
DALI enables complex lighting scenes to be implemented with group functions.

Using the WAGO I/O System 750/753, DALI control devices are seamlessly integrated with all supported BA and fieldbus protocols.

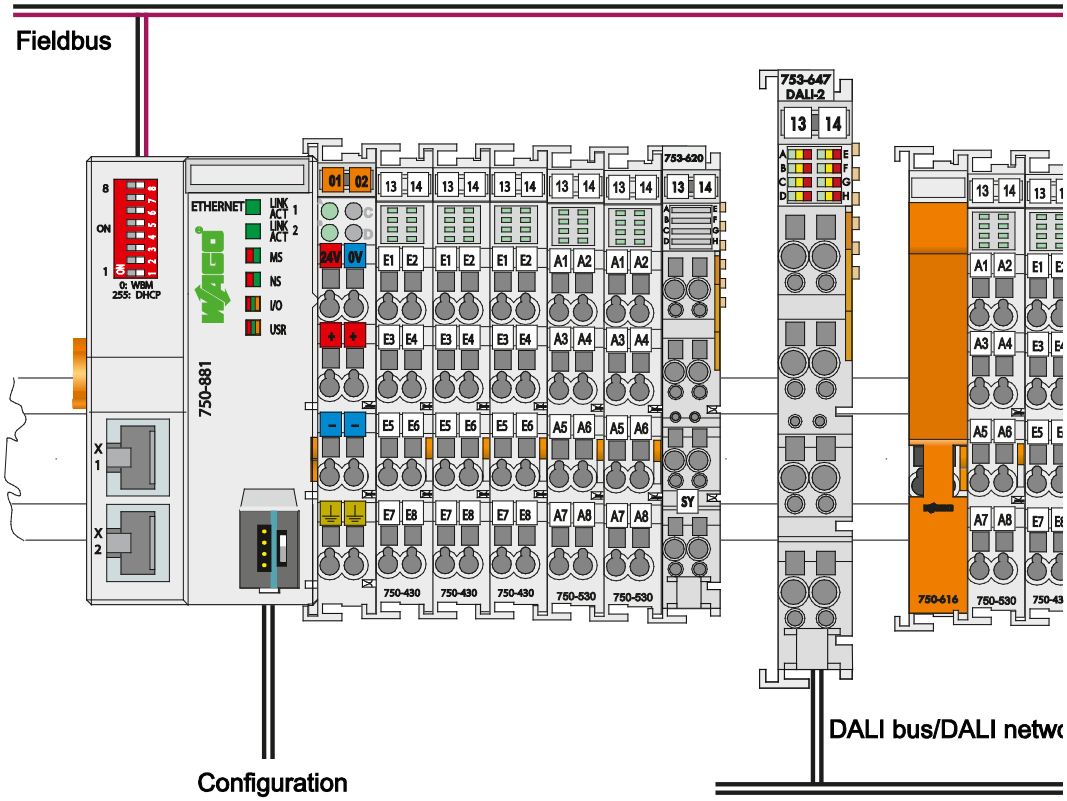

Figure 1: Overview of DALI Network with a WAGO I/O System 750/753

With HW version 03, the 753-647 DALI Multi-Master Module complies with the DALI-2 standard according to DIN EN IEC 62386. This manufacturer-independent protocol ensures interoperability of DALI devices in lighting applications.

Two options are available for power supply for the DALI Multi-Master Module; via the DALI Multi-Master DC/DC Converter (Item No.:753-620), which provides power for one DALI Multi-Master Module from the 24 V system power supply, or via the 230 V primary switch mode power supply unit (Item No.: 787-2857) for parallel supply of several DALI Multi-Master modes (see section “Connect Devices” > … > ”Module Supply”).

The DALI Multi-Master Module supplies bus power of 200 mA for power supply of the DALI bus slaves.

The maximum number of bus slaves depends on the sum current consumption of the specific devices and the address range for the actuators and sensors.

The module is equipped with 2 connections for the bus line (+DA and −DA) for connection of the DALI bus (DALI line).

The bus line is installed in free topology. However, ring structures should be avoided.
As the length of the line of a bus line is limited and as the maximum line lengths between the bus devices may not be exceeded, general DALI guidelines must be observed (see section “Connect Devices” > … > “Installation Notes”).

The I/O module supports 64 addresses total for control gear (ECG) and 64 addresses for control devices (DALI Multi-Sensors: Connection of max. 16 sensors is recommended due to the cyclic transmission characteristics). You can select from several addressing methods for this.
After successful address allocation, 16 groups and 16 scenes can be assigned to each of the DALI ECGs. A further 16 virtual groups can also be configured on the DALI bus.

The WAGO-I/O-*PRO* programming software respectively the ***e!****COCKPIT* programming software is used to program the fieldbus nodes.
An extensive IEC-61131-3 library is available with simple modules for implementing complex lighting applications.

The WAGO DALI Configurator can be used for simple commissioning and maintenance and for easy configuration of the DALI Multi-Master Module and the interconnected DALI line.

Information

More information about the WAGO DALI Configurator
You can download the WAGO DALI Configurator as a stand-alone tool from the WAGO Internet site.
You can download the manual for the software tool from the WAGO Internet site at: www.wago.com.

Information

More information about WAGO-I/O-*PRO*
You can order the WAGO software under the following item number:
WAGO-I/O-*PRO* programming tool (Item No.: 759-333)
You can download the manual for the software tool free of charge from the WAGO Internet site at:
www.wago.com

The DALI Multi-Master Module can be operated in two different modes.

- “Full mode”
- “Easy mode”

In the “Full mode”, acyclic data transfer with the PLC is implemented using a mailbox interface via acyclic transmission channels (see section “Process Image” >… > “Full Mode”).

As mentioned above, an “Easy mode” is also available which enables lighting control using simple binary signals without any complicated PLC programming (see section “Process Image” > … > “Easy Mode”).

The “Easy mode” is the standard state for the DALI Multi-Master Module.
The “Full mode” can be activated via PLC modules.

The behavior in the event of a local bus failure or lack of communication with the higher-level controller can be monitored by enabling a watchdog (see section “Process Image” > ... > “Watchdog”).

8 colored LEDs on the I/O module enclosure signal active and inactive operating modes, data transfer via DALI and the data bus, application of DALI bus power and internal statuses or errors of the I/O module. The LEDs also signal the identification function with FW version 20 or higher (see section “Display Elements”).

The I/O module 753-647 can be used with fieldbus couplers and fieldbus controllers of the WAGO I/O System 750.

3.4 View

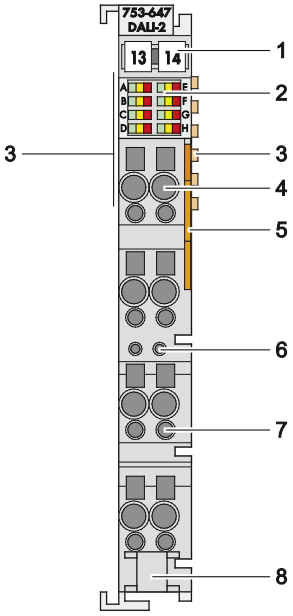

Figure 2: View

Table 7: Legend for Figure “View”

Pos.	Description	Details See Section
1	Marking possibility with Mini-WSB	---
2	Status-LEDs	“Device Description” > “Display Elements”
3	Data contacts	“Device Description” > “Connectors”
4	CAGE CLAMP® connectors	“Device Description” > “Connectors”
5	Pull tab	“Mounting” > “I/O Modules with Pluggable Wiring Level (Series 753)”
6	Coding possibility with coding fingers	“Mounting” > “Coding”
7	Test port	---
8	Fixing lug for cable ties	“Mounting” > “I/O Modules with Pluggable Wiring Level (Series 753)”

3.5 Connectors

3.5.1 Data Contacts/Local Bus

Communication between the fieldbus coupler/controller and the I/O modules as well as the system supply of the I/O modules is carried out via the local bus. The contacting for the local bus consists of 6 data contacts, which are available as self-cleaning gold spring contacts.

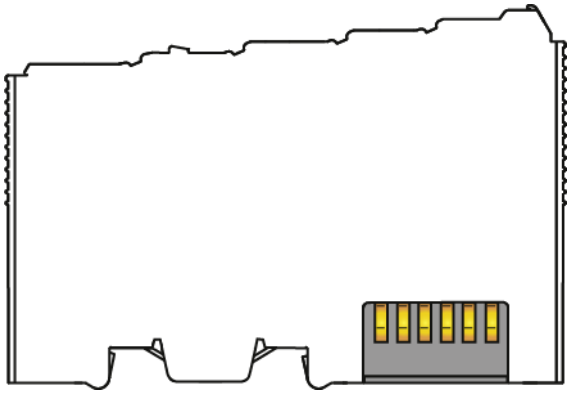

Figure 3: Data Contacts

NOTICE

Do not place the I/O modules on the gold spring contacts!
Do not place the I/O modules on the gold spring contacts in order to avoid soiling or scratching!

NOTICE

Pay attention to potential equalization from the environment!
The devices are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the devices, please ensure that environmental factors (personnel, work space and packaging) are properly equalized. Do not touch any conducting parts, e.g., data contacts.

3.5.2 Power Jumper Contacts/Field Supply

The I/O module 753-647 has no power jumper contacts.

Note

Use a power supply module!
Use a power supply module for field-side power supply of downstream I/O modules.

3.5.3 CAGE CLAMP® Connectors

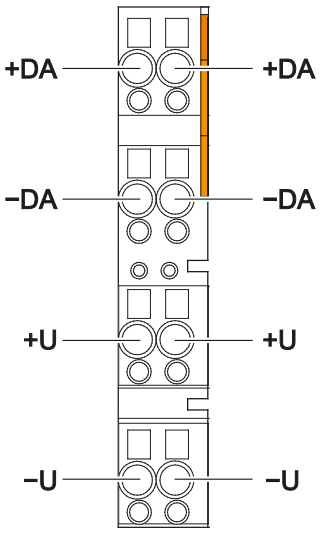

Figure 4: CAGE CLAMP® Connectors

Table 8: Legend for Figure “CAGE CLAMP® Connectors”

Designation	Connector	Function
+DA	1	DALI Bus connection +
	5	DALI Bus connection +
−DA	2	DALI Bus connection −
	6	DALI Bus connection −
+U	3	Supply +
	7	Supply +
−U	4	Supply −
	8	Supply −

Information

Configuration diagram for connections!

The power supply configuration for the I/O module and the configuration for the DALI network are shown in the figures given in the sub-sections “Power Supply Configuration for 753-620” and “Power Supply Configuration for 787-2857”. You can also refer to the main section “Installation Notes” > … > “Module Supply.”

3.6 Display Elements

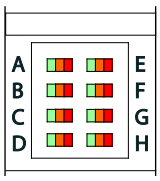

Figure 5: Display Elements

Table 9: Legend for Figure “Display Elements”

LED	Name/Function
A	• Easy mode • Firmware-update
B	DALI line (transmit)
C	Operational readiness (local bus communication)
D	• 1 or 2-button operation (only in “easy mode”) • Interruption of the power supply of the I/O module (18 V)
E	Full mode
F	DALI line (receive)
G	Power supply • Internal • External • Error
H	• Latching relay function (only in “easy mode”) • Short circuit on the DALI line *)

*) Short circuit detection and signaling is only possible if the DALI line is also powered via the DALI Multi-Master Module, which is powered by a WAGO power supply.

Note

Diagnosis of the LED Statuses
You can find a detailed overview of the LED statuses and their meanings in the “Diagnostics” section.

3.7 Operating Elements

The 753-647 I/O module does not have any electro-mechanical operating elements.

Changes to the configuration and parameters are made via the higher-order control, or using the special WAGO DALI Configurator.

3.8 Schematic Diagram

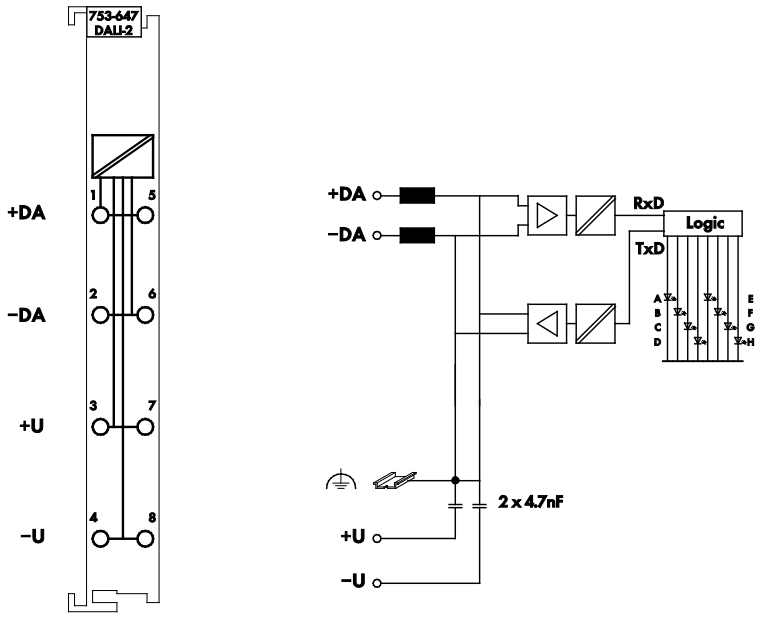

Figure 6: Schematic Diagram

3.9 Technical Data

3.9.1 Device

Table 10: Technical Data – Device

Width	12 mm
Depth (from upper edge of DIN 35 rail)	64 mm
Height	100 mm
Weight	55 g

3.9.2 Supply

Table 11: Technical Data – Supply

Power supply	Via system voltage (+5 VDC)
Current consumption (internal)	85 mA
I/O Module power supply at +U and −U	18 V via 753-620 or 787-2857 power supplies *)
Maximum supply current (according to DALI specification)	250 mA
Guaranteed supply current (acc. to DALI specification)	200 mA
Current consumption from DALI bus with alternative supply via DALI bus	10 mA
Isolation	2100 VDC DALI bus/local bus
Maximum bus voltage startup time (according to DALI specification)	400 ms

*) No other power supply must be active on the DALI bus when indirectly powering the DALI network subscribers via the 753-647 DALI Multi-Master. Otherwise, it is not possible to address the DALI network subscribers.

3.9.3 Communication

Table 12: Technical Data – Communication

DALI specification	DIN EN IEC 62386
Max. number of addressable subscribers (DALI addresses) up to HW 02 from HW 03	 64 control devices 63 control devices + WAGO DALI-Multi Master
Transmission channel	1
Internal bit width	24-byte data
Commissioning and parameterization	Via WAGO-I/O-*CHECK*, ***e!****COCKPIT* and/or via WAGO-I/O-*PRO*
Configuration	With WAGO DALI Configurator

3.9.4 Connection Type

Table 13: Technical Data – Field Wiring

Connection technology	CAGE CLAMP®
Conductor cross-section	0.08 mm² … 2.5 mm², AWG 28 … 14
Strip length	8 mm … 9 mm / 0.33 in

Table 14: Technical Data – Data Contacts

Data contacts	Slide contact, hard gold plated, self-cleaning

3.9.5 Climatic Environmental Conditions

Table 15: Technical Data – Climatic Environmental Conditions

Surrounding air temperature, operation	0 °C … 55 °C
Surrounding air temperature, storage	−25 °C … +85 °C
Operating altitude	0 … 2000 m
Relative humidity	Max. 5 % … 95 % without condensation
Pollution degree	2
Protection type	IP20
Resistance to harmful substances	Acc. to IEC 60068-2-42 and IEC 60068-2-43
Maximum pollutant concentration at relative humidity < 75 %	$SO_2 \leq 25$ ppm $H_2S \leq 10$ ppm
Special conditions	Ensure that additional measures for components are taken, which are used in an environment involving: – dust, caustic vapors or gases – ionizing radiation

3.10 Approvals

For current approvals, please go to: www.wago.com/<Item number>.

The following approvals have been granted to 753-647 I/O modules:

Conformity Marking

UL508

DALI-2 certified

Korea Certification MSIP-REM-W43-MSM750

The following ship approvals have been granted to 753-647 I/O modules:

Temperature:	B (cold test with 0 °C/16 h)
Humidity:	A
Vibration:	B
Enclosure:	A
EMC:	A/B*)

*) dependent on the combination of power supply filter and DC/DC converter – see Section “Power Supply for Use in the Maritime Sector”

PRS (Polski Rejestr Statków)

Note

Applicable from FW 01 / HW 02!
This ship approval is only applicable from FW 01 / HW 02!

3.11 Standards and Guidelines

753-647 I/O modules meet the following requirements on emission and immunity of interference:

EMC CE-Immunity to interference	EN 61000-6-2
EMC CE-Emission of interference	EN 61000-6-3

Note

EMC CE Immunity to interference and transmission provided only in conjunction with the 753-620 or 787-1007 power supply unit!
Compliance with the indicated EMC standards for CE immunity to interference and transmission can only be reliably maintained when power to the DALI Multi-Master module is provided via the 753-620 or 787-2857 power supply units!

EMC marine applications-Immunity to interference	acc. to DNV
EMC marine applications-Emission of interference	acc. to DNV

4 Process Image

The DALI Multi-Master Module always has a 24-byte process image.

This enables the I/O module to be addressed and configured either via a dedicated IEC application, or using the WAGO DALI Configurator.

If the WAGO DALI Configurator is used, the DALI Multi-Master Module is operated in the “Full mode”, as a special DALI master module is employed. The DALI master module switches the DALI Multi-Master Module to this operating mode.

There is no difference between the “Full mode” and “Easy mode” when representing the I/O modules in the process images for the fieldbuses and software tools (except for the control configuration in WAGO-I/O-*PRO*).

The “Easy mode” is the set default. This mode must also be used if no program is being used that has a DALI master module.

The mode depends on whether the mailbox is active or not.

4.1 Watchdog

The DALI Multi-Master Module can be configured in such a way that the communication with a higher-level controller and the local bus communication can be monitored by a watchdog. The watchdog is disabled in the factory settings. If the watchdog detects a loss of communication, the DALI Multi-Master Module briefly switches the DALI bus off and back on in order to trigger the “System Failure Level” (SFL) of the DALI operating devices

Note

No monitoring function with external power supply
This functionality only exists if the DALI Multi-Master Module powers the DALI bus. If power is supplied by an external DALI power supply unit, the DALI bus cannot be switched off in order to trigger the SFL.

In “Easy mode,” the watchdog must be toggled actively via the process image. Bit 4 in byte 0 is available for this purpose. If no toggling occurs beyond the watchdog time corresponding to the setting, the SFL is triggered.

No active toggling is necessary in “full mode,” since a regular status query is made via the mailbox.

The communication monitoring can be parameterized via the DALI Configurator or with the help of macro 24. The time for the watchdog can be set in register 47. The setting range is from 1 to 255 minutes. The watchdog can be enabled/ disabled with the WAGO DALI Configurator staring from Version 3.18.0.1180.

4.2 Dedicated IEC Application

In principle, the DALI Multi-Master Module can directly access the ECGs, groups and scenes in the “Easy mode” without any further configuration of the module being necessary (as long as the DALI network has already been addressed).

The WAGO-I/O-*PRO* library “DALI_647_xx.lib” can be integrated into the application for programming of a dedicated IEC application. This library contains the special DALI master module for processing the data that switches the DALI Multi-Master Module to the “Full mode”.
The DALI Multi-Master Module is operated in the “Full mode” for this for creating own programs with the DALI master module.

Note

Download the WAGO-I/O-*PRO* library free of charge!
To use and create your own IEC application, download the current version of the WAGO-I/O-*PRO* “DALI_647_xx.lib” or “DALI_647_PFC_xx.lib” (for 750-82xx) and “DALI_647_SpecialSensor_xx.lib” library at no cost from the WAGO website at: www.wago.com

4.3 Full Mode

In the “Full mode”, the 24 bytes for the process image is used (as for other complex WAGO I/O modules, such as KNX, MP bus, etc.) for tunneling of a protocol via a mailbox interface.

In the “Full mode” the process image for the DALI Multi-Master Module consists of the following 24 bytes: 1 byte for Control/Status and 23 bytes for acyclic data.

The advantage for the user is that no further programming is required to easily perform all settings and data evaluation via the WAGO DALI Configurator user interface.

The I/O module can query and control the status of the interconnected devices in the DALI line by systematic polling. Systematic polling can also be configured to enable polling of the active devices to be conducted more rapidly per cycle than the inactive devices.

Some selected device settings (e.g., status information for the ECGs and sensors with HW version 03 or higher) are stored in a permanently updated, internal database of the I/O module when configured. The operating hours of the devices (active times of the lights) are also recorded.

If a defective device must be replaced, the replacement device can be reconfigured automatically using the "Auto-Replace" function.

Note

Restart of the I/O module necessary!
If an existing DALI line is changed, i.e. one or more devices are added or removed, the DALI Multi-Master Module must be restarted. This restart maintains the “Auto-Replace” function.

4.4 Easy Mode

The “Easy mode” can be run as an alternative when no DALI master module is used. The “Easy mode” provides lighting control using simple binary signals, without complicated PLC programming.
In the “Easy mode”, changes to individual bits of the process image are converted directly into DALI commands for a pre-configured DALI network.

23 bytes of the 24-byte process image can be used directly for switching of devices, groups or scenes in the “Easy mode”.

The structure of the process data is described in detail in the following tables.

Depending on the switching action, short or long, either “ON/OFF” or “Dim brighter/darker” is entered in the output process map. “ON/OFF” switching is implemented via the “Latching relay” function, while “Dim brighter/darker” is realized via the “Dim in 1- and 2-button mode” function. These functions are described briefly in the directly ensuing sections.

4.4.1 Latching Relay Function

Each time a button is pressed for a latching relay an electrical pulse is transmitted to the latching relay and alters the circuit state. This status is stored until a new pulse results in a further status change.

The WAGO DALI Configurator is used to switch to the latching relay mode.

4.4.2 Dim in 1- and 2-Button Mode

A short press of the button in one-button mode switches the lighting on or off. A long button press (longer than 500 ms) increases or decreases the lighting intensity.

Dimming in the two-button mode functions similarly, except that in this case one button is used to switch on and increase the intensity of the lighting and a second one for dimming and switching off of the lighting:

- If the lighting is off, the “ON” rocker switch is used to switch on the lighting and slowly increase the lighting intensity.
- The “OFF” rocker switch is used to dim the lighting.
  When the minimum dimming level is reached, the lighting is switched off.

Table 16: Lighting Control via Buttons

Button	Press	Description
“ON” rocker switch	Short	Switch lighting on.
	Long	Increase light intensity (brighter).
“OFF” rocker switch	Short	Switch lighting off.
	Long	Dim lighting (darker).

The WAGO DALI Configurator is used to switch between one-button and two-button operation.

4.4.3 Process Image Overview in the “Easy Mode”

Table 17: Overview of the Output Process Image in the “Easy Mode”

Byte	0	1	2 ... 17	18 ... 21	22 ... 23
Output process image	Switch broadcast; broadcast increase/decrease lighting intensity; toggle watchdog	0	Switch short addresses, increase/decrease lighting intensity	Switch group addresses; increase/decrease lighting intensity	Call up scene

Table 18: Overview of Input Process Image in the “Easy Mode”

Byte	0	1	2 ... 17	18 ... 21	22 ... 23
Input process image	Status Activate Broadcast	(Reserved)	Status, Activate short addresses	Status Activate group addresses	(Not in use)

4.4.4 Activating/De-activating 64 DALI Actuators, Dimming

Table 19: Output and Input Process Image of the DALI Multi-Master Module in “Easy Mode” – Bytes 0 and 1

Byte.Bit	DALI address (DA)	Output process image		Input process image
		1-button mode	2-button mode	
0.0	Broadcast	Broadcast ON		0 = 1-button mode 1 = 2-button mode
0.1		Broadcast OFF		-
0.2		Short: ON/OFF Long: Dimming brighter/darker	Short: ON/OFF Long: Dimming brighter	0 = Broadcast status OFF 1 = Broadcast status ON
0.3		ON/OFF	-	-
0.4	Watchdog*)	Toggle watchdog		-
0.5	-	(reserved)		-
0.6		(reserved)		-
0.7		(reserved)		-
1.0…1.7		(reserved)		(reserved)

*) Enabling/disabling in Version 3.18.0.1180 or higher of the DALI Configurator and FW 20 of the DALI Multi-Masters

Table 20: Output and Input Process Image of the DALI Multi-Master Module in “Easy Mode” – Bytes 2 … 17

Byte.Bit	DALI address (DA)	Output process image		Input process image
		1-button mode	2-button mode	
2.0	DA0	Short: ON/OFF Long: Dimming brighter/darker	Short: ON/OFF Long: Dimming brighter	Status: ON/OFF
2.1		ON/OFF	Short: ON/OFF Long: Dimming darker	Status: No error/Error
2.2	DA1	Short: ON/OFF Long: Dimming brighter/darker	Short: ON/OFF Long: Dimming brighter	Status: ON/OFF
2.3		ON/OFF	Short: ON/OFF Long: Dimming darker	Status: No error/Error
2.4	DA2	Short: ON/OFF Long: Dimming brighter/darker	Short: ON/OFF Long: Dimming brighter	Status: ON/OFF
2.5		ON/OFF	Short: ON/OFF Long: Dimming darker	Status: No error/Error
…				
17.4	DA62	Short: ON/OFF Long: Dimming brighter/darker	Short: ON/OFF Long: Dimming brighter	Status: ON/OFF
17.5		ON/OFF	Short: ON/OFF Long: Dimming darker	Status: No error/Error
17.6	DA63	Short: ON/OFF Long: Dimming brighter/darker	Short: ON/OFF Long: Dimming brighter	Status: ON/OFF
17.7		ON/OFF	Short: ON/OFF Long: Dimming darker	Status: No error/Error

4.4.5 Activating/De-activating 16 Groups, Dimming

Table 21: Output and Input PI for the DALI Multi-Master Module in the “Easy Mode” – Byte 18 … 21

Byte.Bit	Group address (GA)	Output process image		Input process image
		1-Button mode	2-Button mode	
18.0	GA0	Short: ON/OFF Long: Dimming brighter/darker	Short: ON Long: Brighter dimming	Status: ON/OFF
18.1			Short: OFF Long: Darker dimming	Status: No error / Error
18.2	GA1	Short: ON/OFF Long: Dimming brighter/darker	Short: ON Long: Brighter dimming	Status: ON/OFF
18.3			Short: OFF Long: Darker dimming	Status: No error / Error
18.4	GA2	Short: ON/OFF Long: Dimming brighter/darker	Short: ON Long: Brighter dimming	Status: ON/OFF
18.5			Short: OFF Long: Darker dimming	Status: No error/Error
…				
21.4	GA14	Short: ON/OFF Long: Dimming brighter/darker	Short: ON Long: Brighter dimming	Status: ON/OFF
21.5			Short: OFF Long: Darker dimming	Status: No error/Error
21.6	GA15	Short: ON/OFF Long: Dimming brighter/darker	Short: ON Long: Brighter dimming	Status: ON/OFF
21.7			Short: OFF Long: Darker dimming	Status: No error/Error

4.4.6 Activating/De-activating 16 Scenes

Table 22: Output and Input PI for the DALI Multi-Master Module in the “Easy Mode” – Byte 22 and 23

Byte.Bit	Scene	Output process image	Input process image
22.0	0	Switch to scene 0.	-
22.1	1	Switch to scene 1.	-
22.2	2	Switch to scene 2.	-
22.3	3	Switch to scene 3.	-
22.4	4	Switch to scene 4.	-
22.5	5	Switch to scene 5.	-
22.6	6	Switch to scene 6.	-
22.7	7	Switch to scene 7.	-
23.0	8	Switch to scene 8.	-
23.1	9	Switch to scene 9.	-
23.2	10	Switch to scene 10.	-
23.3	11	Switch to scene 11.	-
23.4	12	Switch to scene 12.	-
23.5	13	Switch to scene 13.	-
23.6	14	Switch to scene 14.	-
23.7	15	Switch to scene 15.	-

5 Mounting

5.1 Mounting Sequence

Fieldbus couplers, controllers and I/O modules of the WAGO I/O System 750 are snapped directly on a carrier rail in accordance with the European standard EN 60175 (DIN 35).

The reliable positioning and connection is made using a tongue and groove system. Due to the automatic locking, the individual devices are securely seated on the rail after installation.

Starting with the fieldbus coupler or controller, the I/O modules are mounted adjacent to each other according to the project design. Errors in the design of the node in terms of the potential groups (connection via the power contacts) are recognized, as the I/O modules with power contacts (blade contacts) cannot be linked to I/O modules with fewer power contacts.

⚠ CAUTION

Risk of injury due to sharp-edged blade contacts!
The blade contacts are sharp-edged. Handle the I/O module carefully to prevent injury. Do not touch the blade contacts.

NOTICE

Insert I/O modules only from the proper direction!
All I/O modules feature grooves for power jumper contacts on the right side. For some I/O modules, the grooves are closed on the top. Therefore, I/O modules featuring a power jumper contact on the left side cannot be snapped from the top. This mechanical coding helps to avoid configuration errors, which may destroy the I/O modules. Therefore, insert I/O modules only from the right and from the top.

Note

Don't forget the bus end module!
Always plug a bus end module (e.g. 750-600) onto the end of the fieldbus node! You must always use a bus end module at all fieldbus nodes with WAGO I/O System 750 fieldbus couplers or controllers to guarantee proper data transfer.

5.2 Inserting and Removing Devices

DANGER

Do not work when devices are energized!
High voltage can cause electric shock or burns.
Switch off all power to the device prior to performing any installation, repair or maintenance work.

5.2.1 Inserting the I/O Module

1. Position the I/O module so that the tongue and groove joints to the fieldbus coupler or controller or to the previous or possibly subsequent I/O module are
engaged.

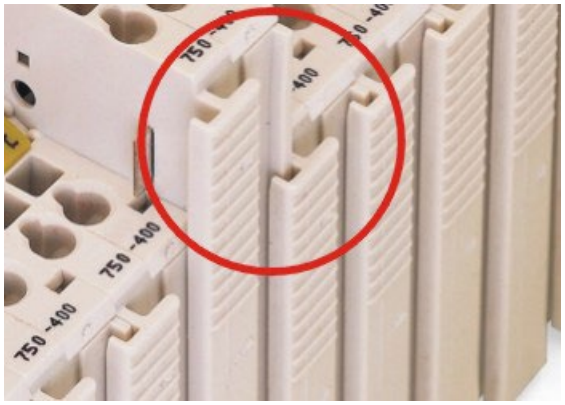

Figure 7: Insert I/O Module (Example)

2. Press the I/O module into the assembly until the I/O module snaps into the carrier rail.

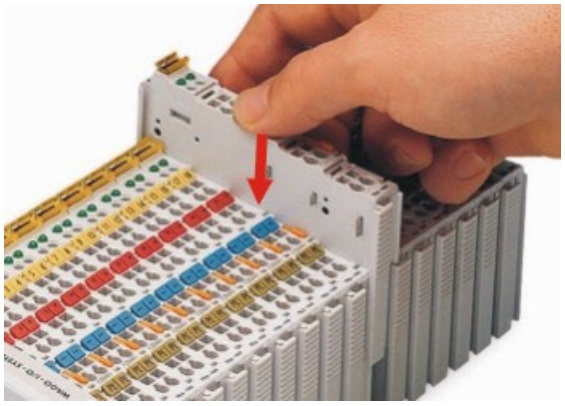

Figure 8: Snap the I/O Module into Place (Example)

With the I/O module snapped in place, the electrical connections for the data contacts and power jumper contacts (if any) to the fieldbus coupler or controller or to the previous or possibly subsequent I/O module are established.

5.2.2 Removing the I/O Module

Note

Remove pluggable wiring!
Before removing a 753 Series I/O Module from the node, you must first remove the plug (pluggable wiring) from the I/O module (see section “Plug Removal”)!

1. Remove the I/O module from the node by pulling the tab.

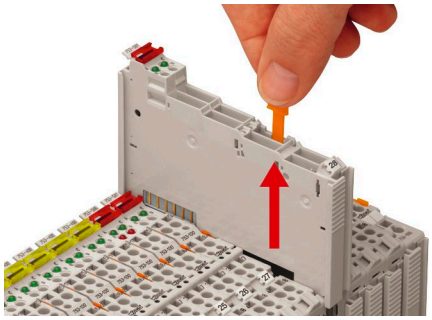

Figure 9: Removing the I/O Module (Example)

Electrical connections for data or power jumper contacts are disconnected when removing the I/O module.

5.3 I/O Modules with Pluggable Wiring Level (Series 753)

For wiring, a plug is plugged into the bottom of the module of all 753 Series I/O modules. The plug can be completely removed together with the wiring, simplifying replacement of defective modules from the assembly.

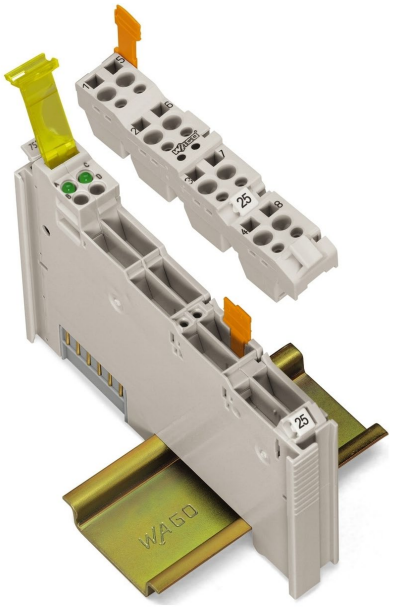

Figure 10: Plug and I/O Module

Miniature WSB marking tags ensure that the right plug is matched up with the right I/O module (see figure below).

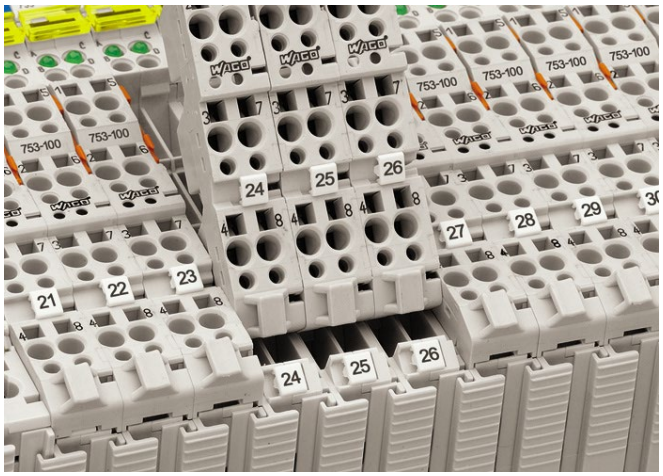

Figure 11: Assignment of I/O Module to Plug Using Mini-WSB Tags

This plug provides an option for attaching cable binders.

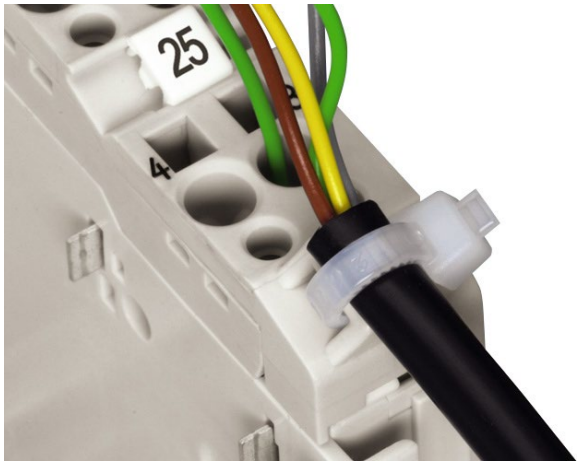

Figure 12: Attachment of Cable Binders

5.3.1 Coding

Coding using small plastic pins and sockets facilitates mating of the I/O module with the appropriate plug.

1. Insert the pin into the socket.

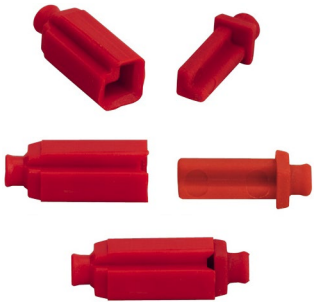

Figure 13: Assembling the Coding Fingers

2. Position the assembled coding fingers in the I/O module. Due to its design, each coding finger allows 4 different coding options (i.e.; 16 different options using 2 coding fingers).

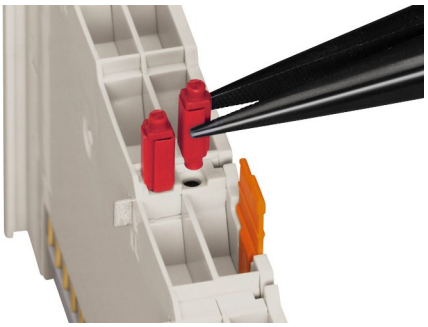

Figure 14: Inserting the Coding Fingers

3. Place the plug onto the I/O module.

Figure 15: Plugging the Plug into Place

4. When the plug is removed the sockets remain in the I/O module. The coded plug can only fit in the corresponding coded I/O module (see figures below).

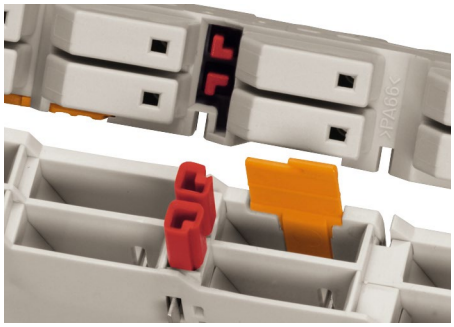

Figure 16: “Sure Match” Coding Fingers

5.3.2 Plug Removal

1. Remove the plug from the I/O module by pulling the orange pull tab on the plug toward the top of the I/O module.

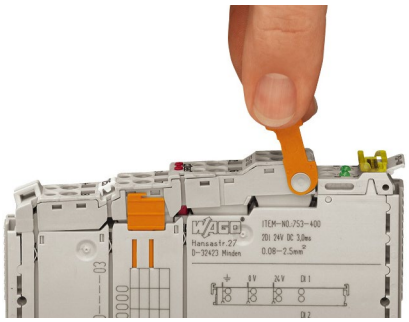

Figure 17: Pulling the Pull Tab

The plug detaches from the I/O module.

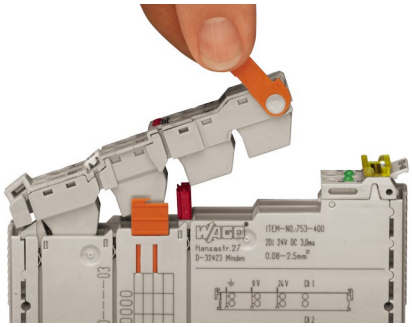

Figure 18: Removing the Plug Without Tools

2. Alternatively, you can also use a standard screwdriver at the position shown (in the figure below) to remove the plug.

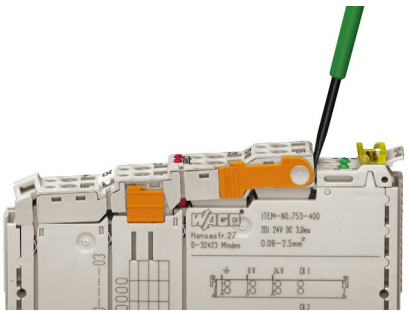

Figure 19: Removing the Plug Using a Screwdriver

6 Connect Devices

6.1 Connecting a Conductor to the CAGE CLAMP®

The WAGO CAGE CLAMP® connection is appropriate for solid, stranded and finely stranded conductors.

Note

Only connect one conductor to each CAGE CLAMP®!
Only one conductor may be connected to each CAGE CLAMP®.
Do not connect more than one conductor at one single connection!

If more than one conductor must be routed to one connection, these must be connected in an up-circuit wiring assembly, for example using WAGO feed-through terminals.

1. For opening the CAGE CLAMP® insert the actuating tool into the opening above the connection.
2. Insert the conductor into the corresponding connection opening.
3. For closing the CAGE CLAMP® simply remove the tool. The conductor is now clamped firmly in place.

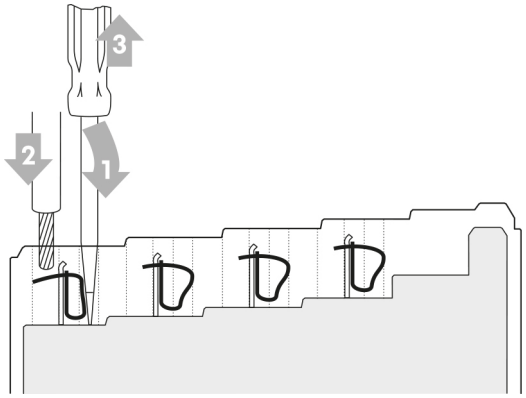

Figure 20: Connecting a Conductor to a CAGE CLAMP®

6.2 Power Supply for Marine Applications

⚠ WARNING

When operating in marine applications, filter modules are to be used for the power supply!

Power must be supplied via the appropriate filter module when using DALI Multi-Master Module (753-647) in marine applications.
The exact arrangement of filter module(s), AC/DC power supply or DC/DC converter(s) in a system configuration can be found in the following tables and figures.

Marine applications:

- Class A: All areas except bridge and open deck
- Class B: All areas **including** bridge and open deck

6.2.1 Power Supply Concept (Marine Applications) with DC/DC Converter – Class A

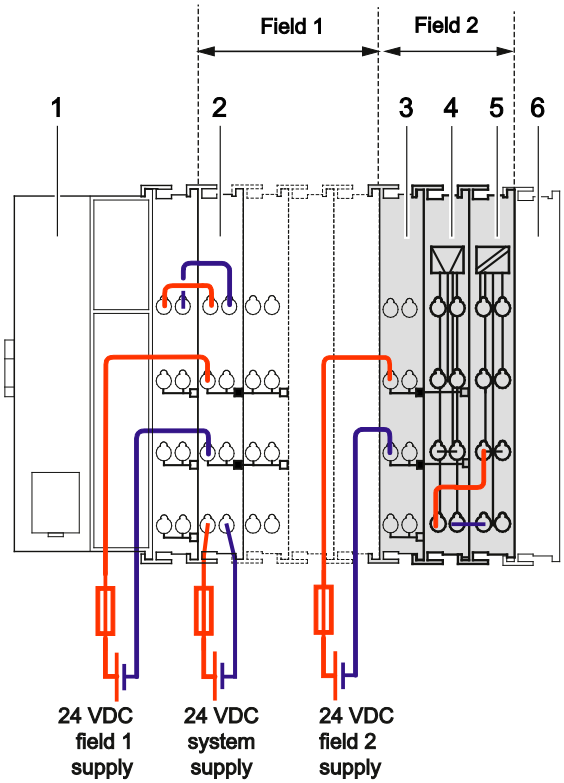

Figure 21: Power Supply Concept (Marine Applications) with DC/DC Converter (753-620) – Class A

Table 23: Legend for Figure “Power Supply Concept (Marine Applications) with DC/DC Converter (753-620) – Class A”

Pos.	Explanation
1	Fieldbus coupler/controller
2	Filter module 24 VDC, HI GF (750-626/020-002) or Filter module 24 VDC, HI (750-626/020-000) or Filter module 24 VDC, HI /T (750-626/025-001)
3	Filter module 24 VDC, HI without power jumper contact (750-624/020-001)
4	DALI Multi-Master DC/DC converter (753-620)
5	DALI Multi-Master (753-647)
6	End module

Code	Explanation
HI	High Isolation (filter for systems with insulation monitoring)
GF	Ground Fault (filter with ground fault diagnostics)
T	Extended temperature range

6.2.2 Power Supply Concept (Marine Applications) with AC/DC Power Supply Unit – Class A

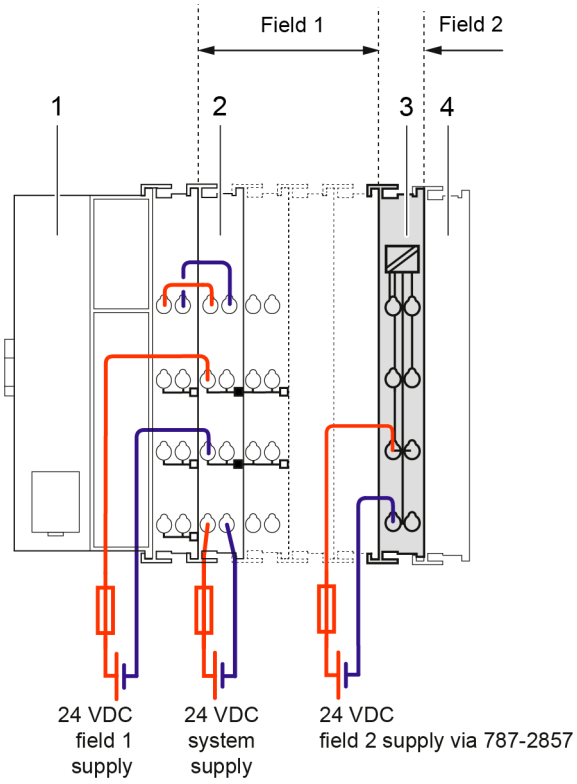

Figure 22: Power Supply Concept (Marine Applications) with AC/DC Power Supply Unit (787-2857) – Class A

Table 24: Legend for Figure “Power Supply Concept (Marine Applications) with AC/DC Power Supply Unit (787-2857) – Class A”

Pos.	Explanation
1	Fieldbus coupler/controller
2	Filter module 24 VDC, HI GF (750-626/020-002) or Filter module 24 VDC, HI (750-626/020-000) or Filter module 24 VDC, HI /T (750-626/025-001)
3	DALI Multi-Master (753-647)
4	End module

Code	Explanation
HI	High Isolation (filter for systems with insulation monitoring)
GF	Ground Fault (filter with ground fault diagnostics)
T	Extended temperature range

6.2.3 Power Supply Concept (Marine Applications) – Class B

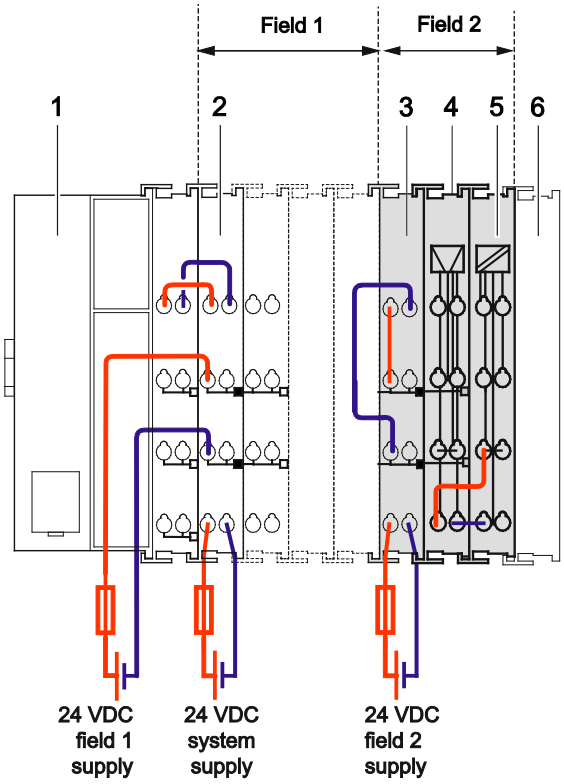

Figure 23: Power Supply Concept (Marine Applications) – Class B

Table 25: Legend for Figure “Power Supply Concept (Marine Applications) – Class B”

Pos.	Explanation
1	Fieldbus coupler/controller
2	Filter module 24 VDC, HI GF (750-626/020-002) or Filter module 24 VDC, HI (750-626/020-000) or Filter module 24 VDC, HI /T (750-626/025-001)
3	Filter module 24 VDC, HI GF (750-626/020-002) or Filter module 24 VDC, HI (750-626/020-000) or Filter module 24 VDC, HI /T (750-626/025-001)
4	DALI Multi-Master DC/DC converter (753-620)
5	DALI Multi-Master (753-647)
6	End module

Code	Explanation
HI	High Isolation (filter for systems with insulation monitoring)
GF	Ground Fault (filter with ground fault diagnostics)
T	Extended temperature range

6.3 Installation Notes

NOTICE

Only perform work on the components when the system is de-energized!
Working on devices when the system is energized can damage the devices. Therefore, turn off the power supply before working on the devices.

NOTICE

De-energize all lights on the network!
When operating several lighting groups in different circuits, there is a risk that line voltage can transfer to other lighting groups via the DALI data line in the event of error. Therefore, generally de-energize all lighting circuits on your network when working on data lines.

Note

Observe IEC standard!
Observe the validity of DIN EN IEC 62386 when setting up your DAL network! The following descriptions for setting up a DALI network are only recommendations.

6.3.1 Module Assembly

Note

Supply module is required!
The DALI Multi-Master Module has no power jumper contacts. The field supply potential of the adjacent I/O modules in the node will not be passed to the following modules. A supply module is therefore required to provide any additional I/O modules.

6.3.2 Module Supply

NOTICE

Destruction of DALI subscribers due to misuse of the power supply
Please note that the WAGO power supply (Item No. 787-2857) may only be connected to the DALI Multi-Master Module (Item No.: 753-647). Power for the DALI bus is supplied indirectly via the DALI Multi-Master Module. Connecting to the DALI bus directly can result in the destruction of connected DALI subscribers. Therefore, never connect the WAGO power supply (787-2857) to a DALI network directly.
A DALI Multi-Master Module (753-647) must always be interconnected.

Note

Do not connect another power supply to the DALI bus when powering the DALI network subscribers via the integrated DALI Multi-Master's power supply unit

No other power supply must be active on the DALI bus when indirectly powering the DALI network subscribers via the DALI Multi-Master Module (753-647) (e.g., when using a DALI Multi-Master Module DC/DC converter (Item No.: 753-620) or the power supply unit for DALI Multi-Master Module (Item No.: 787-2857)). Otherwise, it is not possible to address the DALI network subscribers.

Note

EMC regulations comply by DIN rail grounding!

In order to meet the EMC regulations, the DC/DC converter must be connected to ground using the appropriate FE-connection on the rail.

Note

Required Accessories

A suitable DALI power supply unit is required for the 18 V power supply to the DALI network via the DALI Multi-Master Module (753-647). This provides for reliable electrical isolation between the DALI bus and local bus that is required for installation of 230 V electrical loads. DALI Multi-Master Module DC/DC converter (Item No.: 753-620) or the power supply unit for DALI Multi-Master Module (Item No.: 787-2857) are suitable.

The length of power supply cable between WAGO power supply (787-2857) and DALI Multi-Master Module (753-647) may be 1 m maximum.
The power supply cable must also be shielded when used in marine applications.

6.3.2.1 Power Supply Configuration for 753-620

If you use a DALI Multi-Master DC/DC Converter (753-620) for power supply, exactly 1 DALI Multi-Master Module can be supplied with power.

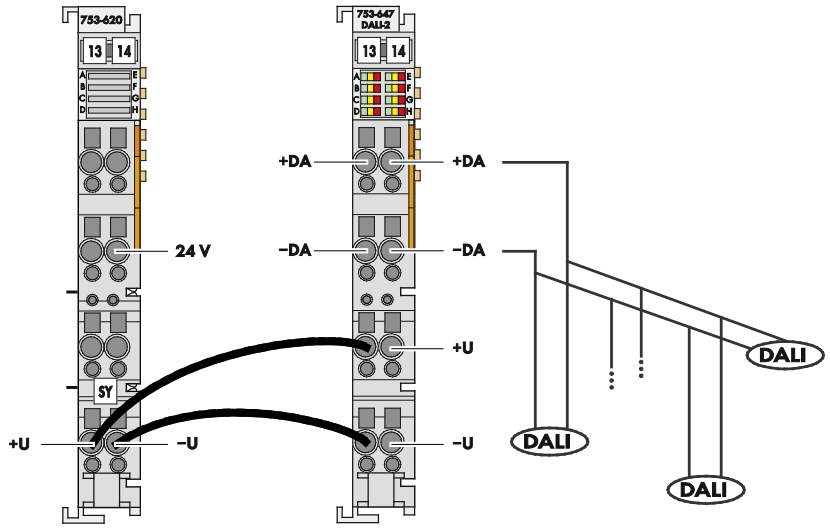

Figure 24: Configuration Diagram for the DALI Multi-Master DC/DC Converter (753-620) with 1 DALI Multi-Master Module

Ensure that the DALI Multi-Master DC/DC Converters are initially installed adjacently in groups, as they pass on potential via power jumper contacts. Each of the DALI Multi-Master Modules are then wired individually to the power supply terminals (see figure below).

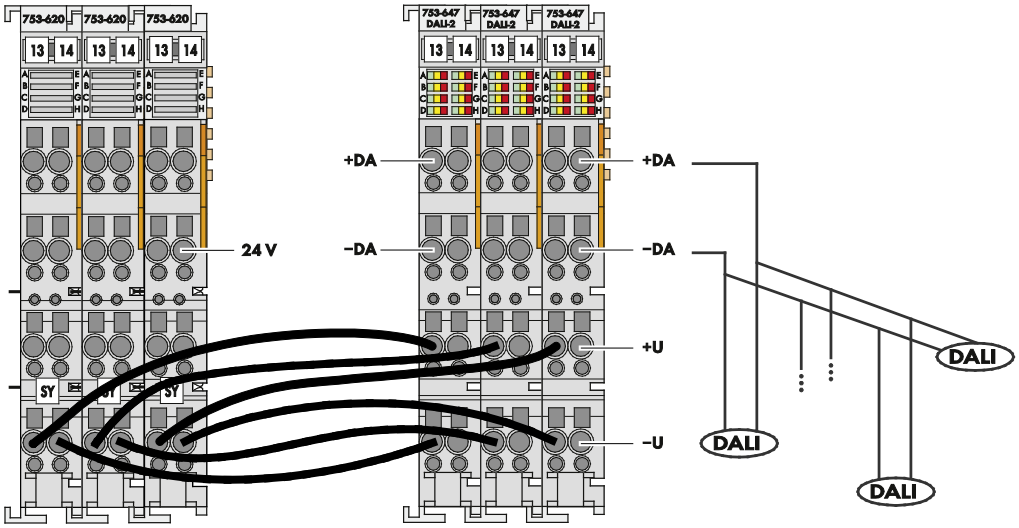

Figure 25: Configuration Diagram for 3 DALI Multi-Master DC/DC Converters (753-620) with 3 DALI Multi-Master Modules

6.3.2.2 Power Supply Configuration for 787-2857

If a power supply unit (787-2857) is used, it can supply power to multiple DALI Multi-Master Modules (753-647). With total power consumption of 200 mA per DALI line, up to five DALI Multi-Master Modules (753-647) can be powered with a 787-2857 power supply unit.

Note

230 V power supply required!
Note that the 787-2857 power supply unit requires 230 V power supply.

Connection of power supply is made at the first DALI Multi-Master Module. Power must be passed on via cable bridges for supply of the other I/O modules.

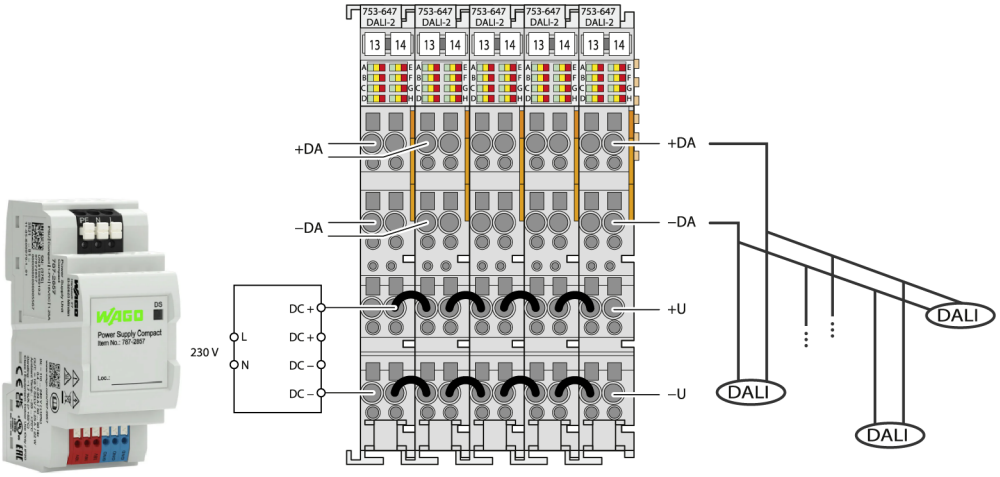

Figure 26: Configuration Diagram for a 787-2857 Power Supply with 5 DALI Multi-Master Modules

6.3.3 DALI Bus Line

The DALI bus control line consists of one pair of conductors which can be run together with the 230 V installation.
For example, a 5-conductor cable can be used combining both the voltage supply and the DALI control line.

The minimum cross section of the conductors depends on the cable length.

Table 26: Conductor Cross Section Depending on the Cable Length

Cable Length	Conductor Cross Section (Min.)
< 100 m	0.5 mm²
100 m … 150 m	0.75 mm²
> 150 m	1.5 mm²

Note

Maximum cable length 300 m!
The maximum voltage drop of the DALI line should not exceed 2 V. Therefore, the maximum cable length between the more distant components is depending on the conductor cross-section limited to 300 m.

6.3.4 DALI Bus Topology

A DALI Master can control a line with a maximum of 64 slaves consumming 2 mA each. 16 separate groups and 16 separate scenes can be allocated to each slave.

Additionally, up to 64 addresses for DALI sensors can be used. The actual possible number of sensors is determined by the following factors:

- Number of addresses per multi-sensor
- Power consumption of the sensor
- Bus performance

Note

Individual short address from HW 03
Since from HW 03 the DALI Multi-Master itself has a control device short address, up to 63 control devices can be connected to the DALI line.

For use with the DALI Multi-Master Module (753-647) are recommended max. 16 multi-sensors per module.

The topology of the DALI bus is not defined. Line, tree, star or mixed structures are possible. However, ring structures should be avoided.

The same installation regulations apply for both lighting equipments and power supply cables.
This also applies to the installation of special rooms (“harmonized installation regulations“).

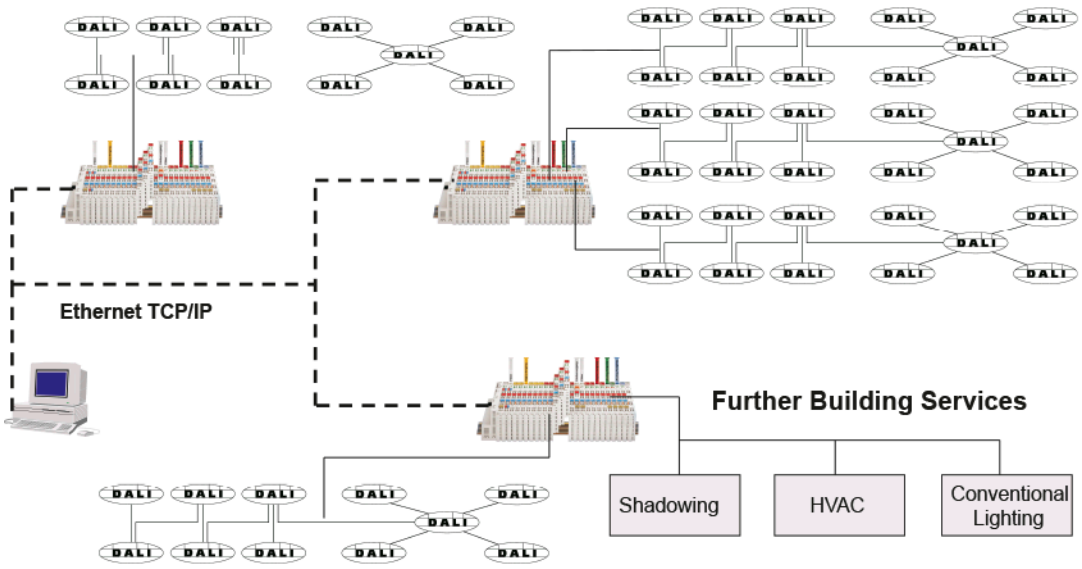

Figure 27: Example of DALI Topology

For operation with 2 DALI Multi-Master Modules (753-647) in one DALI line, the “Network Polling after Power On” parameter must be disabled for one of the two 753-647s. The same applies to the “Enable Internal Power Supply” parameter.

You disable these using the WAGO DALI configurator by unchecking the box next to the respective parameter.

To avoid collisions between data packets, you should also set the “Control gear polling interval [s]” with enabled cyclic control gear polling for both DALI Multi-Master Modules (753-647)!

Note

Change from HW03 / FW20
This restriction is no longer mandatory for the current hardware/firmware version or higher. 2 DALI Multi-Master Modules start now even if the parameter is enabled in both.

6.3.5 DALI-1 Compatibility

Because the DALI-1 standard was not subject to certification tests, electronic control gear (ECG) has hit the market that did not comply with the timing requirements of EN 62386. While the WAGO DALI-1 module was still allowed to make allowances for timing ranges beyond the defined limits in terms of firmware, and thus could be very tolerant for communication, this is no longer permitted in accordance with the new DALI-2 standard. With the introduction of the DALI-2 standard, the limits for permissible timing are now also being checked.

If you are using DALI ECGs with faulty timing behavior in your system, the new 753-647 module (distinguishable by the word “DALI-2” and the DALI-2 logo) can go into DALI-1 compatibility mode by downgrading the firmware when replacing the DALI Multi-Master Module (753-647). This firmware is available from WAGO Support on request.

Please note that in such case, the DALI-2 certification expires and must also be rendered unrecognizable on the I/O module (lettering and logo must be crossed out). In addition, it should be noted that the extended functionalities of DALI-2 controllers and control gear (e.g., extended fade times and manufacturer-specific operating modes) are no longer supported when downgrading.

7 Commissioning

7.1 Preparation

A prerequisite for the commissioning example described below is that you have correctly installed and set up the hardware for your fieldbus node and the DALI network and that these items all function properly.

In a fieldbus node, the system supply of the DALI Multi-Master Module (753-647) is implemented via the local bus. Either the DALI Multi-Master Module DC/DC converter (753-620) or the external power supply (787-2857) can be used for DALI bus supply of a DALI Multi-Master Module. Connection of the power supply is made as explained in the installation instructions (see section “Installation Notes”).

In the example given here, the fieldbus node consists of the following WAGO I/O System components:

Table 27: Example of a Fieldbus Node Setup

Item Number	Designation
750-881	Controller ETHERNET
753-620	DALI Multi-Master DC/DC Converter
753-647	DALI Multi-Master Module
750-600	End Module

- The DALI bus has been connected to the +DA/−DA connectors of the DALI Multi-Master Module and has at least one DALI ECG as a bus slave.
- The PC is linked to the fieldbus node via an RJ-45 network cable.
  The PC's network card must be set based on the address range for the fieldbus node.

As an alternative, connection can also be made via the fieldbus controller serial interface. Use the WAGO communication cable to set up a physical connection via the serial service port. This cable is supplied with the WAGO-I/O-*PRO* (Item No.: 759-333) programming software, or can be obtained as an accessory under Item No.: 750-920.

The WAGO DALI Configurator is required to start up the DALI Multi-Master Module and then configure the DALI network connected to the module.

Information

WAGO DALI Configurator
You can download the WAGO DALI Configurator as a stand-alone tool from the WAGO Internet site: www.wago.com.

Information

Additional information
More information on commissioning is available on the WAGO website at:
www.wago.com

7.2 Accessing the DALI Multi-Master Module

You can access the DALI Multi-Master Module (753-647) from the WAGO DALI Configurator.
A communication link must be set up via the IP address of the respective WAGO PLC connected at the fieldbus node to ensure proper data exchange with the DALI Multi-Master Module via the WAGO DALI Configurator. To set up the link, click the **[Settings]** button on the ribbon of the WAGO DALI Configurator directly.

7.3 Module Configuration Notes

In the WAGO DALI Configurator view for module configuration, you can perform general settings for the DALI Multi-Master Module. You can access this configuration area in the MODULE SETTINGS tab. In this tab, you can define specific settings for:

- Easy mode
- Full mode

You can also define general settings:

- Network polling after power ON
- Cyclic control gear polling
- Behavior in the event of faulty telegrams

In addition, the internal DALI network power supply can be disabled in the DALI Multi-Master Module in the MODULE SETTINGS tab to connect an external DALI network power supple (“Enable Internal Power Supply” checkbox).

You can press the **[Read]** button on the ribbon to read the settings of the DALI Multi-Master Module. You can press the **[Write]** button to write the settings made to the DALI Multi-Master Module.

7.4 “Construction Site Function” for Initial Startup

A helpful function when configuration a module for initial startup is the so-called “Construction Site Function”. To use this function, the DALI line must be supplied via the DALI Multi-Master Module.

Proceed as follows:

1. Select the “Central OFF” function in the WAGO DALI Configurator in the MODULE SETTINGS tab (“Behavior after Short Circuit” selection box).

2. To short-circuit the DALI bus, toggle a button between both DALI bus lines.
   - As long as the “System Failure Level” parameter value is greater than zero for the connected control gear (default value = 100 %), a short circuit of the DALI bus causes the lighting to switch ON.
   - If the short circuit lasts approx. 5 seconds (±2 seconds), the “OFF” command is sent as a broadcast after the short circuit and all control gear and lighting are switched OFF simultaneously.

7.5 Notes on Data Management

If online access to the devices on the bus is not possible, you can define virtual DALI devices as an initial step and match these to the actual installation online at a later time. Offline configuration of the entire DALI network, including control gear and control devices can be performed in a limited scope using the WAGO DALI Configurator. Device configurations can also be saved and restored, enabling a replaced device to be reconstructed using the values valid in the database. This enables you to copy device settings to a different device or to several ones.

7.6 Notes on RESET Commands

After some commands, some time must be given to DALI subscribers to complete an operation. For the “RESET” command, that is a time window of 350 ms according to the DIN EN IEC 62386 standard and for the “RESET MEMORY BANK (DTR0)” command, 10.1 s. No DALI telegrams can be sent to the DALI bus in that time.

7.7 Configuration of the DALI Network Using the WAGO DALI Configurator

The following steps are to be performed to configure the DALI Multi-Master Module and the DALI network linked with the module using the WAGO DALI Configurator:

1. Define addresses for the DALI devices
2. Configure DALI devices
3. Define DALI groups and scenes
4. Perform diagnosis

Information

More information about configuration using the WAGO DALI Configurator!

A detailed description of the software and the individual configuration steps using the WAGO DALI Configurator is given in the corresponding manual.
You can download the WAGO DALI Configurator manual from the WAGO Internet site at: www.wago.com.

8 Diagnostics

Color-coded LEDs A … H provide information about different statuses in the operation of the I/O module.

8.1 LED “A” Status Diagnosis

LED “A” provides information about statuses of the I/O module when it is operated in “easy mode”:

Table 28: LED “A” Status Diagnosis

Status	Explanation	Additional Information
Green	Easy mode is operating.	The I/O module is set to “easy mode” by default and also always returns to “easy mode” after a reset.
Green flashing	Easy mode being initialized.	
	A firmware update is being performed.	
	“Identification” function is enabled. *)	
Green-yellow flashing	No addressed devices were found; the configuration from the internal database could not be read.	As a result, the I/O module does not have a current configuration, and the function may therefore be limited.
Yellow	Addressed devices were found; no current configuration was read.	
Yellow flashing	No addressed ECGs were found; a current configuration is being read.	Sensors do not count as “addressed ECGs.” However, if the DALI line only contains sensors but no ECGs, the LED will flash yellow.
Yellow-red flashing	A firmware update is being initialized.	

*) See also Section “LEDs A-H Flashing Together”

8.2 LED “B” Status Diagnosis

Led “B” provides information about signal transmission (send):

Table 29: LED “B” Status Diagnosis

Status	Explanation	Additional Information
Off	No signal transmission present	No DALI signal transmission present
Green flashing	Transmission OK	Error-free DALI signal transmission (sending)
	“Identification” function is enabled. *)	
Yellow flashing	Transmission not OK	DALI telegrams could not be transmitted.

*) See also Section “LEDs A-H Flashing Together”

8.3 LED “C” Status Diagnosis

LED “C” provides information about the status of the local bus communication:

Table 30: LED “C” Status Diagnosis

Status	Explanation	Additional Information
Green	Uninterrupted local bus communication	
Green flashing	“Identification” function is enabled. *)	
Red	Local bus communication absent or interrupted	

*) See also Section “LEDs A-H Flashing Together”

8.4 LED “D” Status Diagnosis

LED “D” provides information about
- which button mode is enabled
- whether a firmware update is currently being initialized/performed
- whether there is an interruption in the 18 V power supply of the I/O module:

Table 31: LED “D” Status Diagnosis

Status	Explanation	Additional Information
Off	1-button mode is enabled.	Only in “easy mode”; the WAGO DALI Configurator is used to switch between 1-button and 2-button mode – see also section “Dim in 1- and 2-Button Mode.”
Green	2-button mode is enabled.	
Green flashing	“Identification” function is enabled. *)	
Red	The 18 V power supply of the I/O module is interrupted.	The internal power supply is enabled, i.e. the “Enable Internal Power Supply” box is checked (see also section “Module Configuration Notes”), but the 18 V I/O module is not present.

*) See also Section “LEDs A-H Flashing Together”

8.5 LED “E” Status Diagnosis

LED “E” provides information about statuses of the I/O module when it is operated in “full mode”:

Table 32: LED “E” Status Diagnosis

Status	Explanation	Additional Information
Green	Full mode is operating.	“Full mode” can be switched on via PLC modules.
Green flashing	Full mode is being initialized.	
	“Identification” function is enabled. *)	
Yellow	No addressed devices were found, and the configuration could not be read from the internal database.	As a result, the I/O module does not have a current configuration; the function may therefore be limited.
Yellow flashing	No addressed ECGs are found.	Sensors do not count as “addressed ECGs.” However, if the DALI line only contains sensors but no ECGs, the LED will flash yellow.

*) See also Section “LEDs A-H Flashing Together”

8.6 LED “F” Status Diagnosis

Led “F” provides information about signal transmission (receive):

Table 33: LED “F” Status Diagnosis

Status	Explanation	Additional Information
Off	No signal transmission present	No DALI signal transmission
Green flashing	Receipt OK	Receipt of the DALI signals is error-free.
	“Identification” function is enabled. *)	
Yellow flashing	Receipt not OK (faulty signal transmission)	Signal transmission occurs, but frames may be incorrect upon receipt of the DALI telegram signals.

*) See also Section “LEDs A-H Flashing Together”

8.7 LED “G” Status Diagnosis

LED “G” provides information about whether the power supply of the DALI line and I/O module is present and whether it is provided

- via a WAGO power supply (see section “I/O Module Power Supply”) of the I/O module or
- via an external power supply (third-party product):

Table 34: LED “G” Status Diagnosis

Status	Explanation	Additional Information
Green	The DALI line is powered by internal voltage, i.e. by a WAGO power supply via the I/O module.	The I/O module is powered correctly, and voltage is present on the DALI line.
Green flashing	“Identification” function is enabled. *)	
Yellow	The DALI line is powered by external voltage.	The I/O module is supplied with 18 V; the internal power supply is not enabled, i.e. the “Enable Internal Power Supply” box is unchecked (see also section “Module Configuration Notes”).
Red	No power supply is present on the DALI line.	The DALI power supply is not connected, or there is a short circuit on the DALI line. Observe LED “H” as well.

*) See also Section “LEDs A-H Flashing Together”

8.8 LED “H” Status Diagnosis

LED “H” provides information about

- whether the latching relay function is enabled,
- where there is a short circuit of the DALI power supply:

Table 35: LED “H” Status Diagnosis

Status	Explanation	Additional Information
Off	Latching relay function is switched off.	Only in “easy mode.” The WAGO DALI Configurator is used to switch to the latching relay mode; see section “Latching Relay Function.”
Green	Latching relay function is switched on.	
Green flashing	“Identification” function is enabled. *)	
Red	There is a short circuit on the DALI line.	The 18 V power supply of the I/O module is present, the internal power supply is enabled and the DALI voltage is not present.

*) See also Section “LEDs A-H Flashing Together”

Note

Short circuit detection only with WAGO power supply

A short circuit on the DALI line is only detected if the 18 V power is supplied via a WAGO power supply (item no.: 787-2857 or item no. 753-620).

For this purpose, the “Enable Internal Power Supply” box must be checked (see section “Module Configuration Notes”).

If an external DALI power supply is used, it is not possible to distinguish between “short circuit” and “voltage not present.”

8.9 LEDs A-H Flashing Together

With DALI-2, HW 03/FW 20 or higher, the “Identification” function can be used in which all display elements of the DALI Multi-Master Module flash green for approx. 10 sec. This “Wink Function” can be used to identify the affected module in the node.

9 Appendix

9.1 Device Types

The following Device Types are supported by the DALI Multi-Master Module:

Table 36: DALI Device Types

Icon	Function	Icon/type		Label
	Control Gear (ECG)		0	Standard ECG
			1	Separate emergency lighting
			2	Discharge lamp
			3	Low voltage halogen lamp
			4	Filament lamp
			5	Converting the digital signal into a DC voltage
			6	LED lamp
			7	Switching function
			8	Color control device
			9	Sequencer

The DALI Multi-Master Module with FW 20 or higher also supports the following DALI-2 device types:

Table 37: DALI Device Types as of DALI-2

Icon	Function	Icon/Type		Label
	Control gear (ECG)		0	Fluorescent light (standard ECG)
			1	Separate emergency lighting
			2	Discharge lamp
			3	Low voltage halogen lamp
			4	Filament lamp
			5	Converting the digital signal into a DC voltage
			6	LED lamp
			7	Switching function
			8	Color control device
			9	Sequencer
			15	Load referencing
			16	Thermal gear protection
			17	Dimming curve selection
			19	Centrally supplied emergency operation
			20	Load shedding
			21	Thermal lamp protection
			23	Non-replaceable light source
			49	Integrated Bus Power Supply
		OEM	50	Memory Bank 1 Extension
			51	Energy Reporting
			52	Diagnostics and Maintenance

Table 37: DALI Device Types as of DALI-2

Icon	Function	Icon/Type		Label
	Control gear (ECG)		250	Error message: duplicate address or undefined response. *)
		[List of all recognized device types]	255	Multiple device types are supported.
	Sensors		0	Universal input
			1	Button
			2	Absolute input
			3	Presence detector
			4	Light sensor
		[+ device type]		Error message: duplicate address or undefined response. *)
	Sensor type 1: Light sensor			MSensor – Brightness sensor function
	Sensor type 1: Presence detector			MSensor – Presence detection function
	Sensor type 1: Button			Button
	Sensor type 1: Error message	[+ device type]		*Error message: duplicate address or undefined response.* *)
	Sensor type 2: Light sensor			MSensor – Brightness sensor function
	Sensor type 2: Presence detector			MSensor – Presence detection function
	Sensor type 2: Remote control			MSensor – Remote control
	Sensor type 2: Button			Button
	Sensor type 2: Error message	[+ device type]		*Error message: duplicate address or undefined response.* *)

*) Procedure for resolving duplicate addresses: See section “DIAGNOSTICS Tab.”

Glossary

A

Auto-Replace Function

In the event that exactly one device is defective and is replaced by an unaddressed device, the “Replace” function automatically assigns the old short address of the previous device to the new device and subsequently restores the settings for the device using the data stored in the I/O module database.

C

Control Gear

Control gears are found in DALI networks as one or more components between the power supply and one or more lamps. They are used to supply power to the lighting and for their DALI communication. The control gears provide the switch-on voltage and warm-up current for the lamps to prevent a cold start, thus enhancing the power factor and reducing electromagnetic interference.

→ *See “ECG.”*

Control Device

“Control Device” is the IEC designation for the device and includes both the DALI (Multi)-Master Module and the active sensors.

D

DALI (**D**igital **A**ddressable **L**ighting **I**nterface)

“DALI” is a protocol for control of lighting control gears in building automation, such as power supplies (“electronic transformers”), electronic control gears (ECGs) and electronic dimmers.

The individual specifications are described in the IEC 62386 series of standards.

→ *See also: “IEC 62386.”*

DALI-2 (**D**igital **A**ddressable **L**ighting **I**nterface Edition **2**)

DALI-2 is a further development of the IEC 62386 series of standards that adapts the structure of the individual parts of the standards, distinguishes between the electrical and functional requirements on the control gears and sets the requirements on the sensors in order to achieve a higher level of interoperability for backwards compatibility with existing DALI installations.

DALI Short Address

Each device with a DALI interface is addressed in the network using a DALI short address. For some multifunction devices, such as the multi-sensors, each individual function (brightness, presence, remote control) can be

assigned a dedicated DALI short address, enabling the function to be addressed individually.

E

Easy Mode

In “Easy” mode, attached DALI devices are represented in binary form with two bits each on the process image. These two bits correspond to the button functions (ON/OFF, DIMMING) and are implemented in the DALI Multi-Master Module (753-647). The status is queried in cycles.
“Easy” mode is implemented via modules in the firmware.

→ *See also “Full Mode.”*

ECG (Electronic Control Gear)

→ *See “Control Gear.”*

F

Full Mode

In “Full” mode, switching commands are specified by a higher-order control system via a PLC application.
Transmission within the I/O module takes place via the module-internal mailbox. Querying of process data is acyclic.
“Full” mode is implemented by modules in WAGO-I/O-*PRO*.

→ *See also “Easy Mode.”*

I

IEC 62386

“IEC 62386” (“Digitally addressable interface for lighting”; German version DIN EN 62386: “Digital adressierbare Schnittstelle für die Beleuchtung”) is a series of standards that defines details specific to DALI. The series of standards is being revised by the IEC SC 34C subcommittee and contains the following parts (version of 2018):

- 101: System
- 102: Control gears
- 103: Control devices
- 201 to 224: Device types 0–23:

- 201: Device type 0: Fluorescent lamps
- 202: Device type 1: Emergency lighting with individual battery
- 203: Device type 2: Discharge lamps
- 204: Device type 3: Low-voltage halogen lamps,
- 205: Device type 4: Incandescent lamp dimmers
- 206: Device type 5: Conversion of the digital input signal to DC
- 207: Device type 6: LED modules
- 208: Device type 7: Switching function
- 209: Device type 8: Color control
- 210: Device type 9: Sequencers

- 216: Device type 15: Load referencing
- 217: Device type 16: Thermal gear protection
- 218: Device type 17: Dimming curve selection
- 220: Device type 19: Centrally-supplied emergency operation
- 221: Device type 20: Load shedding
- 222: Device type 21: Thermal lamp protection
- 224: Device type 23: Integrated light source

• 301 to 304: Input devices:

- 301: Push buttons
- 302: Absolute input devices
- 303: Occupancy sensors
- 304: Light sensors

M

Multi-Master

In a “multi-master,” control of the intelligent measuring and automation devices on the fieldbus is performed locally, in contrast to a master/slave system.
The WAGO DALI Multi-Master Module (753-647) is a multi-master that supports the DALI interface and can utilize this interface together with other master devices.

R

Random Address

The “random address” (or “search address”) is a 24-bit address generated by an ECG during initialization.

S

Single Master

In contrast to a multi-master, a “single master” does not support collision detection and is not suitable for connection at the same interface with other masters.

Settling Time

The “settling time” is the minimum time period between two frames.

V

Virtual Group

A DALI group is a logical combination of devices to which a common group address is assigned so that these devices execute a common function synchronously. These devices do not necessarily have to be physically linked (e.g., the group for all emergency lighting systems, all hallway lights etc.).
In case the 16 available group addresses (0 ... 15) are not sufficient

because further groups are required, an additional 16 virtual groups can be created (with group addresses 17 ... 31). These groups cannot, however, be addressed via a DALI group command, but only one after the other by individual commands from the DALI Multi-Master Module (753-647). A maximum of eight devices may be assigned to each virtual group in order not slow down or impede DALI data exchange on the bus.

List of Figures

List of Tables

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