

Translation of the German Original User Manual



## SAFEMASTER W

User Manual  
Wireless Safety System  
Radio controlled safety module UH 6900



**SAFEMASTER W**

Enter the Wireless Safety Systems' identity code here and the used radio frequency:

Identity code: \_\_\_\_\_  
 System code: \_\_\_\_\_  
 Device code device 1 (target device code at device 2): \_\_\_\_\_  
 Target device code device 1 (device code at device 2): \_\_\_\_\_  
 Selected frequency: ..... Channel: \_\_\_\_\_  
 Alternative frequency: ..... Channel: \_\_\_\_\_  
 Alternative frequency: ..... Channel: \_\_\_\_\_

It is in the responsibility of the manufacturer of the equipment or machine to ensure its function in general. DOLD does not accept any liability for the recommendations made or implied in this manual. Also, no additional guarantee, warranty, or liability claims beyond those included in our delivery and payment terms can be derived from this.

13	23	33		O4	O5	O6	O7
S11	S22	S24	S13	F0	F1	F2	F4
A1+	S12	S14	A2	I IR		A3+	48

☐ I IR  
☐ O IR  
☐ quali 25%

☐ RUN 1  
☐ RUN 2  
☐ K1  
☐ K2  
☐ 48  
☐ 58

☐ S12  
☐ S14  
☐ S22  
☐ S24  
☐ S32  
☐ S34  
☐ S42

☐ RST  
☐ SST  
☐ RNA  
☐ SNA  
☐ Q4  
☐ Q3  
☐ Q2  
☐ Q1

☐ O0  
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☐ F4  
☐ F5  
☐ F6  
☐ F7

UH6900  
 0067213

	Y2	Y1	S42	O IR	Q25		S8
S31	S32	S34	S33	F4	F5	F6	F7
14	24	34		O0	O1	O2	O3

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## 1 Important Notes

This manual is for your safety and for the safety of the plant operators. Read this manual carefully before you install or commission the SAFEMASTER W system and use it when working on the protected machine or equipment.

If you encounter technical problems, please contact our customer service at:

Tel: +49 77 23 / 654-0

Fax: +49 77 23 / 654-356

e-mail: [dold-relays@dold.com](mailto:dold-relays@dold.com)

### 1.1 General safety instructions



- **SAFEMASTER W must only be installed and set up by authorized and skilled personnel**
  - that is familiar with the correct and proper handling of safety components,
  - that is familiar with the relevant regulations and standards for safety at work and accident prevention and has read and understood this user manual.
  - that is familiar with the applicable regulations for the installation of radio systems.
- **The operator must be adequately trained and authorized to operate the machine.**
- **A visible emergency stop button must always be functional.**

In some operating modes, one of the two modules is temporarily not functional, therefore precautions must be taken to ensure that any emergency stop devices connected there are not visible.
- **The operator must have a clear overview of the hazard zone at all times.**

If the operator's direct view on the relevant equipment or plant parts is restricted in any way, for example the view on the access to the machine, on the drilling/milling head, etc., that is, if such areas cannot be seen from all operator positions, we recommend the installation of an additional position indicator, for example a light curtain. Then, zones with a good overview can be defined as start zones. The application can be started from within these zones only.
- **The operator must be able to switch off the machine all the time**

While starting the machine or during operation the operator must always be able to reach the emergency stop button.
- **Restarting the machine**

After the machine was shut down by the safety function of the wireless SAFEMASTER W safety system, the machine must not be restarted by resetting the start button before the reason for the shut-down is detected and the problem solved.
- **If more than one wireless systems are used at the same location**, the different systems must be set up for different radio frequencies. There must be at least one blank channel between two active ones (for example, use channels 5, 7, 9, etc.).
- **The equipment must be handled with care and be checked in regular intervals, depending on the usage and as necessary.**

You, as the installer of the machine or plant, must make clear reference to these safety instructions in the relevant operating manual.
- **After programming, configuration or parameterization, the safety function must be checked.**

If secondary equipment is supplied, the extended safety regulations for secondary equipment shall also apply in addition to the general safety regulations.

## 1.2 Extended safety requirements for secondary devices

Each device is identified by an ident code stored in the unit. This ident code is programmed by E. Dold & Söhne KG and cannot be changed by the customer.

On customers request identical devices can be delivered.

For devices with identical ident code the following extended safety rules must be observed:



- **Simultaneous use of secondary devices can result in life-threatening hazards.**
- **Replacement devices**  
If radio-controlled safety modules with identical (already assigned) ident code are delivered for replacement purposes, these devices should be kept under lock and key. Before commissioning a replacement device, the device to be replaced must be permanently decommissioned.
- **Secondary devices in a system**  
If there is a secondary device in a system, measures must be implemented to ensure that the simultaneous use of two or more radio-controlled safety modules with identical ident code is impossible. It must be guaranteed that only one device is supplied with electrical power at any given time.
- **Secondary devices in two or more systems**  
If the secondary device is in another system, the systems must be far enough apart to ensure that a radio link between the two systems can be permanently ruled out. Furthermore, measures must be implemented to prevent the devices coming together.
- **Risk of mix-up**  
Non-active emergency stop devices shall not be mixed up with active emergency stop devices. If there is a secondary device in a system, measures must be implemented to prevent mix-ups.  
The emergency stop devices must always be able to be uniquely assigned.



### 1.3 Regulatory Information for devices in the US industry

E. Dold & Soehne GmbH & Co. KG  
UH6900



FCC ID: 2A3XQUH6900

DOLD article numbers: 0069358, 0069359, 0069362, 0069363, 0069366, 0069367

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: Devices with FCC approval do not have CE approval since the frequencies used do not comply with the radio equipment directive 2014/53/EU (RED) guidelines and vice versa.

NOTE: Changes or modifications made to this equipment not expressly approved by E. Dold & Söhne GmbH & Co. KG may void the FCC authorization to operate this equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**NOTE: Radiofrequency radiation exposure Information:**

The radiated output power of the device is far below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

NOTE: Use of other accessories listed in this operation instructions may void the FCC authorization to operate this equipment.

NOTE: Professional Installation only

### 1.4 Disposal

Do not dispose of household garbage!

The device must be disposed of in compliance with nationally applicable rules and requirements.



## 2 Quick guide

A brief overview of the system and instructions for the initial set-up procedure in just a few steps using a simple example configuration.

### 2.1 Components list

In the delivery, you will receive:

- 2 or more UH 6900 modules,
- 2 antennas with connection adapters or connection cables,
- 1 CD with SAFEMASTER W Manager software, handbook, and license key,
- Any separate accessories (e.g. light barrier)

### 2.2 Configuration at delivery

Depending on the intended use of the modules, they are delivered in one of the following configurations.

#### **Bidirectional mode**

System with 2 identical modules UH 6900

- Device variant: MF
- Operating mode: Complete safety mode (rotary switch A=0, rotary switch B=0)
- Radio mode: paired operation
- Device name: not yet assigned
- Radio channel: channel 05, 433.200 MHz or 869.8125 MHz, (EU)  
912.000 MHz (USA)
- Transmission power: 0 dBm (EU)  
-7.5 dBm (USA)

#### **Unidirectional mode**

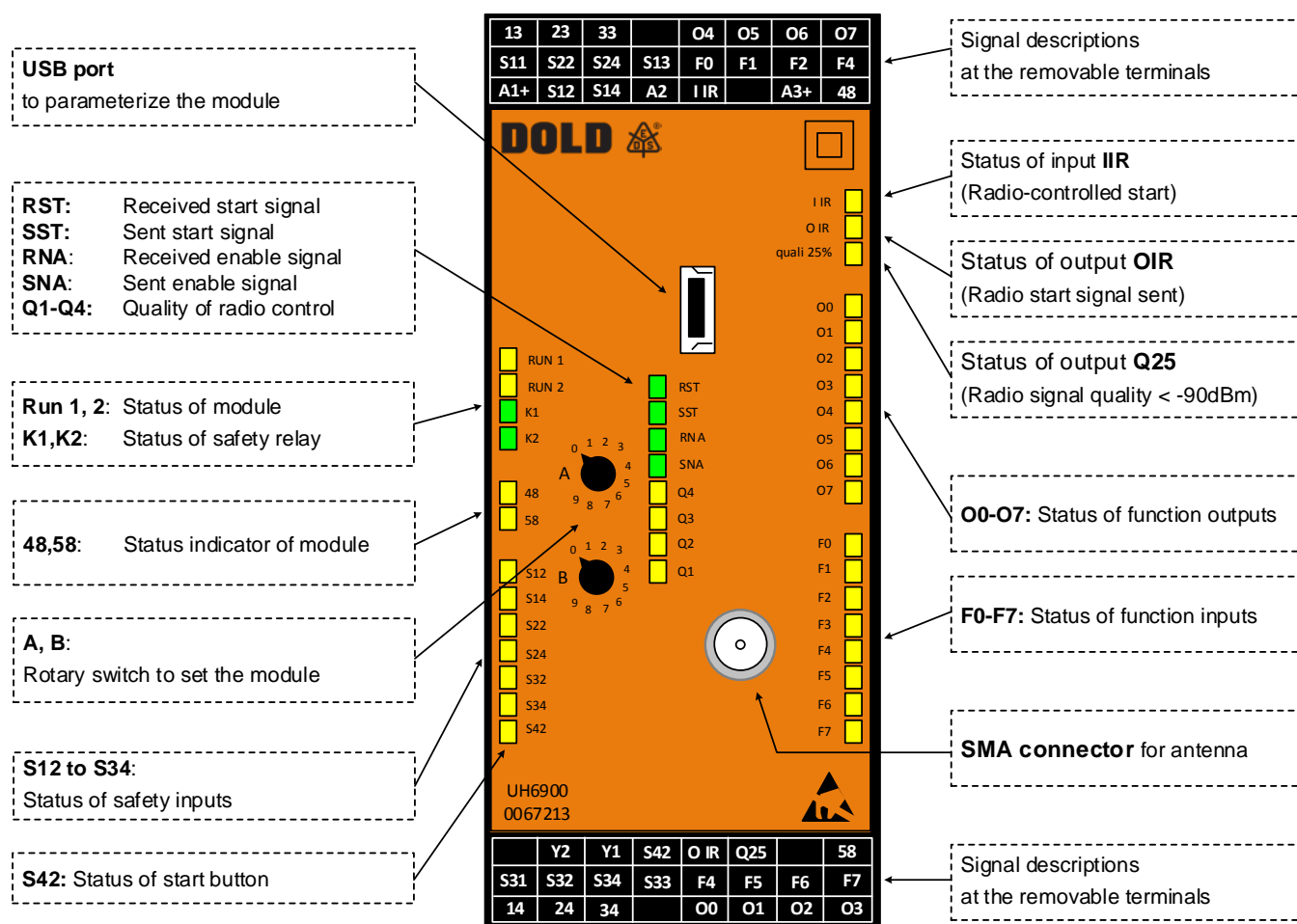
Systems with one group controller and several group receivers

- Device variant: Group controller (GC) / group receivers (GR)
- Operating mode: Cross operation for controller (rotary switch A=2, rotary switch B=0)  
Switchable radio mode for receivers (A=6, B=0)
- Radio mode: Group control for controller  
Group reception for receivers
- Device name: not yet assigned
- Radio channel: channel 05, 433.200 MHz or 869.8125 MHz, (EU)  
912.000 MHz (USA)
- Transmission power: 0 dBm (EU)  
-7.5 dBm (USA)

These configurations must be adapted later according to the desired system installation by means of the supplied software / the rotary switches on the front side of the modules.

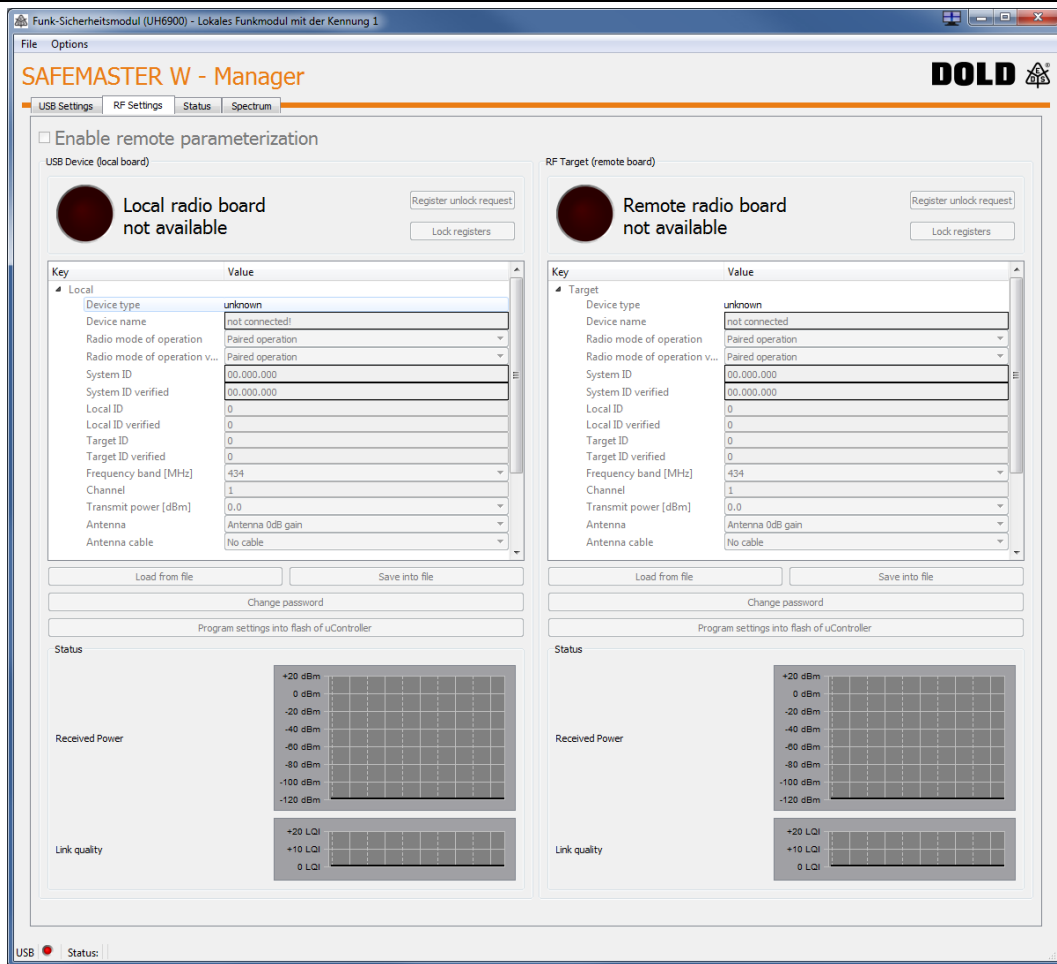
The identification numbers (system ID, radio mode, device ID, target device ID) are already assigned.

## 2.3 Front view UH 6900



## 2.4 Installation of SAFEMASTER W Manager

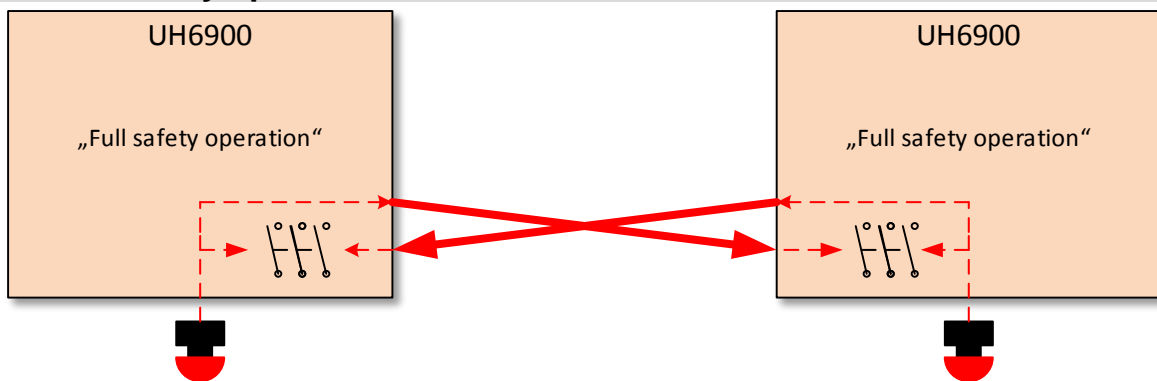
- Insert the included CD and install the SAFEMASTER W Manager on your PC (Windows operating system). The installation will start automatically, or you can also call up the setup file manually.
- A program folder will be created on your PC, and the program will be added to the start menu.
- Start the SAFEMASTER W Manager and enter the license key, which is found in a text file on the CD. Then the program will be ready for operation.



## 2.5 Bidirectional mode (device variant MF)

The modules always work in pairs using bidirectional safety radio transmission. In general, there are three different operating modes available.

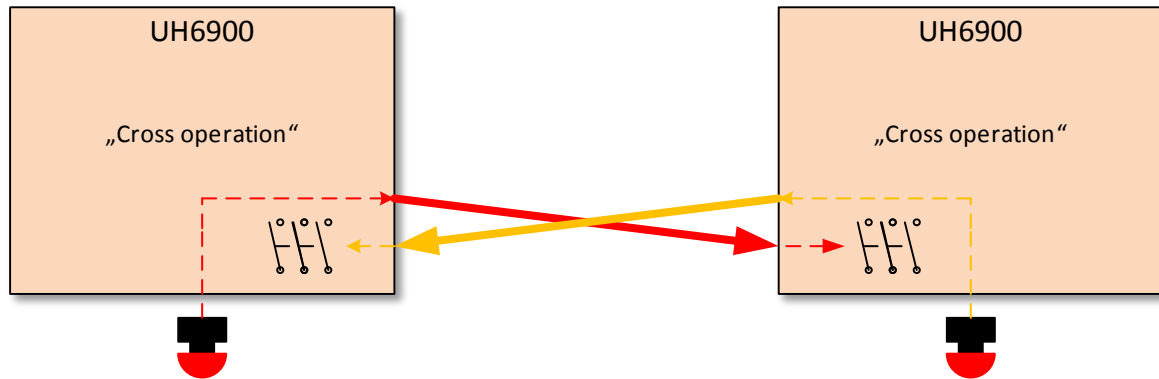
### 2.5.1 Full safety operation



- One safety circuit
- Safety inputs influence the local and remote controlled safety output
- Configurable start options:
  - Manual, automatic, two-handed, additional IR enable signal

see [chapter 6.4.1 Operating mode: 'Full safety operation'](#)

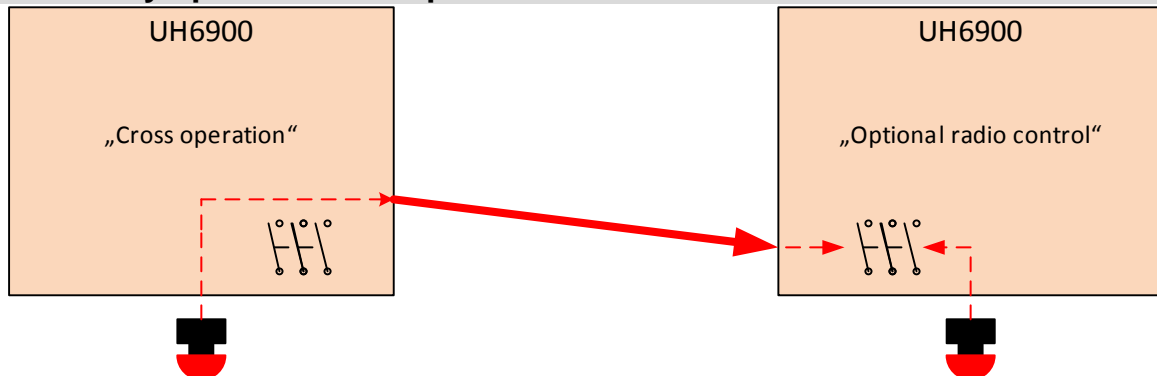
## 2.5.2 Cross operation



- Two independent safety circuits
- Safety inputs influence the remote controlled safety output
- Configurable start options:
  - Manual, automatic, two-handed, additional IR enable signal

see [chapter 6.4.2 Operating mode: 'Cross operation'](#)

## 2.5.3 Safety operation with optional radio control

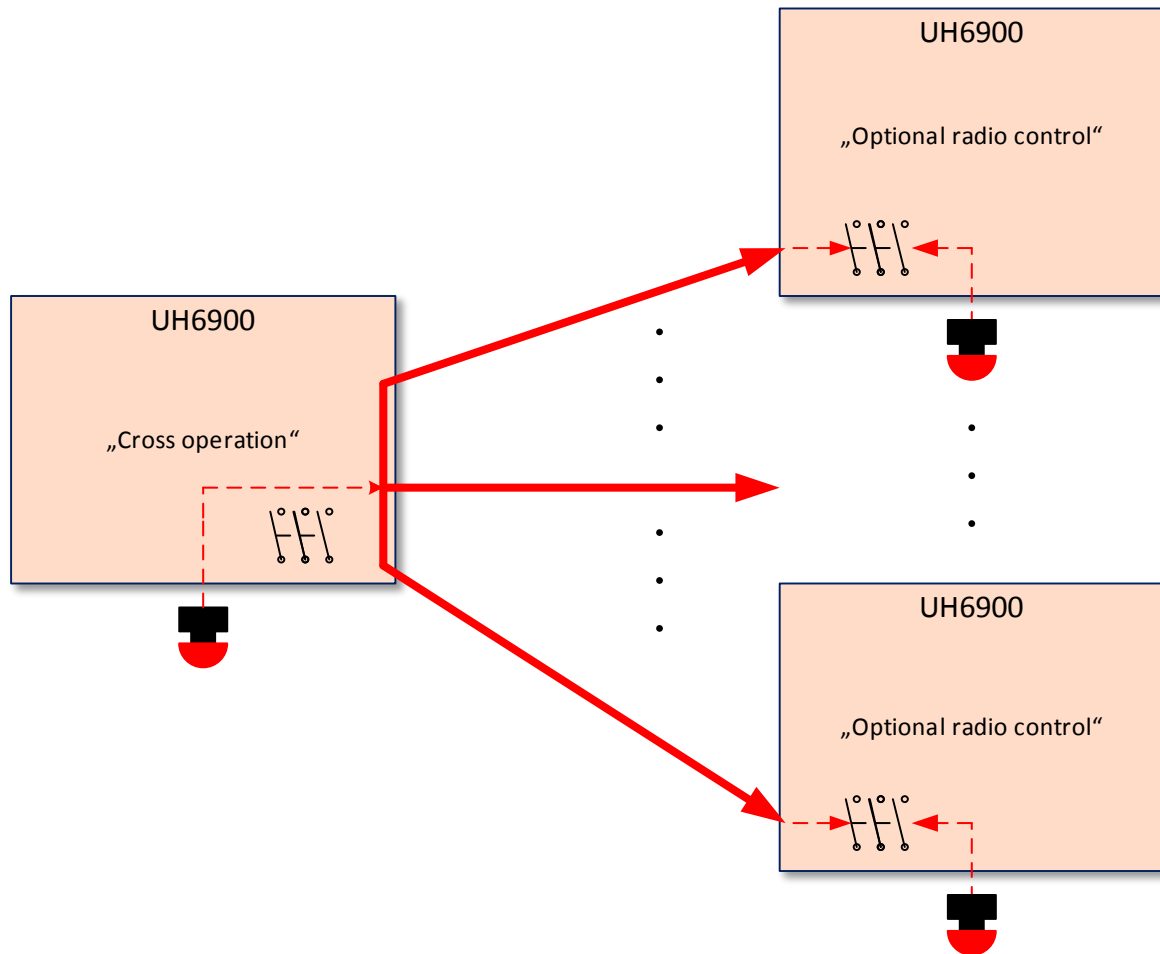


- One safety circuit
- One modulator unit and one receiver unit
- Safety inputs influence safety output on the receiver unit
- Modulator unit connectable with activated safety output
- Configurable start options:
  - Manual, automatic, two-handed, additional IR enable signal

see [chapter 6.4.3 'Safety operation with optional radio control' mode of operation](#)

**2.6 Unidirectional mode (device variant GC/GR)**

The device variant (GC) always works as controller and controls several receivers via a unidirectional safety radio transmission. There is only one controller within a group.

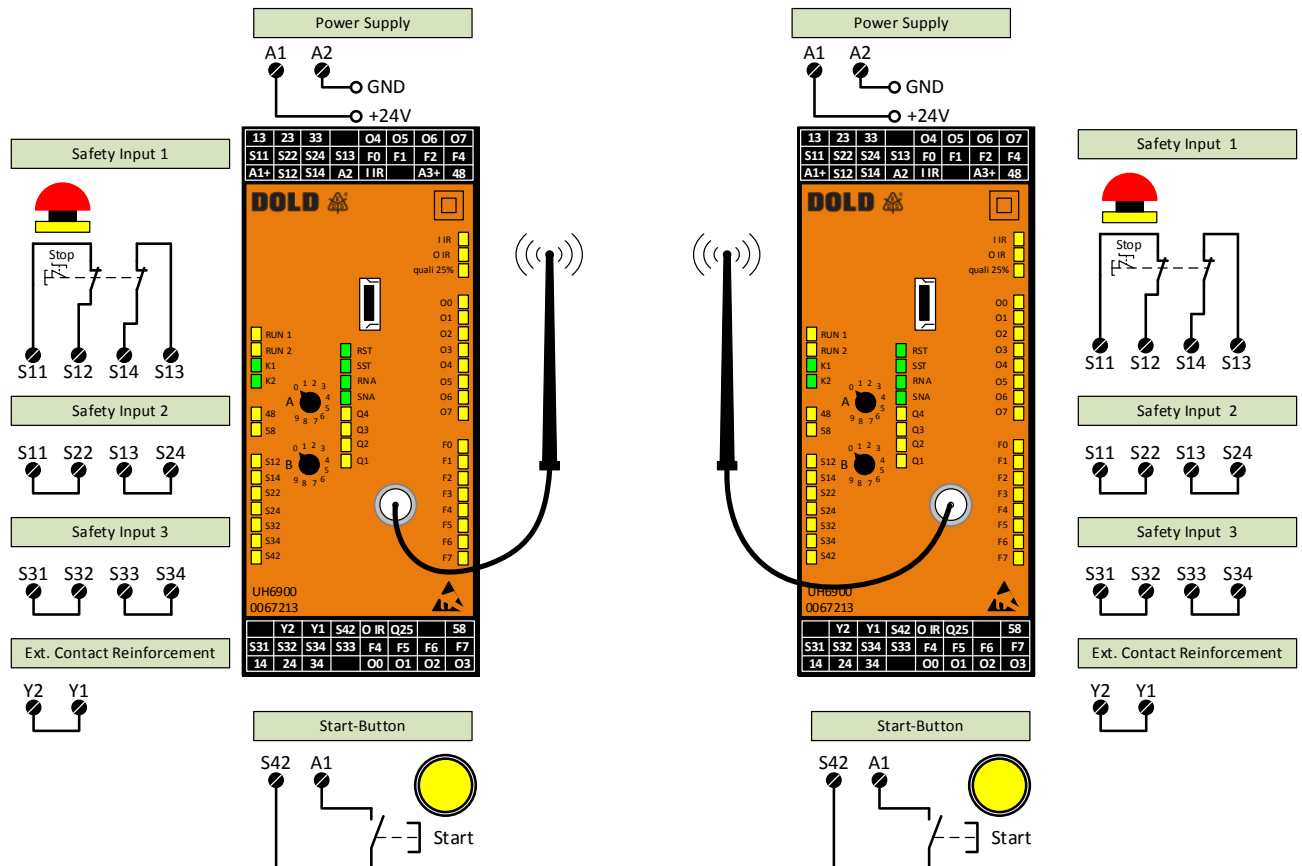


- One safety circuit
- One controller and several receivers
- Safety inputs of the controller affect the safety outputs of all receivers
- Start options adjustable:
  - Manual, automatic, two-hand, additional IR release signal

see [6.6.2 Group mode \(device variants GC and GR\)](#)

## 2.7 Device connection for bidirectional operating mode

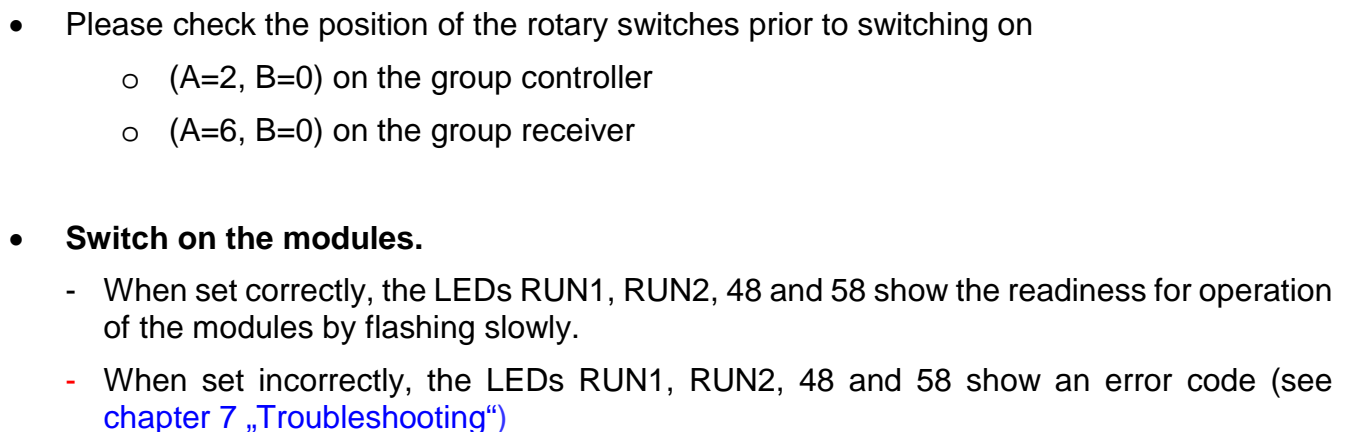
- For the initial start-up procedure, at least the voltage supply (A1, A2), 1 safety transmitter, a start signal transmitter, the Y1, Y2 bridge and the antenna must be connected. The unused safety inputs 2 and 3 must be bridged.



- Before switching on, please check the position of the rotary switch (A=0, B=0).
- Switch the module on.**
  - If the setting is correct, the LEDs RUN1, RUN2, 48, and 58 will flash slowly to indicate that the module is ready for operation.
  - If the setting is incorrect, the LEDs RUN1, RUN2, 48 and 58 will issue an error code (see [chapter 7 „Troubleshooting“](#))

Remark: An exact description of wiring and connection options is provided in [chapter 5.5 „Terminal connections of the radio-controlled safety module“](#) and [chapter 6.3 „Wiring and connection options“](#)

- For the initial commissioning, at least the controller (GC) and one receiver (GR) must be used.
- On the controller, the voltage supply (A1,A2), 1 safety sensor, one start signal sensor, the Y1,Y2 link and the antenna must be connected. The unused safety inputs 2 and 3 are bridged.
- On the receiver, the voltage supply (A1,A2) 1 safety sensor, one start signal sensor (optional), the Y1,Y2 link and the antenna must be connected. The unused safety input 2 is bridged, safety input 3 must be open.



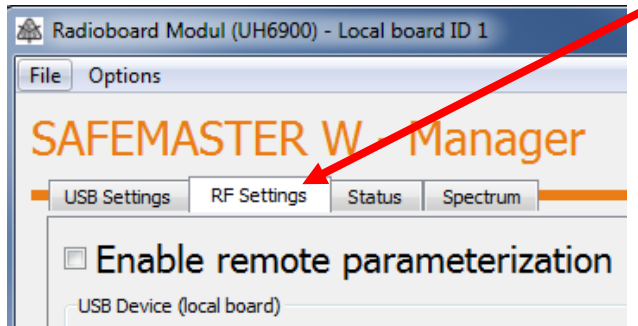
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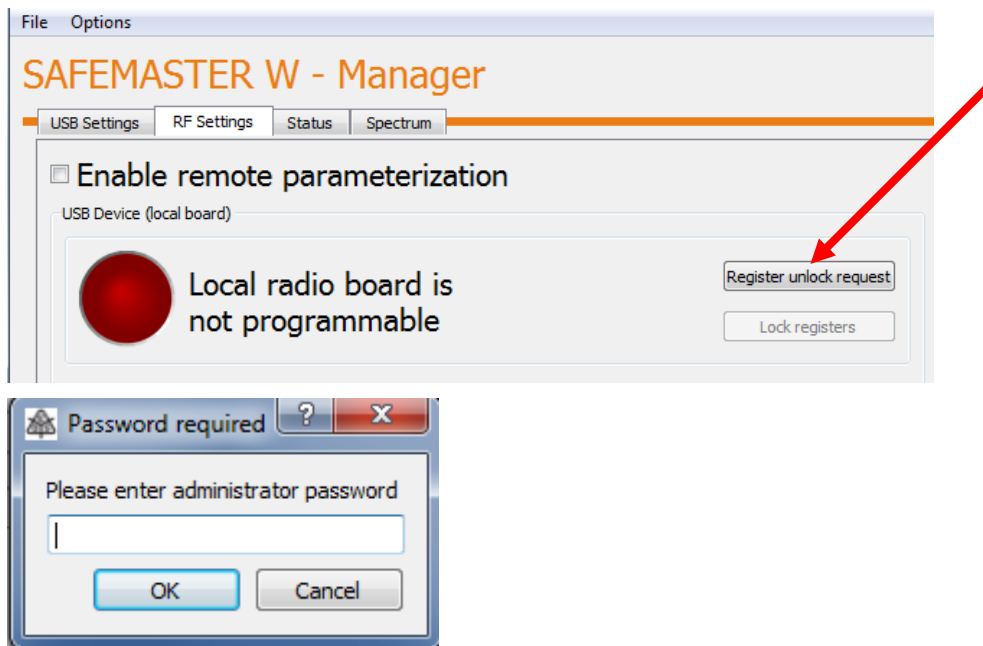


## 2.9 Parameterisation

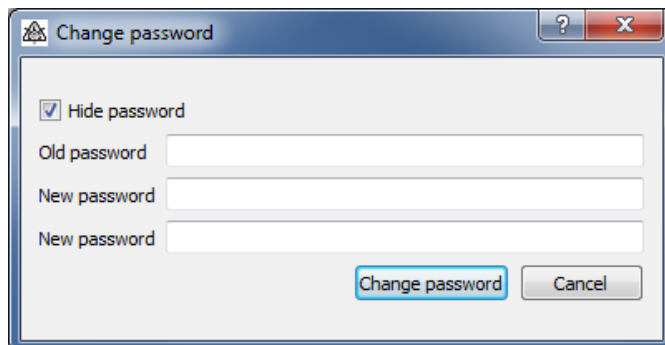
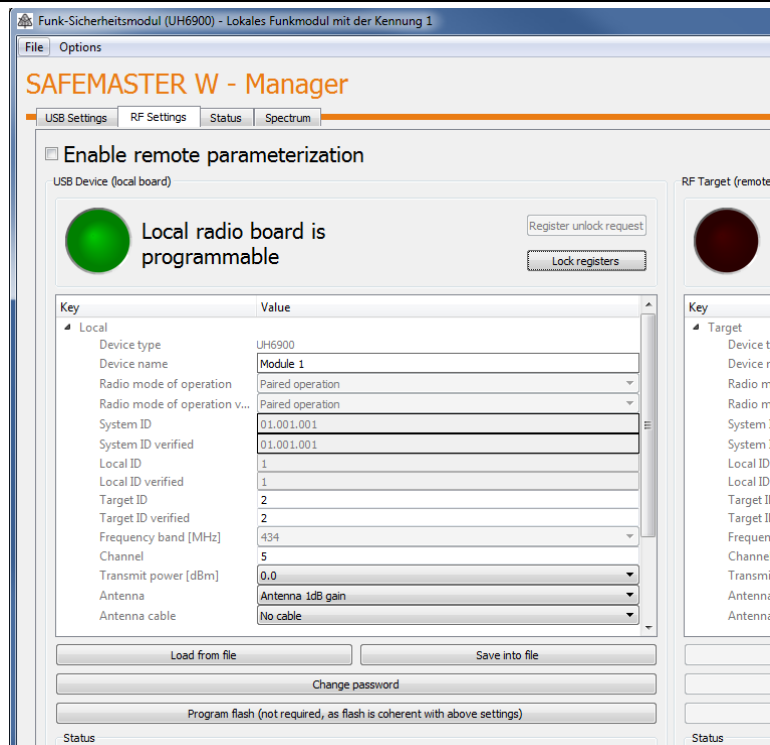
- Connect both UH 6900 modules at the same time or in succession to your PC via USB to complete parameterization.
- For simultaneous parameterization, the SAFEMASTER W Manager can be started twice so that you can access both devices in parallel.
- If there is already a radio connection, it is possible to access both modules with one instance of SAFEMASTER W Manager.
- Select the tab “RF settings”



- Open the tab and enter the password.  
The standard password upon delivery is “0000.”



**Remark:** It is best to change the password immediately to ensure that only authorized personnel can change the parameters.

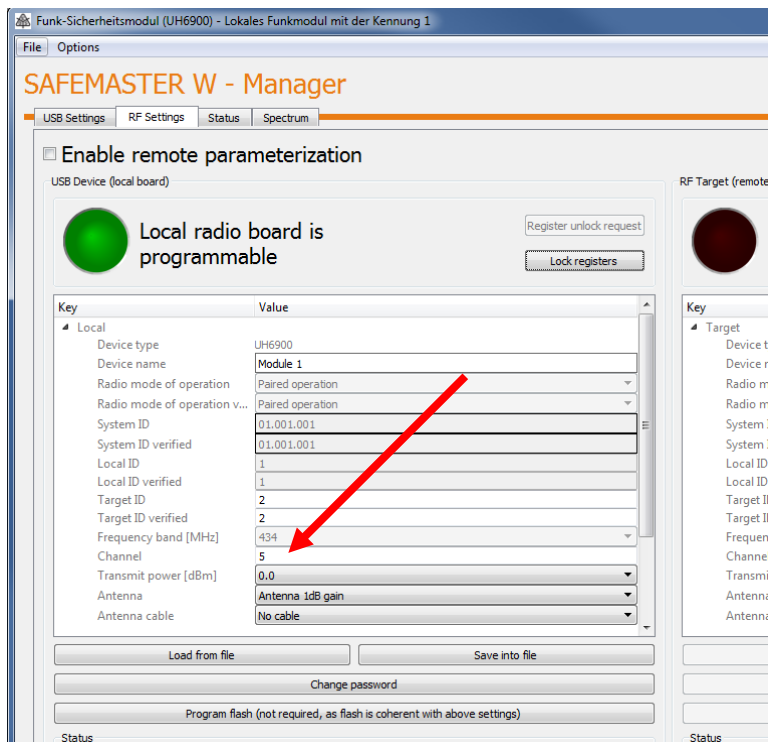


- After opening the tab, you can change the device name, frequency channel, and transmission power.
- The radio mode “paired mode” is shown for devices for bidirectional mode. Either the radio mode “group control” or “group reception” is shown for devices for unidirectional mode.

### 2.9.1 Frequency channel

The modules can only communicate with one another if they are both set to the same channel, if they emit sufficient transmission power, and if they are not disrupted by other devices transmitting on the same channel.

- Therefore, it is necessary to prepare a frequency plan for the entire system in order to avoid mutual disturbances by devices.
- Channel 5 is set at delivery. Change this channel according to your specifications. Permitted values are 1..64 in the 433 MHz range, 1..12 in the 869 MHz range and 1..128 in the 915 MHz range.



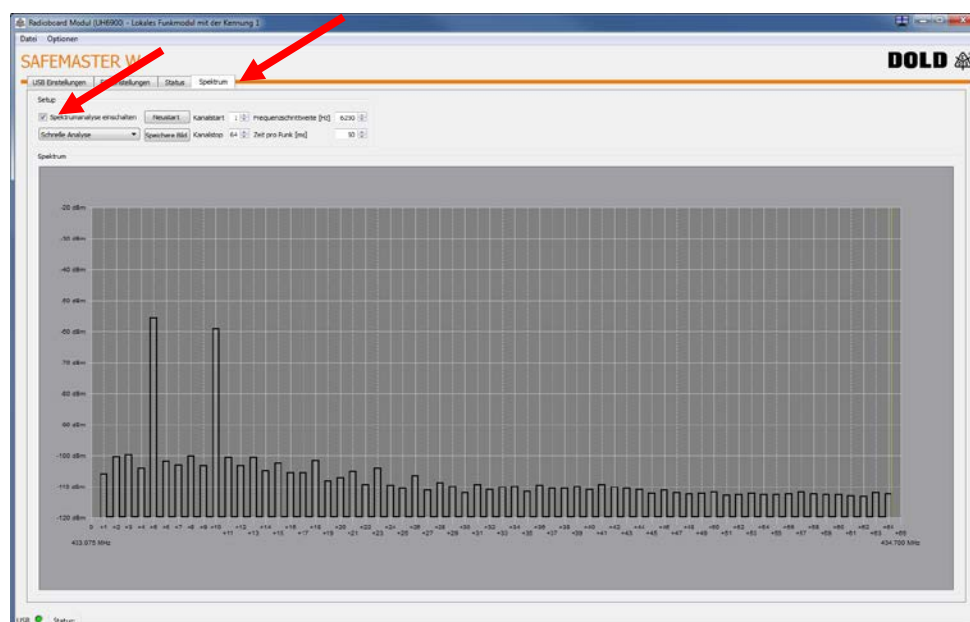
## 2.9.2 Integrated spectrum analyzer

You can use the integrated frequency analyzer to quickly check the set channels and frequencies in your system environment. It will go through all channels in the frequency range and measure the received power. This allows you to very easily determine which channels are already in use.

However, this measurement in no way replaces an exact frequency plan of your system.

- Select the spectrum analyzer by switching to the “Spectrum” tab.
- Turn on the spectrum analysis.  
It will take approximately 50 seconds to go through all 64 channels.

The example shows one transmitter on channel 5 and another on channel 10.

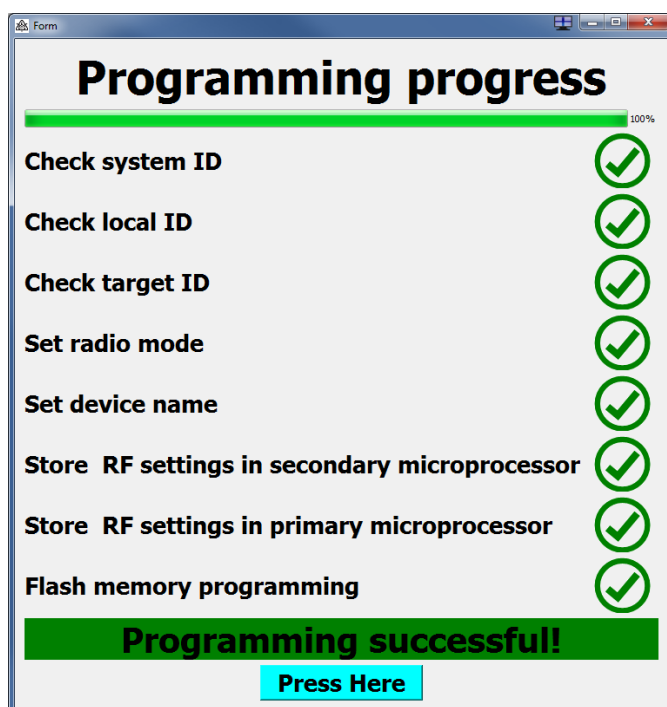
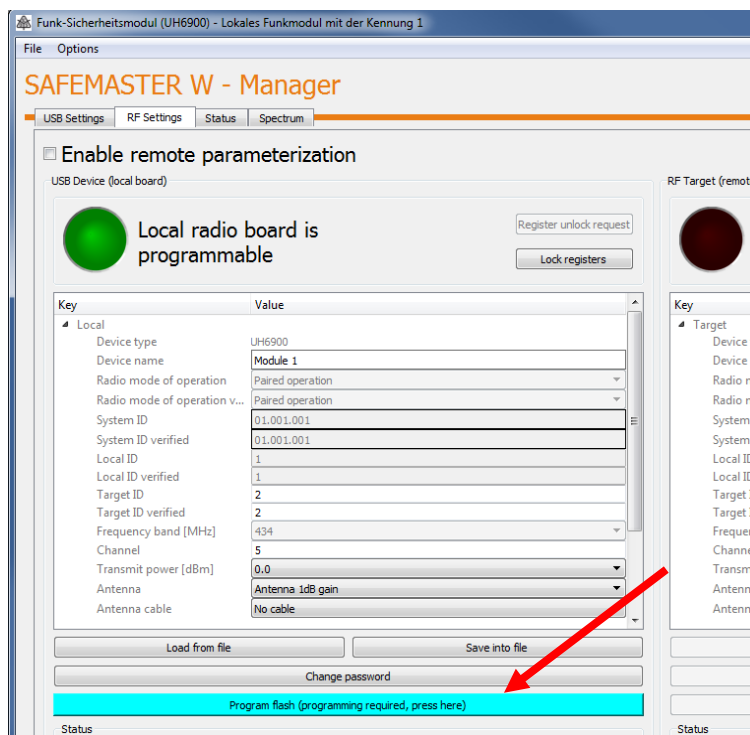


### 2.9.3 Further adjustments

The transmission power and device name do not have to be changed for initial start-up

### 2.9.4 Programming

If the channel was changed in the previous step, this setting must be permanently saved in the device. The programmer button will now appear blue. The status window will indicate that the programming was successful.



## 2.10 Power on and standby test

After successful parameterization and after switching on the modules once again, the LEDs RUN1, RUN2, 48, and 58 should flash slowly to indicate they are ready for operation.

If there is an error, these LEDs will show different flashing codes.

see [chapter 7.2 „Status and error codes“](#)

### Bidirectional mode (device variant MF)

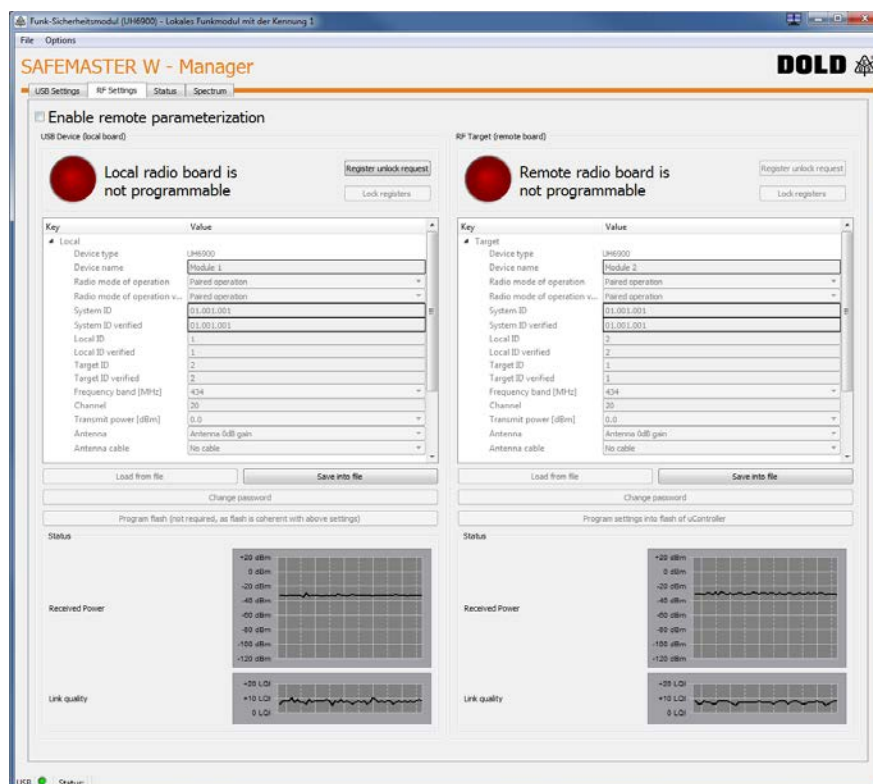
- Press the start key on one of the two devices
  - ➔ The safety relays on both devices are activated
- Activate the emergency-off on one of the two devices
  - ➔ The safety relays on both devices drop out

### Unidirectional mode (device variants GC and GR)

- Press the start key on the group controller (GC)
  - ➔ The safety relays on the group receiver are activated
- Activate the emergency-off on the group controller (GR)
  - ➔ The safety relays on the group receiver drop out

For further controlling, you can check the current status of the transmission path using the SAFEMASTER W Manager.

- If the connection was established successfully, both modules will be displayed in the window with the set parameters.



### 3 Introduction of the system

SAFEMASTER W – is an innovative wireless safety system to protect man and machine. A feature of the Wireless Safety System is its **safety-oriented bi-directional radio transmission** for transmitting signals between two wireless safety modules so that the two separate safety devices, each of them installed on a different machine part that is not connected to the other by wires (for example, moving machine parts), work together as one system. In addition, the systems allows the configuration of different operating modes.

Optionally, the system can also be operated via a safety unidirectional radio transmission with more than two devices.

SAFEMASTER W **definitely solves** the problem of wear on trailing cables without the necessity to compromise **safety and response time**.

#### 3.1 Directives, standards, and certification

The Wireless Safety System SAFEMASTER W meets all the safety requirements of the currently valid directives and standards.

- Machine directive 2006/42/EC
- IEC/EN ISO 13 849-1: Category 4, Performance Level “e”
- IEC/EN 61 508: SIL Claim Limit SIL 3
- IEC/EN 61 511: SIL Claim Limit SIL 3
- IEC/EN 62 061: Safety Integrity Level SIL CL 3
- EN ISO 13851: Safety of machinery – Two-hand control devices –

Furthermore, the Wireless Safety System SAFEMASTER W is in accordance with the standard

- DIN EN 300 220 Radio – EU – variants  
Electromagnetic compatibility and Radio spectrum Matters (ERM)  
– Short Range Devices (SRD) –  
Radio equipment to be used in the 25 MHz to 1 000 MHz  
frequency range with power levels ranging up to 500 mW



- FCC Part 15.249 Radio – US – variants  
Regulations for ISM Band Devices 902-928 MHz



Please note: Validation according to DIN EN ISO 13849-2 is always required for the complete system.

#### 3.2 Applications, intended use

Typical applications of SAFEMASTER W are:

- Hazard areas where protective equipment is necessary for the safety of persons but where wiring is impossible or not reasonable, for example in applications with extremely wide-spread, extensive hazard zones;
- Mobile and stationary plants and equipment, for example large machines, assembly halls and scaffolds, conveyor belts, high-rack warehouses, warehouses, forklifts, etc.

The UH 6900 radio-controlled safety modules are intended for the wireless remote control of machines and plant parts that used to be controlled by cable. Their usage is only restricted by valid safety instructions that prohibit, for example, staying under suspended loads.

The radio transmission range is up to 800 m.

### 3.3 Design

The main components of the safety system are the two or more radio-controlled safety modules. Each UH 6900 radio-controlled safety module is installed in a switch cabinet or on a mobile device and is operated with a plug-in or external antenna. It detects the signals of up to three wired safety elements plus the signals from the related second active radio-controlled safety module that are sent through a safe radio transmission. Safety-relevant switching commands are switched by relay outputs, non-safety-relevant control signals through semiconductor outputs.

In addition to the up to three 2-channel safety devices, there are 8 non-safety function inputs (DC 24 V) and 8 non-safety function outputs (semiconductor outputs, DC 24 V), whose states are transmitted or received through the safe radio transmission. LEDs inform about the states of all inputs and outputs and indicate the current state of the internal radio-controlled safety module.

The current state of the UH 6900 radio-controlled safety module is also indicated by two non-safety-relevant semiconductor outputs.

In addition, a non-contact sender and a non-contact receiver (for example, light curtain or infra-red sender and receiver) may be connected to force the system to start from a specific location via radio.

### 3.4 Functions

The modules allows the selection of three different main operating modes by a rotary switch.

- [Full safety operation](#)
- [Cross-operation](#)
- [Safety operation with optional radio control](#)

For each of these operating modes, the start mode (auto start, manual start, or start by two-hand control) of the module can also be selected by the rotary switch.

The individual operating modes are described in more detail in section [6.4 Setup and commissioning of the](#) UH 6900 radio-controlled safety module.

The UH 6900 radio-controlled safety module is equipped with a DC 24 V semiconductor output **OIR** that reproduces the start signal to enable the safety relay.

As an additional accident prevention measure, all of the above-mentioned operating modes can be set to detect this additional start signal from the opposite side via the DC 24 V **IIR** input. This allows, for example, the determination of start areas by the use of a light curtain or infra-red sender and receiver. **Only from these start areas, the application can be started via radio.** For a successful start, the system then requires a start signal at the **IIR** input in addition to the start signal via the safety radio transmission.



### 3.5 Radio mode types

The radio mode is generally divided in the following radio mode types. These are permanently programmed by Dold and cannot be changed.

**Paired mode** (device variant MF)

In this mode, a system always consists of two equally paired devices that communicate with each other via a safety bidirectional radio transmission.

In complete safety mode, an emergency-off on one device switches off the safety relays on both devices.

**Group mode** (device variants GC and GR)

In this mode, a system always consists of one group controller and several group receivers. The safety radio transmission is here unidirectional.

- An emergency-off on the controller causes a safety switch-off of the safety relays on all receivers.
- An emergency-off on one receiver only has a local safety effect. Optionally, all other receivers can also be switched off, however not safety related.

Furthermore, the group controller can be paired with one of the group receivers to exchange status data.

## 4 System description

### 4.1 Design and functions of the UH 6900 radio-controlled safety module

#### 4.1.1 Main features of the UH 6900 radio-controlled safety module

- Depending on the operating mode, to connect:
  - Emergency-stop push-button (2-channel), safety gate, LC (non-contact safety system, for example light curtain) of the type 4 in accordance with EN 61 496 or the two-hand type III A in accordance with EN ISO 13851.
  - 1 start button
  - Changeover switch (2-channel) to indicate radio use in the 'Safety operation with optional radio control' operating mode
- For two-way communication via radio:
  - Safety shut-down commands
  - Signals from 8 non-safety-relevant DC 24 V inputs at 8 non-safety-relevant DC 24 V semiconductor outputs
- Broken wire and short circuit detection with fault indication
- Semiconductor output to indicate poor or no radio control
- 2 semiconductor outputs for status indication
- LEDs to indicate status of module
- LEDs to indicate status of all inputs and outputs
- LEDs to indicate the radio transmission and its quality
- 45 mm in width
- Compact device easy to install
- Mounting on profile DIN rail
- Removable screw terminal blocks
- Functions that can be selected by rotary switches:
  - 'Full safety operation' with different start modes (two-hand type III A and/or manual start, auto start)
  - 'Cross-operation' with different start modes (two-hand type III A and/or manual start, auto start)
  - 'Safety operation with optional radio control' with different start modes (manual start on S42, manual start via radio, or auto start)
  - Valid for all operating modes:  
Radio start function via radio with or without detection of an additional start signal at the IIR input.
- Frequency range 433 MHz or 869 MHz (license-free radio frequencies)
- Radio channel, transmitter power, and module name can be set by means of a parameterization software
- Status indicator for the devices connected via radio, by means of the parameterization software including status of radio transmission quality

### 4.1.2 Inputs and outputs

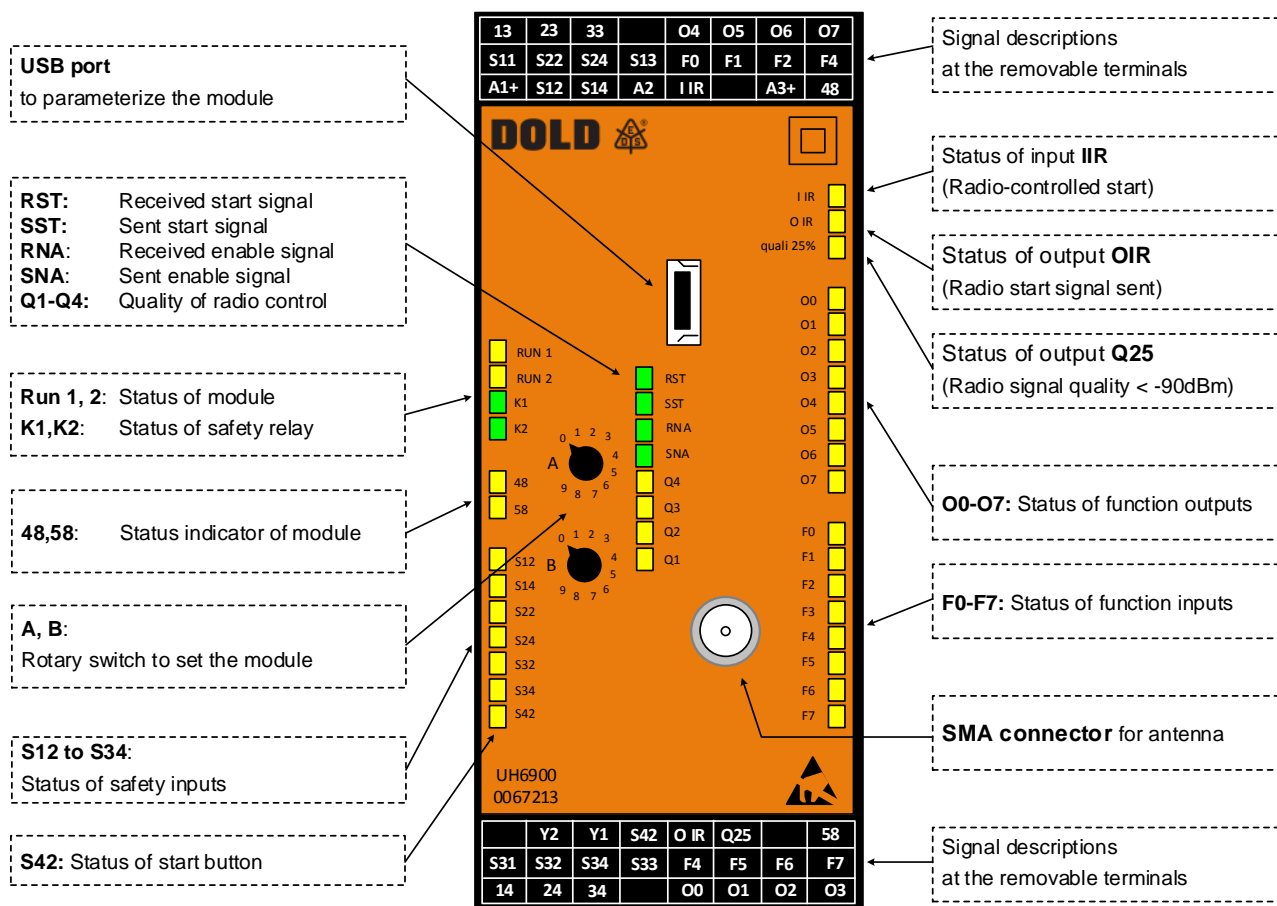
#### Inputs

- 3 two-channel safety inputs DC 24 V
- 1 DC 24 V input for start button
- 1 feedback circuit to monitor external relays
- 1 DC 24 V input that can be used as start signal in addition to the start signal received via radio.
- 8 non-safety-relevant DC 24 V functional inputs, the status of which is sent to the opposite side.

#### Outputs

- 3 safety-relevant NO contacts or  
2 safety-relevant NO contacts + 1 NC contact (can only be used as an indicator contact)
- 1 DC 24 V semiconductor output that reproduces the start signal sent via radio as an additional start signal for the release of the safety relay on the opposite side
- 8 non-safety-relevant DC 24 V semiconductor outputs that are controlled by the opposite side
- 2 DC 24 V semiconductor outputs to display the status of the radio-controlled safety module
- 1 non-safety-relevant DC 24 V semiconductor output to indicate poor or no radio control

### 4.1.3 Overview UH 6900 radio-controlled safety module; front view



### 4.1.4 Detection of safety elements

If the radio-controlled safety module is switched off through a hard-wired safety element (for example, the emergency stop push-button) the following requirements must be met for a restart: Both control signals of the operated 2-channel safety element must have been switched off simultaneously (open contact). Restart (closed contact) of the two signals must take place within 3 s (in case of two-hand, 500 ms).

If the control signals of the safety elements are already applied when power is switched on, the safety elements meet the start requirements.

Any specifics regarding the detection of the safety signals based on the selected modes of operation are mentioned in the descriptions of the operating modes.



## 4.1.5 Start options

### 4.1.5.1 Manual start and reset

The start button to be connected to terminal S42 is used for the manual start and also to reset the radio-controlled safety module. The maximum activation time for the start buttons is 3 sec. If the button is pressed longer than 3 sec., the unit will not start. A start button must not be pressed when power is being applied to the UH 6900 radio-controlled safety module.

### 4.1.5.2 Auto start

The safety inputs S12-S14, S22-S24 and S32-S34 can be set up for automatic start (see operating modes). This means that the radio-controlled safety module UH 6900 enables the safety relays as soon as the safety function is active again (for example, the safety gate is closed again).

### 4.1.5.3 Two-hand

In some operating modes, the safety input on S12-S14 can be used for a two-hand control of the type III A.

In this case, the following steps - in the order prescribed below - must be carried out each time a safety relay is disabled:

- The two-hand buttons must be released.
- All other safety inputs must be closed again and (if they are set to manual start) reset.
- Only now, the safety relays can be enabled again by the two-hand control.

If this order is not observed the safety relays will not start.

### 4.1.5.4 Start via radio



**Starting the plant or machine must be limited to a specific start zone with a good overview of the hazard zone.**

If one of the radio-controlled safety modules is installed on a mobile device (for example a fork-lift truck) and if it is intended that starting via radio is possible from that device as well, enabling start through the **IIR** input is the best option. For example, the output of an infra-red receiver can be connected to this input when the related infra-red sender is controlled by the **OIR** output of the other radio-controlled safety module. This forces the operator to go to the defined start zone.

When this option is selected the receiver of the start signal waits for 2 conditions to be fulfilled before the safety relay is enabled:

1. Receipt of a valid start command sequence.
2. Detection of a start signal at the IIR input that fetches to the received start sequence.



If this start signal IIR is used with a two-hand control in the safety system, this option must be activated at the module, with the connected two-hand control buttons.

#### 4.1.6 Semiconductor outputs

Except for the contact-type safety outputs, all outputs are non-safety-related DC 24 V semiconductor outputs.

- Outputs 48 and 58 provide information about the current state of the safety module.
- Output Q25 is set if the signal quality falls below -90 dBm or if no signal is received at all.
- Output OIR is set as long as the module sends a radio start command to the second radio-controlled safety module that belongs to the SAFEMASTER W system.
- The function outputs O0 to O7 are controlled via radio through the function outputs F0 to F7 of the other radio-controlled safety module that belongs to the system.  
In order to safely switch off all function outputs, their DC 24 V power supply is connected to a separate terminal (A3+).

#### 4.1.7 Assignment of function inputs to semiconductor outputs

The function inputs of a module are directly (one-to-one) assigned to the function outputs of the other module. This means that, for example, the F1 function input controls the O1 function output of the opposite side.

#### 4.1.8 Identity code

Before it is dispatched, each radio-controlled safety module receives a unique and fixed identity code (comprising a system code and a device code) by which it is permanently assigned to its related radio-controlled safety module (same system code and target device code).

These settings cannot be changed by the user.

A SAFEMASTER W system will only function if the system codes of both radio-controlled safety modules match and the device code of one module is stored as the target device code of the other module. The radio-controlled safety modules check any incoming commands for their own identity codes and the identity codes of the respective sender module. Only those commands are carried out by a radio-controlled safety module that can be properly assigned.



When you order a system, keep in mind that any SAFEMASTER W radio-controlled safety system that is realized with UH 6900 radio-controlled safety modules will always consist of two units whose identity codes have been paired at DOLD already.

**The customer can neither determine their identity codes nor change them.**

Deliveries of devices with identical identity codes are possible on customers request, e.g. replacement devices. Please observe the general safety instructions and contact us for this.

#### 4.1.9 Receiver antenna

The radio connection between the two radio-controlled safety modules of a SAFEMASTER W system is made via an antenna that may be attached directly to the front of the radio-controlled safety module. If the unit is installed at a location that is not suited for radio control (for example in a metal cabinet) the antenna can be installed at a more favorable place and connected via a special shielded coaxial cable.

#### 4.1.10 Radio frequency

The radio-controlled safety modules communicate via a free radio frequency in the 433 MHz, 869MHz or 915MHz MHz frequency band. The frequency can be set by selecting the channels using the parameterization software.

If more than one SAFEMASTER W systems are used at the same location, the different systems must be set up for different radio frequencies. The used frequency channels must not be neighbouring channels, there must always be an unused one in between.

The frequency can be set by the user (see Section [6.2.2.1 Set the radio frequency](#))

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#### **4.1.11 Transmitter power**

To adjust the device's working range to the required conditions, the transmitter power can be set with the parameterization software, depending on the frequency channel, frequency band and regulations.

See chapter 8.2.2.5 for configuration of transmission power.



## 5 Installation and connection

### 5.1 Important notes on installation and connection



- Before you turn on the radio-controlled safety module for the first time, the required operating mode must be set (see [6.4 Setup and commissioning of the radio-controlled safety module](#))
- **A visible emergency stop push-button must always be functional.**  
Because the safety functions on one of the two modules are temporarily not functional in some operating modes, precautions must be taken to ensure that any emergency stop devices connected to it are not visible during this time.
- This device is not suitable for use in places where children might be present.



Provide for potential equalization before making any adjustments or cable connection.

It has shown that a successful installation depends on the following factors:

- Location of radio-controlled safety module and the antenna
- Connection and positioning of the radio-controlled start device (for example, light curtain, or infra-red sender and receiver)
- Connection of safety elements
- Careful and proper wiring
- Protection of power supply
- Min. and max. switching current of the different outputs
- Disturbance protection

### 5.2 Wiring

Do not install cables of different classes in parallel. Maintain a minimum distance (20 cm) between the different cable classes:

Class 1: Radio, antenna wires (antenna extension wires)

Class 2: Electric circuit for supply of the different enclosures

Class 3: Power control for motors, controls, etc.

Ideally, each cable class is installed in its own cable duct. If only one cable duct is available, the different classes of cables should be installed at the maximum possible distance from each other.



The electrical connection of the power supply must be installed in a way that with deactivation of the main power switch the radio-controlled safety module is deactivated as well.

If the power supply circuit of industrial installation is not equipped with an all-pole power circuit-switch, a suitable separator must be available as a part of the electrical system of the building.

Protection against contact of the connected elements and insulation of the supply lines must be designed for the maximum voltage applied to the device.

### 5.3 Protection of power supply

Protection against overcurrent resulting from overvoltage (EN 60204-1, Sec. 7.2).

The power supply of the UH 6900 radio-controlled safety module is protected by means of an internal PTC.

## 5.4 Positioning of the radio-controlled safety module and the antenna

### 5.4.1 Positioning of the radio-controlled safety module

The radio-controlled safety module must be installed as close as possible to the machine to be controlled, preferably inside the control cabinet. It must be protected against shocks and weather influences.

### 5.4.2 Distribution of radio signals

Radio signals are electro-magnetic waves that are attenuated on their way from the sender to the receiver. Their transmitter field intensity decreases inversely proportional to the quadrature of the distance between sender and receiver. In addition, the signals are attenuated further if they need to penetrate other materials than air (e.g. walls, objects, or persons).

Examples for the attenuation of the signals through different materials:

Material	Penetration
Glass, plaster, wood	90 ... 100 %
Bricks, chip boards	65 ... 95 %
Reinforced concrete	10 ... 90 %
Metal, aluminium cladding	0 ... 10 %

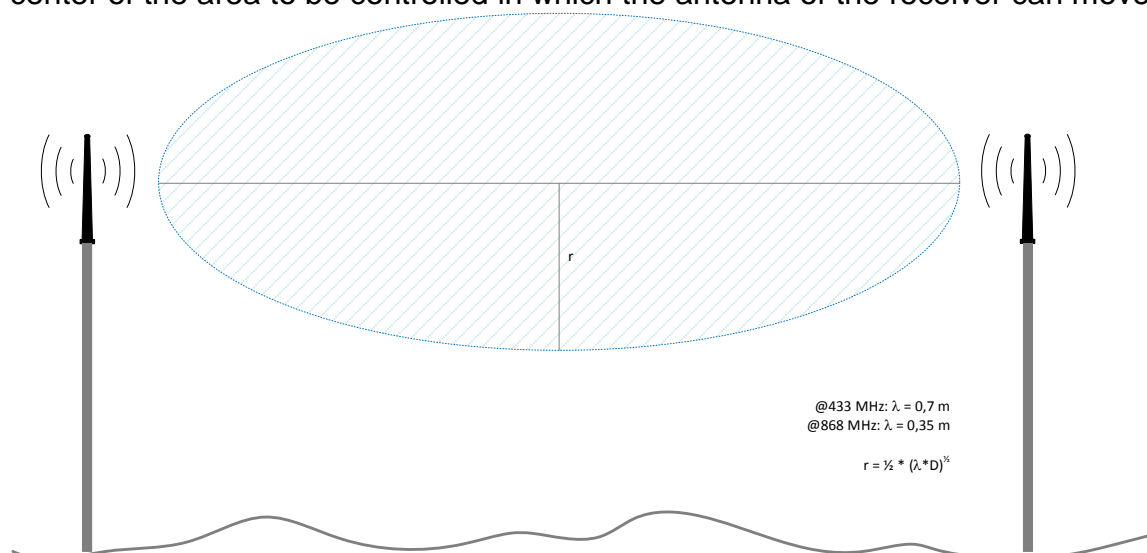
In addition, it should be noted that the material strength is increased by the same proportion when the signal must penetrate the material diagonally. It should therefore be ensured that the material is penetrated in an angle that is as close as possible to the right angle.

### 5.4.3 Antenna positioning for horizontal transmission

The antenna shall be located outside the enclosure as far as possible from Class 3 cables and power elements (power supply, motors, converters) and at the same time in an area suitable for radio reception. If necessary, use an antenna extension cable. The antenna extension cable must not be bent as this would cause additional attenuation of the radio signal.

The radio link between the antennas can be described as the Fresnel zone. Where ever possible, this zone should not contain any materials that could have a shielding effect. Ideally the other antenna should be seen from one antenna.

The antenna should therefore be placed as high as possible in the room or terrain above the center of the area to be controlled in which the antenna of the receiver can move.

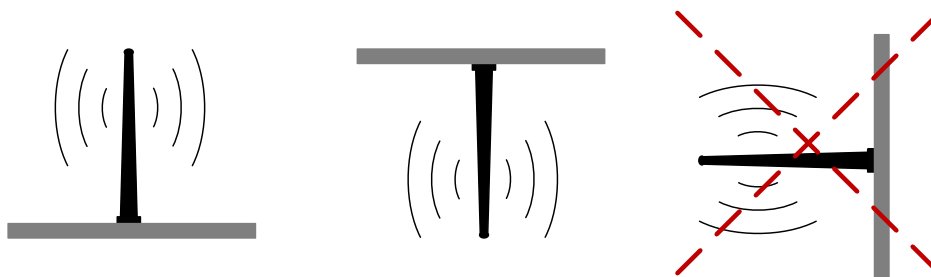


The ideal minimum antenna height for a given radio distance depends on the used wavelength and is

Distance [m]	Antenna height 433 MHz [m]	Antenna height 868 MHz [m]
100	4,2	3,0
200	5,9	4,2
300	7,2	5,1
400	8,4	5,9

These are optimal values that are not normally achieved in reality, either because the Fresnel zone is reduced in size by a lower antenna height or because obstacles (buildings, trees, vehicles ...) are located in the Fresnel zone.

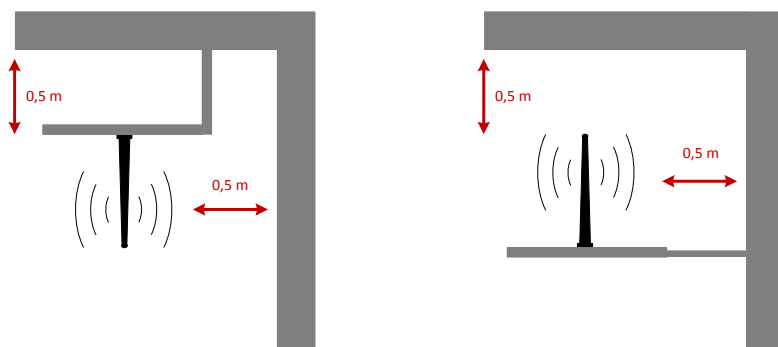
The antennas should be placed vertically and not horizontally for a horizontal transmission and horizontally for a vertical transmission



For horizontal transmission

Antenna cables should be kept as short as possible and should always be connected to the antenna from below in outdoor areas. If necessary, provide for a drip arch.

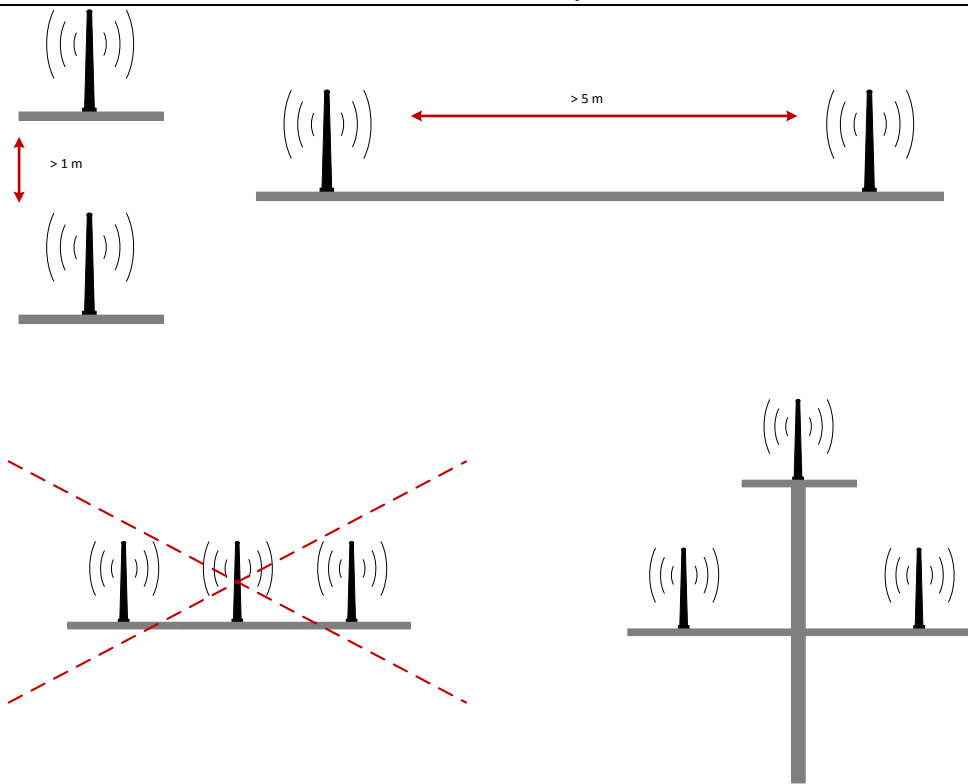
The minimum distance is 0.5 m from ceilings and walls.



The transmission and reception characteristics of the  $\lambda/4$  antennas can be improved if they are mounted on a metal plate (e.g. switch cabinet).

When operating several antennas, make sure that they do not interfere with each other. For this purpose, the antennas must be sufficiently separated and the frequency channels used should be as far apart as possible.

A vertical arrangement of the antennas is much more favorable and less sensitive to interference than a horizontal arrangement for horizontal transmission.

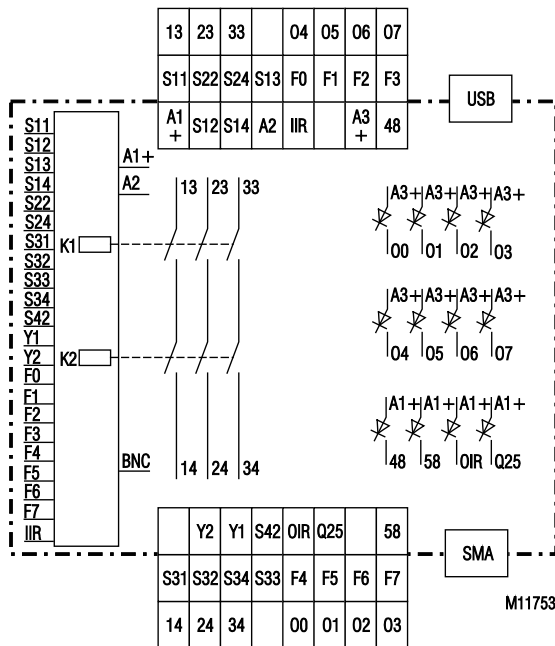


The transmission power should be adjusted according to the external conditions. An excessively high transmission power can have a negative effect on the performance of the radio system, as can an excessively low transmission power.

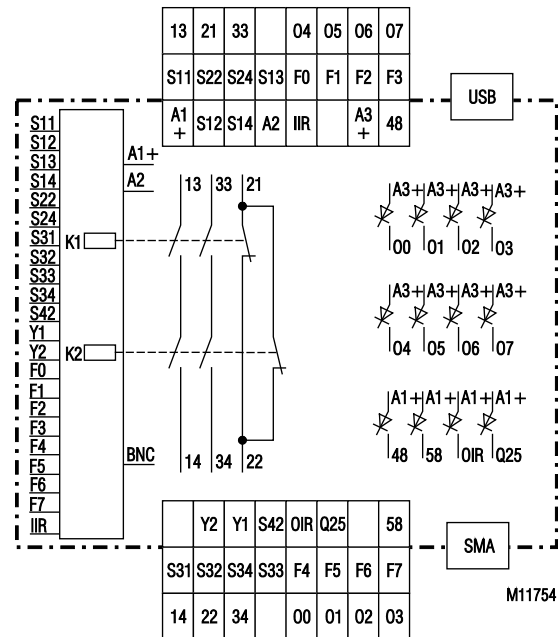


Radio systems can receive interference signals from other systems and thus be disturbed or even interfere with other systems via radio.

- The antennas of two systems in different frequency bands, e.g. GSM or WLAN, should be at least 0.5 m apart.

**5.5 Terminal connections of the radio-controlled safety module**

UH 6900.03



UH 6900.22

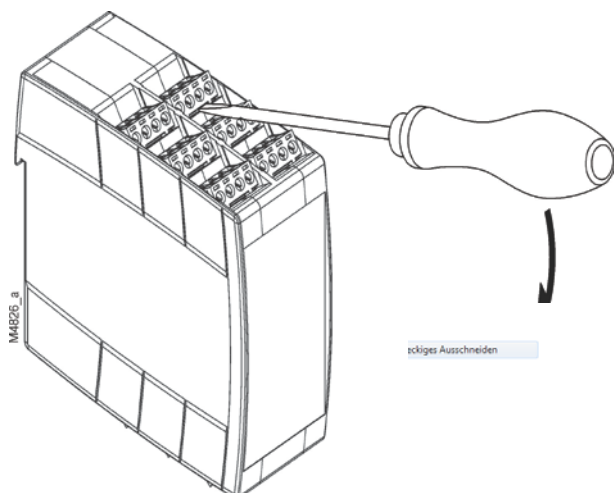
Terminal	Description
A1+	DC 24 V supply voltage for radio-controlled safety module
A2	Common earth
48/58	Non-safety DC 24 V semiconductor outputs: State of radio-controlled safety module
S11, S31	Test outputs for short circuit detection of the safety inputs Sx2
S13, S33	Test outputs for short circuit detection of the safety inputs Sx4
S12, S14	Inputs of the two-channel safety input 1
S22, S24	Inputs of the two-channel safety input 2
S32, S34	Inputs of the two-channel safety input 3
S42	Input for hard-wired start button

Terminal	Description
Y1/Y2	Input for feedback loop of external contact reinforcement
13/14	1st safety output, safety NO contact
23/24	2nd safety output, safety NO contact
or	
21/22	Monitoring output (NC contact)
33/34	3rd safety output, safety NO contact
IIR	Input for enabling the received start signal
OIR	Output with image of sent start signal
Q25	Output for input signal quality < -90 dBm
F0 to F7	Non-safety function inputs
O0 to O7	Non-safety DC 24 V function outputs
A3+	DC 24 V power supply of the function outputs = O0 to O7


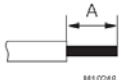
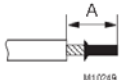
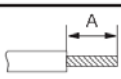
**5.6 Connection of safety elements**

The safety elements must always be connected as shown in the connection examples. When connecting safety elements with semiconductor outputs (e.g. LC type 4 according to EN 61496) the unit will not detect any short circuit between the signals. The short circuit must then be detected by the safety element itself.

## 5.7 Installation / removal of the PS / PC terminals



eckiges Ausschneiden

	PS	PC	PT
	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN	DIN 5264-A; 0,6 x 3,5	DIN 5264-A; 0,4 x 2,5
 M10248	A = 7 mm 1 x 0,2 ... 2,5 mm <sup>2</sup> 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm <sup>2</sup> 2 x AWG 24 to 18	A = 10 mm 1 x 0,2 ... 2,5 mm <sup>2</sup> 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm <sup>2</sup> 1 x AWG 24 to 16
 M10249	A = 7 mm 1 x 0,25 ... 2,5 mm <sup>2</sup> 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm <sup>2</sup> 2 x AWG 24 to 18	A = 10 mm 1 x 0,25 ... 2,5 mm <sup>2</sup> 1 x AWG 24 to 12 2 x 0,25 ... 1,5 mm <sup>2</sup> mit TWIN-Aderendhülse	A = 8 mm 1 x 0,25 ... 1,5 mm <sup>2</sup> 1 x AWG 24 to 16
 M10250	A = 7 mm 1 x 0,2 ... 2,5 mm <sup>2</sup> 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm <sup>2</sup> 2 x AWG 24 to 16	A = 10 mm 1 x 0,2 ... 2,5 mm <sup>2</sup> 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm <sup>2</sup> 1 x AWG 24 to 16

## 5.8 Minimum and maximum output currents

Make sure that the minimum and maximum output currents stated under [Technical data](#) are not underrun or exceeded. If necessary, install additional power or interface relays (e.g. an amplifying relay in the switch cabinet to control power).

## 5.9 Disturbance protection

If inductive loads are connected to relay outputs (contactor coils, electrovalves or electric brakes) make sure to provide the right protection devices (such as capacitors, RC circuits, diodes, etc.) directly at the controlled elements and connect them with the shortest possible wiring.

## 6 Commissioning (operating manual)

### 6.1 General instructions for commissioning

- Before you turn on the UH 6900 radio-controlled safety module for the first time, it must be set for the required operating mode (see Section [Setup and commissioning of the radio-controlled safety module](#)).
- Check for a proper matching of identity codes and radio channels of both radio-controlled safety modules of the SAFEMASTER W system.
- Check if the selected radio channel corresponds to the frequency plan set up for the location.
- Determine the range of the radio signals during operation in the entire work area and take into consideration interferences with other radio equipment at the location.
- Check if the function inputs of the radio-controlled safety module are correctly assigned to the function outputs of the other radio-controlled safety module. During these checks, make sure that the outputs O0 to O7 on both radio-controlled safety modules remain disabled before enabling the radio transmission.
- When you start the system through the IIR input, check if the start detection is limited to the area defined for this application. **It must be excluded that the system can be started from outside the defined start area.**

#### 6.1.1 Close-by machines equipped with SAFEMASTER W systems

If several machines are equipped with SAFEMASTER W systems that are operated close-by (for example, in a workshop) - and especially if one radio-controlled safety module is installed on a mobile device - each individual machine part must be marked clearly so that the machine operators can identify to which machine they belong without any doubt. For this, the system code of the SAFEMASTER W system could be attached to the relevant machine parts so that it is clearly visible and can be read from further away.



## 6.2 Configuration at shipment



The modules are always shipped with the default settings listed below: We recommend changing the frequency channel immediately upon receipt to prevent inadvertent influences in case of spare part deliveries or close-by new plants or machines. Enter these new settings on [page 1 of this manual](#).

### Bidirectional mode

System with 2 identical modules UH 6900

- Device variant: MF
- Operating mode: Complete safety mode (rotary switch A=0, rotary switch B=0)
- Radio mode: paired operation
- Device name: not yet assigned
- Radio channel: channel 05, 433.200 MHz or 869.8125 MHz, (EU)  
912.000 MHz (USA, Canada)
- Transmission power: 0 dBm (EU)  
-7.5 dBm (USA)
- One to one assignment of the function inputs to the function outputs of the opposite side (F0 → O0,... F7 → O7)

### Unidirectional mode

Systems with one group controller and several group receivers

- Device variant: Group controller (GC) / group receivers (GR)
- Operating mode: Cross operation for controller (rotary switch A=2, rotary switch B=0)  
Switchable radio mode for receivers (A=6, B=0)
- Radio mode: Group control for controller  
Group reception for receivers
- Device name: not yet assigned
- Radio channel: channel 05, 433.200 MHz or 869.8125 MHz, (EU)  
912.000 MHz (USA, Canada)
- Transmission power: 0 dBm (EU)  
-7.5 dBm (USA)
- One to one assignment of the function inputs to the function outputs of the opposite side (F0 → O0,... F7 → O7)

These configurations must be adapted later according to the desired system installation by means of the supplied software / the rotary switches on the front side of the modules.

The identification numbers (system ID, radio mode, device ID, target device ID) are already assigned.

### 6.2.1 Display of identity code

The module's own identity code and the identity code of the assigned radio-controlled safety module are clearly marked on the device enclosure. They are also displayed by the supplied parameterization software in three groups of figures:

- The unique common system code of the two modules of a SAFEMASTER W system
- The device code
- The target device code

Both radio-controlled safety modules of a SAFEMASTER W system must be matched to each other by these three groups of figures.

### 6.2.2 Selection and setting of the radio frequency

The 64 radio channels in the 433 MHz frequency band and the 12 radio channels in the 869 MHz frequency band of the UH 6900 radio-controlled safety module provide a broad selection of available channels.

For USA there are 128 channels in the 915 MHz range available.

### 6.2.2.1 Set the radio frequency

The modules' radio frequency is set by using the supplied parameterization software, via the USB interface.

Both radio-controlled safety modules of a SAFEMASTER W system must be set to the same frequency channel.

Close-by SAFEMASTER W systems must be set to different frequency channels.

For a good operation quality, it is necessary to make sure that the selected frequency channel is not used by any other equipment in the working area.



If several SAFEMASTER W systems are operated at the same location, it is necessary to have at least one free channel between 2 active ones (e.g. 5, 7, 9). It is recommended to set up a frequency plan listing all the active frequencies of a system and the controlled equipment.

Which frequencies are used in a working area can be easily detected by means of a cost-efficient standard frequency scanner.

It is recommended to select at least two spare frequencies for each application in order to quickly change to another frequency in the case of an interference without having to measure the frequency first.

Availability of the selected free frequencies must be checked in regular intervals.

### 6.2.2.2 Set the transmitter power:

The modules' transmitter power is set by using the supplied parameterization software, via the USB interface.

See chapter 8.2.2.5 for configuration of transmission power.



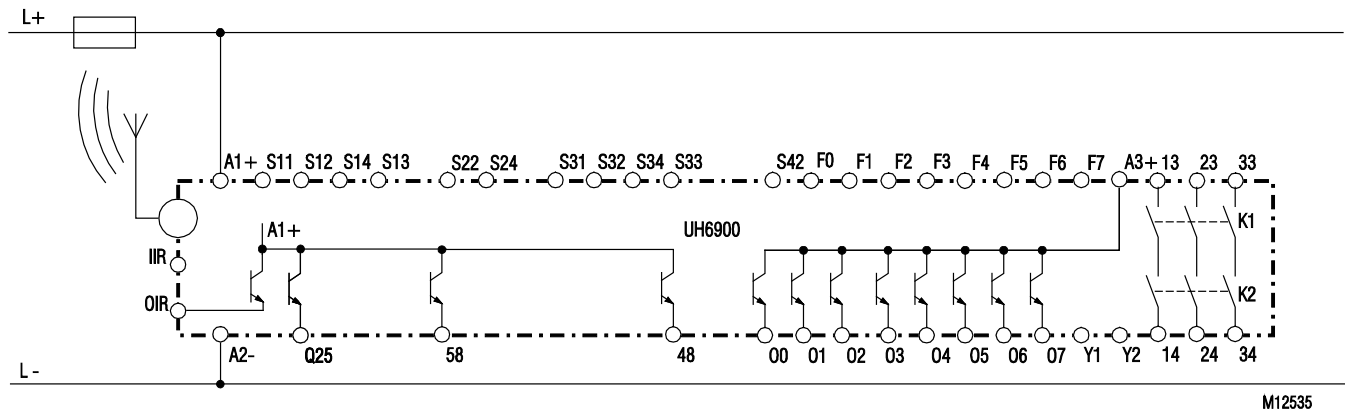
In the 433 MHz frequency band, the full range of 64 frequency channels can only be set for a transmitter power of up to 0 dBm (1 mW). With a power of > 0 dBm (1 mW to 10 mW), only the channels 40 to 64 are available.

In the 869 MHz frequency band, the transmitter power can only be set to a maximum of 7 dBm (5 mW).

In the 915MHz frequency band, the transmitting power must be set so that the field strength of the emissions at a distance of 3 m doesn't exceed 94 dBμV/m. Therefore only in chapter 8.2.2.5 listed configurations are allowed.

## 6.3 Wiring and connection options

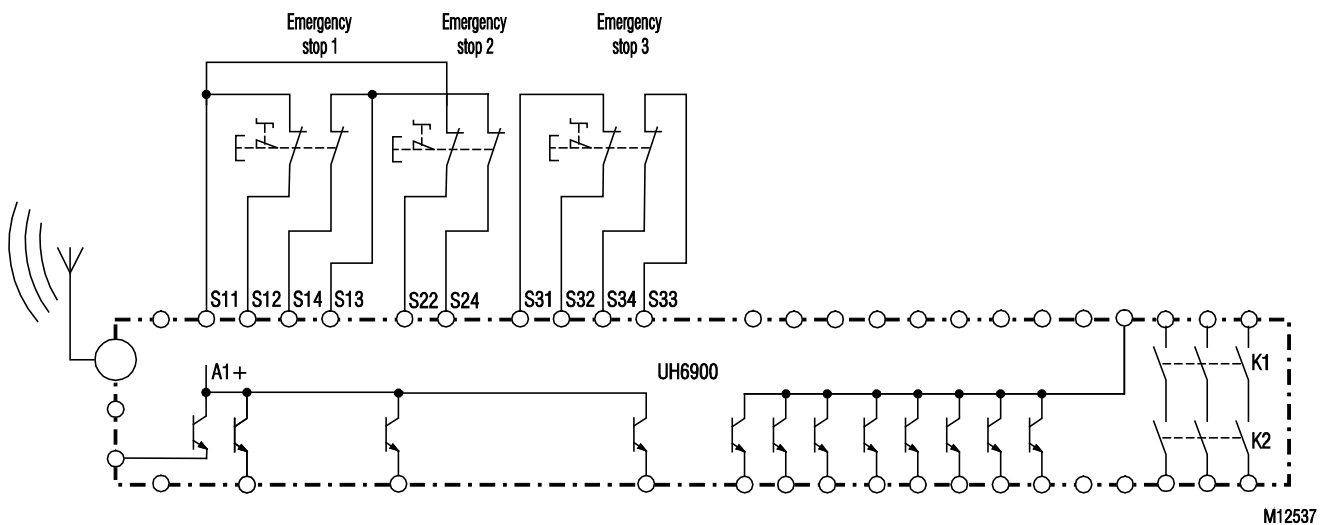
### 6.3.1 Connection of power supply

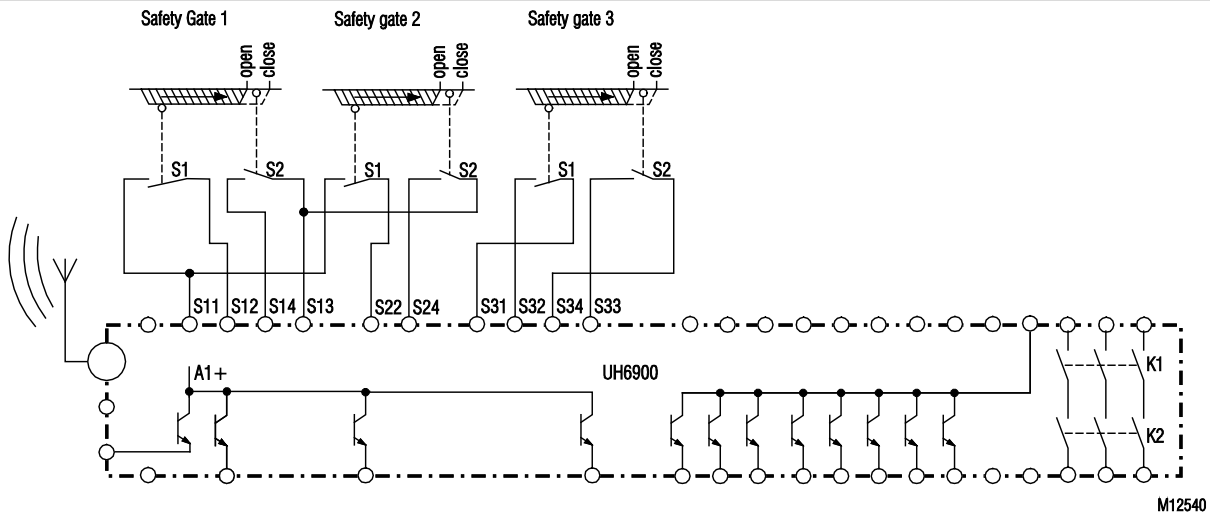
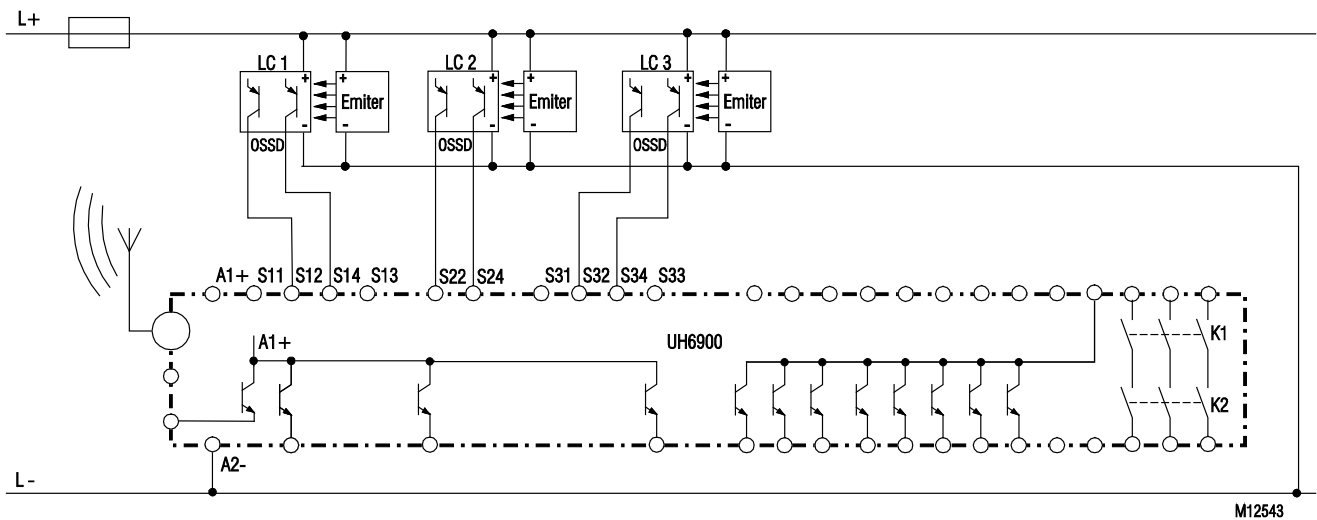


### 6.3.2 Connection of safety elements

- Note: If used, the two-hand control must always be connected to the terminals S11 to S14.
- Note: In the “Full safety operation” mode of operation, a maximum of one two-hand control units may be available in the system.
- Note: Emergency stop, safety gates, and LC can be connected in any combination, also together with a two-hand control.
- Note: If a safety input is not required, jumpers must be connected to the respective terminals instead of the NC contacts for an emergency stop push-button.

#### 6.3.2.1 Connection of emergency stop push-buttons



**6.3.2.2 Connection of safety gates****6.3.2.3 Connection of LC type 4 in accordance with EN 61 496**

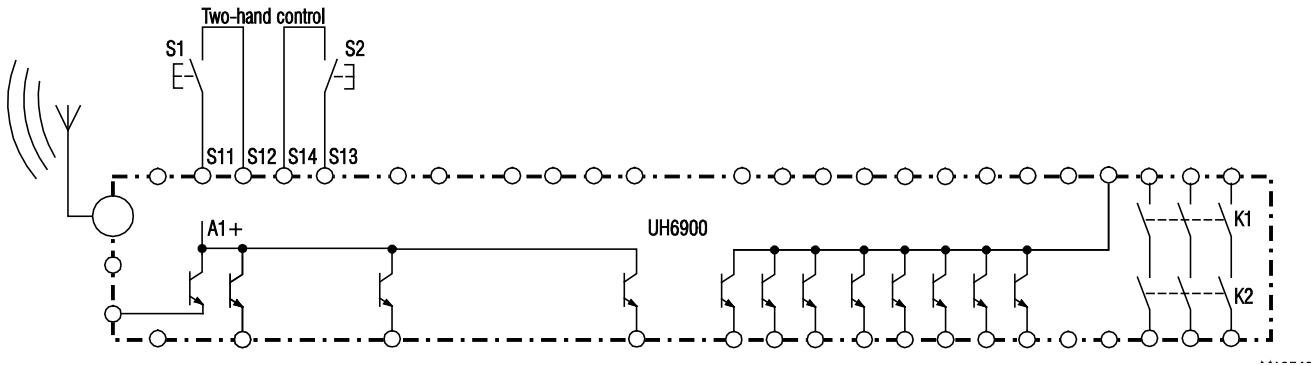
LC: non-contact protective equipment

**6.3.2.3.1 Calculation of the safety distance of an LC connected to a UH 6900**

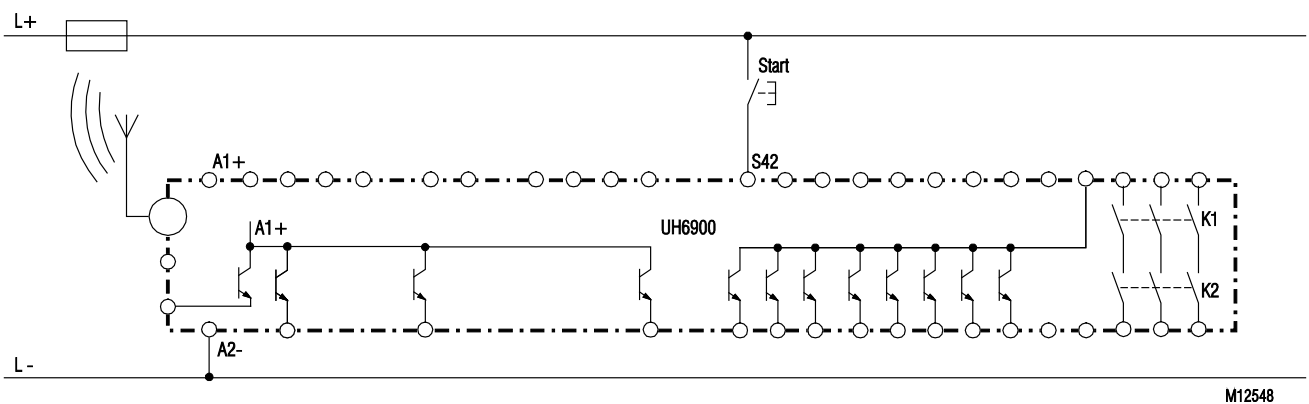
Any LCs connected to the UH 6900 radio-controlled safety module must be installed at a distance that corresponds to or exceeds the minimum safety distance  $S$  so that it is impossible to reach a dangerous spot before the machine has stopped a dangerous movement.

**Note:**

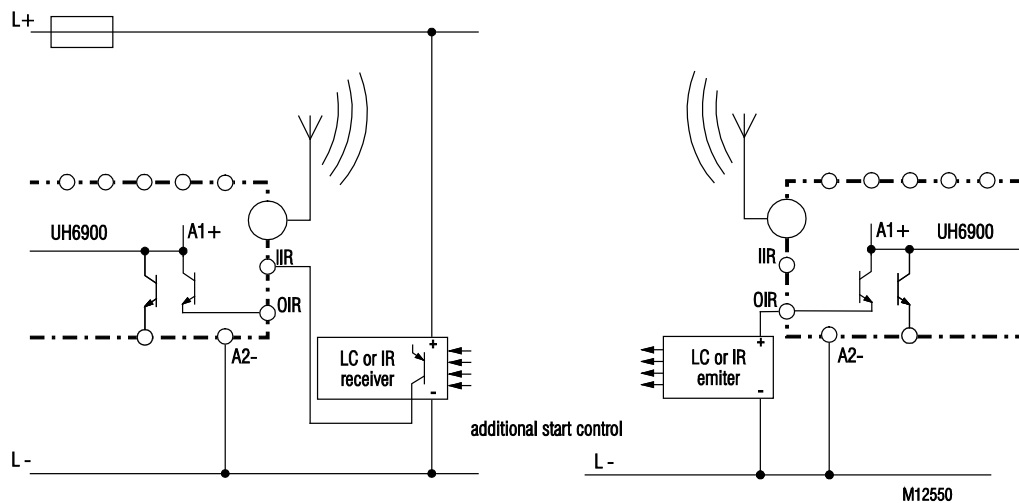
- The European EN ISO 13855:2010 standard (Safety of machines – Positioning of protective equipment with respect to the approach speeds of parts of the human body) provides the information necessary for the calculation of the correct safety distance.
- Carefully read the installation instructions for each individual LC to obtain knowledge of specific information regarding their positioning.
- Always keep in mind that the total response time of the system depends on the following factors:  
Total response time = response time of LC + response time of SAFEMASTER W system + response time of machine (in seconds).
- Note that the response time of the SAFEMASTER W system is increased if the stop signal must be transmitted to the machine via radio.

**6.3.2.4 Connection of two-hand control III A in accordance with EN ISO 13851**

- In the “Full safety operation” mode of operation, only one two-hand control unit may be available in the system.
- A two-hand control must always be connected to the terminals S11 to S14.

**6.3.3 Connection of the start button**

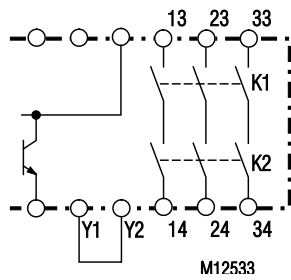
M12548

**6.3.4 Connection of an additional start control over IR or LC**

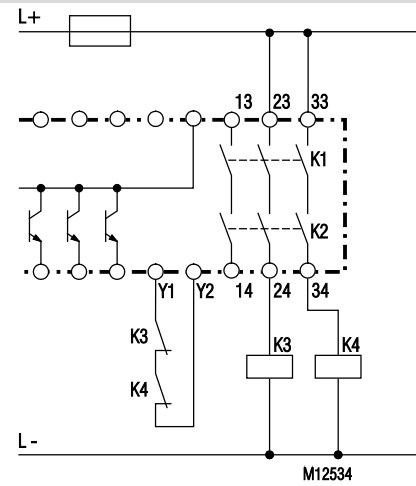
M12550

Only **one** device in a system can be set to the operating mode 'Detection of the radio start signal together with the start signal on the IIR terminal'.

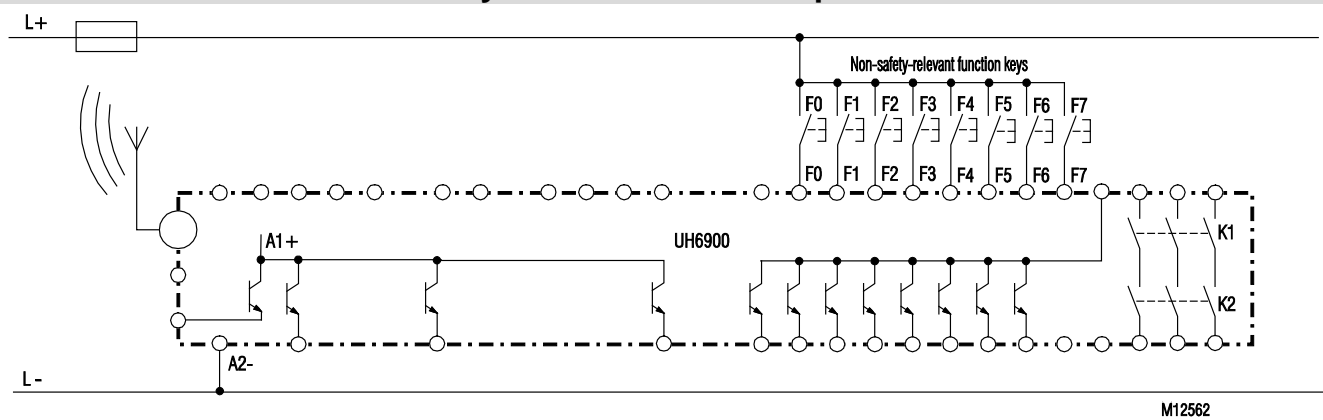
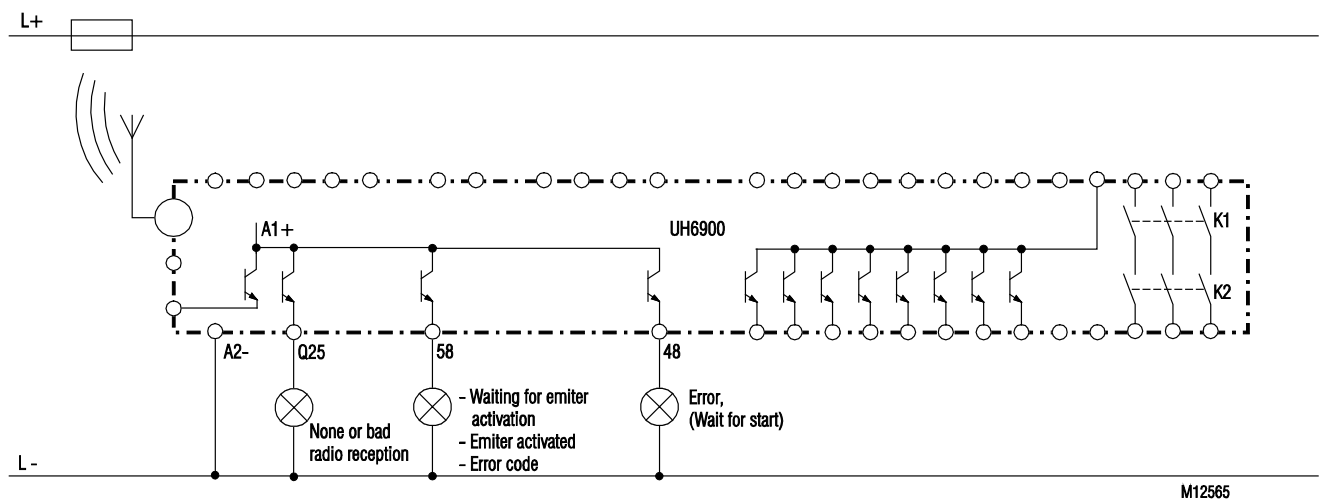
The additional start control belongs to that device at which the IR/LC receiver is connected.

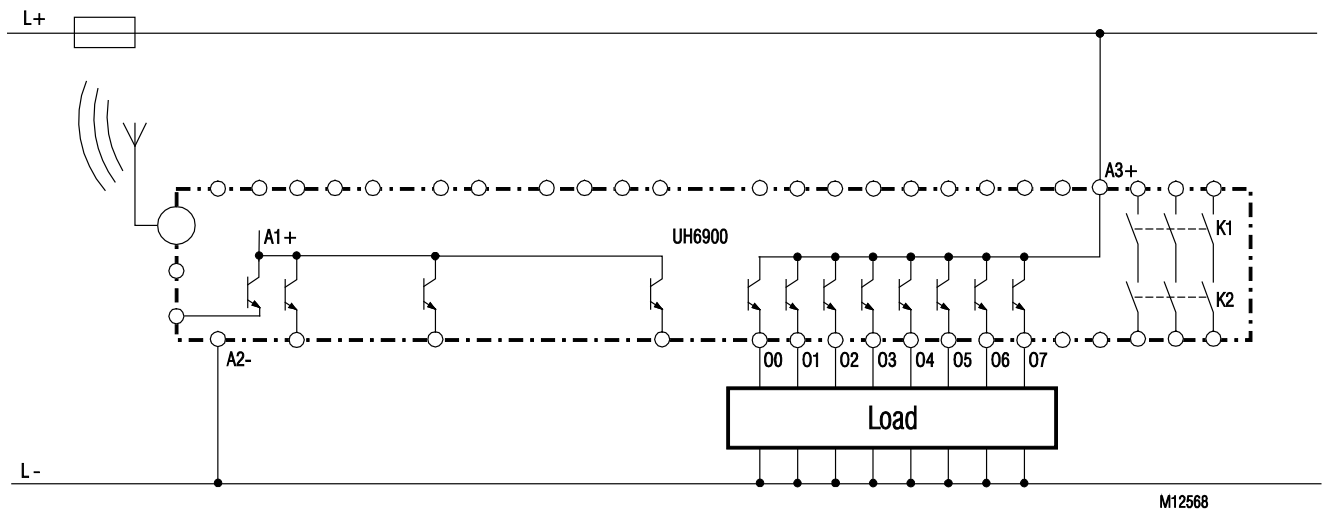
**6.3.5 Operation with or without external contact reinforcement**

No external contact reinforcement

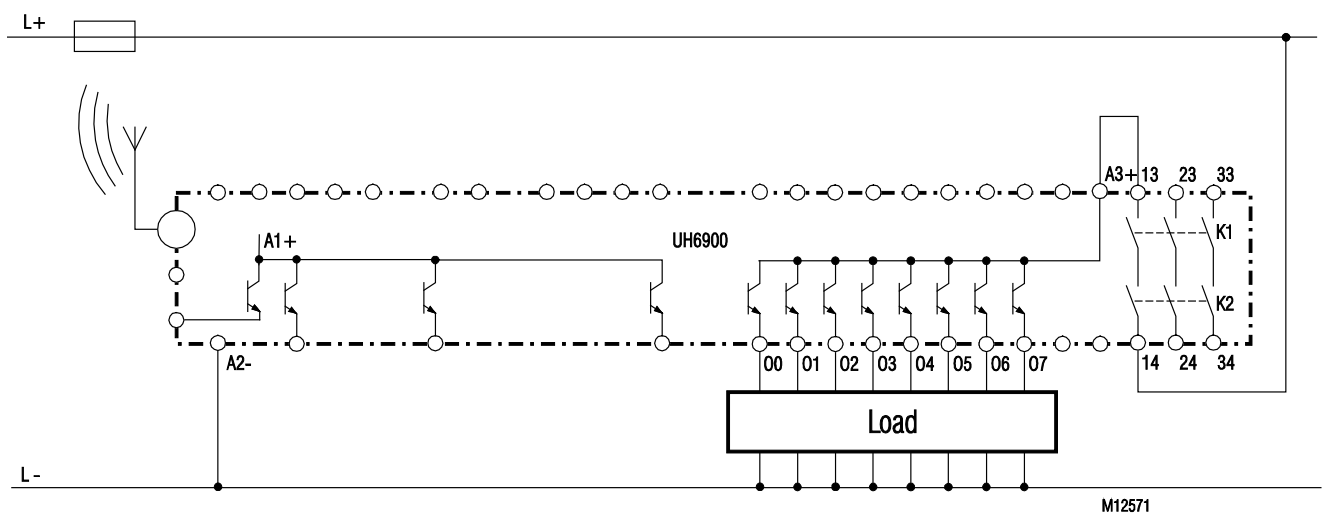


External contact reinforcement

**6.3.6 Connection of non-safety-relevant function inputs****6.3.7 Connection of status indicators**

**6.3.8 Connection of non-safety-relevant function outputs**

Without safe disconnection of function outputs



With safe disconnection of function outputs

**6.4 Setup and commissioning of the UH 6900 radio-controlled safety module**

Adjustments must only be carried out by trained staff while the unit is disconnected from power.



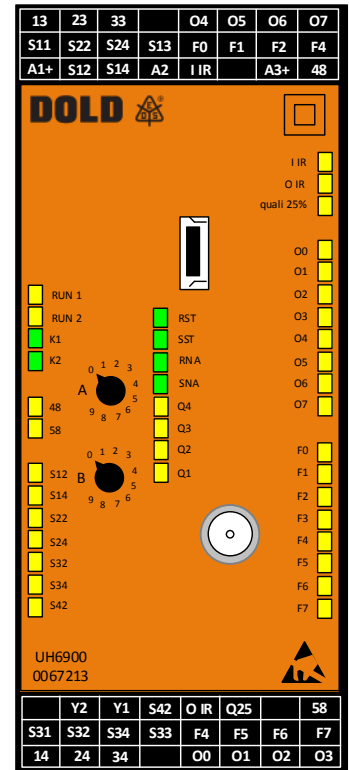
Provide for potential equalization before making any adjustments.

The operating modes of the UH 6900 radio-controlled safety module listed below are selected using the rotary switches A and B.

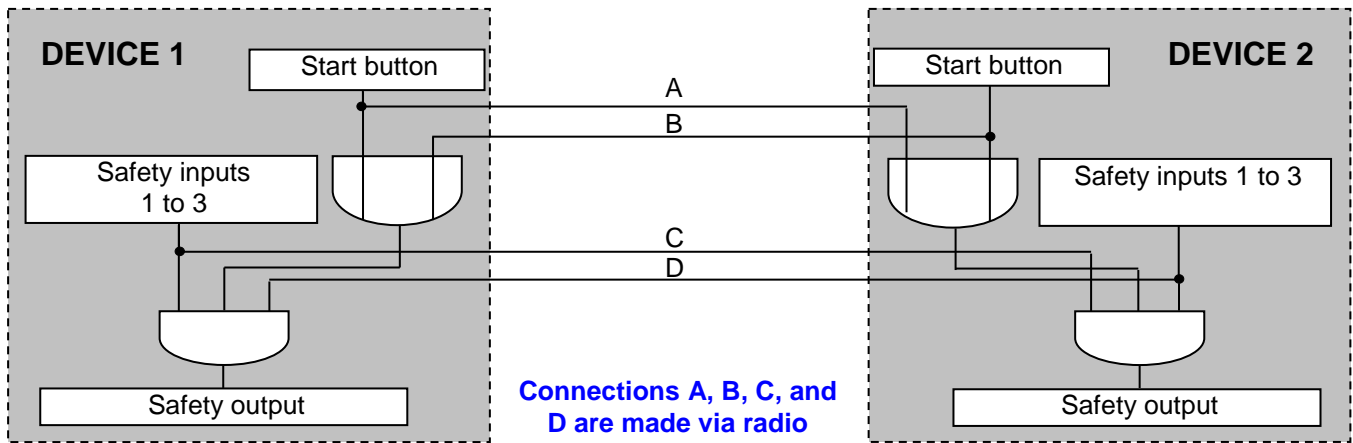
- 'Full safety operation' with the sub-functions:
  - 3 x manual start
  - 2 x manual start + 1 x auto start
  - 1 x manual start + 2 x auto start
  - 3 x auto start
  - 1 x two-hand type III A + 2 x manual start
  - 1 x two-hand type III A + 1 x manual start + 1 x auto start
  - 1 x two-hand type III A + 2 x auto start
- 'Cross-operation' with the sub-functions:
  - 3 x manual start
  - 2 x manual start + 1 x auto start
  - 1 x manual start + 2 x auto start
  - 3 x auto start
  - 1 x two-hand type III A + 2 x manual start
  - 1 x two-hand type III A + 1 x manual start + 1 x auto start
  - 1 x two-hand type III A + 2 x auto start
- 'Safety operation with optional radio control with the sub-functions:
  - 2 x manual start
  - 2 x auto start
  - With radio control on, reset of remote deactivation through sender
  - With radio control on, reset of remote deactivation through start button on S24 after restarting the sender
  - With radio control on, reset of all deactivation functions through sender

The maximum time allowed for activating the control unit can be set between 5 s and 30 s.
- Valid for all operating modes:
 

Radio start function via radio with or without detection of the additional start signal at the IIR input (LC or IR)





**6.4.1 Operating mode: 'Full safety operation'**

In 'Full safety operation' mode, always two radio-controlled safety modules work together which are both set to this mode of operation.



















Both modules are permanently connected via radio. The safety relays on both sides are only enabled if all of the conditions for enabling the safety output are fulfilled.

As soon as any of the safety inputs becomes inactive on either one of the modules or if the radio transmission is disconnected, the safety relays of both modules drop out.

**6.4.1.1 Set-up of safety inputs and start mode**

Both devices must be set to one of these operating modes.

Protective equipment on S11-S14, S22-S24, S31-S34, and S11-S14, S22-S24, S31-S34 on the opposite side will always influence the safety relays on both sides.

Operation mode	Rotary switch		Start		Autostart			Tww-hand S11-S14	Remarks
	A	B	Radio	&IIR	S31-S34	S22-S24	S11-S14		
Full Safety Operation	0	0	✓						
	0	1	✓		✓				
	0	2	✓		✓	✓			
	0	3	✓		✓	✓	✓		
	0	4	✓					✓	Two-hand without Autostart
	0	5	✓	✓					
	0	6	✓	✓	✓				
	0	7	✓	✓	✓	✓			
	0	8	✓	✓	✓	✓	✓		
	0	9	✓	✓				✓	Two-hand without Autostart
	1	0	✓		✓			✓	Two-hand with Autostart S31-S34
	1	1	✓		✓	✓		✓	Two-hand with Autostart S31-S34, S22-S24
	1	2	reserved						
	1	3	reserved						
	1	4	reserved						
	1	5	✓	✓	✓			✓	Two-hand with Autostart S31-S34
	1	6	✓	✓	✓	✓		✓	Two-hand with Autostart S31-S34, S22-S24
	1	7	reserved						
	1	8	reserved						
	1	9	reserved						

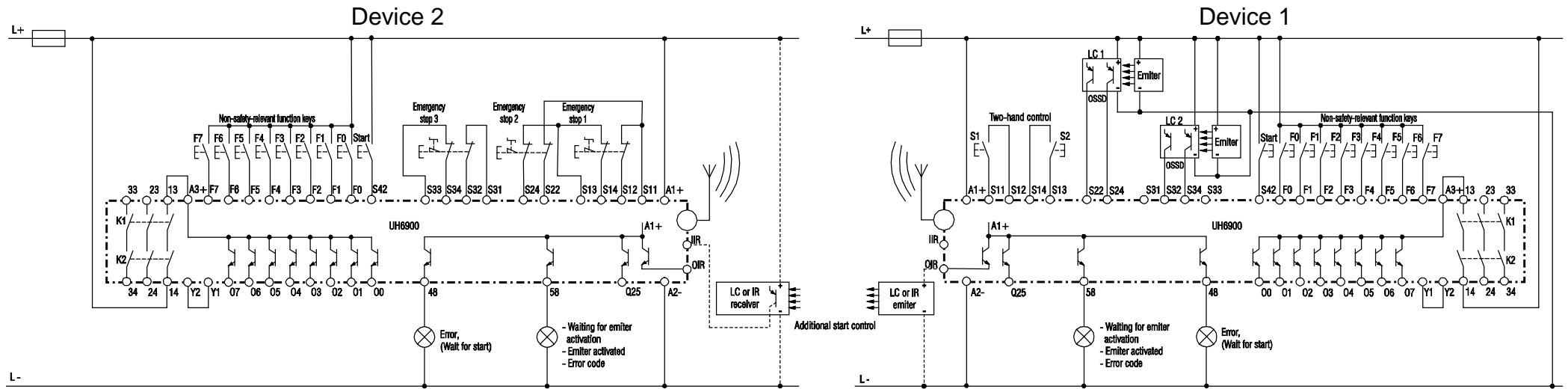


- Only **one** device in a system can be set to the operating mode 'Detection of the radio start signal together with the start signal on the IIR terminal'.
- Only **one** device in a system can be set to the operating mode 'two-hand control'.

In the operating modes with two-hand control, both push-buttons of the two-hand control must be released if another safety element of the radio-controlled safety system responds.

Only after all other safety elements of both modules are free again and reset, if necessary, the safety relays on both sides can be enabled again with the two-hand control.

## 6.4.1.2 Application examples

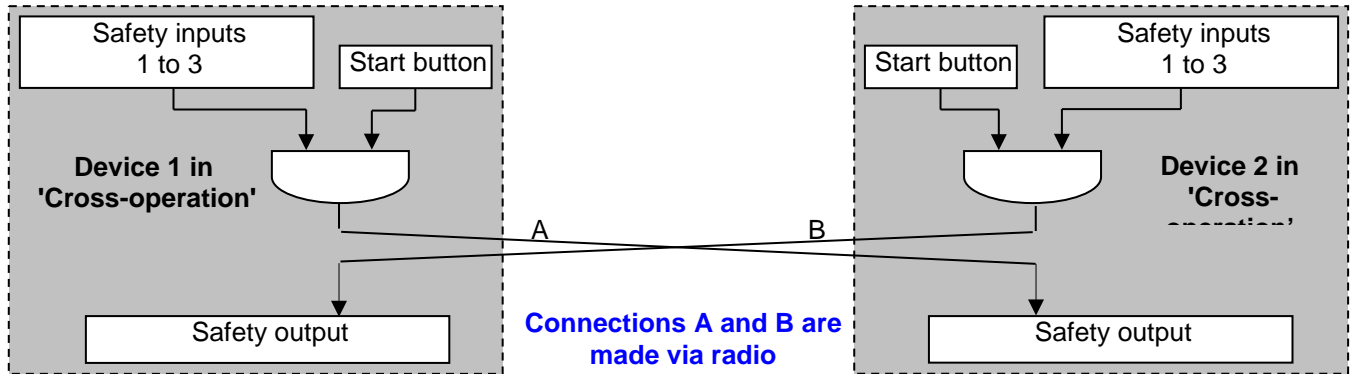


- The safety inputs on S11-S14, S22-S24, and S31-S34 can all be equipped with a two-channel push-button or with a LC of the type 4 in accordance with EN 61 496.
- The two-hand push-buttons are always connected to S11-S14 and there must be only **one** device in the system equipped with a two-hand control.
- Only **one** device in a system can be set to the operating mode 'Detection of the radio start signal together with the start signal on the IIR terminal'.

#### 6.4.1.3.1 Full safety operation without two-hand control

#### 6.4.1.3.1 Full safety operation without two-hand control



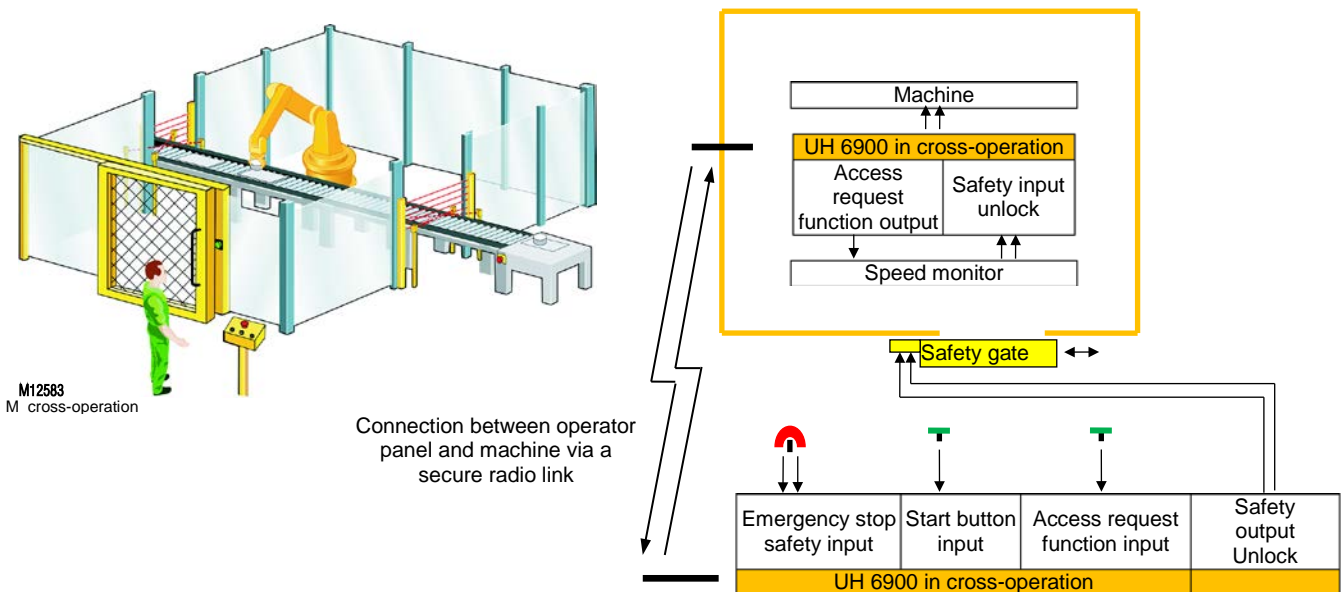
**6.4.2 Operating mode: 'Cross-operation'**

The two radio-controlled safety modules represent two independent systems where the inputs, including the start button input, on one side only control the safety relays and function outputs on the other side.



Emergency stop actuators must shut down the entire plant or machine. Therefore, this operating mode is suitable for emergency stop functions only if the safety outputs of the device, to which the emergency stop actuator is connected, are not used to stop dangerous movements.

**Note:** This operating mode can be used, for example, to request a speed reduction for a machine from a greater distance via radio and to allow access only after the slower speed has been confirmed via radio.





















Example for a cross-operation application

**Note:** A UH 6900 radio-controlled safety module that is set to the 'cross-operation' mode of operation can also be used to control a UH 6900 radio-controlled safety module that is set to the operating mode 'Safety operation with optional radio control'

**6.4.2.1 Set-up of safety inputs and start mode**

Results from the states of the safety elements on S11-S14, S22-S24, S31-S34 and the start signal on S42 are sent to the opposite side. They have no influence on the local safety relays.

Safety relays are enabled by the results from the states of the safety elements on S11-S14, S22-S24, S31-S34 and the start signal S42 that were sent from the opposite side.

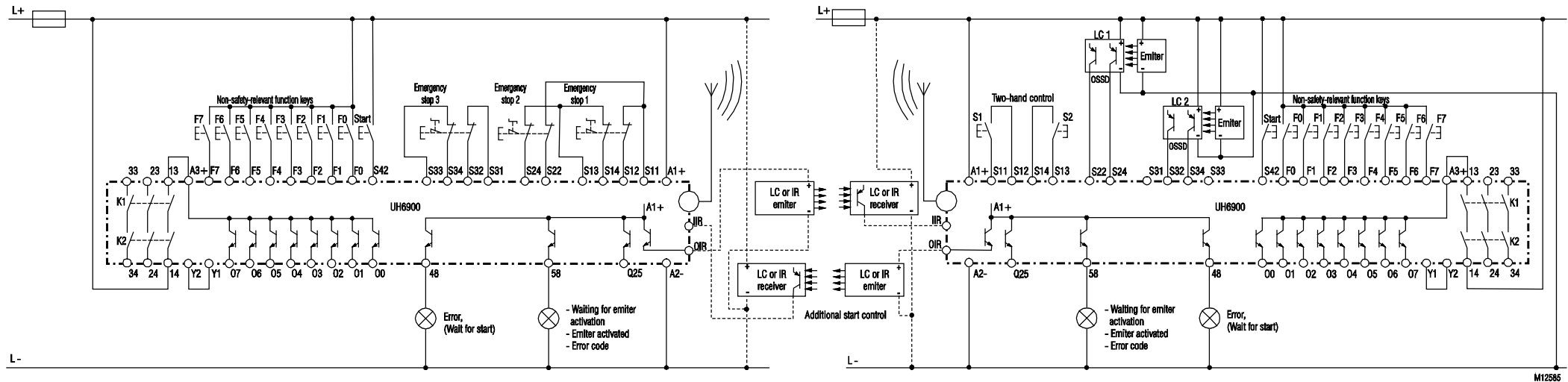
Operation mode	Rotary switch		Start		Autostart			Tww-hand S11-S14	Remarks
	A	B	Funk	&IIR	S31-S34	S22-S24	S11-S14		
Cross Operation	2	0	✓						
	2	1	✓		✓				
	2	2	✓		✓	✓			
	2	3	✓		✓	✓	✓		
	2	4	✓					✓	Two-hand without Autostart
	2	5	✓	✓					
	2	6	✓	✓	✓				
	2	7	✓	✓	✓	✓			
	2	8	✓	✓	✓	✓	✓		
	2	9	✓	✓				✓	Two-hand without Autostart
	3	0	✓		✓			✓	Two-hand with Autostart S31-S34
	3	1	✓		✓	✓		✓	Two-hand with Autostart S31-S34, S22-S24
	3	2	reserved						
	3	3	reserved						
	3	4	reserved						
	3	5	✓	✓	✓			✓	Two-hand with Autostart S31-S34
	3	6	✓	✓	✓	✓		✓	Two-hand with Autostart S31-S34, S22-S24
	3	7	reserved						
	3	8	reserved						
	3	9	reserved						

**Note:** In the operating modes with two-hand control, both push-buttons of the two-hand control must be released if another safety element of the UH 6900 radio-controlled safety module responds.

Only after all other safety elements are free and reset, if necessary, the safety relays on the opposite side can be enabled again with the two-hand control.

**Note:** The start button connected on S42 can be used to simulate the obligatory opening and closing of the safety elements with auto start (for ex. safety gates) after power ON of the UH 6900 radio-controlled safety module.

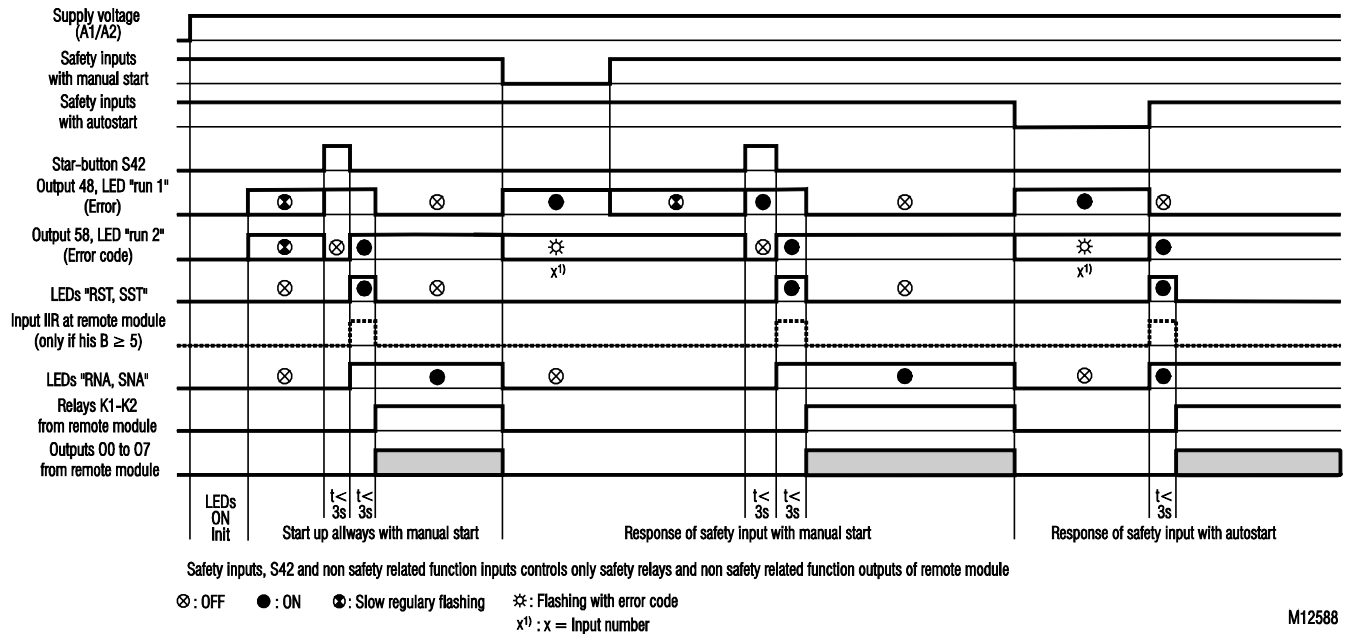
## 6.4.2.2 Application examples



- The safety inputs on S11-S14, S22-S24, and S31-S34 can all be equipped with a two-channel push-button or with an LC.
- Two-hand push-buttons are always connected to S11-S14.

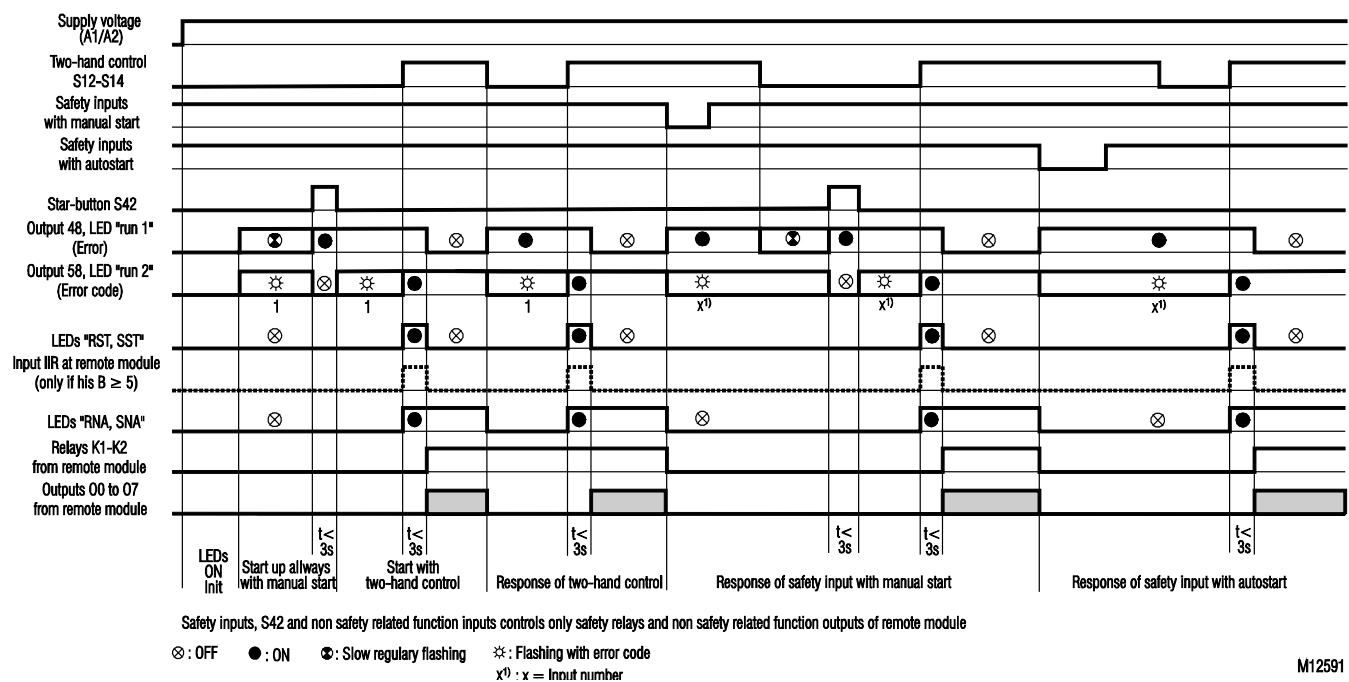
### 6.4.2.3 Function diagrams

#### 6.4.2.3.1 Cross-operation without two-hand control

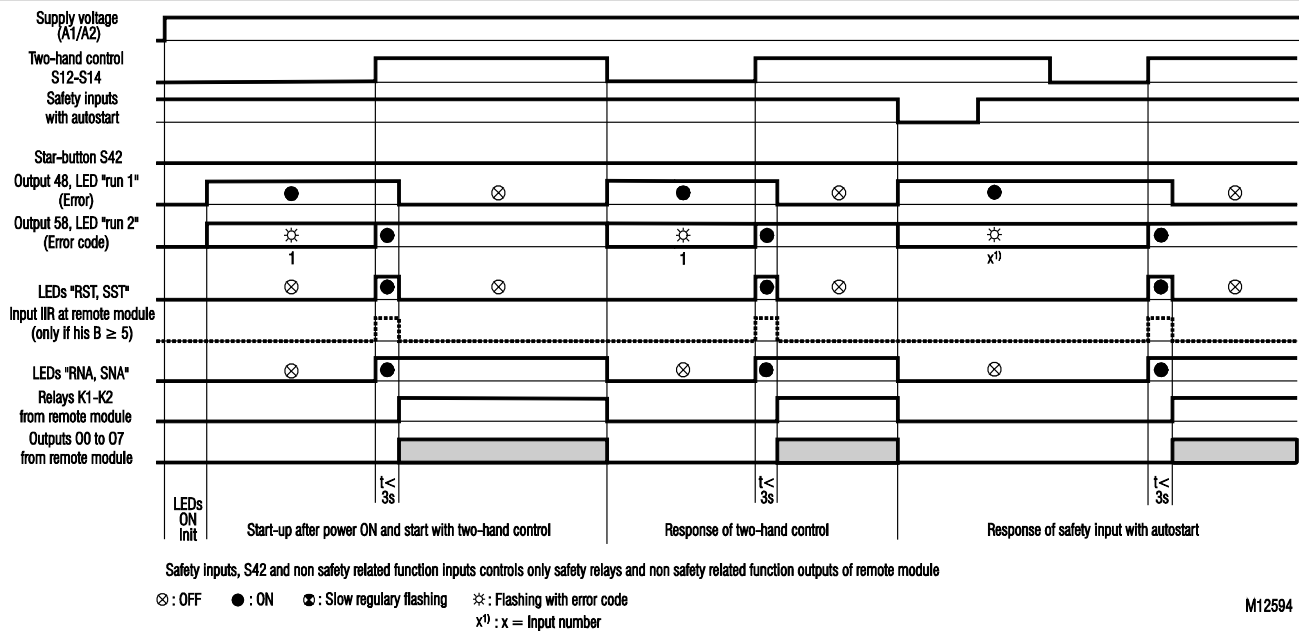


M12588

#### 6.4.2.3.2 Cross-operation with two-hand control, manual start, and auto start

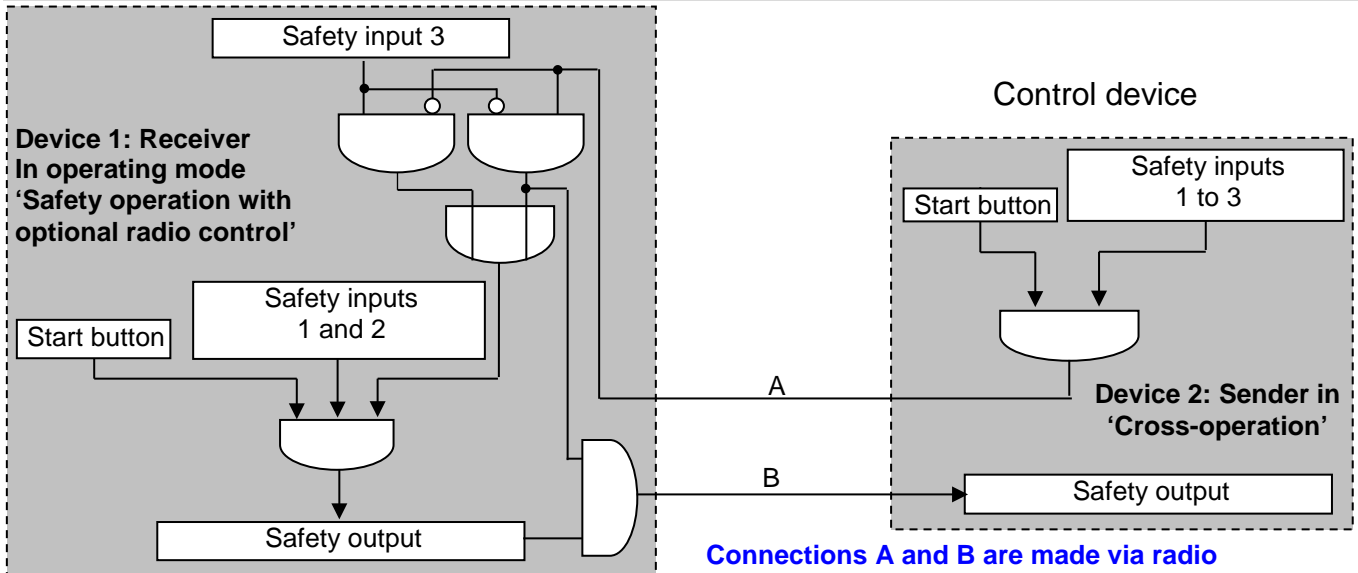


M12591

**6.4.2.3.3 Cross-operation with two-hand control and auto start only**

M12594



**6.4.3 'Safety operation with optional radio control' mode of operation**

Device 1 basically works as a receiver. Device 2 basically works as an optional control device. The safety inputs 1 and 2 of the receiver module (device 1) are always enabled. They can be set for the manual or auto start types.

The state of safety input 3 switches the receiver (device 1) to one of the two operating modes below:

- **Operating mode 1**  
Both external contacts of the safety input are closed, current is thus applied to the safety inputs. The receiver works only with its own safety inputs 1 and 2. In this mode no radio signal is evaluated.
- **Operating mode 2**  
Both external contacts of the safety input are open, thus no current is applied to the safety inputs.

**There must be a radio link to the control device (device 2).**

In this state, the safety elements of the control device also switch off the safety relay of the receiver.

The non-safety-relevant function inputs of the control device switch the non-safety-relevant function outputs of the receiver.

The receiver sends the states of its safety relays and its non-safety-relevant function inputs to the control device, which uses them to control its safety relays and function outputs.

Devices in the '**Safety operation with optional radio control**' mode of operation are controlled by devices operating in the different variants of the '**Cross-operation**' mode of operation.



WARNING

**In this application mode the output contacts of the control device must not be used as safety outputs**

They are only used as status feedback signals of the safety outputs of the receiver module.

The following conditions apply for the opening and closing of the external contacts of the safety input 3 with activated output relays:

- **Case 1**

**After both external contacts of the safety input 3 were closed, the first contact of safety input 3 opens:**

The controller must successfully establish the radio connection within the radio activation time set via rotary switch B, and the second external contact of safety input 3 must also open in this time. Otherwise, the output relays drop out after expiry of the time.

The standby of the reception module is shown by the fast flashing of its LED run 2 and its output 58.

The successful establishing of a connection is signalled as follows:

- LED run 1 goes off.
- Output 48 switches off.
- LED run 2 switches from flashing to continuous light.
- Output 58 is activated continuously.

- **Case 2**

**After both external contacts of safety input were open, the first contact of safety input 3 closes:**

The second external contact of safety input 3 must be closed within the set radio activation time. Furthermore, the radio connection must not be interrupted, as long as the second external contact of the safety input is open. If one of the two conditions is not fulfilled, both output relays drop out.

The standby of the reception module is shown by the fast flashing of its LED run 2 and its output 58.

**The second external contact closes:**

The receiver interrupts the radio connection to the controller and only the own wired safety inputs are evaluated.

This state is signalled as follows:

- LED run 2 goes off.
- Output 58 switches off.
- LED run 1 switches from flashing to continuous light.
- Output 48 is activated continuously.

In this operating mode, different controllable conditions are available at the receiver module for enabling the safety relays.

**6.4.3.1 Setting the start mode and the radio activation time**

Rotary switch B Monitoring time for radio activation									
0	1	2	3	4	5	6	7	8	9
5 s	10 s	15 s	20 s	30 s	5 s	10 s	15 s	20 s	30 s
Detection of radio start signal only					Detection of the radio start signal together with the start signal on the IIR terminal				

Operation mode	Rotary switch		Start		Autostart			Twv-hand	Remarks
	A	B	Funk	&IIR	S31-S34	S22-S24	S11-S14	S11-S14	
Safety operation with optional radio control	4	0..4	✓ <sup>1)</sup>						Reset of deactivations on control device if such deactivations were triggered by the control device <sup>3)</sup>
	4	5..9	✓ <sup>1)</sup>	✓ <sup>1)</sup>					
	5	0..4	✓ <sup>1)</sup>						Reset of deactivations, that were triggered by the control device, through reset on the control device and the S42 on the receiver <sup>3)</sup>
	5	5..9	✓ <sup>1)</sup>	✓ <sup>1)</sup>					
	6	0..4	✓ <sup>1)</sup>						Reset of all deactivations through control device possible <sup>3)</sup>
	6	5..9	✓ <sup>1)</sup>	✓ <sup>1)</sup>					
	7	0..4	✓ <sup>1)</sup>				✓ <sup>2)</sup>	✓ <sup>2)</sup>	Reset of all deactivations through the control device <sup>3)</sup>
	7	5..9	✓ <sup>1)</sup>	✓ <sup>1)</sup>			✓ <sup>2)</sup>	✓ <sup>2)</sup>	
	8	0..4	✓ <sup>1)</sup>				✓ <sup>2)</sup>	✓ <sup>2)</sup>	Reset of all deactivations through S42 on the receiver after reset on control device <sup>3)</sup>
	8	5..9	✓ <sup>1)</sup>	✓ <sup>1)</sup>			✓ <sup>2)</sup>	✓ <sup>2)</sup>	
	9	0..9	reserved						
<sup>1)</sup> Radio signal only decoded if S32-S34 not power supplied									
<sup>2)</sup> Autostart function only if S32-S34 power supplied									
<sup>3)</sup> After deactivations at the receiver module the safety elements on the control device must also be enabled again									

<sup>\*)</sup> If the receiver module is disabled while the radio control is active, for example by pressing a wire-connected emergency stop push-button, the safety elements on the control device must also be enabled again in order to enable the receiver module. This prevents that a second person switches on the machine while a person on a mobile machine equipped with a control device (for example a fork-lift truck) stays in the hazard zone.

**Specialty with auto start settings:**

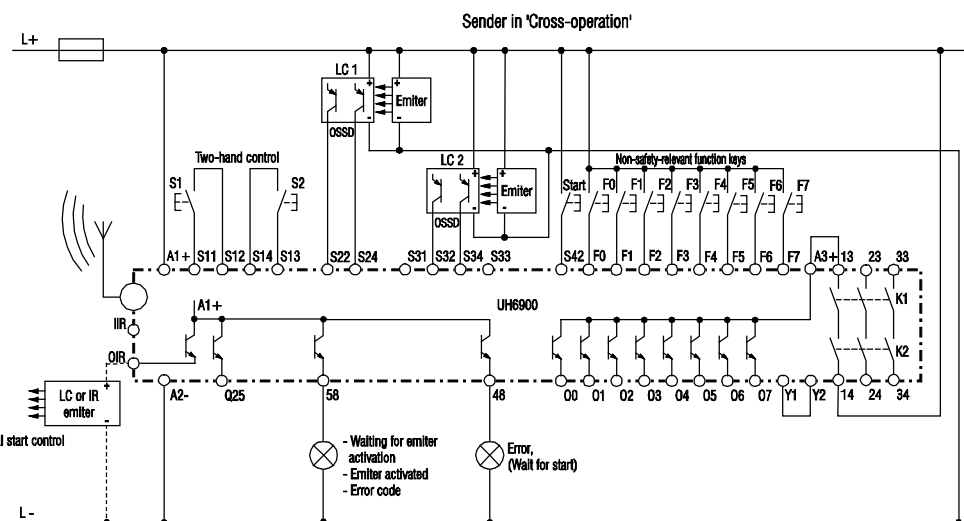
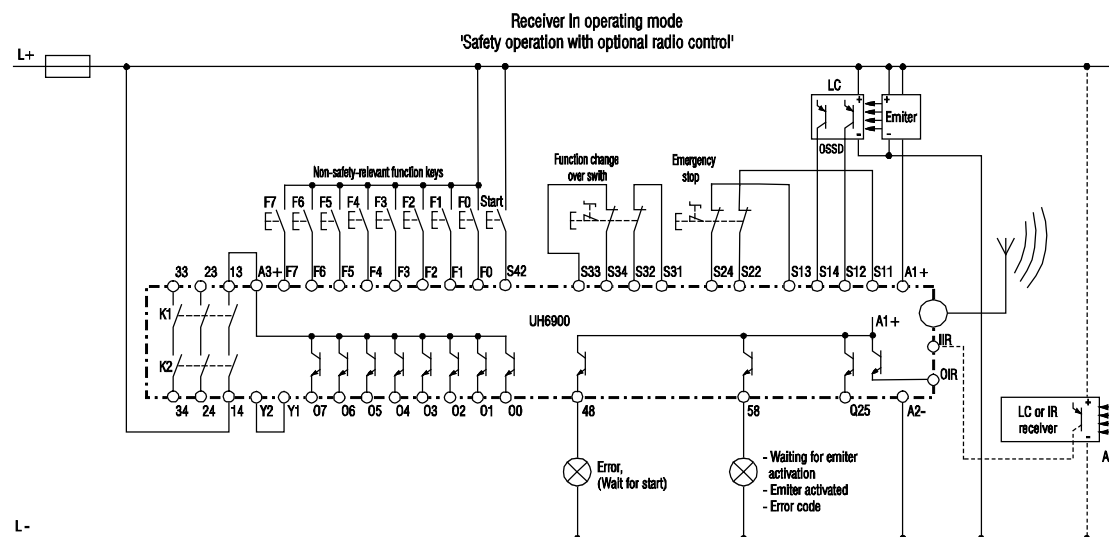
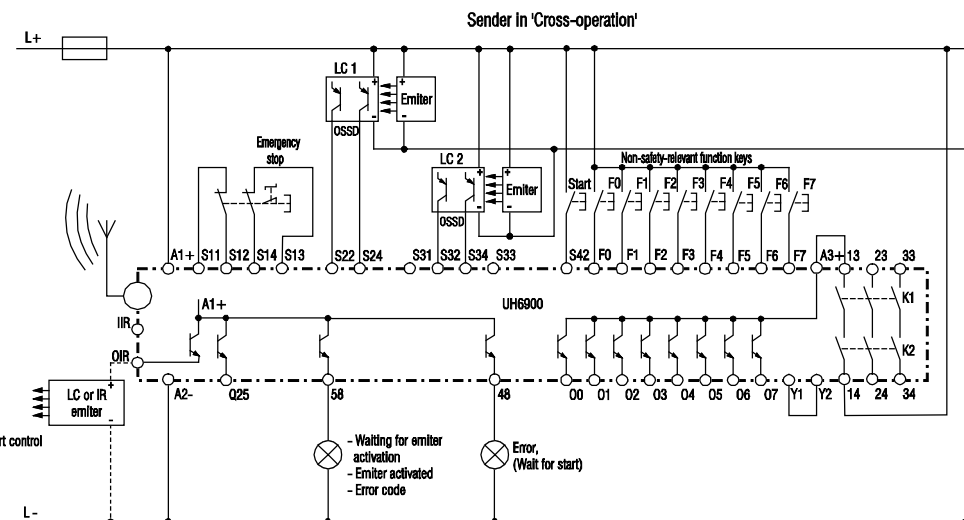
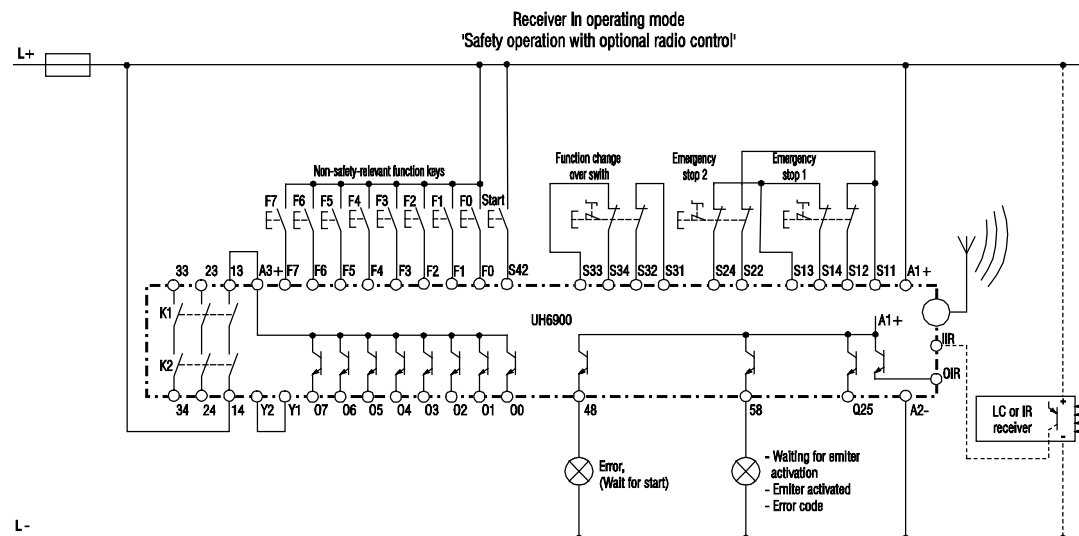
If, after switching off with radio control enabled, inputs S32, S34 are supplied with power again through a wired safety element, the safety relays of the UH 6900 radio-controlled safety module are not enabled automatically. In such case, it is always the receiver module that must be enabled again by pressing the start button on S42.



**If it is intended that a person can enter the hazard zone of a machine in operation with the help of the activated radio-controlled safety module** (for example one-shift operation) the machine must be running at a safe speed. The two status signals on the outputs 48 and 58 of the radio-controlled safety module UH 6900 can be used to reduce speed and activate monitoring.

To obtain reliable status information, the states of both outputs must be analysed together.

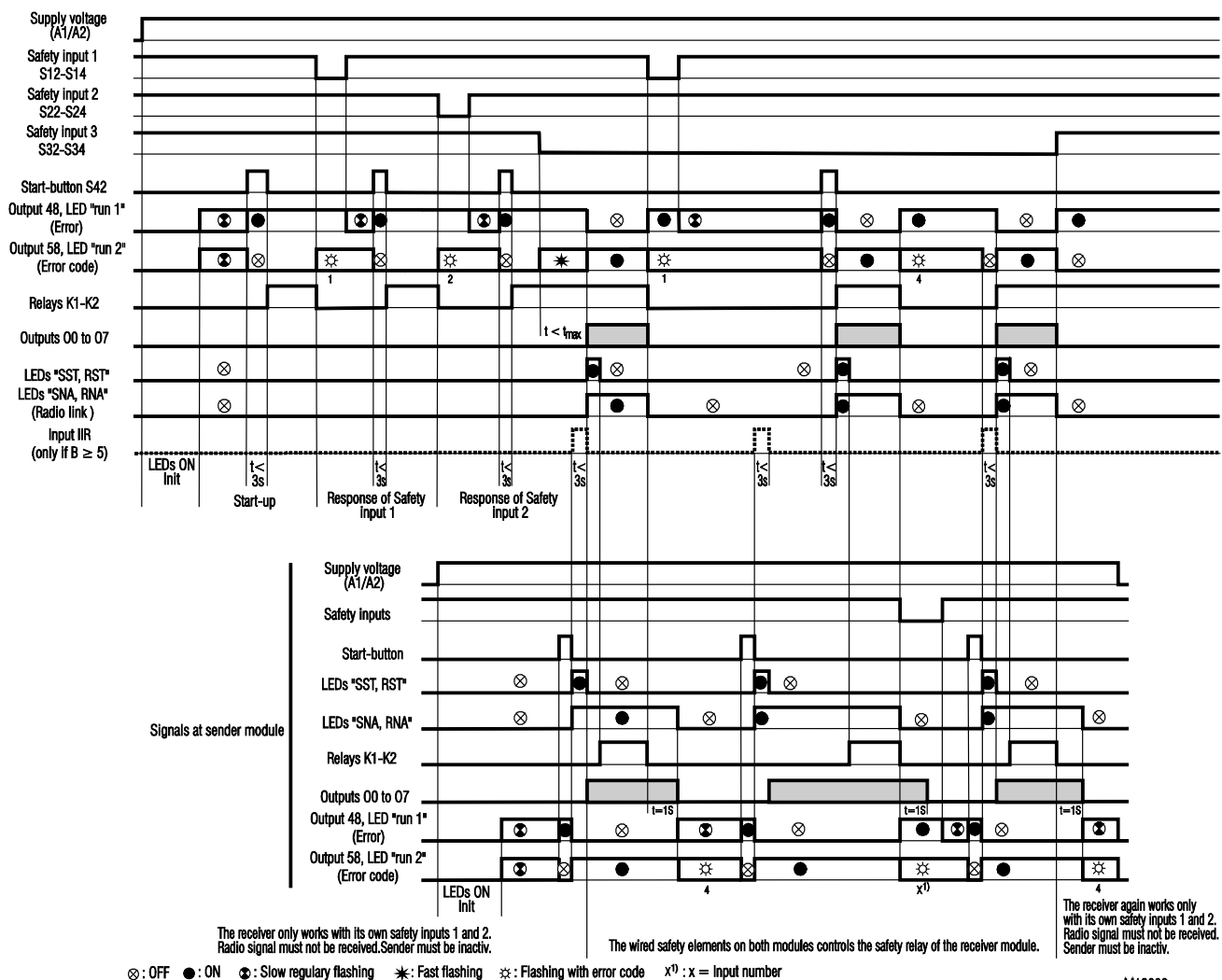
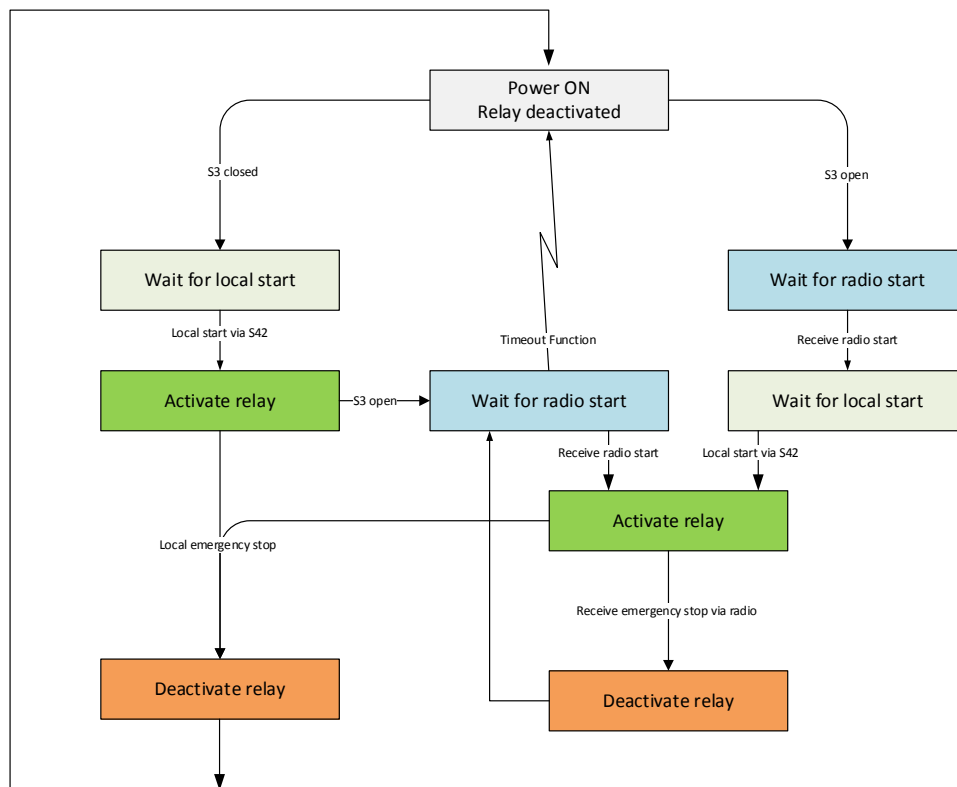
### 6.4.3.2 Application examples



- The safety inputs on S11-S14 and S22-S24 of the receiver module in the 'Safety operation with optional receiver' operating mode can all be equipped with a two-channel push-button or with a LC of the type 4 in accordance with EN 61 496.
- For the control module ('Cross-operation' operating mode), only the operating modes without detection of the IIR input (rotary switch B≤ 5) may be used.

## 6.4.3.3 Function diagrams

## 6.4.3.3.1 Setting A = 4: 2 x manual start, reset of remote deactivation through control module



M12603

```
graph TD; Start([Power ON  
Relay deactivated]) -- "S3 closed" --> WaitLocal1[Wait for local start]; Start -- "S3 open" --> WaitRadio1[Wait for radio start]; WaitLocal1 -- "Local start via S42" --> ActivateRelay1[Activate relay]; WaitRadio1 -- "Timeout Function" --> Start; WaitRadio1 -- "Receive radio start" --> ActivateRelay2[Activate relay]; ActivateRelay1 -- "S3 open" --> WaitRadio2[Wait for radio start]; ActivateRelay2 -- "Local start via S42" --> WaitLocal2[Wait for local start]; ActivateRelay1 -- "Local emergency stop" --> DeactivateRelay1[Deactivate relay]; ActivateRelay2 -- "Receive emergency stop via radio" --> DeactivateRelay2[Deactivate relay]; DeactivateRelay1 --> Start; DeactivateRelay2 --> Start;
```



```
graph TD; Start([Power ON  
Relay deactivated]) -- "S3 closed" --> WaitLocal[Wait for local start]; Start -- "S3 open" --> WaitRadio1[Wait for radio start]; WaitLocal -- "Local start via S42" --> ActivateRelay1[Activate relay]; ActivateRelay1 -- "S3 open" --> WaitRadio2[Wait for radio start]; ActivateRelay1 -- "Local emergency stop" --> DeactivateRelay1[Deactivate relay]; WaitRadio1 -- "Receive radio start" --> ActivateRelay2[Activate relay]; WaitRadio2 -- "Timeout Funktion" --> WaitRadio1; WaitRadio2 -- "Receive radio start" --> ActivateRelay2; ActivateRelay2 -- "Receive emergency stop via radio" --> DeactivateRelay2[Deactivate relay]; DeactivateRelay1 --> Start; DeactivateRelay2 --> Start;
```

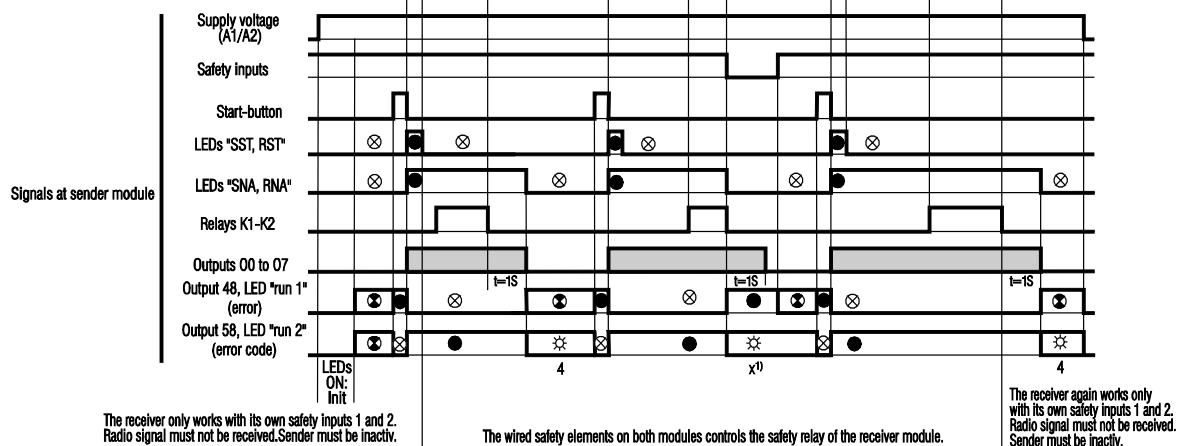
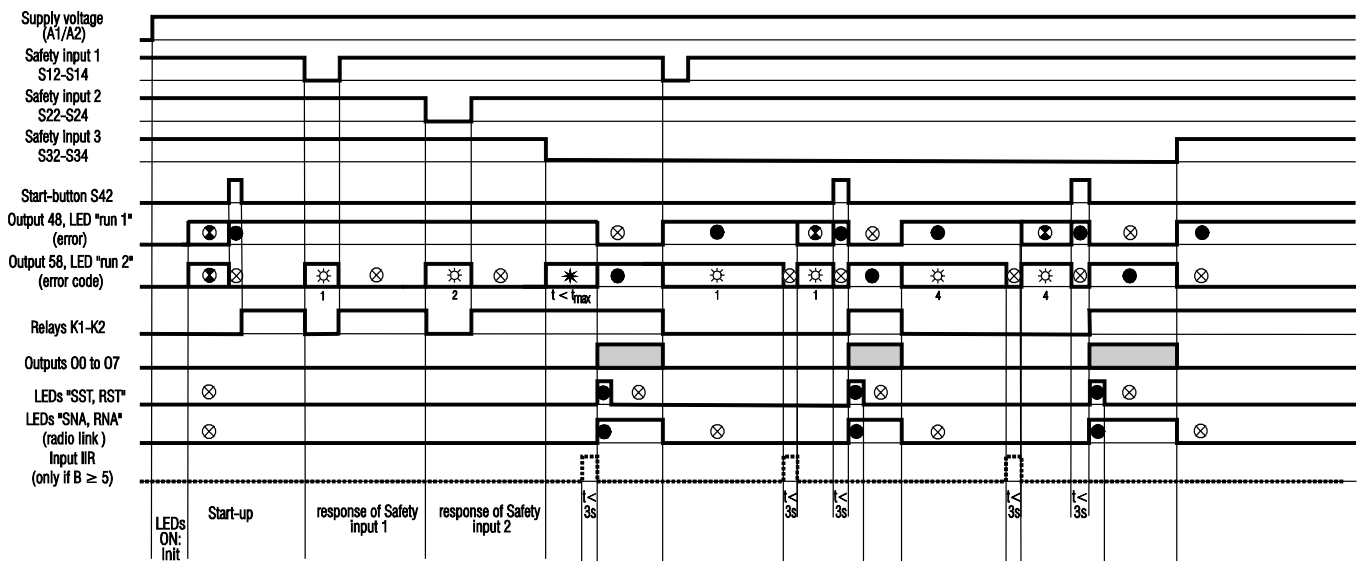
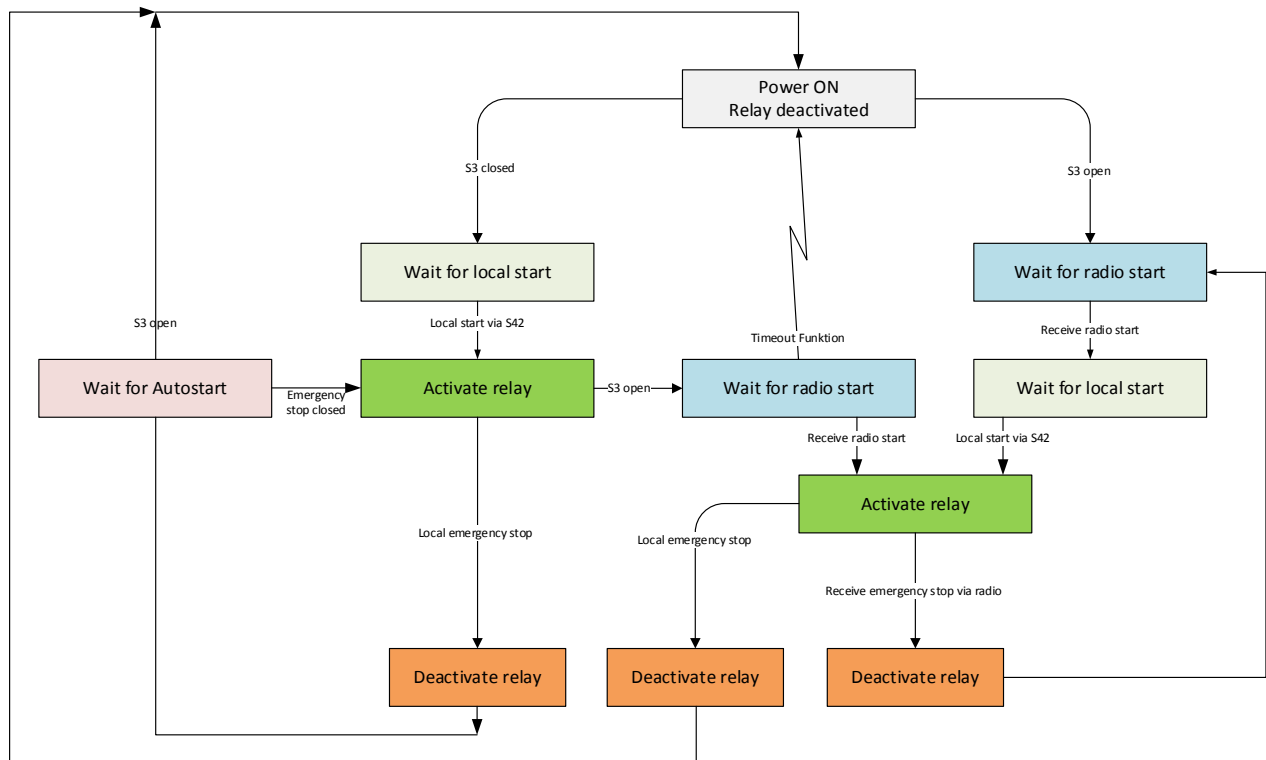


```

graph TD
    Start([Power ON  
Relay deactivated]) -- "S3 closed" --> WaitLocal[Wait for local start]
    Start -- "S3 open" --> WaitRadio[Wait for radio start]
    
    WaitLocal -- "Local start via S42" --> ActivateRelay1[Activate relay]
    WaitRadio -- "Timeout Funktion" --> ActivateRelay1
    
    WaitRadio -- "Receive radio start" --> ActivateRelay2[Activate relay]
    
    ActivateRelay1 -- "Local emergency stop" --> DeactivateRelay1[Deactivate relay]
    ActivateRelay2 -- "Receive emergency stop via radio" --> DeactivateRelay2[Deactivate relay]
    
    DeactivateRelay1 --> Start
    DeactivateRelay2 --> Start
  
```





**6.4.3.3.5 Setting A = 8: 2 x auto start, reset of remote deactivation through S42 after reset on control module**

The receiver only works with its own safety inputs 1 and 2. Radio signal must not be received. Sender must be inactive.



























The wired safety elements on both modules controls the safety relay of the receiver module.

The receiver again works only with its own safety inputs 1 and 2. Radio signal must not be received. Sender must be inactive.

⊗ : OFF    ● : ON    ⊕ : slow regulary flashing    ✱ : flashing with error code  
x<sup>(1)</sup> : x = input number

M12553

## 6.5 Overview Control modes

Operation mode	Rotary switch		Start		Autostart			Two-hand S11-S14	Remarks
	A	B	Radio	&IIR	S31-S34	S22-S24	S11-S14		
Full Safety Operation	0	0	✓						Two-hand without Autostart
	0	1	✓		✓				
	0	2	✓		✓	✓			
	0	3	✓		✓	✓	✓		
	0	4	✓					✓	
	0	5	✓	✓					
	0	6	✓	✓	✓				
	0	7	✓	✓	✓	✓			
	0	8	✓	✓	✓	✓	✓		
	0	9	✓	✓				✓	Two-hand without Autostart
	1	0	✓		✓			✓	Two-hand with Autostart S31-S34
	1	1	✓		✓	✓		✓	Two-hand with Autostart S31-S34, S22-S24
	1	2	reserved						Two-hand with Autostart S31-S34 Two-hand with Autostart S31-S34, S22-S24
	1	3	reserved						
	1	4	reserved						
	1	5	✓	✓	✓			✓	
	1	6	✓	✓	✓	✓		✓	
	1	7	reserved						
Cross Operation	1	8	reserved						Two-hand with Autostart S31-S34 Two-hand with Autostart S31-S34, S22-S24
	1	9	reserved						
	2	0	✓						
	2	1	✓		✓				
	2	2	✓		✓	✓			
	2	3	✓		✓	✓	✓		
	2	4	✓					✓	Two-hand without Autostart
	2	5	✓	✓					
	2	6	✓	✓	✓				
	2	7	✓	✓	✓	✓			
	2	8	✓	✓	✓	✓	✓		
	2	9	✓	✓				✓	
	3	0	✓		✓			✓	Two-hand with Autostart S31-S34
	3	1	✓		✓	✓		✓	Two-hand with Autostart S31-S34, S22-S24
	3	2	reserved						Two-hand with Autostart S31-S34 Two-hand with Autostart S31-S34, S22-S24
	3	3	reserved						
	3	4	reserved						
	3	5	✓	✓	✓			✓	
	3	6	✓	✓	✓	✓		✓	
	3	7	reserved						
Safety operation with optional radio control	3	8	reserved						Reset of deactivations on control device if such deactivations were triggered by the control device <sup>3)</sup>
	3	9	reserved						
	4	0.4	✓ <sup>1)</sup>						
	4	5..9	✓ <sup>1)</sup>	✓ <sup>1)</sup>					
	5	0.4	✓ <sup>1)</sup>						
	5	5..9	✓ <sup>1)</sup>	✓ <sup>1)</sup>					
	6	0.4	✓ <sup>1)</sup>						Reset of all deactivations through control device possible <sup>3)</sup>
	6	5..9	✓ <sup>1)</sup>	✓ <sup>1)</sup>					
	7	0.4	✓ <sup>1)</sup>			✓ <sup>2)</sup>	✓ <sup>2)</sup>		
	7	5..9	✓ <sup>1)</sup>	✓ <sup>1)</sup>		✓ <sup>2)</sup>	✓ <sup>2)</sup>		
	8	0.4	✓ <sup>1)</sup>			✓ <sup>2)</sup>	✓ <sup>2)</sup>		
	8	5..9	✓ <sup>1)</sup>	✓ <sup>1)</sup>		✓ <sup>2)</sup>	✓ <sup>2)</sup>		
	9	0..9	reserved						• Reset of all deactivations through S42 on the receiver after reset on control device <sup>3)</sup>
	<sup>1)</sup> Radio signal only decoded if S32-S34 not power supplied								
	<sup>2)</sup> Autostart function only if S32-S34 power supplied								
	<sup>3)</sup> After deactivations at the receiver module the safety elements on the control device must also be enabled again								

## 6.6 Bidirectional paired mode and unidirectional group mode

The radio mode type determines if the devices work in bidirectional or unidirectional radio mode. It is already permanently programmed and cannot be changed by the user.

You can select from:

### **Paired mode** (device variant MF)

In this mode a system always consists of two equally paired devices that communicate with each other via a safety **bidirectional** radio transmission. In complete safety mode, an emergency-off on one device switches off the safety relays on both devices.

### **Group mode** (device variants GC and GR)

In this mode, a system always consists of one group controller and several group receivers. The safety radio transmission is here **unidirectional**.

- An emergency-off on the controller causes a safety switch-off of the safety relays on all receivers.
- An emergency-off on one receiver only has a local safety effect.  
Optionally, all other receivers can also be switched off, however not with orientation on safety.

Furthermore, the group controller can be paired with one of the group receivers to exchange status data.

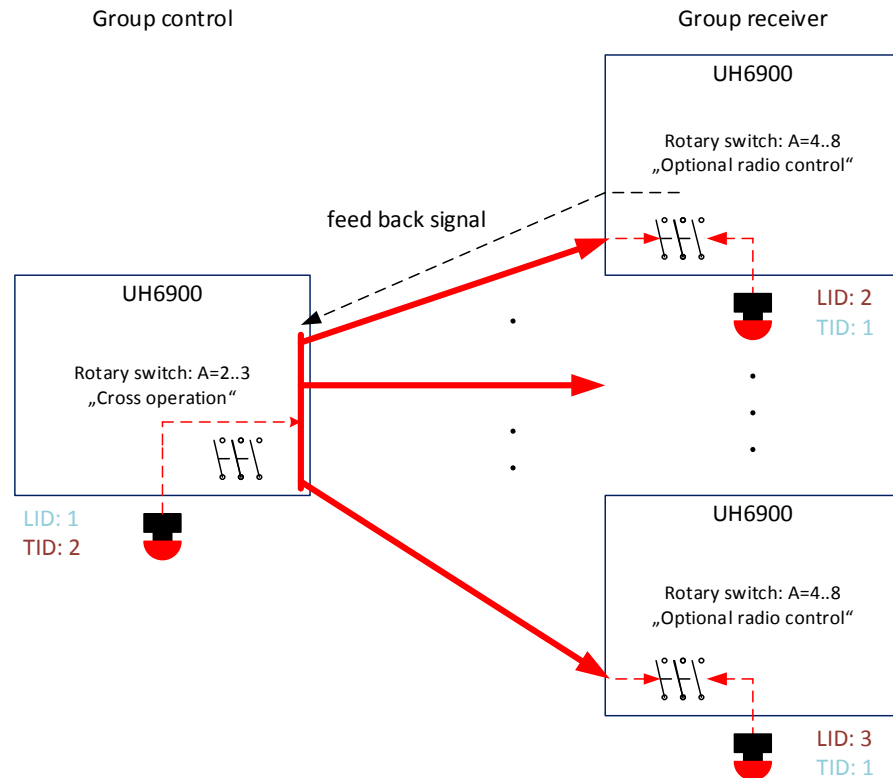
### 6.6.1 Paired mode (device variant MF)

This mode corresponds to the already presented operating modes that are set via the rotary switches (complete safety mode, cross operation, safety mode with connectable radio reception).

In all cases, always two equal devices work together, the device IDs and destination IDs of which are paired crosswise.

### 6.6.2 Group mode (device variants GC and GR)

In group mode, a device is always configured as controller and all others as receivers.



For the group controller, the rotary potentiometer A must be set to “cross mode” (A=2..3) and for all group receivers to “connectable radio mode” (A=4..8).

Furthermore, the target device IDs (ITD) of the receivers must be set to the device ID of the controller (LID).

$$LID|_{\text{"Steuergerät"}} = TID|_{\text{"Empfangsgerät"}}$$

In this configuration, an emergency-off signal is sent from the controller to all receivers.

A wired local emergency-off on a receiver affects only the local safety outputs of this device.

The receivers in the operating mode “**safety mode with connectable radio reception**” are controlled by the controller in the operating mode “**cross mode**”.



**The output contacts on the controller must not be used as safety outputs in this application.**

They can only be used for feedback of the state of the safety outputs of a receiver module.

A receiver can be additionally paired with the controller. For this, the target device ID on the controller (TID) must match the device ID of the receiver (LID).

$$TID|_{\text{"Steuergerät"}} = LID|_{\text{"Empfangsgerät"}}$$

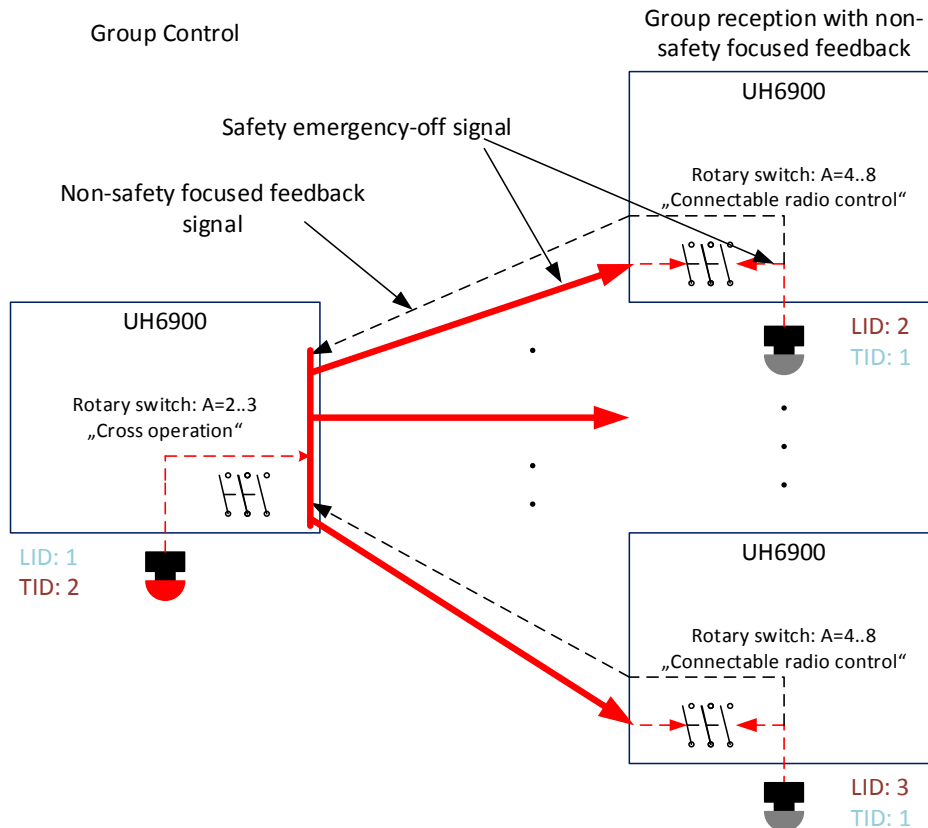
In this configuration, the controller can receive the feedback of the safety outputs of this receiver. Furthermore, the function inputs and outputs of the two paired devices can switch alternately (not safety relevant).

**6.6.2.1 Optional: Group reception with non-safety focused feedback**

The group reception with feedback offers the additional option of grouped switching off from the group receiver.

The local emergency-off causes a safe switching off of the local safety outputs. At the same time, the group receiver sends a non-safety focused status signal to all group members to switch off their safety outputs.

This option can be switched on or off using the supplied parameterisation software.



**A group receiver can be safely switched off locally. The status signal to switch off the remaining receivers in the group is not safety relevant and must therefore not be used as emergency-off signal.**

**6.6.2.2 Optional: Controlling the digital functional outputs of all group receivers**

In the normal group control mode a single receiver can be paired additionally with the group controller. For that the target ID set the group controller (TID) must be identical to the local ID of the group receiver (LID).

$$TID|_{\text{„Steuergerät“}} = LID|_{\text{„Empfängergerät“}}$$

In this configuration the group controller can switch the digital functional outputs of that single paired group receiver (not safety relevant).

There is another optional possibility, that the group controller can simultaneously control and

switch the digital functional outputs of all group receivers (instead of only one).

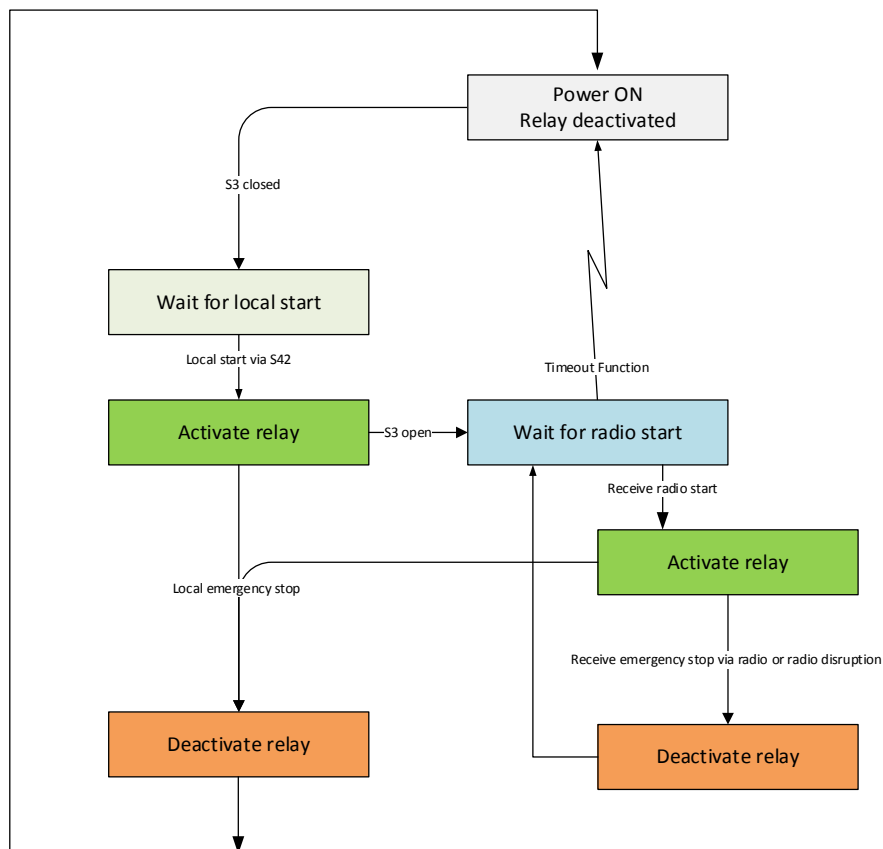
The digital functional outputs of every group receiver will therefore be set always to the same value.

This option can be switched on or off using the supplied parameterisation software.

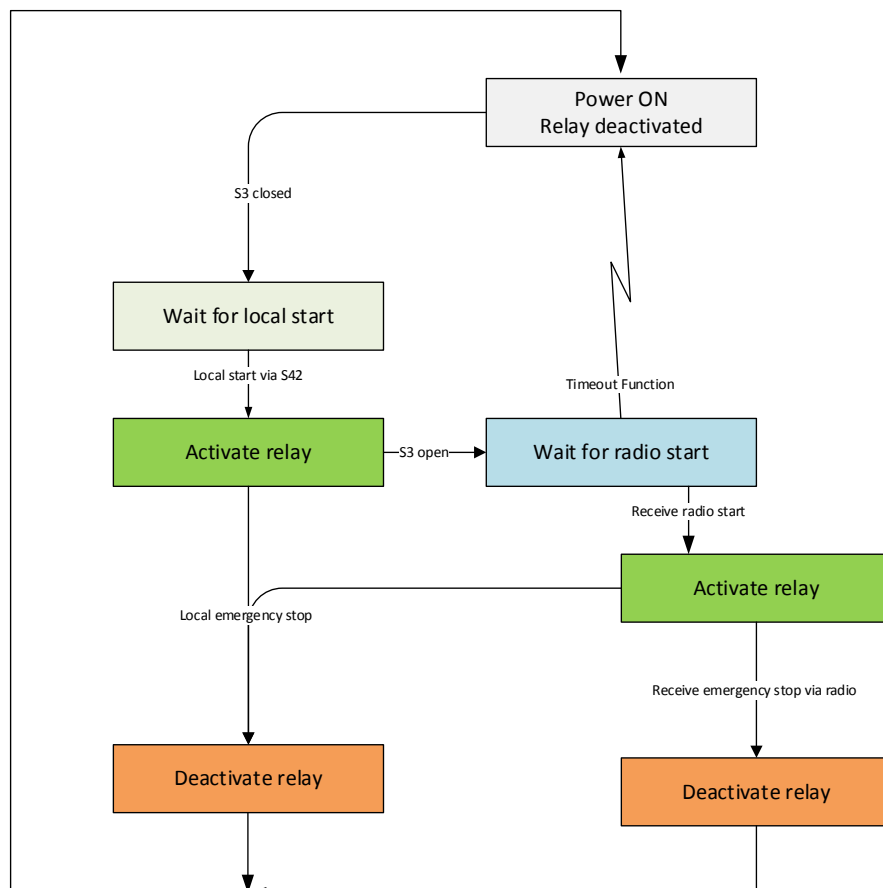
While configuring the group receiver one can define whether the group receiver should always accept the controlling commands for the functional output or only when the group controller and the group receiver are paired.

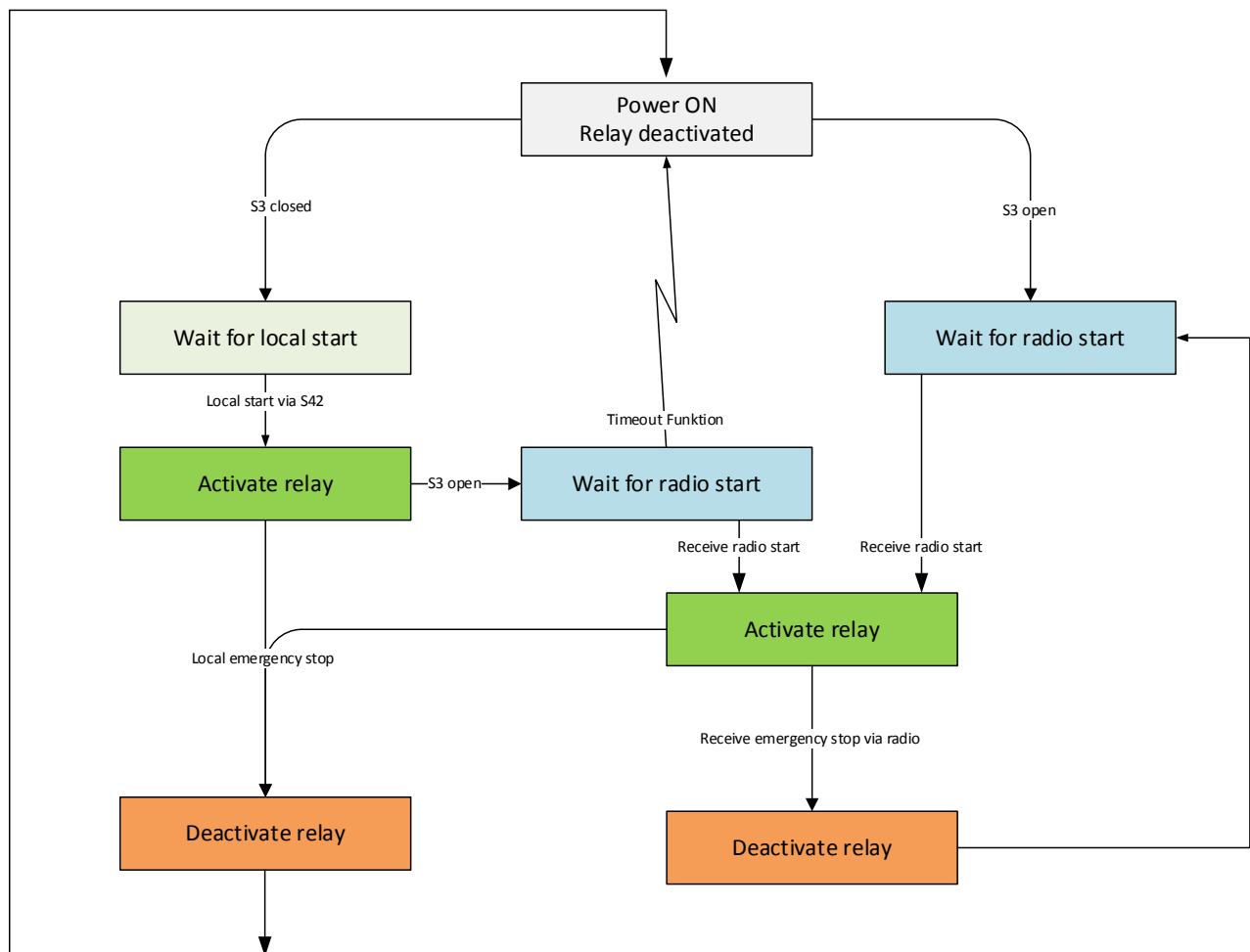
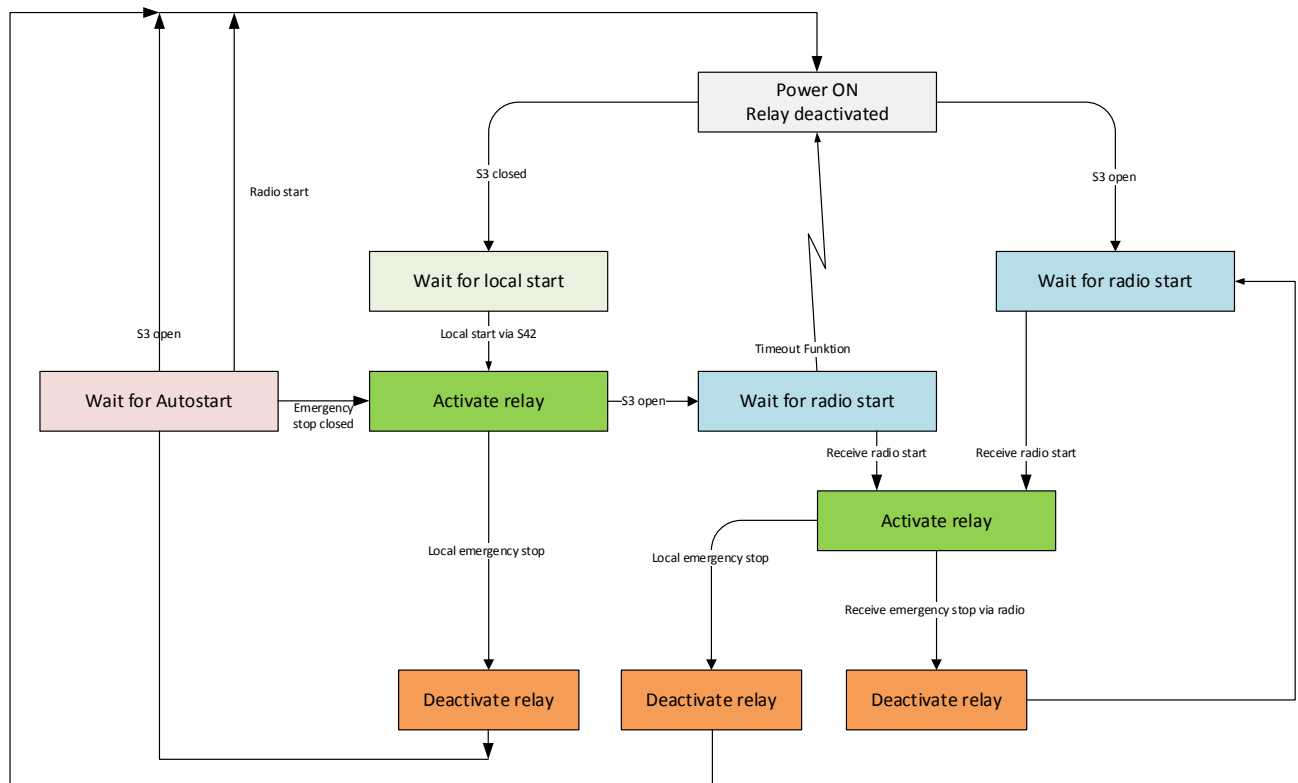
### 6.6.3 Function diagrams

#### 6.6.3.1 Setting A = 4: 2 x manual start, reset of the remote shutdown by means of the control module

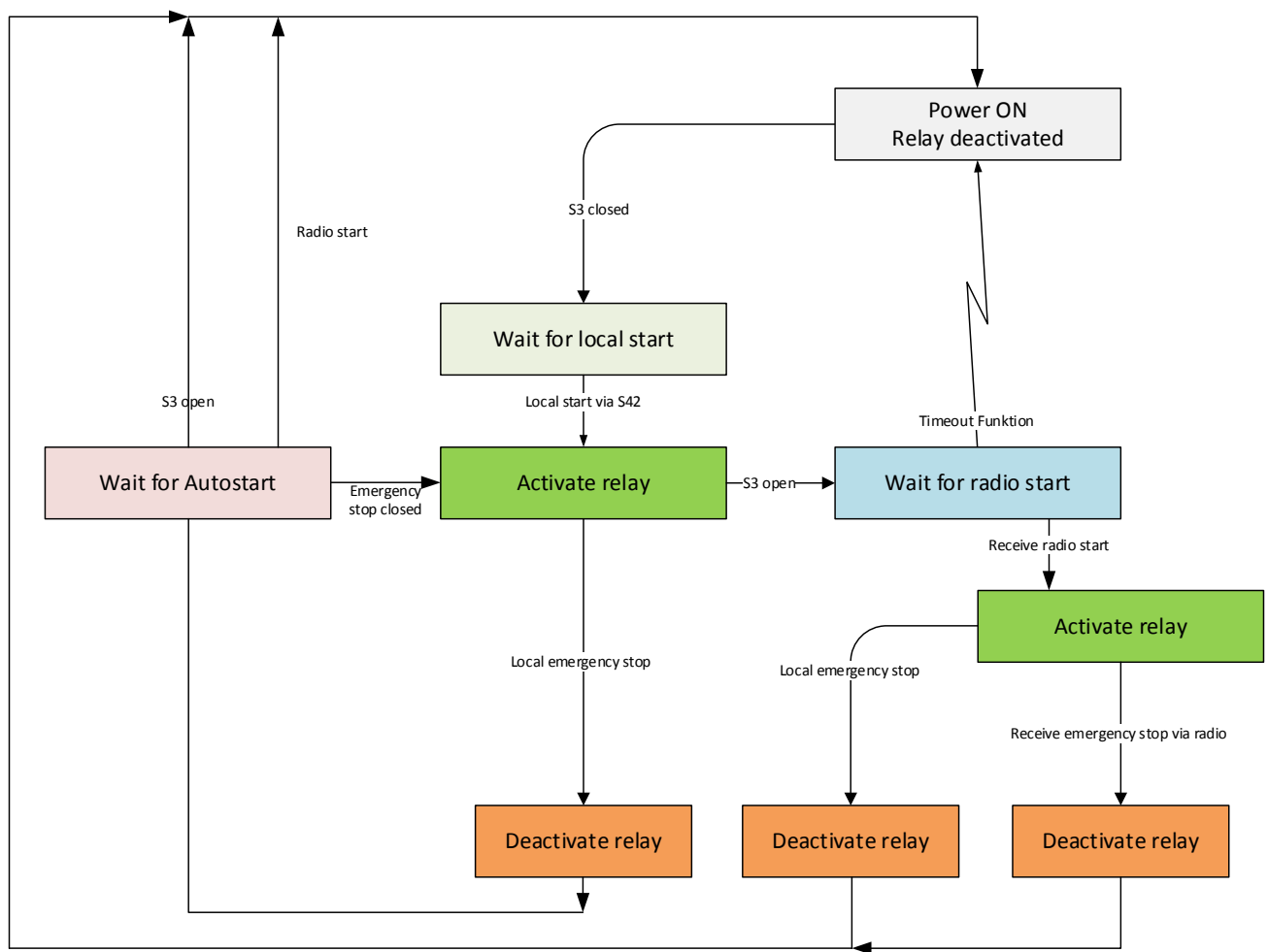


#### 6.6.3.2 Setting A = 5: 2 x manual start, reset of the remote shutdown with S42 after reset on the control module



**6.6.3.3 Setting A = 6: 2 x manual start, reset of all shutdowns also on the control module****6.6.3.4 Setting A = 7: 2 x auto start, reset of the remote shutdown on the control module**



**6.6.3.5 Setting A = 8: 2 x auto start, reset of the remote shutdown with S42 after reset on the control module**

## 7 Troubleshooting

### 7.1 Display and status indicators on UH 6900 radio-controlled safety module

Through three status semiconductor outputs and the LEDs on the front side of the radio-controlled safety module, different states are indicated:

	OFF	Flashing	Continuous signal
Output 48	<ul style="list-style-type: none"> <li>Radio operation, Relays K1, K2 enabled or</li> <li>System error if output 58 is OFF as well</li> </ul>	<b>Regular slow flashing:</b> Function error removed, waiting for start	<ul style="list-style-type: none"> <li>If output 58 and LED run 2 show a flashing code: Function error, relay K1, K2 disabled</li> </ul>
Yellow LED run 1	<ul style="list-style-type: none"> <li>Operation with radio, relays K1, K2 enabled</li> <li>System error when Run 2 with error code</li> </ul>	<b>Regular slow flashing:</b> Function error removed, waiting for start <b>Flashing code:</b> System error	<ul style="list-style-type: none"> <li>If output 58 and LED run 2 are OFF: Operation without radio, relays K1, K2 enabled</li> </ul>
Output 58	<ul style="list-style-type: none"> <li>Operation without radio, relays K1, K2 enabled or</li> <li>Start button was pressed for reset or</li> <li>System error when Output 48 is OFF as well</li> </ul>	<b>Regular slow flashing:</b> Waiting for start after power is turned on <b>Regular fast flashing:</b> Waiting for radio link in optional radio operating mode <b>Flashing code:</b> Function error	Radio operating mode, Relays K1, K2 enabled
Yellow LED Run 2	<ul style="list-style-type: none"> <li>Operation without radio, relays K1, K2 enabled or</li> <li>Start button was pressed for reset or</li> <li>System error when Run 1 with error code</li> </ul>	<b>Regular slow flashing:</b> Waiting for start after power is turned on <b>Regular fast flashing:</b> Waiting for radio link in optional radio operating mode <b>Flashing code:</b> <ul style="list-style-type: none"> <li>Function error if Run 1 is permanently on</li> <li>System error if Run 1 is off or with error code</li> </ul>	
Green LEDs K1, K2	Safety relays K1, K2 disabled		Safety relays K1, K2 enabled
Yellow LEDs Q1 – Q4	Flashing: Failure of radio unit or system error of safety module		
	Indication of radio signal quality: From Q1 to Q4 Off: poor reception From Q1 to Q4 On: excellent reception		
Green LEDs SST, RST	No radio start request		Radio start request enabled
Green LEDs SNA, RNA	No radio signal enabled to enable the safety relays		Radio signal enabled to enable the safety relays
Output Q25 and LED quality 25 %	Level of received radio signal above -90 dBm		No radio control or level of received radio signal below -90 dBm

The remaining yellow LEDs indicate the detected signal of the inputs and the control signal of the outputs.

## 7.2 Status and error codes

### 7.2.1 System errors in safety operation

A system error exists if all of the outputs (safety relays and all of the semiconductor outputs) are disabled and their related LEDs are off.

**System errors are indicated by flashing codes of LED run1 and/or LED run 2, depending on the error. At the same time, LEDs 48 and 58 are OFF.**

The LEDs can also show different error codes at the same time (No. = number of short flashes). In case of a system error in safety operation the LEDs Q1 and Q2 of the radio unit flash as well.

No.	Description	Notes and measures
0 (OFF)	Communication failure between the processors	1) If a processor detects a system error, it indicates such error by a flashing code and interrupts communication with the other processor. The other processor will then display error 0. 2) If both LEDs remain OFF, the device is defective and must be repaired.
5	Setting error	1) The rotary switch settings for both channels do not match. 2) Invalid setting.
6	Under- or overvoltage	1) Left LED 'run 1' flashes: The supply voltage has fallen below the minimum voltage level of $< 0.85 \text{ UN..}$ 2) Right LED 'run 2' flashes: The supply voltage is too high ( $> 1.15 \text{ UN} + 5 \% \text{ residual ripple}$ ).
7	Input failure	A short circuit has occurred on the inputs.
8	Failure on relay outputs	1) If the safety relays are disabled, the feedback circuit on Y1-Y2 is not closed. (The feedback circuit must close within 50ms after disabling the relays). 2) One of the output relays or its control is defective. Unit must be repaired.
9*)	Output failure	1) If the feedback circuit on Y1-Y2 is not closed when the module is switched on the LED 'run 2' flashes indicating error 9 and LED 'run 1' indicates error 11. 2) For one of the two channels it was detected that the required positions of the output contacts do not match.
10*)	Software error	A processor detected an error in it's own routine.
11*)	Matching error	1) If the feedback circuit on Y1-Y2 is not closed when the module is switched on the LED 'run 2' flashes indicating error 9 and LED 'run 1' indicates error 11. 2) It takes too long until both hardware channels match.
12	Version error	The software versions of both device components do not match. Unit must be repaired.
13	Checksum error	The program memory of a processor is defective. Unit must be repaired.
14	RAM failure	The working memory of a processor is defective. Unit must be repaired.
15	Timer failure	The timer of a processor is defective. Unit must be repaired.

\*) Errors 9, 10 and 11: Try and analyse the procedure that has led to this error and pass this information to the manufacturer or supplier of the unit.

In case of questions with regard to behaviour that cannot be explained it can be beneficial if you send us a video recording of the front side that shows the flashing sequences of all LEDs in full length (minimum of 2 cycles of the LED that displays the highest error code).

**7.2.2 Status indicator**

As opposed to system errors, regular statuses that lead to a disabling of the safety outputs are indicated by LED 'run2' and the LED of output 58 with an error code (No.: number of flashes). As long as this error continues, the LEDs 'run 1' and 48 are permanently on and output 48 is enabled.

LED 'run 1' and output 48 flash regularly if enabling by the start button or via radio is possible again.

No.	Message	Explanation
1	Deactivation through safety input 1	The safety function on S12, S14 has responded.
2	Deactivation through safety input 2	The safety function on S22, S24 has responded.
3	Deactivation through safety input 3	The safety function on S32, S34 has responded.
4	Deactivation through radio signal	The safety relay was deactivated via radio or by the other radio-controlled safety module, or the radio signal was interrupted.
5	Time-out error	Both signals of a safety input have not been enabled within 3 s. The required release of the safety relays of the other radio-controlled safety module was not properly confirmed. In the operating mode ' <b>Safety operation with optional radio control</b> ', the time limit for enabling or disabling the radio link after switching the contacts of safety input 3 was not met.
6	Start button pressed	Input S42 (start button) or input IIR is already supplied with power when the UH 6900 radio-controlled safety module is switched on or when the safety relay is disabled. The start button is pressed for more than 3 seconds.

## 8 Parameterization and diagnosis of radio features

You can adjust the radio features of the UH 6900 SAFEMASTER W module with the parameterization software “SAFEMASTER W Manager” that can be installed on any common personal computer.

The parameterization software provides the following options both for a device connected to the computer via USB or via radio:

### 1. Displayfunctions:

The following parameters can be displayed, but not changed:

- Radio mode type (paired mode, group control, group reception)
- System ID of the devices
- Device ID of the devices
- set frequency band (433 MHz or 869 MHz)
- received transmission power

### 2. Settingfunctions:

The following parameters can be displayed and changed:

- Device names for the two UH 6900 modules connected wirelessly
- Group reception mode if group reception is set as radio mode type. (Local breaker acts locally only, local breaker switches off entire group)
- Target device ID of the devices
- Frequency channel
- Transmission power
- Antenna type
- Antenna cable
- Standard and memory values of the semiconductor outputs

### 3. Diagnostic function:

The current state of the radio module of the device that is connected to the personal computer via USB can be displayed in a status screen and also the signal states that it can send or receive via radio.

## 8.1 Parameterization software “SAFEMASTER W Manager”

### 8.1.1 Computer HARDWARE requirements

- Operating system: Windows XP or higher
- RAM: 256 MB
- Hard disk Free disk space  $\geq$  30 Mbyte
- USB port: 1.1, 2.0, or 3.0
- CD ROM drive



Provide for potential equalization before connecting USB-cabel.

### 8.1.2 Installation of parameterization software

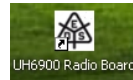
- Insert the installation CD;
- Wait for the installation program to request the SETUP of the software;

If it does not start automatically, open the Explorer and find and open the file **UH6900-Setup.exe**;

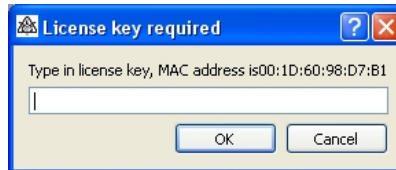
After the program has been installed, a window appears that prompts you to close the setup program.

If installation was successful, **UH6900-Setup.exe** will create an icon on your desktop.

To start the program, double-click on the icon. =>



The following dialogue appears:

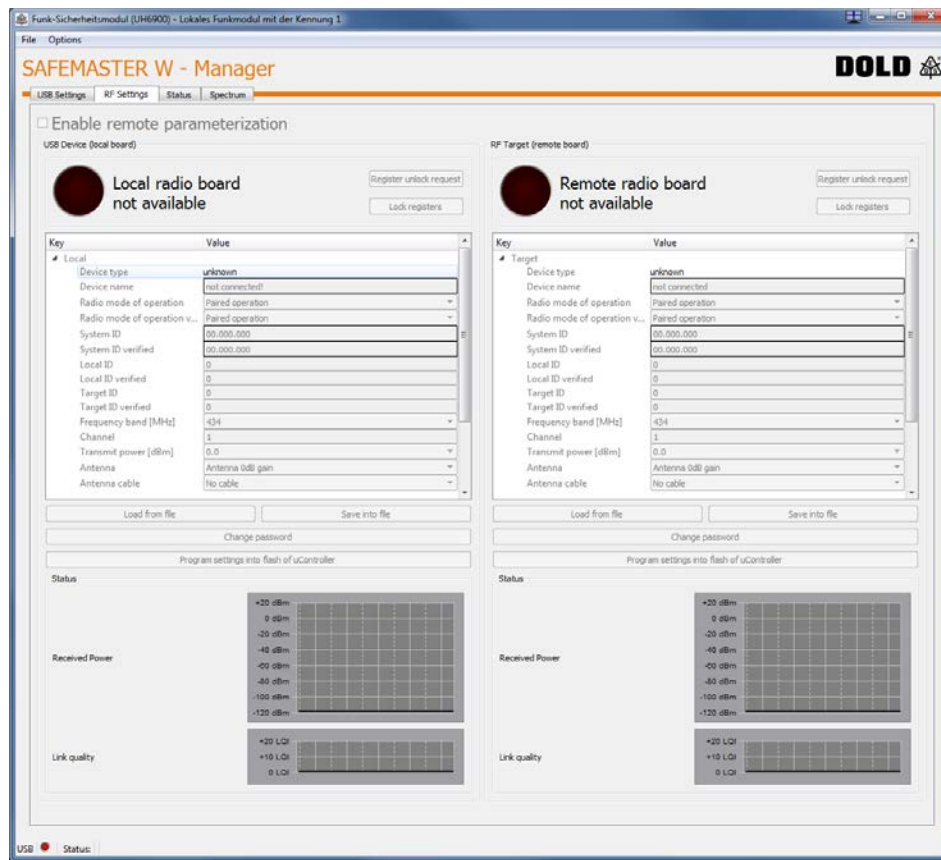


In this dialogue, enter the license key that is supplied within a text file on CD.

## 8.2 RF Settings window

### 8.2.1 Display of radio parameters

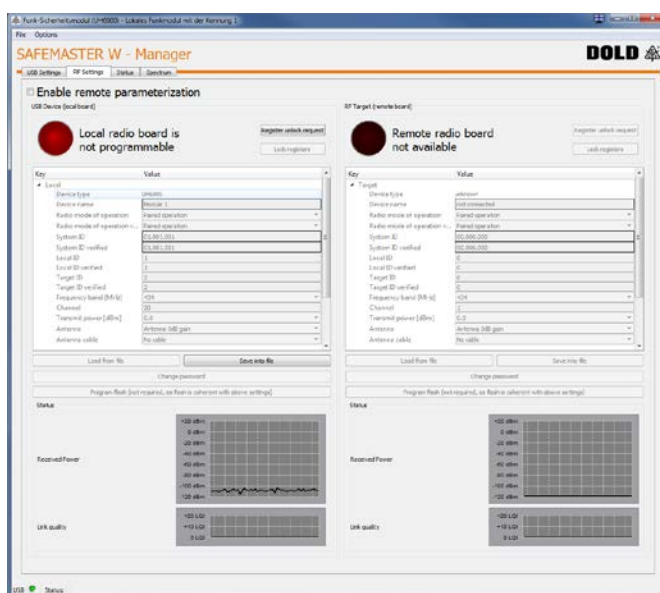
If installation was successful and after entering the license key, the following screen will appear (and also later when you start the parameterization software directly):



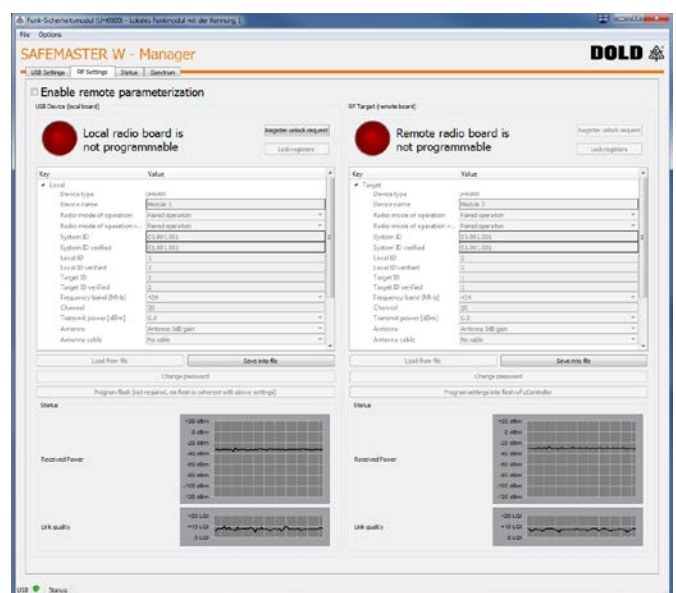
e\_Seite\_RF\_Einstellungen\_ohne\_USB.jpg

If one of the two devices of the system is connected to the computer via USB and there is no radio link to the other device this screen shows the current settings for the device:

If both devices of the system are switched on and the radio link is active the settings of the target device and the received transmitter power are also displayed for both devices:



e\_Seite\_RF\_Einstellungen\_nur\_USB.jpg



e\_Seite\_RF\_Einstellungen\_alles.jpg

You can save the displayed settings to a file on the computer by clicking on **'Save into file'** so that you can reset your modules to their original states later, if necessary.

### 8.2.1.1 Device names

The device name is only used for diagnostic purposes by the user; otherwise, it has no function in the system. If you enter meaningful names for the devices, they can be easily recognized in the screens of the parameterization software.

### 8.2.1.2 Radio mode

The radio mode type determines if the devices work in bidirectional or unidirectional mode. In bidirectional paired mode, always two UH6900 modules are coupled with each other. The unidirectional group mode is characterised in that an UH6900 module is always configured as group controller, which can control a variety of group receivers.

**The radio mode type is programmed on delivery by Dold and cannot be changed by the user.**

For the group receivers, however, the user can determine, if a local emergency-off should affect the devices of the entire group or not. This function is not safety relevant.

### 8.2.1.3 System codes of the devices

Both devices of a SAFEMASTER W system are linked with each other by their common unique system code.

This system code is assigned by DOLD before the devices are shipped and cannot be changed. Only the two devices that have the same system code can communicate with each other.

Because the devices are designed with two channels, the system code is also stored twice in a device and the parameterization software also shows both instances of the system code.

**The system code cannot be changed by the user.**

### 8.2.1.4 Device code and target device code

In addition to the system code, the device code is also used to clearly assign the devices to each other. Therefore, the device's own device code and also the device code of the target device is stored in a device. Because the devices are designed with two channels, the device code and the target device code are also stored twice in a device and the parameterization software also shows both instances of the device codes.

**The device ID cannot be changed by the user.**

**The target device ID can be changed by the user.**

### 8.2.1.5 Frequency band

The UH 6900 devices are intended for the frequency bands of 433 MHz, 869 MHz and 915 MHz. The parameterization software shows for which frequency band the device hardware was equipped.

**Because this only shows which Hardware version is installed this parameter cannot be changed by the user.**

### 8.2.1.6 Frequency channel

The following numbers of channels are available.

Conformity	Frequency Range	Number of channels
EN 300 220	433 MHz	64
EN 300 220	869 MHz	12
FCC 15.249	915 MHz	128

The parameterization software can be used to set a frequency channel that is not yet used at the site. With the function '**Enable remote parameterization**', any change made to the frequency channel of a device is also transferred to the other device that is connected via radio.



---

**8.2.1.7 Transmitter power**

---

To adjust the device's working range to the required conditions, the transmitter power can be set with the parameterization software, depending on the frequency band, channel and regulations. The set power corresponds to the power output at the socket.

---

**8.2.1.8 Antenna type, Antenna extension cable**

---

Antennas have, depending on their design, different radiation properties. Consequently, the transmission power of the module must be adapted to the antenna used.

Similarly, when using antenna cables, their signal dampening must be compensated by adapting the transmission power.

---

**8.2.1.9 Group GPIO mode**

---

If the device is a group receiver, with this option one can define how the digital functional outputs of the device should be controlled. Either these functional outputs can always be switched by the controller (regardless whether paired or not with the controller) or only when both, controller and receiver, are paired.

---

**8.2.1.10 Standard- and default status of the semiconductor outputs**

---

Here the user can specify what values should be assigned to the semiconductor outputs O0-O7, if there is no wireless connection to the other device.

If the option "Save value of the function outputs", the previously set value of the outputs remains set.

---

**8.2.1.11 Received transmitter power**

---

The presentation of the received transmitter power of both devices in a diagram shows the quality of the radio link.

This graph is very helpful to assess the effects of a change in the transmitter power.

---

**8.2.1.12 Software version**

---

The software version of the radio link is shown in the device.

This information is relevant for the manufacturer only if there are any questions with regard to a reported problem.

## 8.2.2 Setting of radio parameters

These settings are protected by a password that is stored in the device.

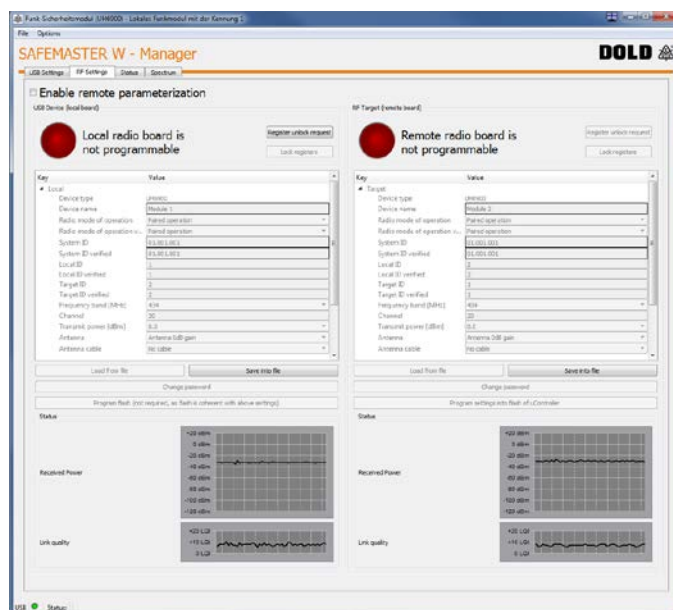
When the devices are shipped, this password is set to **0000**. The password should be changed during installation of the device and must only be disclosed to such persons who are authorized to change the settings.

For the password, numerical and also alphabetical characters are allowed.

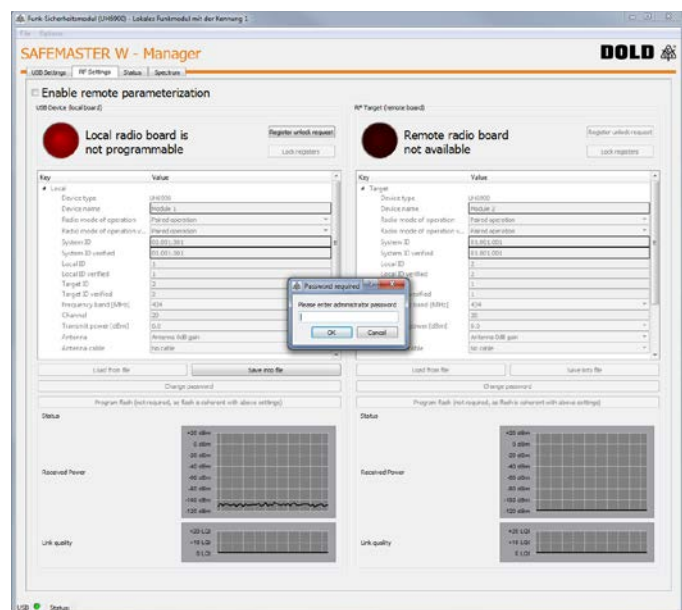
Only the following parameters can be changed:

- Device names for the two UH 6900 modules connected wirelessly
- Target device ID
- Frequency channel
- Transmission power
- Antenna type / antenna cable
- Standard / memory value of the semiconductor outputs

Changes to the parameters of the devices can only be made if their registers are unlocked by clicking on the **'Register unlock request'** button and the subsequent entering of a valid password.



e\_Seite\_RF\_Einstellungen\_alles.jpg

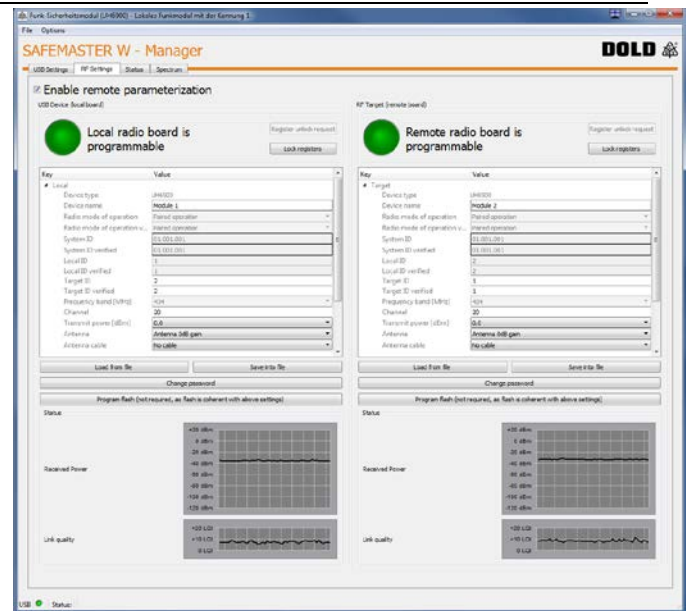
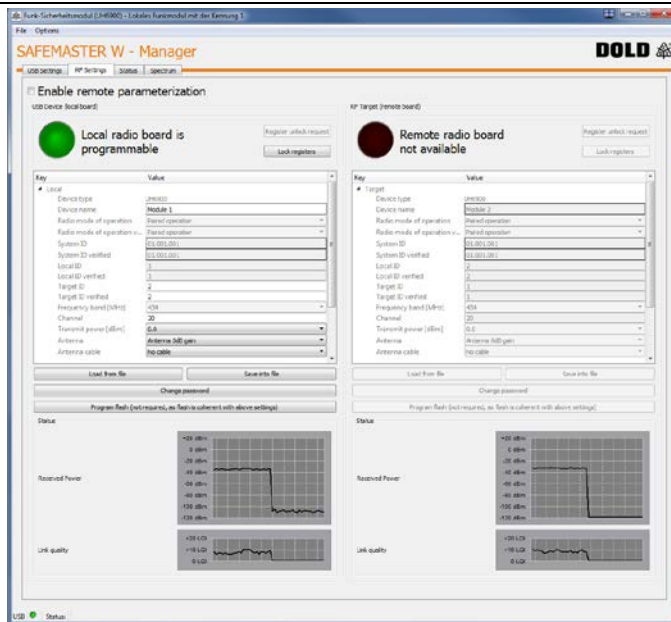


e\_Seite\_RF\_Einstellungen\_passwort.jpg

If the **'Enable remote parameterization'** box is ticked, the target device may also be set via radio (but only if the password is known and the register is unlocked).



- To change the frequency channel you should use the **'Enable remote parameterization'** function. With this function, any change of the radio channel is transferred to both devices immediately.
- As long as the registers are locked, all settings are shown **with a grey background**.
- Once a register has been successfully unlocked, you can change the parameters which are then shown with a **white background**.



Changes to parameters become valid immediately but at first, they are only saved in the working memory of the devices.

Therefore, when the first change is made the 'Program flash ...' button lights up. This is to indicate that the changes must be saved by clicking on this button.

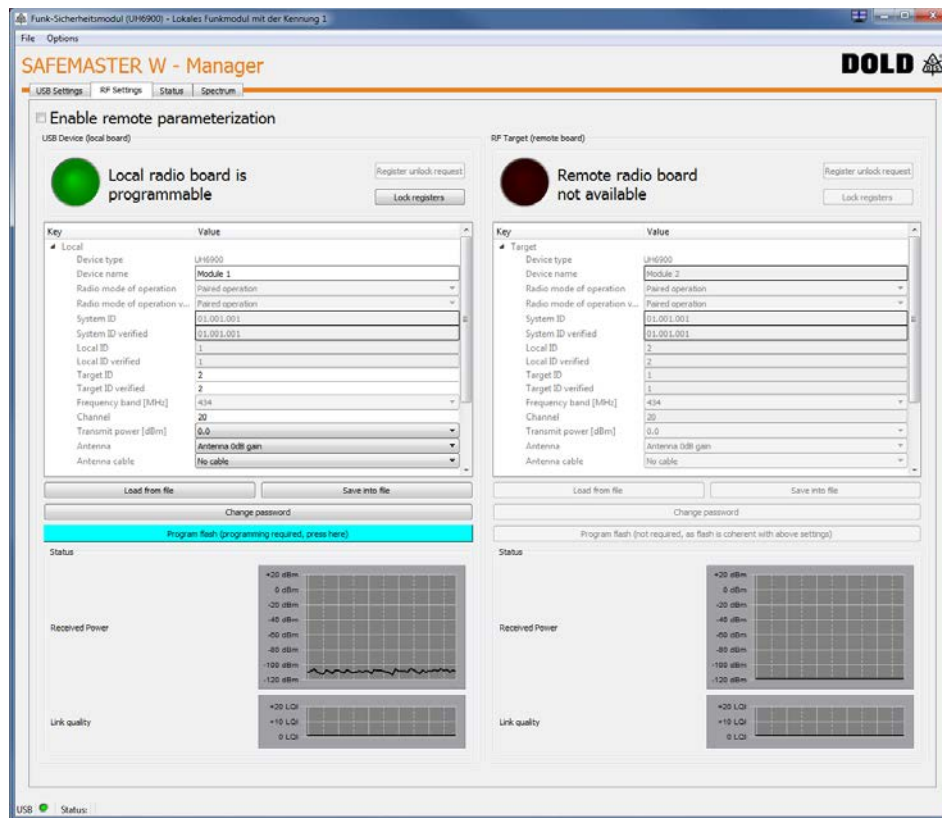


By enabling the remote parameterization or by unlocking the registers, the system will enter into a safe state in which the machine release paths are deactivated immediately through the safety relays. A restart of the machine is possible only after the steps listed below have been taken in the order mentioned:

- Program the flash memories of the devices on which this is indicated by the blue markings.
- Lock the registers.
- Disable the remote parameterization function.
- 



If the transmitter power is reduced too much through the remote parameterization function of the target device it may be that the target device cannot be reached any longer and that it becomes necessary to parameterize the target device locally via the USB interface, or by turning off and on the target device, in order to increase the transmitter power to an adequate level.



e\_Seite\_RF\_Einstellungen\_geaendert.jpg



As long as the changes have not been saved to the flash memory ('Program flash ...' button with a blue background), the system may be reset to its original state by simply turning it off and on again.



Too many changes using the remote parameterization function within a short period of time (for example, by the mouse wheel) may lead to transmission errors that result in a locking of the registers of both devices although the settings have not been saved in the flash memory yet. In such case, you have to repeat the remote parameterization and the unlocking of the registers on both devices in order to save the settings in the flash memory.

### 8.2.2.1 Device names

The device name is only used for diagnostic purposes by the user; otherwise, it has no function in the system. By assigning a meaningful device name, the devices can be recognized more easily in the screens of the parameterization software.

### 8.2.2.2 Radio mode type ( see 8.2.1.2)

**The radio mode type is programmed on delivery by Dold and cannot be changed by the user.**

If a device is configured as group receiver, the user can specify if a local emergency-off should also affect all other devices of the entire group or not. This function is not safety relevant.

### 8.2.2.3 Target device ID ( compare 8.2.1.4)

While the device ID is already permanently programmed on delivery by Dold and cannot be changed, the user can change the target device ID of the devices according to its installation. This might be required if modules are replaced or if new group reception modules should be added in group mode.

After programming, configuration or parameterization, the safety function must be checked.

**8.2.2.4 Frequency channel**

The following numbers of channels are available.

Conformity	Frequency Range	Number of channels
EN 300 220	433 MHz	64
EN 300 220	869 MHz	12
FCC 15.249	915 MHz	128

By enabling the 'Enable remote parameterization' function, any frequency channel change made on one device is also transferred to the other device that is connected via radio.

**8.2.2.4.1 List of available frequencies in the 433 MHz band**

Frequency 433 MHz, distance between channels: 0.025 MHz.

Channel	Frequency MHz	Channel	Frequency MHz	Channel	Frequency MHz	Channel	Frequency MHz
01	433.100	17	433.500	33	433.900 <sup>(2)</sup>	49	434.300 <sup>(2)</sup>
02	433.125	18	433.525	34	433.925 <sup>(1, 2)</sup>	50	434.325 <sup>(2)</sup>
03	433.150	19	433.550	35	433.950 <sup>(2)</sup>	51	434.350 <sup>(2)</sup>
04	433.175	20	433.575 <sup>(1)</sup>	36	433.975 <sup>(1, 2)</sup>	52	434.375 <sup>(2)</sup>
05	433.200	21	433.600	37	434.000 <sup>(2)</sup>	53	434.400 <sup>(2)</sup>
06	433.225	22	433.625 <sup>(1)</sup>	38	434.025 <sup>(1, 2)</sup>	54	434.425 <sup>(2)</sup>
07	433.250	23	433.650	39	434.050 <sup>(2)</sup>	55	434.450 <sup>(2)</sup>
08	433.275	24	433.675 <sup>(1)</sup>	40	434.075 <sup>(2)</sup>	56	434.475 <sup>(2)</sup>
09	433.300	25	433.700	41	434.100 <sup>(2)</sup>	57	434.500 <sup>(2)</sup>
10	433.325	26	433.725 <sup>(1)</sup>	42	434.125 <sup>(2)</sup>	58	434.525 <sup>(2)</sup>
11	433.350	27	433.750	43	434.150 <sup>(2)</sup>	59	434.550 <sup>(2)</sup>
12	433.375	28	433.775 <sup>(1)</sup>	44	434.175 <sup>(2)</sup>	60	434.575 <sup>(2)</sup>
13	433.400	29	433.800 <sup>(2)</sup>	45	434.200 <sup>(2)</sup>	61	434.600 <sup>(2)</sup>
14	433.425	30	433.825 <sup>(1, 2)</sup>	46	434.225 <sup>(2)</sup>	62	434.625 <sup>(2)</sup>
15	433.450	31	433.850 <sup>(2)</sup>	47	434.250 <sup>(2)</sup>	63	434.650 <sup>(2)</sup>
16	433.475	32	433.875 <sup>(1, 2)</sup>	48	434.275 <sup>(2)</sup>	64	434.675 <sup>(2)</sup>

<sup>(1)</sup>: List of channels that can be used in Denmark

<sup>(2)</sup>: List of channels that can be used in Singapore

With a transmitter power of > 0 dBm only the channels 40 to 64 are available.



If the frequency channel is changed to an area that does not allow the set transmitter power, the parameterization software will reduce the transmitter power to the maximum value that is allowed.

**8.2.2.4.2 List of available frequencies in the 869 MHz band**

Frequency 869 MHz, distance between channels: 0.025 MHz.

Channel	Frequency MHz	Channel	Frequency MHz	Channel	Frequency MHz	Channel	Frequency MHz	Channel	Frequency MHz	Channel	Frequency MHz
1	869.7125	3	869.7625	5	869.8125	7	869.8625	9	869.9125	11	869.9625
2	869.7375	4	869.7875	6	869.8375	8	869.8875	10	869.9375	12	869.9875

**8.2.2.4.3 List of all frequencies available in the 915 MHz range**

Frequency 911 MHz to 918 MHz, Frequency intervall: 0.050 MHz.

Kanal	Frequenz MHz	Kanal	Frequenz MHz	Kanal	Frequenz MHz	Kanal	Frequenz MHz
1	911,800	33	913,400	65	915,000	97	916,600
2	911,850	34	913,450	66	915,050	98	916,650
3	911,900	35	913,500	67	915,100	99	916,700
4	911,950	36	913,550	68	915,150	100	916,750
5	912,000	37	913,600	69	915,200	101	916,800
6	912,050	38	913,650	70	915,250	102	916,850
7	912,100	39	913,700	71	915,300	103	916,900
8	912,150	40	913,750	72	915,350	104	916,950

<b>9</b>	912,200	<b>41</b>	913,800	73	915,400	<b>105</b>	917,000
<b>10</b>	912,250	<b>42</b>	913,850	74	915,450	<b>106</b>	917,050
<b>11</b>	912,300	<b>43</b>	913,900	75	915,500	<b>107</b>	917,100
<b>12</b>	912,350	<b>44</b>	913,950	76	915,550	<b>108</b>	917,150
<b>13</b>	912,400	<b>45</b>	914,000	77	915,600	<b>109</b>	917,200
<b>14</b>	912,450	<b>46</b>	914,050	78	915,650	<b>110</b>	917,250
<b>15</b>	912,500	<b>47</b>	914,100	79	915,700	<b>111</b>	917,300
<b>16</b>	912,550	<b>48</b>	914,150	80	915,750	<b>112</b>	917,350
<b>17</b>	912,600	<b>49</b>	914,200	81	915,800	<b>113</b>	917,400
<b>18</b>	912,650	<b>50</b>	914,250	82	915,850	<b>114</b>	917,450
<b>19</b>	912,700	<b>51</b>	914,300	83	915,900	<b>115</b>	917,500
<b>20</b>	912,750	<b>52</b>	914,350	84	915,950	<b>116</b>	917,550
<b>21</b>	912,800	<b>53</b>	914,400	85	916,000	<b>117</b>	917,600
<b>22</b>	912,850	<b>54</b>	914,450	86	916,050	<b>118</b>	917,650
<b>23</b>	912,900	<b>55</b>	914,500	87	916,100	<b>119</b>	917,700
<b>24</b>	912,950	<b>56</b>	914,550	88	916,150	<b>120</b>	917,750
<b>25</b>	913,000	<b>57</b>	914,600	89	916,200	<b>121</b>	917,800
<b>26</b>	913,050	<b>58</b>	914,650	90	916,250	<b>122</b>	917,850
<b>27</b>	913,100	<b>59</b>	914,700	91	916,300	<b>123</b>	917,900
<b>28</b>	913,150	<b>60</b>	914,750	92	916,350	<b>124</b>	917,950
<b>29</b>	913,200	<b>61</b>	914,800	93	916,400	<b>125</b>	918,000
<b>30</b>	913,250	<b>62</b>	914,850	94	916,450	<b>126</b>	918,050
<b>31</b>	913,300	<b>63</b>	914,900	95	916,500	<b>127</b>	918,100
<b>32</b>	913,350	<b>64</b>	914,950	96	916,550	<b>128</b>	918,150



**8.2.2.5 Transmitter power**

To adjust the device's working range to the required conditions, the transmitter power can be set with the parameterization software depending on the frequency band, selected frequency channel, equipment and regulations.

**FCC 15.249**

Only following configurations are compliant to FCC 15.249 regulations.

#	Antenna	Cable	Maximum adjustable power in PC Software
1	ZB6900/051	-	-7.5 dBm
2	ZB6900/051	ZB6900/042 (2m)	-7.5 dBm
3	ZB6900/051	ZB6900/043 (5m)	-5.0 dBm
4	ZB6900/051	ZB6900/046 (10m)	-3.5 dBm

Use of other configurations may void the FCC authorization to operate this equipment.

**EN 300 220**

Frequency band	Channel	ERP
433MHz	1..39	0 dBm (1 mW)
433MHz	40..64	10 dBm (10 mW)
868MHz	1..12	7 dBm (5 mW)

ERP is the effective radio power transmitted in relation to half wave dipole.

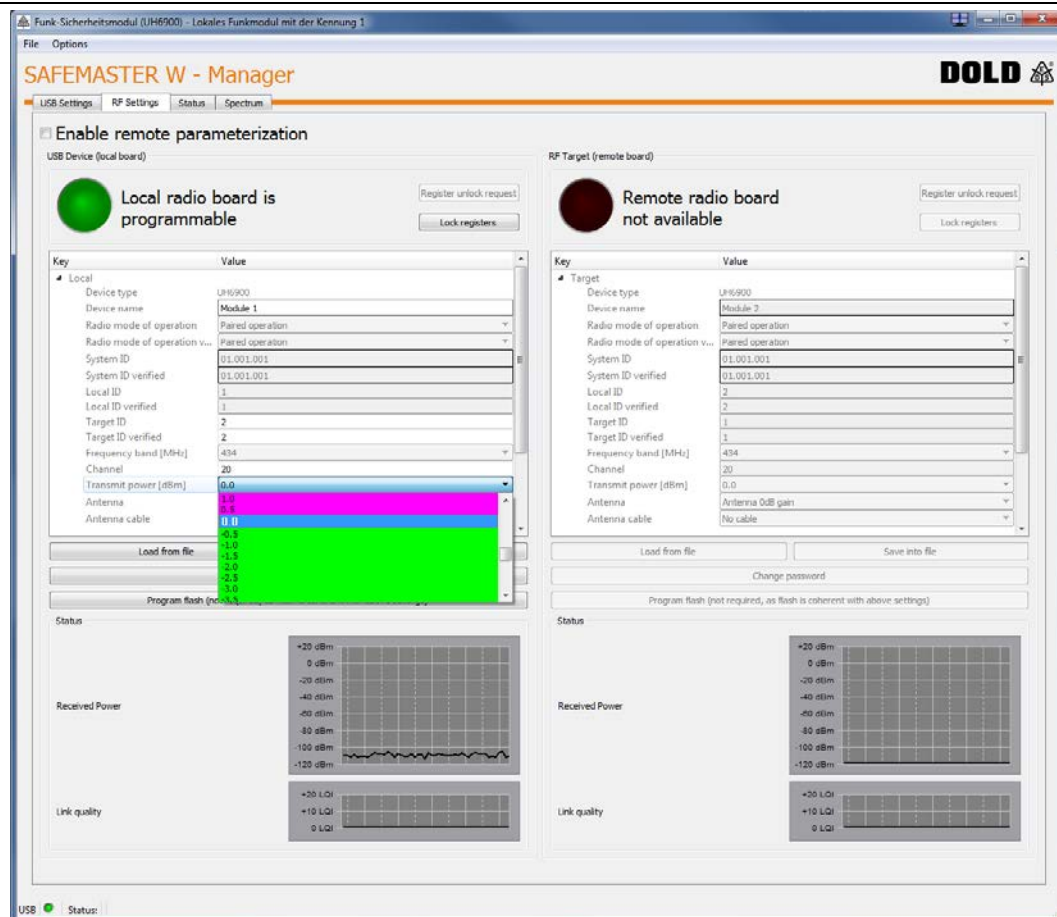
The adjustable transmit power refers to the power at the socket (values in green). The power at the transmitted antenna of the device can be different to that depending on the used antenna and cable.

Typically the antenna cable has an attenuation of 0.3dB/m. A normal sized 1/2-wave dipole antenna has a gain of 0dB, while a 1/4-wave antenna has slightly 5 dB less gain.



When you change the transmitter power, the parameterization software allows only entries that are allowed for the set radio channel. For example, transmitter powers of over 1 mW (0 dBm) are allowed only if the frequency channel is set to  $\geq 40$  in the 433Mhz frequency band.

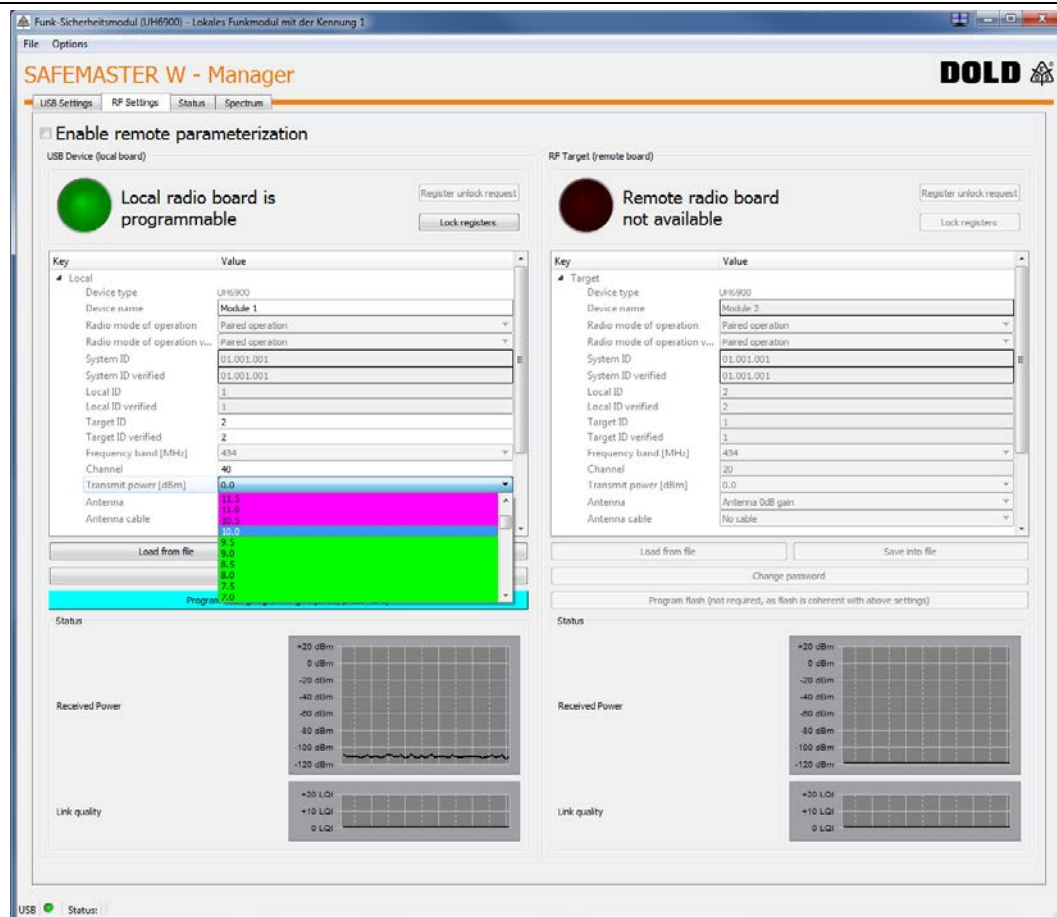
If the '**Enable remote parameterization**' box is ticked, the effects of this change in the transmitter power of a device are immediately shown in the '**Received transmitter power**' diagram of the other device.



e\_Seite\_RF\_Einstellungen\_leistung\_K0\_K39.jpg

Setting of transmitter power for channel numbers &lt; 40 (433 MHz band)



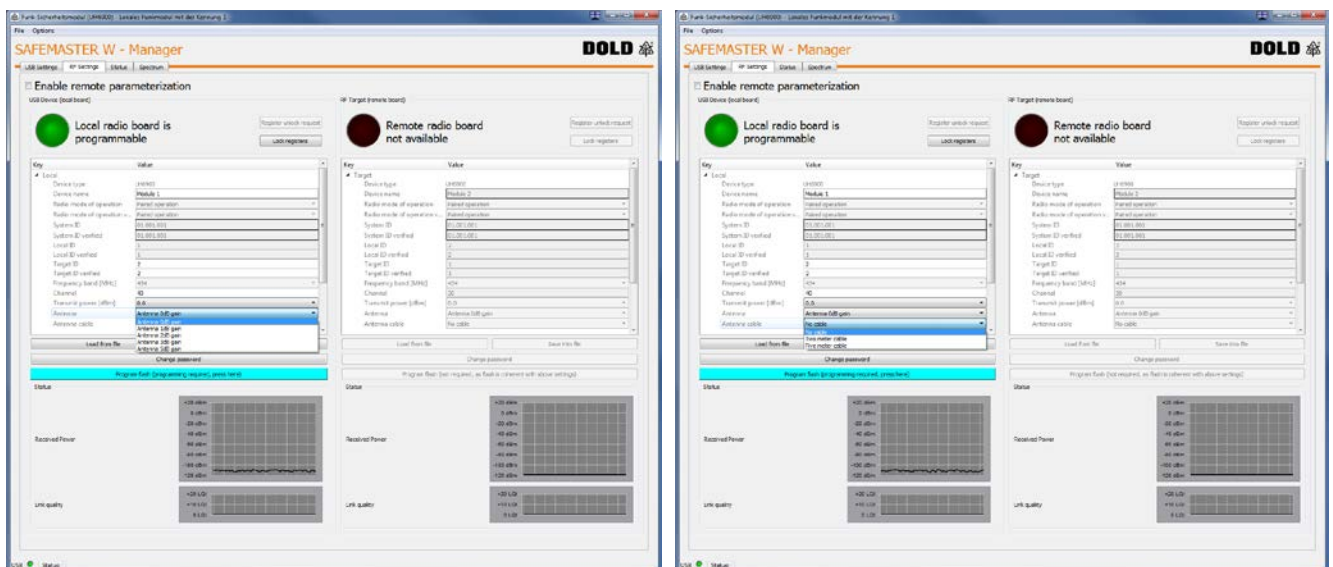


e\_Seite\_RF\_Einstellungen\_leistung\_K40\_K64.jpg

Setting of transmitter power for channel numbers  $\geq 40$  (433 MHz band)

### 8.2.2.6 Antenna type / antenna cable ( see 8.2.1.8)

You can select from six antenna types with a gain of 0dBm to 5dBm as well as three options for the antenna cables (none, 2m, 5m and 10m). The transmission power on the socket is adapted accordingly.



### 8.2.2.7 Group GPIO Mode (see 8.2.1.9)

This option refers only to the functional outputs of a group receiver.

These outputs will be

- controlled by the group controller only if the group receiver is selected (paired)
- always controlled by the group controller (either paired or not).

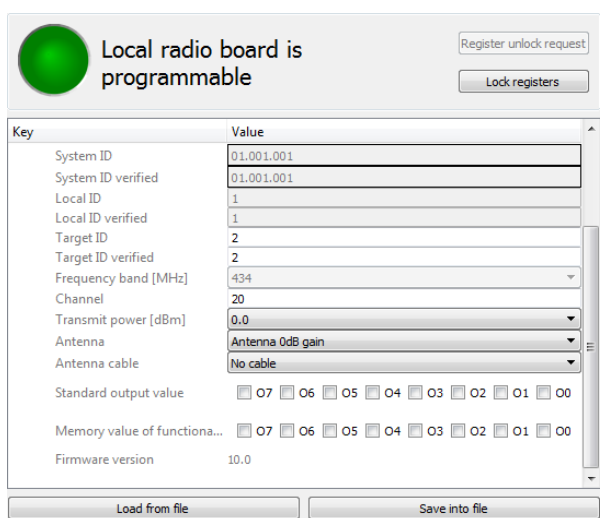
#### 8.2.2.8 Standard and memory values of the semiconductor outputs (see 8.2.1.10)

In normal radio mode, the states of the semiconductor outputs are determined by the settings of the semiconductor inputs on the opposite side. If there is no wireless connection, the semiconductor outputs behave like they are configured here.

If the wireless connection is interrupted, the semiconductor outputs of the module are either switched to the set standard values or, if the option “Save values of the function outputs” was selected, to the last set value.

Each output O7 -O0 can be selected individually.

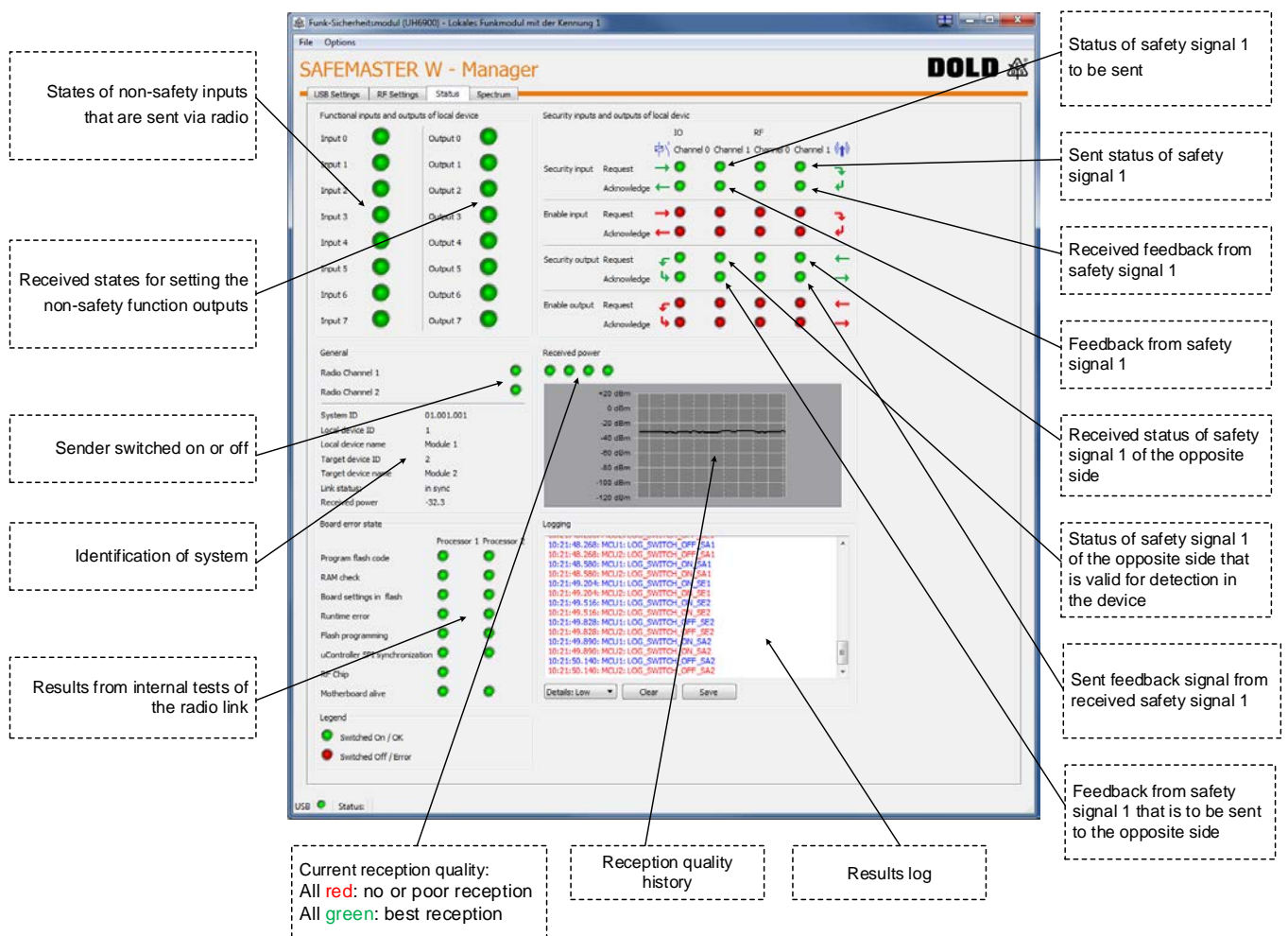
A tick at the “standard output value” means a logical 1 and at “Save value of the function outputs” that the current value is saved and maintained.



Key	Value
System ID	01.001.001
System ID verified	01.001.001
Local ID	1
Local ID verified	1
Target ID	2
Target ID verified	2
Frequency band [MHz]	434
Channel	20
Transmit power [dBm]	0.0
Antenna	Antenna 0dB gain
Antenna cable	No cable
Standard output value	<input type="checkbox"/> O7 <input type="checkbox"/> O6 <input type="checkbox"/> O5 <input type="checkbox"/> O4 <input type="checkbox"/> O3 <input type="checkbox"/> O2 <input type="checkbox"/> O1 <input type="checkbox"/> O0
Memory value of functiona...	<input type="checkbox"/> O7 <input type="checkbox"/> O6 <input type="checkbox"/> O5 <input type="checkbox"/> O4 <input type="checkbox"/> O3 <input type="checkbox"/> O2 <input type="checkbox"/> O1 <input type="checkbox"/> O0
Firmware version	10.0

### 8.3 STATUS screen (diagnostic function)

This screen shows the current state of the radio module of the device that is connected to the personal computer via USB and the signal states that it can send or receive via radio.



It is also possible to open a second instance of the parameterization software or to display the status of another device at the same time via a second USB port.

### 8.4 Spectrum screen (diagnostic function)

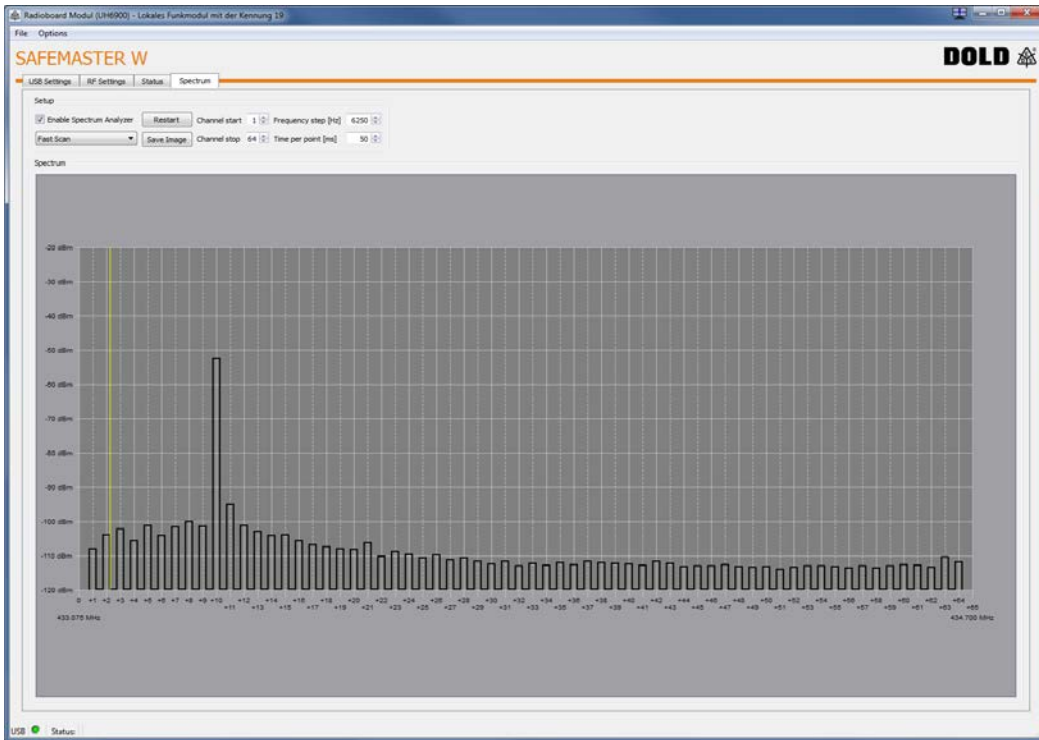
This window can be used to get a quick overview about the current environment i.e. which channels are already occupied or still free.

The radio board will be set into receiver mode where all channels of the frequency range will be scanned and the received power measured.



When activating the spectrum analyzer function the system will enter into a safe state in which the machine release paths are deactivated immediately through the safety relays. That's because the radio module scans all available channels and therefore a safe communication with the normally connected module via a unique channel is not possible anymore.

Using the mode "Fast Scan" all channels defined by Channel Start and Channel Stop will be scanned as fast as possible. Each channel will be sampled at the precise channel frequency and in a distance defined by Frequency Step below and above the middle frequency. The default values don't have to be modified for this measurement.



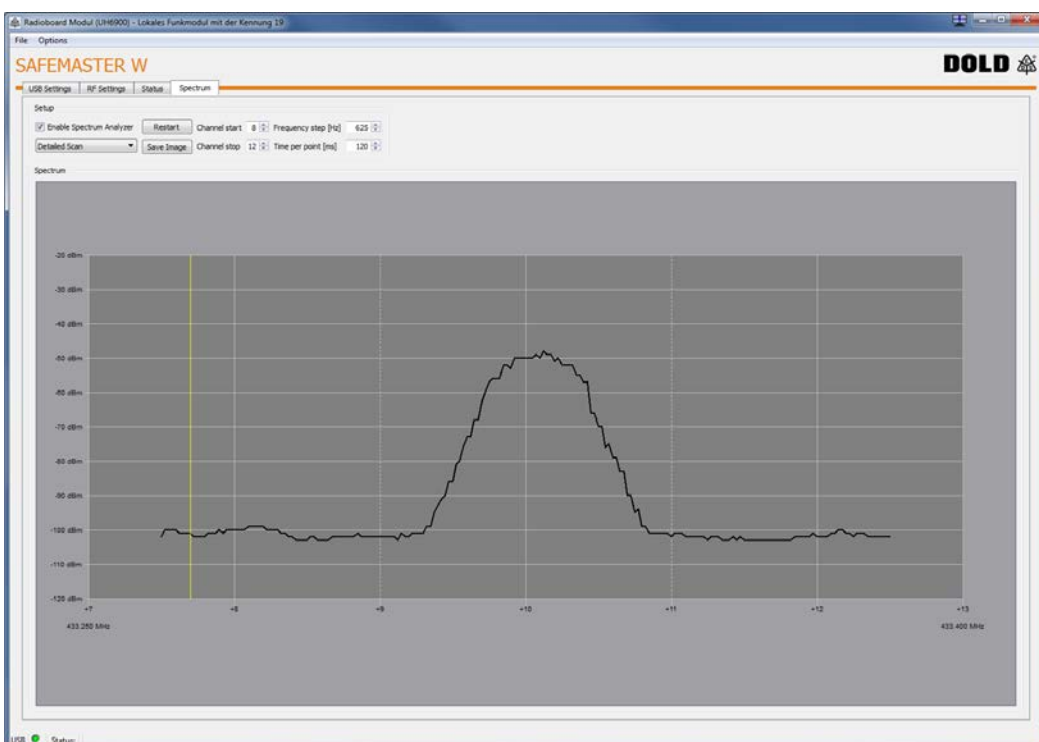
In this example channel 10 is obviously occupied. Measurement values below -90 dBm are normally noise or they are caused by wide band transmitter polluting their neighboring channels.

Using the “Detailed Scan” mode the channels defined by Channel Start and Channel Stop will be scanned and displayed with a higher resolution. Resolution is defined by the parameter Frequency step.

Due to lower speed of measurement this mode should only be used when observing a small number of channels.

Channel start and Channel Stop can be scanned displayed with higher resolution.

Here the desired frequency range will be scanned with a fixed frequency step size while again measuring the reception power. Due to the much lower speed this mode should only be used when analyzing a small number of channels.



**9 Technical data****Radio – EU Variants**

Conformity:	EN 300 220
Carrier frequency:	UHF, frequency modulated (FM)
Channels:	64 channels 433 MHz frequency band 12 channels 869 MHz frequency band
Frequency range (license free):	433.1000 ... 434.6750 MHz 433 MHz frequency band 869.7125 ... 869.9875 MHz 869 MHz frequency band
Maximum HF-transmitter power:	10 dBm (10 mW) 433 MHz frequency band 7 dBm (5 mW) 869 MHz frequency band
Receiver category	1.5

**Radio – US Variants**

Conformity:	FCC 15.249(a) FCC 15.209(a)/15.249(b)(1)(2)(3) FCC 15.207(a) FCC 15.109
Carrier frequency:	UHF, frequency modulated (FM)
Channels:	128 channels 915 MHz frequency band
Frequency range (license free):	911.8000 ... 918.1500 MHz 915 MHz frequency band
Maximum Field Strength in 3m distance:	94 dBμV/m
Maximum adjustable PC Power:	
Antenna: ZB6900/051, Cable: -	-7.5 dBm
Antenna: ZB6900/051, Cable: ZB6900/042 (2m)	-7.5 dBm
Antenna: ZB6900/051, Cable: ZB6900/043 (5m)	-5 dBm
Antenna: ZB6900/051, Cable: ZB6900/046 (10m)	-3.5 dBm

**Radio – General**

Minimum HF transmitter power:	-40 dBm (0.0001 mW)
Range:	up to 800 m in open area <sup>1)</sup>
Aerial:	1/4 wave antenna, impedance 50 Ω, plug in as accessory
Sensitivity:	< -100 dBm

<sup>1)</sup> The range can vary depending on the ambient conditions of the antennas (roof construction, metal walls etc.)

**Power supply:**

Nominal voltage $U_N$ :	DC 24 V
Voltage range:	0.85 to 1.15 $U_N$ at max. 5 % residual ripple
Nominal consumption:	3.6 W (Semiconductor outputs without load)
Control voltage on S11, S13, S31, S33:	approx. DC 23 V pulse, average value approx. 7 V at $U_N$
Control voltage on 48, 58, OIR, Q25, O0, O1, O2, O3, O4, O5, O6, O7:	approx. DC 23 V at $U_N$
Control current on S12, S14, S22, S24, S32, S34, S42, IIR F0, F1, F2, F3, F4, F5, F6, F7:	approx. 4 mA at $U_N$ each
Minimum voltage for active signal on S12, S14, S22, S24, S32, S34, S42, F0, F1, F2, F3, F4, F5, F6, F7:	DC 12 V
Maximum voltage for inactive signal on S12, S14, S22, S24, S32, S34, S42 F0, F1, F2, F3, F4, F5, F6, F7:	DC 4 V
Max. input current on S12, S14, S22, S24, S32, S34, S42 F0, F1, F2, F3, F4, F5, F6, F7:	DC 30 V
Fusing:	Internal with PTC
Max. difference time between input signals of one function	
Emergency stop, LC, safety gate:	3 s
Two-hand:	500 ms



**Safety outputs:****Contacts:**

UH 6900.03: 3 NO contacts

UH 6900.22: 2 NO contacts, 1 NC contact (NC contact must be used as an indicator contact only!)

Contact type: Relay, positive guided

Nominal output voltage:

AC 250 V

DC: see arc limit curve under resistive load

Thermal current  $I_{th}$  (see Quadratic total current limit curve)

5 A

Switching capacity to AC 15

NO contact:

AC 3 A / 230 V IEC/EN 60 947-5-1

NC contact:

AC 1 A / 230 V IEC/EN 60 947-5-1

To DC 13:

DC 2 A / 24 V IEC/EN 60 947-5-1

DC switching capacity:

DC 8 A / 24 V at 0.1 Hz IEC/EN 60 947-5-1  
(two contacts in a row)

Switching of low loads:

Minimum switching voltage:

&gt; 5 V

Minimum switching current:

&gt; 5 mA

Minimum switching capacity:

&gt; 25 mW

**Electrical life**

to AC 15 at 2 A, AC 230 V:

100,000 switching cycles IEC/EN 60 947-5-1

Allowed switching frequency:

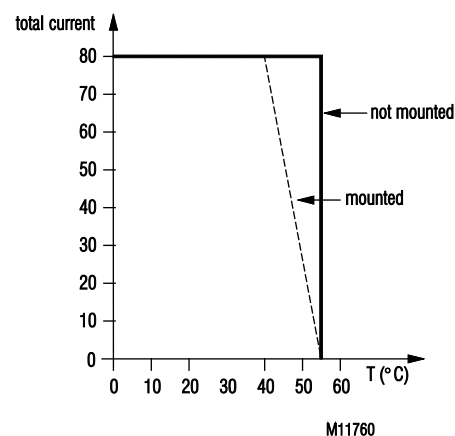
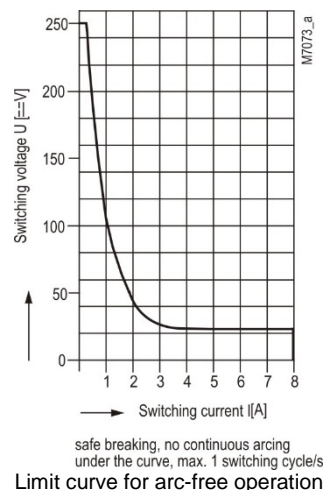
max. 1200 switching cycles / h

Please also refer to section [Disturbance protection](#)**Short circuit strength**

max. fuse rating:

6 A gG / gL IEC/EN 60 947-5-1

Mechanical life:

 $10 \times 10^6$  switching cycles**Typical pick-up times at  $U_N$ :**

Ready for start after power is turned on:

max. 2.5 s

Automatic start:

no operating mode with automatic start

Operating mode 'Full safety operation'

Manual start:

max. 1 s<sup>2)</sup>

Automatic restart:

max. 1.1 s<sup>2)</sup>

Operating mode 'Cross-operation'

Manual start:

max. 650 ms<sup>2)</sup>

Automatic restart:

max. 650 ms<sup>2)</sup>

Operating modes 'Safety operation with optional radio control'

S32, S34 supplied with power:

---

Manual start:	max. 70 ms
Automatic restart:	max. 80 ms
S32, S34 not supplied with power:	
Reset through S42 (after reset on control device):	max. 70 ms
Reset through S42 on control device:	max. 700 ms <sup>2)</sup>
Reset through auto start on control device:	max. 700 ms <sup>2)</sup>
<sup>2)</sup> For the start options with additional detection of the IIR input, the delay time of the safety element connected to this input must be added to the pick-up times.	

**Deactivation time (response time)**

S12-S14, S22-S24, S32-S34:	max. 30 ms
Deactivation via radio (S12-S14, S22-S24, S32-S34 of 2nd device):	max. 200 ms
Passive deactivation in case of interrupted radio signal:	max. 500 ms

**Semiconductor outputs**

Outputs (terminals 48, 58, O0 to O7, OIR, Q25):	Transistor outputs, plus switching
Nominal output voltage (A3+):	DC 24 V
Output voltage at $U_N$ :	min. DC 23 V, max. 100 mA continuous current
	max. 400 mA for 0.5 s internal short circuit, over-temperature and overload protection
	for inductive loads, arrange the necessary safety measures
Minimum operating current:	min. 1 mA
Residual current:	min. 0.1 mA

**General Data**

Nominal operating mode:	Continuous operation
Temperature range:	-25 ° . 55 °C
Storage temperature:	-40 ° . +80 °C
Operating altitude:	≤ 2000 m
Clearance and creepage distance	
Rated impulse voltage / pollution degree:	(contact/contact) 6 kV/2 IEC 60 664-1 (circuit/contact) 4 kV/2 IEC 60 664-1
Overvoltage category	III IEC 60 664-1

**EMC:**

IEC/EN 61 326-3-1, IEC/EN 62 061

Interference suppression:

EU Variants

Limit value class B EN 55 011

US Variants

FCC Part 15 Class B

**Protection category:**

Enclosure:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529

**Enclosure:**

Thermoplastic with V0 behaviour according to UL Subject 94

Vibration resistance Test Fc:	EN 60068-2-6
Amplitude, constant 0.075mm	10 - 57Hz
Acceleration, constant 1g:	57 - 150 Hz

**Shock resistance test Ea**

EN 60068-2-27

Acceleration:	10g
Impulse length:	16 ms
Number of shocks per direction and axis:	1000

**Climate resistance:**

25 / 055 / 04 IEC/EN 60068-1

**Terminal designation:**

In accordance with EN 50 005

**max. terminal cross-section:**

1 x 2,5 mm<sup>2</sup> stranded wire with sleeve or  
 1 x 2.5 mm<sup>2</sup> solid or  
 2 x 1 mm<sup>2</sup> stranded wire with sleeve or  
 2 x 1 mm<sup>2</sup> solid DIN 46 228-1/-2/-3/-4

**min. terminal cross-section:**

0.25 mm<sup>2</sup> stranded wire with sleeve or  
 0.2 mm<sup>2</sup> solid DIN 46 228-1/-2/-3/-4

**Wire fixing:**

removable terminal blocks, with cage clamp terminals  
 or screw terminals

**Quick mounting:**

Profile DIN rail IEC/EN 60 715

**Net weight:**

380 g

**Dimensions:**

Width x height x depth: 45 x 107 x 121 mm



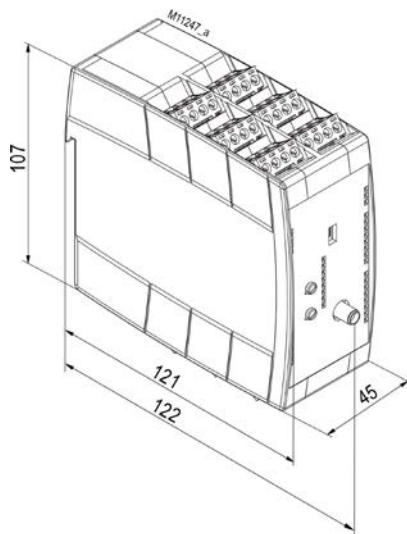
**9.1 Safety related data**

EN ISO 13849-1:		
Category	4	
PL:	e	
MTTF <sub>d</sub> :	187,6	a (years)
DC <sub>avg</sub> :	97,6	%
d <sub>op</sub> :	365	days/a
h <sub>op</sub> :	24	h/day
t <sub>cycle</sub> :	3600	s/cycle

IEC/EN 62061, IEC/EN 61508, IEC/EN 61511:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508, IEC/EN 61511
HFT *)	1	
DC <sub>avg</sub> :	97,6	%
PFH <sub>D</sub> :	3,6E-10	h <sup>-1</sup>
PFD <sub>avg</sub> :	1,2E-4	Low Demand Mode
*) HFT = Hardware Fault Tolerance		

**9.2 Dimension drawing**

Radio-controlled safety module UH 6900



## 10 Order information

### 10.1 Wireless Safety System

#### 10.1.1 Standard type

**UH 6900.03 PS / 00MF0 DV24Volt**

Article number: 0067213  
 Safety output: 3 NO contacts  
 Nominal voltage: DC 24 V  
 Width: 45 mm

#### 10.1.2 Example for ordering variations

**U H 6 9 0 0 . \_ PS / \_ 0 \_ 0 DC 24 V****Power supply****Frequency band:**

EU variants:

0: 433 - 434 MHz (Standard version) (EN 300 220)

1: 869 MHz (EN 300 220)

US variants:

2: 915 MHz (FCC 15.249)

**Device type:**

MF: Multi function,

GC: Group control

GR: Group receiver

**Software version:**

0: Standardversion

**Enclosure:**

0: DOLD Orange

**Terminal type:**

PC: (plug in cage clamp):

Removable terminal blocks, with cage clamp terminals

PS: (plug in screw):

Removable terminal blocks, with screw terminals

PT: (plug in twin clamp):

Removable terminal blocks, with twin clamp terminals

**Contacts:**

03: 3 NO contacts

22: 2 NO contacts, 1 NC contact

(NC contact must be used as indicator contact only)

(The NC contact is not intended for safety-relevant tasks)

The scope of delivery includes a radio-controlled safety system UH 6900 and a CD that includes the parameterization software and this user manual.

**10.2 Accessories**

	description	part no.
CD configuration software radio controlled safety module	ZB6900/100	0067641
Antenna 1/2 wave, 433 - 434 MHz BNC	ZB6900/040	0067254
Antenna 1/4 wave, 433 - 434 MHz SMA	ZB6900/041	0067255
Antenna 1/2 wave, 869 MHz SMA	ZB6900/050	0067256
Antenna 1/2 wave, 925 MHz SMA (FCC 15.249 / ISSED RSS-210)	ZB6900/051	0069490
Extension cable for antenna (2 m) with through hole connector	ZB6900/042	0067257
Extension cable for antenna (5 m) with through hole connector	ZB6900/043	0067258
Extension cable for antenna (10 m) with through hole connector	ZB6900/046	0069491
Adaptor BNC-SMA	ZB6900/044	0067642
Connector SMA 90° angular	ZB6900/045	0067675
Photoelectric switch for additional start control	ZB6900/060	0067259
1 Set of connection cable for photoelectric switch (2m)	ZB6900/061	0067260

## 11 Maintenance and care

### User-friendly maintenance

- Indicator LEDs for diagnosis
- The settings of the radio parameters can be saved in a settings file from which they can be retrieved again.

### Regular checks

In addition to the tests during commissioning and set up, the following test must be carried out in regular intervals and after each maintenance job (once a year at minimum):

- Checking of all safety functions
- User-friendliness, for example easy operation of all connected operating elements
- Response times of the SAFEMASTER W system
- Wiring between the UH 6900 radio-controlled safety modules and the machine circuit
- Proper functioning of active deactivation via radio
- Proper functioning of passive deactivation in case of an interrupted radio signal
- Checking of antenna for:  
correct connection, undamaged antenna shell, cleanliness and check that it is free of oxidation

Safety function requirements on the device		Intervals for regular checking of safety functions
In accordance with EN ISO 13849-1	PL e, category 3 or 4	Once a month
	PL d, category 3	Once a year
In accordance with IEC/EN 62061 IEC/EN 61508	SIL 3, HFT = 1	Once a month
	SIL 2, HFT = 1	Once a year
In accordance with EN 61511	SIL 3	Once a year

## 12 Disclaimer and warranty

The safety instructions listed in the manual **MUST** be observed.

The applications listed in this manual are examples only and each individual case must be reviewed by the user in its own responsibility. Their applicability must therefore be evaluated on a case-by-case basis.

Please be aware that our SAFEMASTER W is a radio-controlled system that could be influenced by external radio signals. In the case of external interferences the availability of the system could be impaired by sudden disconnection, without, however, impairing the safety of men and machine.

We are not liable for influences of this kind.

We recommend setting up an internal frequency plan in order to avoid double usage of frequency channels.

**13 CE declaration of conformity**

EG - Konformitätserklärung

Declaration of Conformity

Déclaration de conformité européenne



**Hersteller:** E. Dold & Söhne GmbH & Co. KG  
*Manufacturer: / Fabricant:*  
**Anschrift:** Bregstraße 18  
*Address: / Adresse:* 78120 Furtwangen  
 Germany

**Produktbezeichnung:** Funk Sicherheitsmodul **UH6900.kkTT/00YYz** mit: kk = 03, 22  
*Product description:* Radio controlled safety module with: TT = PS, PC, PT  
*Désignation du produit:* Module de sécurité à réception radio avec: YY = MF, GC, GR; z = 0, 1

Das bezeichnete Produkt stimmt mit den Vorschriften folgender europäischer Richtlinien überein:

The indicated product is in conformance with the regulations of the following european directives:

Le produit désigné est conforme aux instructions des directives européennes:

<b>Maschinenrichtlinie:</b>	2006/42/EG	EU-Abl. L157/24, 09.06.2006
<i>Machinery directive: / Directives Machines:</i>		
<b>RED-Richtlinie:</b>	2014/53/EU	EU-Abl. L153/62, 22.05.2014
<i>RED directive: / Directives - RED:</i>		
<b>EMV - Richtlinie:</b>	2014/30/EU	EU-Abl. L96/79, 29.03.2014
<i>EMC - Directive: / Directives- CEM::</i>		
<b>RoHS - Richtlinie</b>	2011/65/EU	EU-Abl. L174/88, 01.07.2011
<i>RoHS -Directive: / Directives - RoHS:</i>		

<b>Prüfgrundsätze:</b>	EN ISO 13849-1:2015	EN 61508 Parts 1-7:2010
<i>Basis of Testing:</i>	EN IEC 60664-1:2020 + AC:2020	EN ISO 13850:2015
<i>Lignes de contrôle:</i>	EN ISO 13851:2019	EN 61326-3-1:2008
	EN 55011:2016 + A1:2017	EN 61000-6-1:2007
	EN 61000-6-2:2005	EN 61000-6-3:2007 + A1:2011
	EN 61000-6-4:2007 + A1:2011	EN 62368-1:2014 + AC:2015 (RED Article 3.1a)
	EN 62311:2008 (RED Article 3.1a)	EN 301 489-1 V2.1.0 (RED Article 3.1b)
	EN 301 489-3 V2.1.0 (RED Article 3.1b)	EN 300 220-1 V3.1.1 (RED Article 3.2)
	EN 300 220-2 V3.1.1 (RED Article 3.2)	

Die Übereinstimmung eines Baumusters des bezeichneten Produktes mit der oben genannten Maschinenrichtlinie wurde bescheinigt durch:

Consistency of a production sample with the marked product in accordance to the above machiney directive has been certified by:

La conformité d'un échantillon du produit désigné aux directives machines susmentionnées a été certifiée par:

**Benannte Stelle:** TÜV Rheinland Industrie Service GmbH  
*Certification office: / l'organisme notifié:* Am Grauen Stein, 51105 Köln  
**Numer der benannten Stelle:** NB0035  
*Number of certification office: / Numéro de l'organisme notifié:*  
**Numer der Bescheinigung:** 01/205/5541.02/22  
*Certification number: / Numéro de certificat:*  
**Ausstelldatum :** 05.07.2022  
*Date of issue: / Date de délivrance:*

Die Übereinstimmung eines Baumusters des bezeichneten Produktes mit der oben genannten RED-Richtlinie wurde bescheinigt durch:

Consistency of a production sample with the marked product in accordance to the above RED-directive has been certified by:

La conformité d'un échantillon du produit désigné aux directives-RED susmentionnées a été certifiée par:

**Benannte Stelle:** CTC advanced GmbH  
*Certification office: / l'organisme notifié:* Untertürkheimer Str. 6-10, 66117 Saarbruecken  
**Numer der benannten Stelle:** 0682  
*Number of certification office: / Numéro de l'organisme notifié:*  
**Numer der Bescheinigung:** T817673D-02-TEC  
*Certification number: / Numéro de certificat:*  
**Ausstelldatum :** 28.03.2022  
*Date of issue: / Date de délivrance:*

EG - Konformitätserklärung  
Declaration of Conformity  
Déclaration de conformité européenne



Für die Zusammenstellung der technischen Unterlagen  
ist bevollmächtigt:

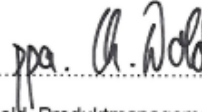
For the compilation of technical documents is authorized:  
Pour la composition des documents techniques est autorisé:



Stefan Müller, stellvertretender Entwicklungsleiter /  
representative R&D Manager

Rechtsverbindliche Unterschrift:

Signature of authorized person:  
Signature autorisée :



Christian Dold, Produktmanagement / Productmanagement

Ort, Datum : Furtwangen, 20.07.2022  
Place, Date: / Lieu, date:

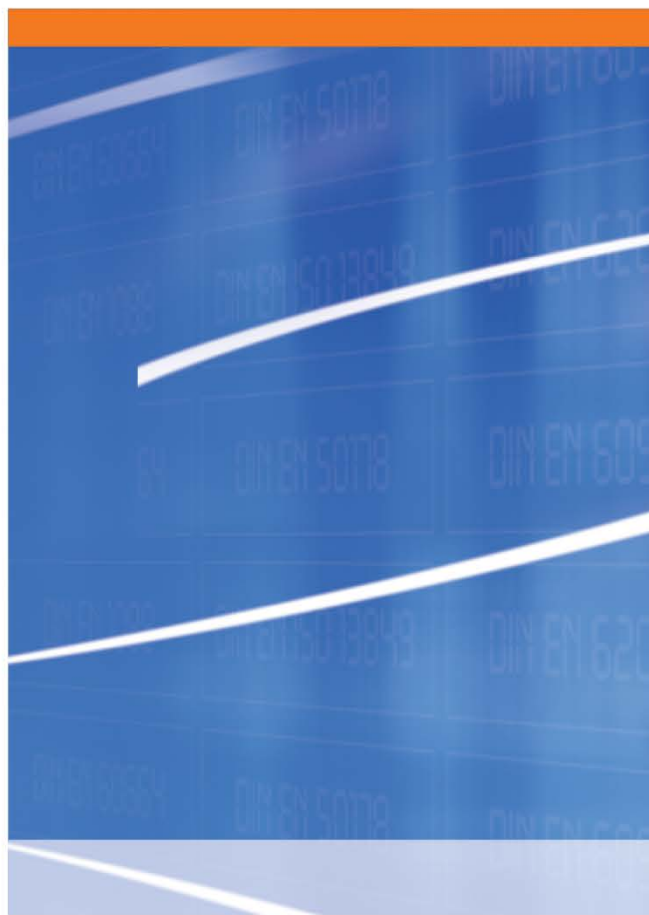
Diese Original - Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften. Die Sicherheitshinweise der Produktdokumentation sind zu beachten.

This original declaration confirms the conformity of the mentioned directives but does not comprise any guarantee of the product characteristics. The safety directives of the product documentation are to be considered.

Cette déclaration originale certifie la conformité des directives nommées mais ne comprend aucune garantie des caractéristiques du produit. Les directives de sécurité de la documentation du produit sont à considérer.







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