DEMAG
Cranes & Components

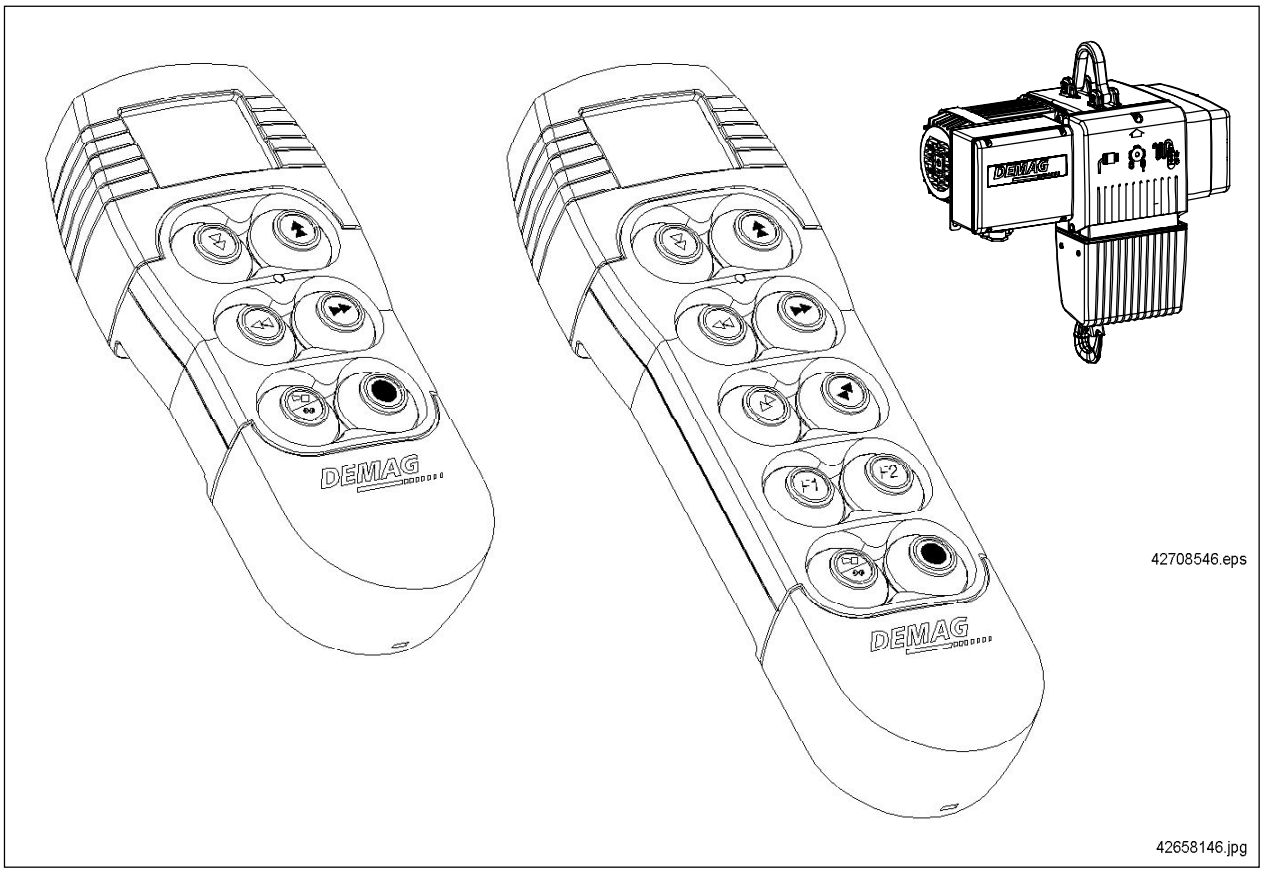
CE

Operating instructions

DRC-DC radio remote control system

Technical data, fitting instructions, component parts

These operating instructions contain additional information for operating these units.
They must always be used together with the following operating instructions:
DC-Pro 1-10 ident no. 214 741 44
DC-Pro 16-25 ident no. 211 033 44
DC-Com ident no. 214 802 44



42708546.eps

42658146.jpg

Manufacturer

Demag Cranes & Components GmbH
P.O. Box 67, D-58286 Wetter
Telephone +49 (0) 2335 92-0 · Telefax +49 (0) 2335 927676
www.demagcranes.de

Please fill in the following table before first putting the unit into service.
This provides you with a definitive documentation of your chain hoist and important information if you ever have to contact the manufacturer or his representative.

Owner _____

Where in use _____

Size _____

Serial number _____

Accompanying documents

Technical data

Demag DC-Pro 1 to DC-Pro 25 chain hoists	203 525 44	714 **IS** 817
Demag DC-Com 1 to DC-Com 10 chain hoists	203 571 44	714 **IS** 817
Technical data – Assembly – Component parts CF 5	203 568 44	714 **IS** 845
Technical data – Assembly – Spare parts U11 / U 22 / U 34	203 569 44	714 **IS** 845
Clamp-fitted buffers	203 313 44	714 **IS** 888

Operating instructions – Assembly – Adjustment – Dimensions

Demag DC-Pro 1 to DC-Pro 10 chain hoists	214 741 44	720 **IS** 817
Demag DC-Pro 16 to DC-Pro 25 chain hoists	211 033 44	720 **IS** 817
Demag DC-Com 1 to DC-Com 10 chain hoists	214 802 44	720 **IS** 817
Operating instructions E 11 / E 22 / E 34 trolleys	214 810 44	720 **IS** 845
KBK installations	206 076 44	720 **IS** 152

21468944.indd/170807

Contents

0 Foreword

You have purchased a Demag quality product.

DRC-DC transmitters and receivers comply with the standards and regulations specified in the EC conformity declaration. This EC conformity declaration is a constituent part of the relevant operating instructions.

Transmitters and receivers of the DRC-DC range can be operated without any registration or operating fee. The resulting benefits for the user are also used by some other manufacturers of equipment for communication and telemetry applications (e.g. crane radio control systems, wireless operating and control devices, radio modems, radio telephones, wireless alarm systems and measuring result transmission equipment, etc.). As a consequence, numerous other transmitters may use the approved frequency ranges at the same time depending on the location and time.

The transmission method used by DCC is intended to ensure extremely robust and interference-resistant radio transmission between transmitter and receiver of the DRC-DC range.

The state-of-the-art transmission method is provided with technical features (e.g. automatic frequency management, adaptive behaviour) which are intended to ensure a minimum of conflicts for radio operation together with other transmitter and receiver devices which use the same frequency range.

In spite of all technical measures taken by DCC, it cannot be completely ruled out that other radio systems, in particular those of other manufacturers, which use the same frequency range, are affected in their transmission properties or that the transmission properties of the system supplied by DCC are influenced in a negative way. In such a case, interferences or interruptions of the radio link may occur which impair communication and functioning of a system supplied by DCC or another manufacturer. Such negative effects or interferences do not represent a defect of DRC-DC transmitters and receivers. DCC will only accept liability for deliberate action or gross negligence.

The number of transmitters which can be operated without interference with reference to the relevant area depends on the radio technology design of all systems and the selectivity of each individual system.

If this limit is exceeded permanently or periodically at an application location, additional technical measures may become necessary in order to achieve simultaneous and interference-free operation of the radio systems. The extent to which such measures are necessary can only be determined on site by appropriate measurements or during commissioning of the system. DCC is not responsible for such additional technical measures.

Persons entrusted with the various types of work must know and comply with the safety regulations and the operating instructions.

The operating instructions must be available to the operating personnel at all times in order to prevent operating errors and to ensure smooth and trouble-free operation of our products.

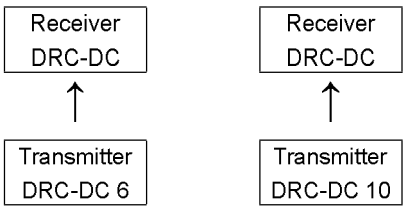
21468944.indd/170807

General description

Demag DRC-DC radio control systems are designed for wireless control of chain hoists of the DC range. They are the interface for manually controlled DC chain hoists and/or DC crane installations.

Demag DRC-DC radio control systems consist of two different operating units with a differing scope of functions and a radio receiver with interface to the chain hoist or crane control system.

DRC-DC 6 and DRC-DC 10 hand-held transmitters in applications in connection with DRC-DC radio receivers are the subject of these operating instructions.



Demag DRC-DC radio receivers are pluggable PCBs.

- for installation in the electrical equipment cover of the DC chain hoist (sizes DC 16 and DC 25)
- or for installation in a separate enclosure for fitting to DC chain hoists, sizes DC 1 to DC 10.

Electrical interface of this receiver component to the chain hoist and/or crane control system is the tri-state interface typical of DC chain hoists and DC cranes.

The receiver component is supplied with power either by the DC electrical equipment (DC 16 and DC 25) or by an externally supplied voltage.

DRC-DC radio receivers are exclusively suitable for operation with DC chain hoists or DC cranes.

1 Safety instructions

1.1 Safety instructions when first putting the unit into service

This documentation contains additional information for operating DRC-DC radio control systems It must always be used together with our operating instructions for the DC-Pro, ident no.: 214 741 44 and DC-Com ident. no. 214 802 44.

Please pay particular attention to the safety instructions in these operating instructions.

When delivered, the transmitter and receiver of the radio control system do not yet have a fixed assignment (indicated by crane identification `c 0 0`). A clear assignment between a transmitter and a receiver/crane is established by means of setting and transmitting the crane identification when putting the unit into service (see section 7.5). If several DRC-DC radio control systems are put into service at the same time, the not yet assigned receivers must be switched on separately one after the other and then be assigned. When several not yet assigned receivers are switched on at the same time, they are inadvertently assigned to the same transmitter.

1.2 Intended use

The hand-held transmitter is intended to be used as an operating unit and transmitter station for the radio receivers. The scope of functions is preferably designed for wireless control of crane installations, travelling hoist units, chain and rope hoists, transfer carriages and similar applications.

The operator can position himself as required. He can control loads and movements from a safe distance. He must always select a location to ensure that all movements of the load and the crane can be monitored and any hazardous movement can be switched off within an appropriate time. Before starting a crane movement by actuating the operating element, the operator must determine which crane is being controlled. The display of the DRC-DC hand-held transmitter shows the identification/crane number of the controlled crane. The radio-controlled crane must be identified by means of the identification/crane number in a way clearly visible to the operator.

If required, a signal must be actuated prior to a crane movement for acoustic control.

Radio remote control systems of the DRC-DC range are exclusively intended for single-transmitter operation; i.e. there is always a clear assignment between a specific transmitter and its corresponding radio receiver.

The hand-held transmitter may only be operated when in perfect working order by trained personnel in accordance with the relevant safety and accident prevention regulations. This also includes compliance with operating and maintenance conditions specified in the operating instructions.

In Germany, the owner of a crane installation with radio control system is responsible for compliance with accident prevention regulations BGV D6.

Hand-held radio transmitters that are ready for operation must not be left unattended. They must be protected against unauthorized use.

For intended use, the information in the operating instructions for the machine/ crane installation to be controlled must be complied with in addition to the information contained in these operating instructions.

Serious personal injury or damage to property may occur in the event of:

- unauthorized removal of covers,
- inappropriate use of the product/system,
- incorrect operation,
- insufficient maintenance,
- working on live parts.

21468944.indd/170807

1.3 Inappropriate use

Certain work and practices are prohibited when using the system as they may involve danger to life and limb and result in lasting damage to the product , e.g.:

- Manipulating electrical equipment,
- Connecting the unit to power supply with voltage or frequency other than those specified on the type plate,
- Non-compliance with specified mounting positions,
- Non-compliance with the max. permissible operating temperature.

Other inappropriate applications may be caused by non-compliance with the information in the operating instructions for the machine to be controlled.

1.4 Safety instructions for operation

Before putting the radio control system into operation, operating personnel must be satisfied that the radio control system is in safe and correct operating condition.

In addition, the safety instructions and measures contained in the operating instructions of the crane must be applied.

The clear assignment between the hand-held transmitter to the radio receiver on the crane is the precondition for safe wireless remote control of a crane. This unique assignment is created by the exchange of the address features between transmitter and receiver when a hand-held transmitter is put into service. The operating personnel recognises which crane is controlled by means of the crane identification shown in the display of the hand-held transmitter.

Before switching on/putting into operation the crane/machine controlled by the radio control system with the hand-held transmitter, it must be ensured that nobody is endangered by operation of this crane.

If the operator notices persons who may be exposed to a risk to health or personal safety by operation of the equipment, he must suspend operation immediately and may not resume operation again until the persons are outside the danger zone.

Stop key function

Actuation of the red Stop key activates the emergency-stop function in the radio receiver on the crane. The emergency-stop function stops any potentially dangerous movement of the crane. For use of the emergency-stop function, in particular the instructions contained in the operating instructions of the crane must be complied with.

When the Stop key has been actuated, the radio system is in “STOP” operating mode. No movement commands are transmitted. The emergency-stop can be unlocked again by entering an electronic key. This may only be done after the operator has made sure that the hazardous situation which resulted in actuation of the Stop key has been eliminated.

Warning device function

Radio-controlled cranes must be provided with a warning device (acoustic or optical). The crane operator can activate this warning device by means of the signal key in the keyboard of the hand-held transmitter to warn persons in the vicinity of the crane and/or load before starting the crane movements. The warning device must also be used, if the crane operator intends to check the assignment between hand-held transmitter and crane receiver by means of a command of the hand-held transmitter.

Range of the radio remote control system

The crane operator may only use the range of the radio control system to the extent that he can freely monitor the danger zone of the crane movements.

The range of the hand-held radio transmitter is limited and can be additionally reduced by ambient conditions. The range may also be limited by utilization of the available frequency range by other radio transmitters. If the connection quality is poor, unintended interruptions of the controlled movements may occur.

21468944.indd/170807

2 Technical data

2.1 Scope of delivery

Part no.

DRC-DC 6 hand-held transmitter **773 400 44**

(Contents of the complete delivery)
1 DRC-DC 6 hand-held transmitter
2 Rechargeable batteries type AA 1,2 V / NiMH / 2100 mAh
1 Plug-in charger incl. 3 adapters for connection to different national plug types 110 – 230 V 50/60 Hz
1 Carrying bag with shoulder strap and belt clip
1 Operating instructions DRC-DC radio remote control system
1 Key symbols for the DRC-DC transmitter

DRC-DC 10 hand-held transmitter **773 700 44**

(Contents of the complete delivery)
1 DRC-DC 10 hand-held transmitter
2 Rechargeable batteries type AA 1,2 V / NiMH / 2100 mAh
1 Plug-in charger incl. 3 adapters for connection to different national plug types 110 – 230 V 50/60 Hz
1 Carrying bag with shoulder strap and belt clip
1 Operating instructions DRC-DC radio remote control system
1 Key symbols for the DRC-DC transmitter

Accessories for the DRC–DC transmitter

Rechargeable batteries type AA 1,2 V / NiMH / 2100 mAh (2 off necessary)	773 437 44
Plug-in charger with Europe plug, 110 – 230 V 50/60 Hz	773 438 44
Carrying bag for DRC-DC 6 with shoulder strap and belt clip	773 433 44
Carrying bag for DRC-DC 10 with shoulder strap and belt clip	773 434 44
Key symbols for the DRC-DC 6 / DRC-DC 10 transmitter	773 465 44

DRC-DC receiver module **773 720 44**

Receiver board for internal use with DC 16/25 chain hoists

DRC-DC receiver set, trolley **773 740 44**

DRC-DC receiver box with cable set for use with DC 1 – 10 chain hoists for stationary hoists or with trolley.
1 DRC-DC receiver box with receiver module

1 Power cable	772 052 45
1 Power cable	772 051 45
1 Control cable, mounting plate incl. fastening material	772 062 45

DRC-DC receiver set, crane **773 745 44**

DRC-DC receiver box with cable set for use with DC 1 – 10 chain hoists for cranes.
1 DRC-DC receiver box with receiver module

1 24 V cable	772 053 45
1 Control cable, mounting plate incl. fastening material	772 062 45

Accessories for crane identification

3 Coding labels, carrier foil, black	895 639 44
3 Coding labels 7 segments (yellow)	895 640 44
1 Travel direction foil for cross travel	895 635 44
1 Travel direction foil for long travel	895 637 44

DRC-DC 6 and DRC-DC 10 hand-held transmitters are sealed in the factory.

The hand-held transmitter may only be opened for repair purposes by authorised parties.

Breaking of a casing seal such as this will result in loss of all warranty rights!

2.2 Transmitter

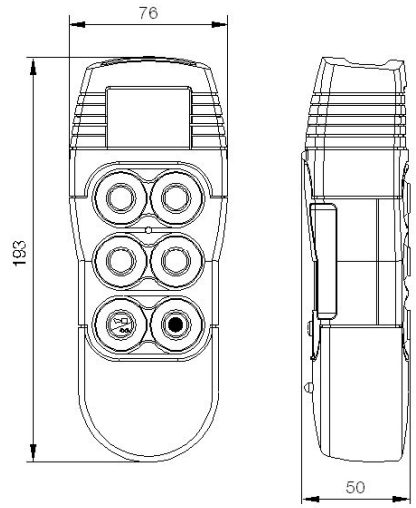
Operating elements	DRC-DC 10	- Keys	6 (2-stage)
		- Stop key	1 (2-stage)
		- Horn key	1 (1-stage)
		- Keys for special functions	2 (1-stage)
	DRC-DC 6	- Keys	4 (2-stage)
		- Stop key	1 (2-stage)
		- Horn key	1 (1-stage)
Indicators		- LED display section, 35 x 25 mm	
Radio transmission		- Transmitter power 10 mW	
		- Typical range approx. 50 m	
		- Frequency range 433.100 – 434.750 MHz	
Transmitter enclosure		- IP 55 enclosure	
	DRC-DC 6	- Weight of transmitter with rechargeable battery 410 g	
		- Weight of transmitter w/o battery 360 g	
	DRC-DC 10	- Weight of transmitter with rechargeable battery 490 g	
		- Weight of transmitter w/o battery 430 g	
Switched-mode power supply unit / charger		- Supply voltage charger 110 – 230 V 50/60 Hz	
		- Weight 55 g	
NiMH rechargeable battery		- Model AA (LR6), IEC 60086	
		- Capacity 2100 mAh	
		- Battery service life 500 charging cycles acc. to IEC 509	
		- Temperature ranges	
		- Quick charging 0 °C to + +40 °C	
		- Discharge / operation -15 °C to +50 °C	
		- Charging time approx. 2,5 hours at 0 °C to 40 °C	
Operation with one battery charge		- 100 % Run mode: typ. 30 h at 20 °C ambient temperature (reduced operating time at negative ambient temperatures)	

2.3 Receiver

Output	Tri-state interface
LED	Status LED
Type of enclosure IP 55	When fitted in receiver box enclosure
Ambient temperature	-20° to +70° C
Weight of radio receiver	90 g
Supply voltage	24 V AC
Output horn / signal	Max. current 1 A, 30 V DC

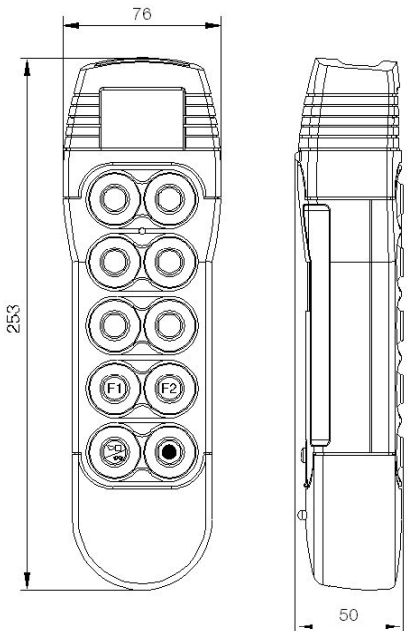
2.4 Dimensions

DRC-DC 6 hand-held transmitter



42661347.jpg

DRC-DC 10 hand-held transmitter



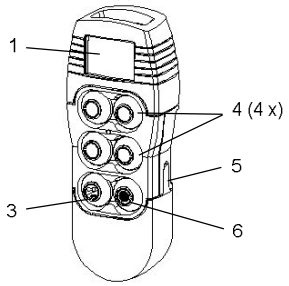
42661346.jpg

3 Identification and display functions

3.1 Hand-held transmitter

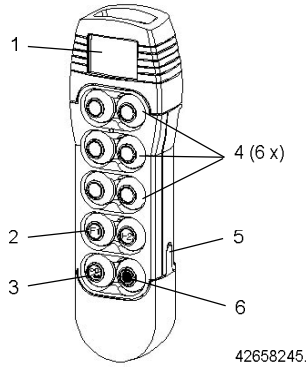
1 Display
2 Function keys
3 Signal
4 Motion keys
5 Charging socket on the side of the enclosure
6 Stop key

DRC-DC 6 hand-held transmitter



42708045.jpg

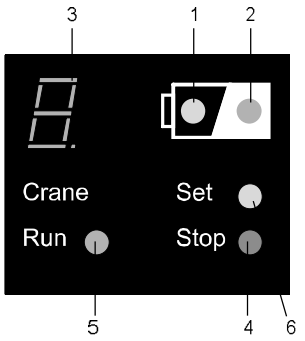
DRC-DC 10 hand-held transmitter



42658245.jpg

21468944.indd/170807

3.2 Display



42708145.eps

1 Battery capacity
2 Charge battery
3 Crane ID
4 Stop
5 Run mode
6 Parameter setting mode

The display section of DRC-DC 6 and DRC-DC 10 transmitters consists of a 7-segment display as well as 5 light-emitting diodes (LED) with different colours:

Battery capacity (1)		
Yellow LED	Indicates the battery charging status:	
	Slow flashing (8 sec. break)	The battery is charged
	Fast flashing (1 sec. break))	Remaining operating time less than 2 h
	LED continuously lit	Remaining operating time less than 10 min. Charge transmitter
	Acoustic warning signal	Battery discharged – automatic cut-out of the transmitter after approx. 2 min.

Charge battery (2)		
Green LED	Indicates the status of the charging process:	
	Flashing (2 times per second)	Quick charging active
	LED continuously lit	Trickle charging mode, batteries are charged with low current

7-segment display **Crane** (3)

The 7-segment display indicates the crane identification (Crane ID). The crane identification consists of an unchangeable letter ` c ` and two adjustable figures which are displayed one after the other.

The crane identification is displayed when the second stage of the Stop key is pressed. The set crane identification is then displayed three times.

Display **Stop** (4)

The red LED is permanently lit in Stop mode of the hand-held transmitter. The emergency-stop contact in the receiver is opened. It is possible to change from Stop mode to Run mode or to Set mode (for programming parameters of the hand-held transmitter). Following a timeout period of 5 minutes, the transmitter automatically switches to the power-saving Standby mode. The Stop LED goes out and the yellow battery LED continues to flash for approx. 5 minutes.

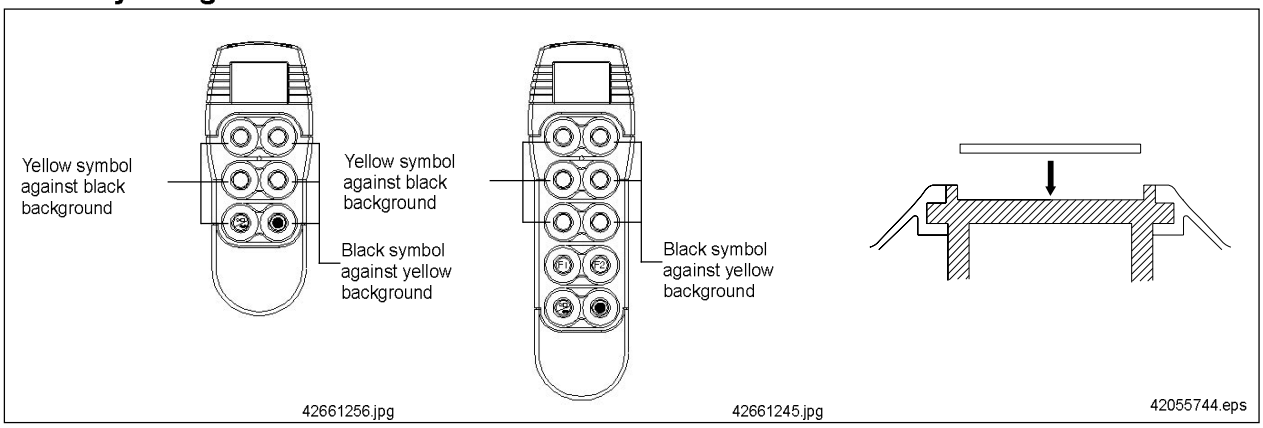
Display **Run** (5)

The green LED flashes in Run mode of the hand-held transmitter. Control commands are transmitted from the transmitter to the crane control system in wireless mode.

Display **Set** (6)

The LED is on in Parameter setting mode of the hand-held transmitter. It is only possible to transmit commands for adjusting the radio control system and for displaying operating data.

3.3 Key designation



As standard, all keys on the hand-held transmitter are designated in the factory with the relevant foil symbols.

If requested by the owner, it is also possible to apply other, for example, country-specific symbols for the direction keys on the radio control system. The owner then has to remove the existing symbols and apply symbols required by him.

To replace the symbols, proceed as follows.

- The keys must be free from adhesive, dust and grease. Clean, as required, with spirit or alcohol.

  Solvents, benzene, cold sprays, etc. could damage the key material.
- Remove the symbol required for the assigned function from the symbol sheet. Attach the adhesive symbols in the relevant function key.

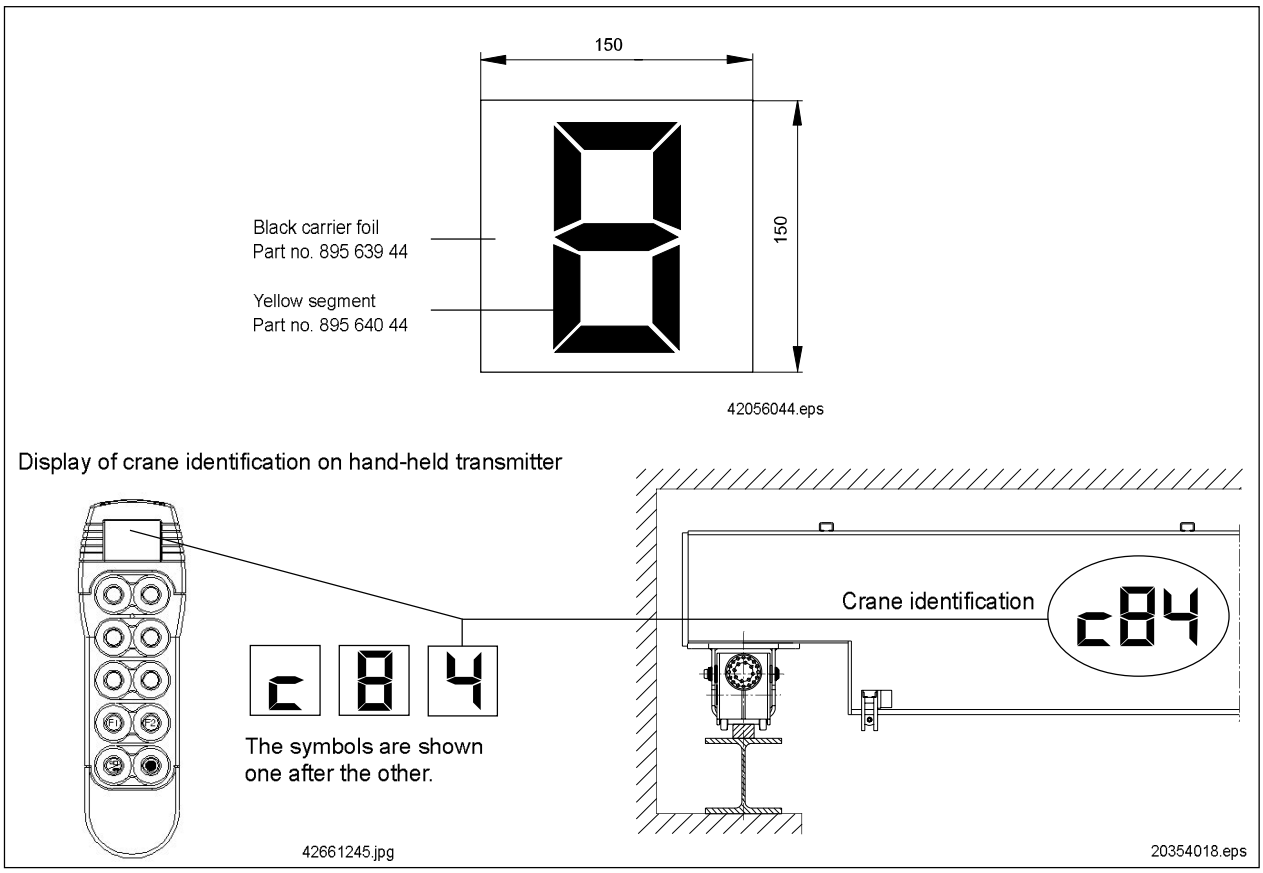
21468944.indd/170807

3.4 Identification labels for the crane installation

Every crane with wireless control must be identified by means of an easily visible crane identification/number.

The coding labels are used for illustration of the crane identification on the trolley or on the crane. The crane identification illustrated by means of the coding labels must be identical with the crane identification shown in the display of the DRC-DC 6 or DRC-DC 10 hand-held transmitter.

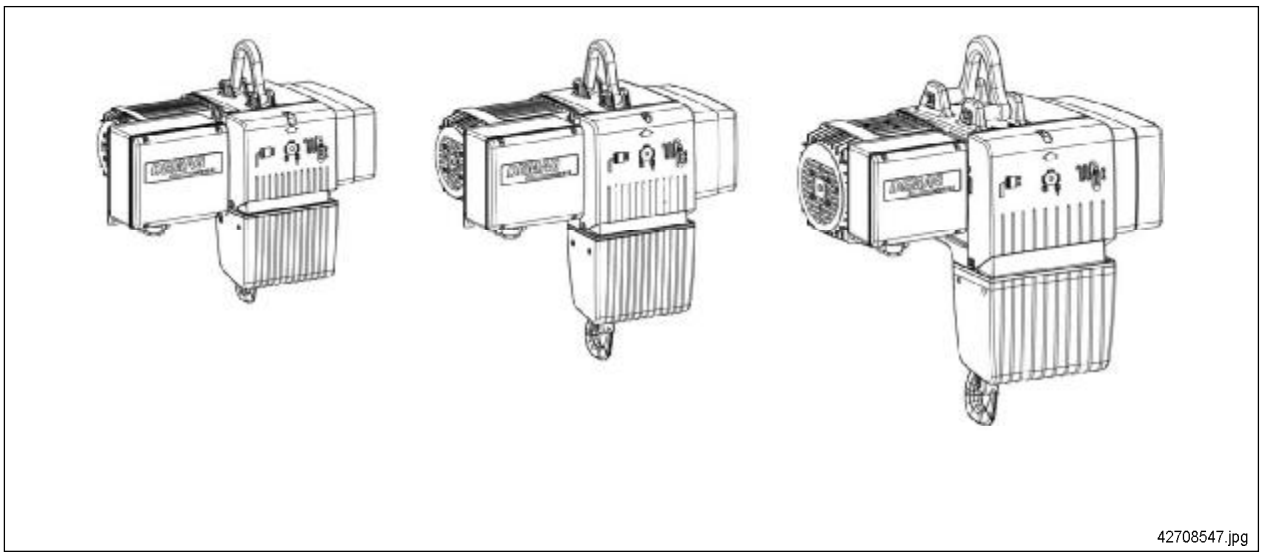
Travel direction symbols on the crane and the trolley must identify the movement directions of the travel motions in line with the identification of the keys on the hand-held control system.



4 Putting the DRC-DC radio receiver into operation for the first time

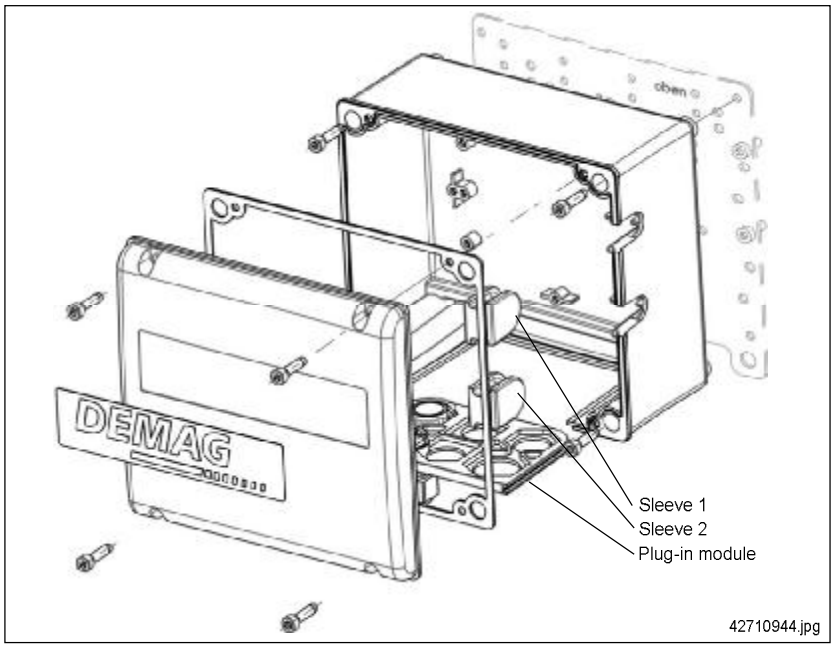
4.1 External fitting of the receiver

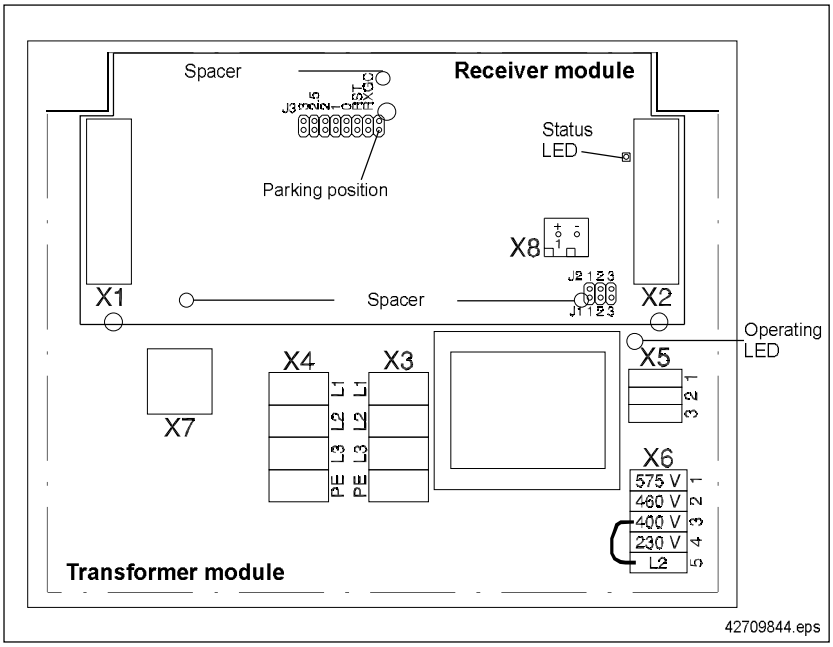
For chain hoists, sizes DC 1 to DC 10, external fitting of the receiver is provided.



4.2 Internal structure of the receiver box

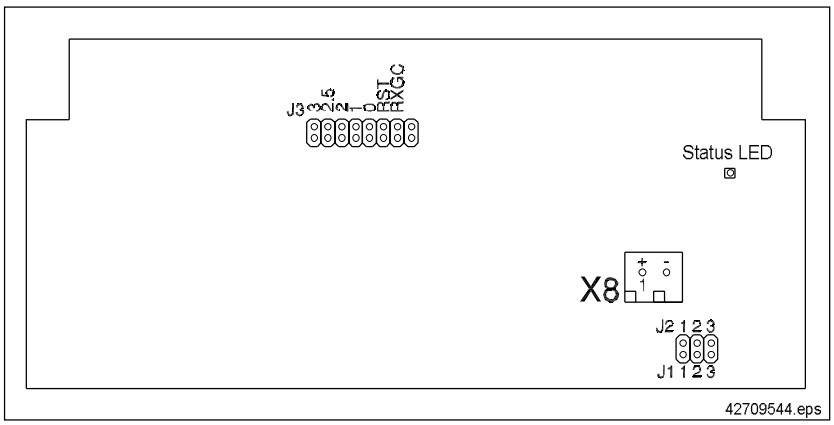
The receiver module is plugged onto the transformer module (X1, X2) and fixed by means of three spacers. Both modules are fitted inside a plastic enclosure. The transformer module features various connections which are listed in the following table. It is possible to check whether 24 V AC are available by means of the operating LED (close to X5) irrespective of whether the 24 V are fed in externally or generated internally.

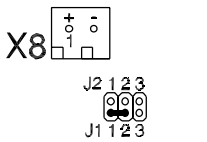
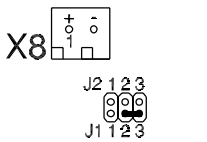




Connection	Designation	Function
X1, X2	Receiver module connector	Used for fitting the receiver card. The card is fixed by means of three spacers.
X3	Output supply	Connection for transmitting the supply voltage (parallel to X4)
X4	Input supply	Power supply is connected here.
X5	24 V AC selection connector	X5.1: Reference X5.2: 24 V external X5.3: 24 V internal (secondary voltage of transformer) for internal 24 V supply, a jumper must be fitted between X5.3 and X5.2 (factory setting)
X6	Selection primary voltage	Selection of primary voltage is made here by means of a wire jumper (e.g. 400 V, see figure) X6.5 – X6.4: 230 V X6.5 – X6.3: 400 V X6.5 – X6.2: 460 V X6.5 – X6.1: 575 V(factory setting)
X7	Connection socket control cable	The control cable is connected here.

5 Receiver module overview



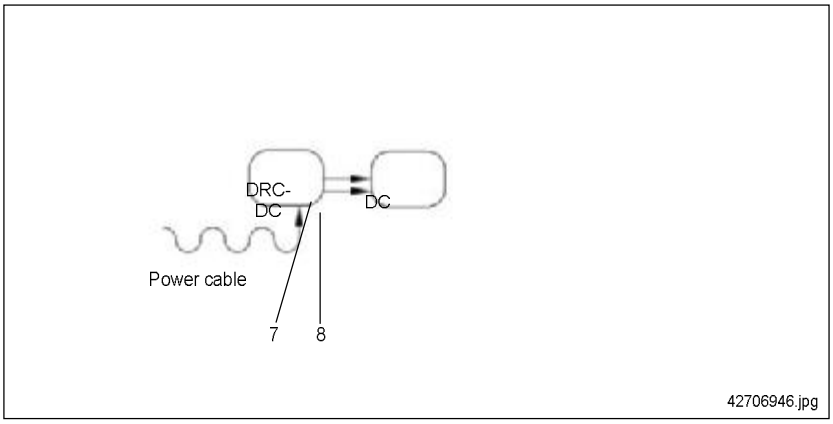
Item	Designation	Function
J3	Jumper J3	BE function and Reset, see Chapter 9 and section 8.3
X8	Connection horn / signal	X8.1: 30 V DC+ X8.2: GND- max. current 2 A, suitable for signal horn, part no. 720 349 45
J2	Jumper J2	Not used at present
J1	Jumper J1	Receiver module internal in DC 16 / 25  42709644.eps
		Receiver module external in receiver box on DC 1 – 10  42709644.eps
Status LED		Continuously lit: Voltage available, no radio signal LED flashes: Radio reception: Transmitter is in Stop mode or Run mode

21468944.indd/170807

6 Schematic illustrations for the electrical connection of DRC-DC receivers

6.1 Fitting the DRC-DC receiver on a stationary chain hoist (1 axis)

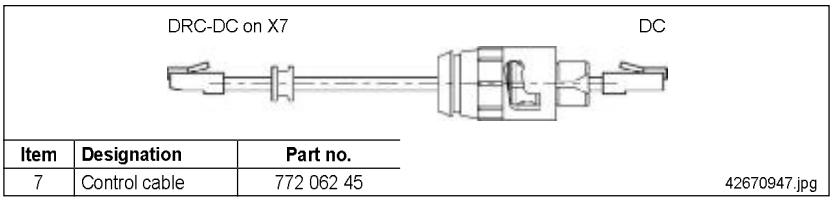
see also figures in section 4.2



- Connect power cable (item 8) on chain hoist,
- Remove sleeve 2 and insert sleeve of power cable,
- Connect control cable (item 7) on chain hoist,
- Remove sleeve 1 and insert sleeve of control cable,
- Check whether jumper is applied between X5.3 and X5.2,
- Apply jumper X6 in accordance with the available primary voltage (see section 4.2)
- Connect power supply to X4 of the receiver box, only the insert of the power cable (item 9) is used.

The control cable item 7 is a pre-assembled cable and is used for transmission of control signals from the receiver to the chain hoist.

The cable is provided with an insert that is adapted to the receiver box.

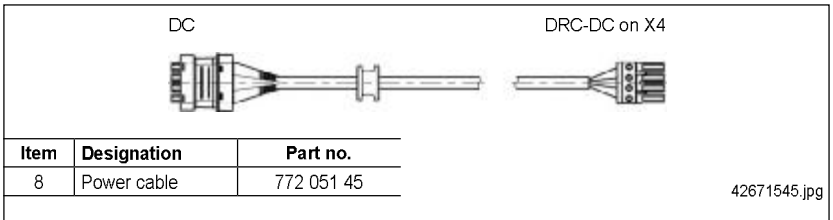


Item	Designation	Part no.
7	Control cable	772 062 45

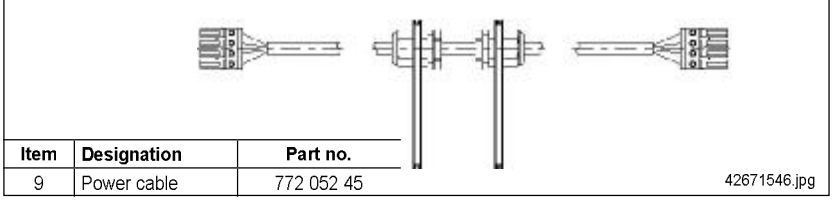
The power cable set (part. no.: 772 050 45) consists of two pre-assembled power cables.

The power cable (item 8) is used for 400 V voltage supply.

The power cable (item 9) transmits 400 V voltage supply from the trolley to the receiver.



Item	Designation	Part no.
8	Power cable	772 051 45



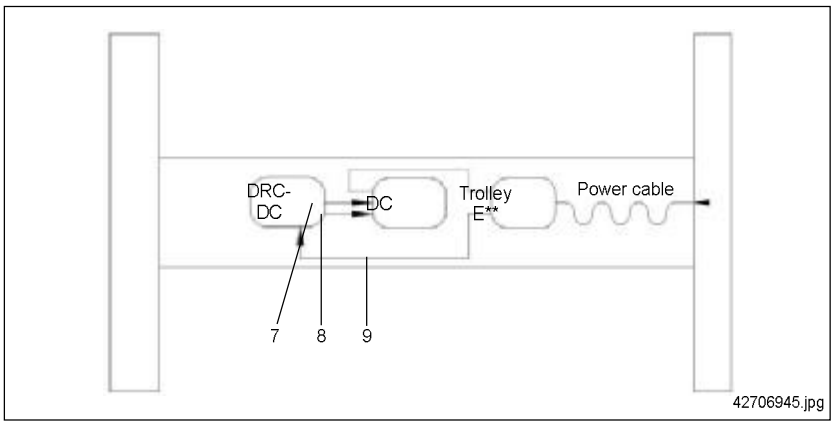
Item	Designation	Part no.
9	Power cable	772 052 45

21468944.indd/170807

6.2 Fitting to DC trolley (2 axes)

see also figures in section 4.2

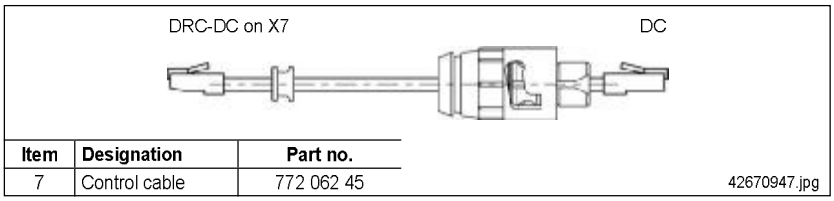
For use of the radio control system with a DC chain hoist trolley, electrical connection of the DRC-DC receiver is via three pre-assembled cables.



- Connect power cable (item 8) on chain hoist,
- Remove sleeve 2 and insert sleeve of power cable,
- Connect control cable (item 7) on chain hoist,
- Remove sleeve 1 and insert sleeve of control cable,
- Connect power cable (item 9)
- Apply jumper X6 in accordance with the available primary voltage (see section 4.2).

The control cable item 7 is a pre-assembled cable and is used for transmission of control signals from the receiver to the chain hoist.

The cable is provided with an insert that is adapted to the receiver box.

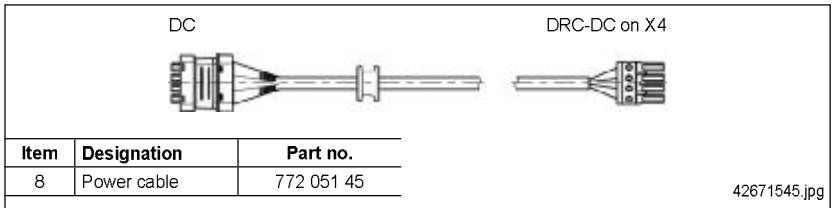


Item	Designation	Part no.
7	Control cable	772 062 45

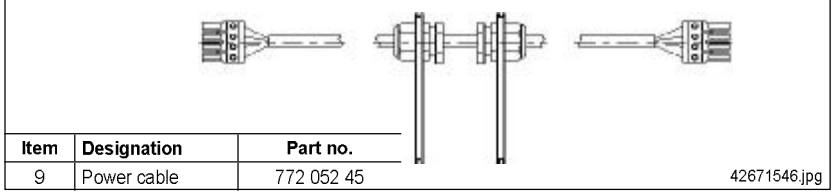
The power cable set (part. no.: 772 050 45) consists of two pre-assembled power cables.

The power cable (item 8) is used for 400 V voltage supply.

The power cable (item 9) transmits 400 V voltage supply from the trolley to the receiver.



Item	Designation	Part no.
8	Power cable	772 051 45



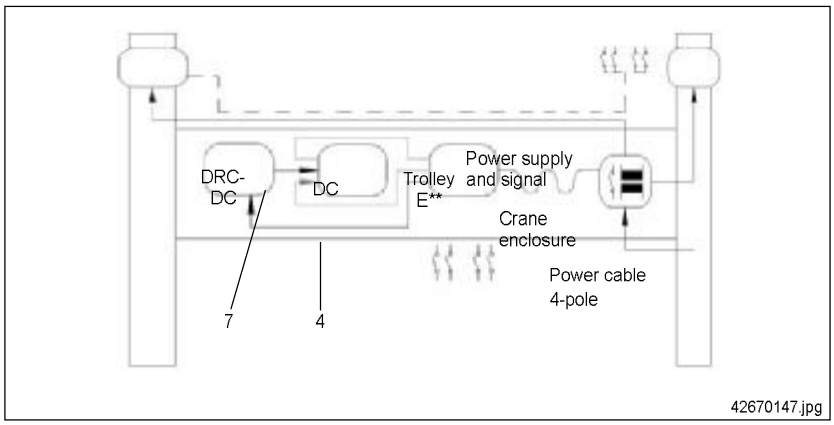
Item	Designation	Part no.
9	Power cable	772 052 45

6.3 Fitting the DRC-DC receiver on the crane (3 axes)

see also figures in section 4.2

For this fitting variant, the DRC-DC receiver is fitted on the DC chain hoist of the DC crane.

Electrical connection of the DRC-DC receiver is via two different cables which are available as pre-assembled cables for this application.

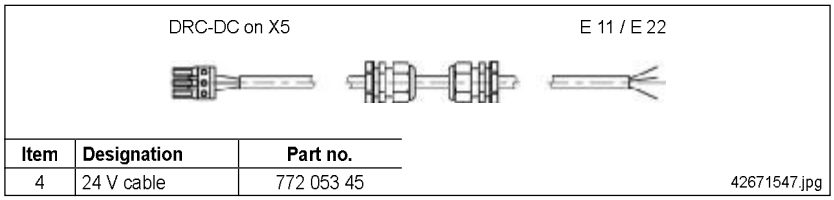


- Connect 24 V cable (item 4) to E 11 / E 22 and DRC-DC,
- Connect control cable (item 7) on DC,
- Remove sleeve 1 and insert sleeve of control cable.

Terminal X9.2 on E 11 / 22 is supplied with 24 V AC from HW version 7.0. For older HW versions, a support terminal must be set at X7.3.

DRC-DC	Conductor	E 11 / 22
X5.1 (reference, GND)	gr	X7.1
X5.2 (24 V AC)	bk	X9.2

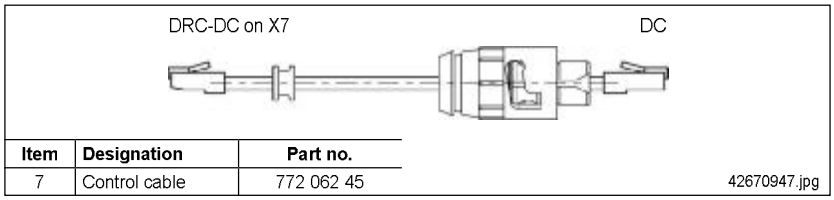
The cable (item 4) is used for 24 V voltage supply of the DRC-DC receiver from the trolley electrics.



Item	Designation	Part no.
4	24 V cable	772 053 45

The control cable (item 7) is a pre-assembled cable and is used for transmission of control signals from the receiver to the chain hoist.

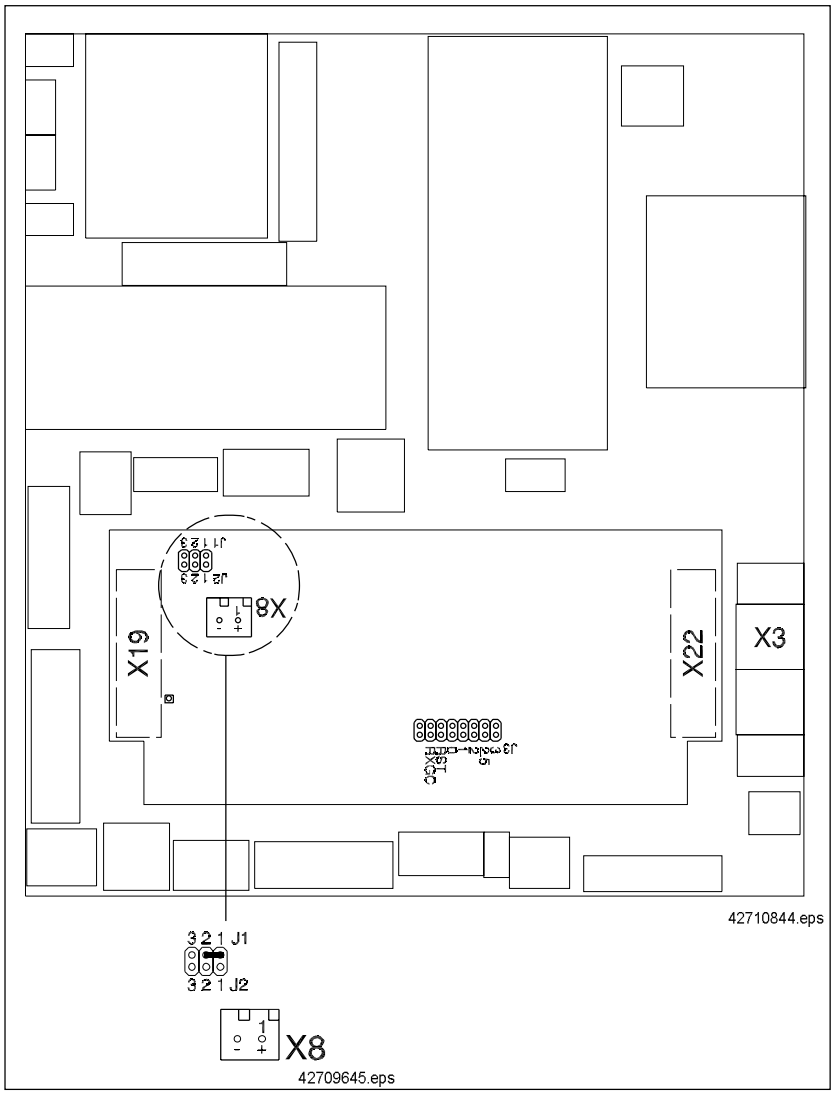
The cable is provided with an insert that is adapted to the receiver box.



Item	Designation	Part no.
7	Control cable	772 062 45

21468944.indd/170807

6.4 Internal fitting of the receiver



The DC 16/25 hoist control system is provided with the receiver module instead of the control pendant jumper. The receiver module is plugged directly onto the hoist control system (between multiple connectors X19 and X22) and locked by means of a plastic spacer.

The jumper of jumper field J1 must be applied between pins 1 and 2, see also chapter 5!

A dummy plug is required at the control pendant input of the hoist control system 0s(X3).

The dummy plug is provided with a wire jumper between X3.A7 and X3.B3 which supplies the voltage for the receiver module.

Emergency control by means of a cable-connected control pendant is easily possible with a DSE10-C. For this purpose, the dummy plug at the control pendant input of the hoist control system (X3) is removed. The DSE10-C can then be connected instead to control the crane without any further adjustments.

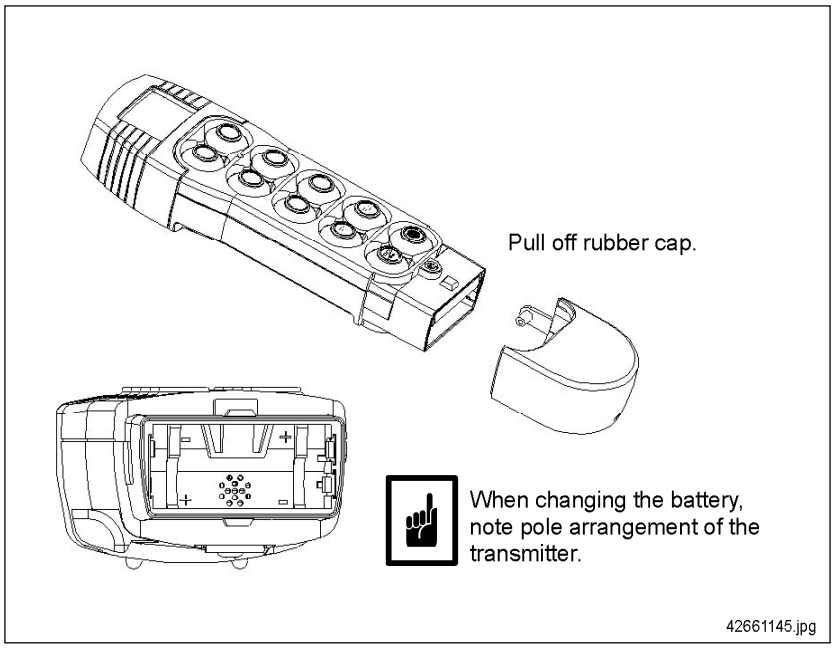
7 Putting the radio control system into operation after installation

7.1 Putting the hand-held transmitter into operation

A radio control system has been put into operation when the hand-held transmitter has been put into operation. The following preparation measures are necessary:

DRC-DC 10 and DRC-DC 6 hand-held transmitters are delivered with 2 rechargeable batteries which have to taken out of the package and inserted in the bracket in the battery compartment ensuring the correct polarity. The batteries are connected in series and must be inserted as illustrated in the figure. Then press the Stop key to check the batteries. When the red Stop LED is not on, the batteries are not inserted correctly or defective.

Since new rechargeable batteries are only partially charged, they must be charged before the unit is put into operation for the first time by connecting them to the plug-in charger (see section 7.2).

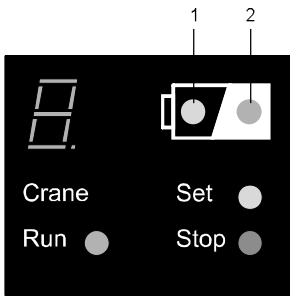


A unique crane identification/number must be selected and fitted on the crane in accordance with section 3.4 for the crane or chain hoist provided with the radio control system.

Following these preparation measures, put the hand-held transmitter into operation by logging it on to the radio receiver of the crane to be controlled. Following this procedure, the radio control system is configured for the specific application.

21468944.indd/170807

7.2 Charging the batteries before putting the unit into operation



1 Battery capacity (yellow)
2 Charge battery (green)

42708145.eps

The hand-held transmitter is supplied with power by means of two NiMH rechargeable batteries, size AA (LR6). The batteries must be charged in good time by means of the appropriate plug-in charger. For the charging process, an ambient temperature between 0 °C to +40 °C is required.

The battery capacity is shown in the display section of the hand-held transmitter.

Battery capacity (1)		
Yellow LED	Indicates the battery charging status:	
	Slow flashing (8 sec. break)	The battery is charged
	Fast flashing (1 sec. break)	Remaining operating time less than 2 h
	LED continuously lit	Remaining operating time less than 10 min. Charge transmitter
	Acoustic warning signal	Battery discharged – automatic cut-out of the transmitter after approx. 2 min.

Charge battery (2)		
Green LED	Indicates the status of the charging process:	
	Flashing (2 times per second)	Quick charging active
	LED continuously lit	Trickle charging mode, batteries are charged with low current

For trouble-shooting information about charging the batteries, see section 11.3.

The yellow LED in the battery icon indicates the capacity of the rechargeable batteries:

For a new and freshly charged battery, **slow flashing** means a useful operating time of the switched-on hand-held transmitter (Run or STOP) of approx. 30 hours.

If this LED is **continuously lit**, this indicates that only residual charge is still available. The hand-held transmitter must be connected to the charger as soon as possible.

The operating time that can be reached for the hand-held transmitter with one battery charge depends on the operating mode of the hand-held transmitter, the ambient temperature and the age of the batteries.

If the hand-held transmitter is continuously switched on, up to 30 hours operating time can be reached with one battery charge (at 20 °C ambient temperature).

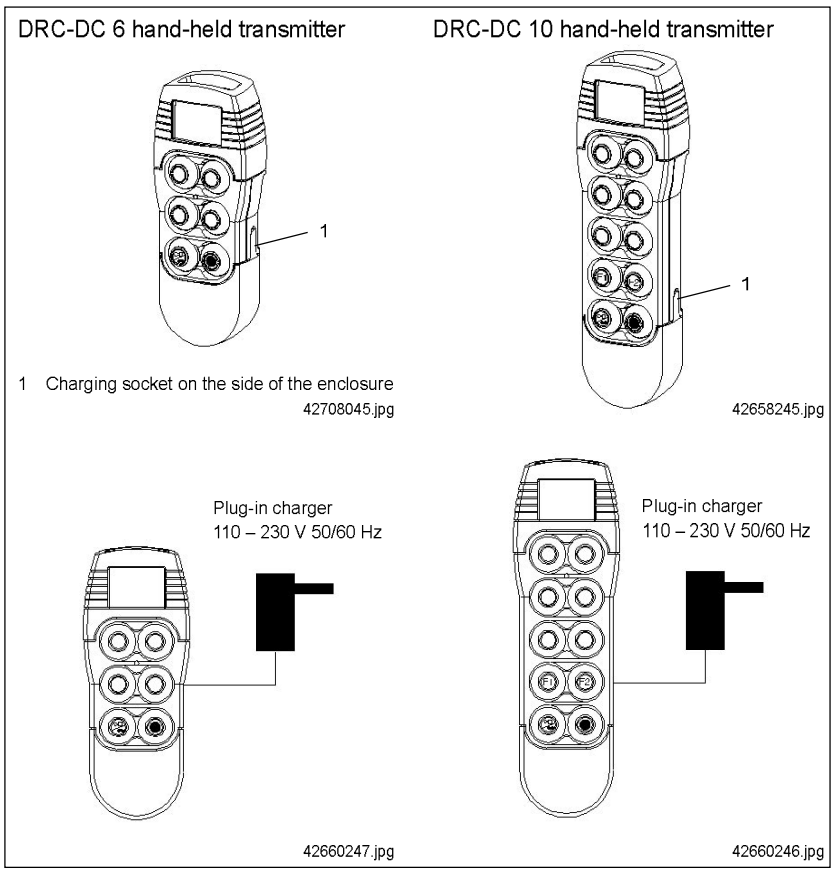
The following measure reduces power consumption:

- Switching off the hand-held transmitter during operating breaks or when the crane is not used, see section 10.3.

When residual charge is displayed (yellow LED is continuously lit), immediately charge the integrated batteries by means of the plug-in charger included in the supply. If the batteries are not charged immediately, the acoustic warning signal sounds after a few minutes and the hand-held transmitter is switched off automatically. When the warning signal is given, the transported load must be set down immediately and the crane be placed in a safe state.

The charging operation of the batteries in the hand-held transmitter is provided with temperature monitoring in order to protect the batteries. If the temperature is too high or too low, the charger automatically switches over to trickle charging. If during the charging operation, ambient temperatures outside the specified range of 0 °C to 40 °C occur, the battery may not be charged or be charged incompletely. The charging operation can be started again by re-connecting the charger plug.

7.3 Charging the batteries



The charging process is monitored and controlled by the electronics in the hand-held transmitter. Partly discharged batteries can also be charged.

Plug charger into a power socket and connect the connection cable in the charger socket of the hand-held transmitter. This starts the charging operation.

During the charging process, the transmitter automatically switches to Stop mode, i.e. operation of the chain hoist or the crane is not possible.

Charge battery (2)		
Green LED	Indicates the status of the charging process:	
	Flashing (2 times per second)	Quick charging active
	LED continuously lit	Trickle charging mode, batteries are charged with low current

21468944.indd/170807

Quick charging mode:

This process takes approx. 2 h if the batteries are discharged, and completely charges the batteries.

Trickle charging mode:

After quick charging, the system switches over to trickle charging mode with a lower charging current so that the hand-held transmitter can remain connected to the charger for any period of time.

Trickle charging mode is indicated by a continuous green light.

To ensure sufficient charging of the empty batteries, it is necessary to connect the hand-held transmitter to the charger for min. 2 hours. In order to ensure the availability of the hand-held transmitter, the hand-held transmitter should be connected to the charger at the end of the second shift, at the latest.

The rechargeable batteries in the hand-held transmitter are subject to ageing as a consequence of charging/discharging cycles and continuously lose charging capacity. We recommend that the rechargeable batteries be replaced after one year, at the latest. They must be replaced immediately, when

- the operating time is drastically reduced and
- the charging time becomes extremely short.

The NiMH rechargeable batteries supplied with the hand-held transmitter have been specifically selected for the requirements of this radio control system. The electrical and mechanical features of the hand-held transmitter and rechargeable batteries have been matched to fulfill all requirements of trouble-free and safe operation.

The specified batteries must be used for replacement.

The use of non-approved rechargeable batteries may result in operating malfunctions of hand-held transmitters or lasting damage to the charger and the hand-held transmitter.

In addition, comply with the following when replacing rechargeable batteries:

- Always replace both rechargeable battery cells at the same time
- Make and type of both rechargeable batteries must be identical
- Only use completely new rechargeable batteries
- Both rechargeable batteries must have the same charging status (do not combine charged batteries with uncharged ones)
- Polarity of the rechargeable battery cells in accordance with the marks in the battery compartment.

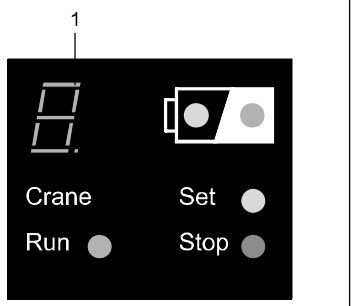
When replacing the rechargeable batteries, check the contacts in the battery compartment for sufficient contact pressure. The new rechargeable batteries must fit tightly between the contact surfaces.

In exceptional situations, when no charged batteries are available, the hand-held transmitter may be operated with two 1,5 V primary cells size AA (LR6) according to EN/IEC 60086. We recommend that Alkaline batteries, make Duracell or Varta, be used. Primary cells cannot be recharged.

If primary cells are used in the hand-held transmitter, it must not be connected to the charger to avoid damage caused by overheating during the charging attempt.

Used rechargeable batteries and primary cells must be disposed of in an environmentally compatible way.

7.4 Assigning a hand-held transmitter to a receiver / crane



1 7-segment display to show the crane ID

42708145.eps

A specific transmitter (DRC-DC 6 or DRC-DC 10) is clearly assigned to a specific DRC-DC receiver by means of the menu described in the following.

A clear assignment is established by transmitting an unequivocal and unique address code from the transmitter to the receiver. The address code of the assigned transmitter is then saved in the receiver protected against power failure and error influences so that no other transmitter can control this receiver / crane.

To indicate the assignment of the transmitter to a specific receiver / crane, the crane identification is shown in the display section of the hand-held transmitter. The crane identification consists of a leading `c` and two following figures (0 – 9).

The crane identification is shown as a sequence of characters in the 7-segment display.

The crane identification to be entered during the assignment procedure must be identical with the identification fitted on the crane or the hoist, see section 3.4.

21468944.indd/170807

7.5 Assigning transmitter and receiver during putting the unit into operation

When the new unit is delivered, transmitter and receiver are set to crane identification `c 0 0`. In this status, there is no clear assignment yet between transmitter and receiver. In order to avoid any hazards, all motion commands are disabled in the transmitter and also in the receiver.

When the unit is delivered, the horn is active so that it can be used for checking radio transmission between transmitter and receiver.

If the assignment of transmitter and/or receiver or the crane identification are to be changed, they must first be reset to the delivery status.

Prior to carrying out the assignment procedure, the following checks must be made and, if required, measures must be taken:

- Does the relevant transmitter have crane identification `c 0 0`? After pressing the Stop key down completely, the crane identification is displayed three times. If the transmitter is set to another crane identification, change the crane identification to `c 0 0`, see section 8.1. Crane identification `c 0 0` can be set on the transmitter independent of a receiver and is effective, if in step 8 `c 0 0` is displayed.

- Switch on the power supply for the receiver on the crane and check whether no transmitter is yet assigned to the receiver. To do this, actuate the horn on the hand-held transmitter. Receivers with crane identification `c 0 0` give a horn signal. If several not yet assigned receivers respond, switch off the other receivers. When several not yet assigned receivers are switched on, they are all assigned to the same hand-held transmitter and controlled at the same time which is not permissible.
- If a transmitter has already been assigned to the receiver (does not respond with a horn signal), either
  - carry out a reset of the receiver (see section 8.3) or
  - transmit crane identification `c 0 0` with the already assigned transmitter.

  As a consequence of the receiver reset or transmission of crane identification `c 0 0`, the relevant receiver is reset to the delivery status of a new unit (no assignment).

8 Setting or changing the crane identification

Setting and changing the crane identification are safety-relevant actions and must only be carried out by experienced technician who carefully comply with these instructions.

In the following, process steps and examples for setting and changing the crane identification (assignment of a transmitter to a receiver / crane) are described. These actions are carried out with the hand-held transmitter in Stop mode and are protected against inadvertent actions by means of an electronic key.

8.1 Process steps

The checks and, if necessary, the measures described in section 7.5 must first be carried out. The steps described in section 8.2 must also be followed if a transmitter is replaced.

Step	Operation	Display on hand-held transmitter	Explanation
1	Actuate the Stop key	Red LED lights up in the display section; Crane identification is shown in 7-segment display and repeated 2 x	Display of the valid crane identification
2	Actuate the Horn key	Red LED is lit in the display section	Horn signal is given on the assigned receiver or for all receivers without assignment for crane identification `c 0 0`. Switch off receivers which are not to be set so that there is only a radio link to one receiver.
3	Input of key sequence for the logon menu: 1. Press and hold down the Stop key, 2. Actuate the Horn key 2 x, 3. Actuate the Lower key and hold it down for approx. 5 seconds until LED 'Set' flashes	LED 'Set' flashes in the display section; 7-segment display shows '0'	Transmitter is now ready for entry of the two-digit number of the crane identification
4	By actuating the 'Right' or 'Left' key, the first figure of the crane identification can be increased or decreased.	7-segment display indicates the first figure of the crane identification	
5	Actuate the 'Horn' key to accept the previously set figure.	No horn signal, LED 'Set' flashes in the display section; 7-segment display shows '0'	Transmitter is now ready for entry of the two-digit figure of the crane identification
6	By actuating the 'Right' or 'Left' key, the second figure of the crane identification can be increased or decreased.	7-segment display indicates the second figure of the crane identification	
7	Actuate the 'Horn' key to accept the previously set figure.	No horn signal, LED 'Set' flashes in the display section; 7-segment display shows: c + `first figure of crane identification ` + `second figure of crane identification `	Both figures of the crane identification have been entered
8	Actuate the 'Lift' key	Red LED lights up in the display section; 7-segment display shows: c + `first figure of crane identification ` + `second figure of crane identification `	Entry of the crane identification completed. After successful transmission of the crane identification, the receiver responds with - two horn signals → clear assignment to transmitter - three horn signals → clear assignment eliminated by crane identification `c 0 0` - no horn signal → assignment of receiver unchanged (check radio link, repeat setting)

Entry of the two-digit crane number can be interrupted and corrected at any time in process steps 4 to 7 by pressing the Stop key.

By actuating the Lift key in process steps 4 to 6, the setting process is aborted without changing the crane identification.

After completion of the setting process, functioning of the radio control system and the crane must be checked.

8.2 Replacing a hand-held transmitter

Putting a reserve transmitter into operation:

The transmitter (A) is already assigned to the crane with identification `c 4 7`. Transmitter A is to be replaced by another transmitter (B).

Procedure:

1. Set transmitter A to crane identification `c 0 0`, see section 8.1 steps 1 to 8.
2. The crane acknowledges the eliminated assignment with 3 horn signals.

   The receiver is now ready for logon of a transmitter with crane identification `c 0 0`. The crane movements are disabled in the receiver.
3. Assignment of transmitter B with the crane identification `c 4 7` fitted on the crane, see section 7.5. See section 8.1 for setting process.

   After successful transmission, the clear assignment of transmitter B to the crane with identification `c 4 7` is acknowledged by the receiver with 2 horn signals. The motion commands are enabled again in the receiver. Transmitter B displays the crane identification.

The assignment between transmitter A and crane C47 is eliminated by the described actions. Transmitter A has no assignment and cannot send any motion commands owing to crane identification c00. Transmitter B is clearly assigned to crane c47. Transmitter A can now be used as a reserve transmitter.

Putting a replacement transmitter into operation:

A specific transmitter (A) is assigned to the crane with identification ‘c 4 7’. This transmitter has been lost or is no longer working. It is to be replaced by transmitter (B). The identification code of transmitter (B) is ‘c 0 0’.

Procedure:

1. As the currently assigned transmitter is no longer available, the receiver must be reset in a hardware reset, see section 8.

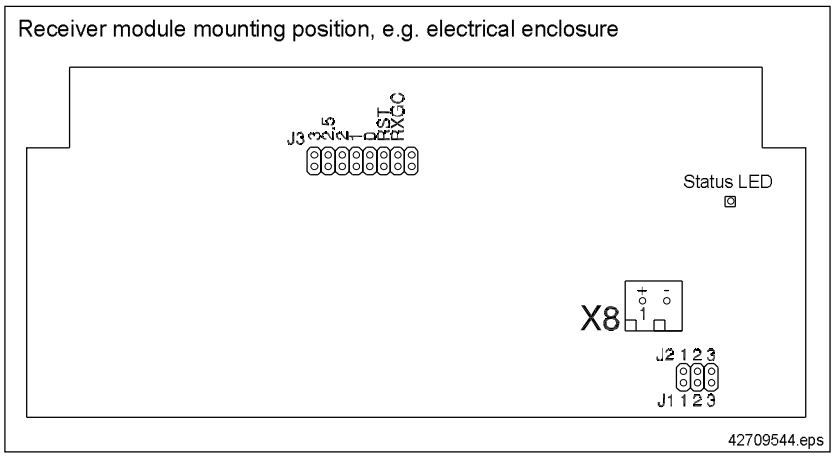
   After this reset, the receiver is reset to crane identification `c 0 0` and ready for logon of a new hand-held transmitter. The crane movements are disabled in the receiver.

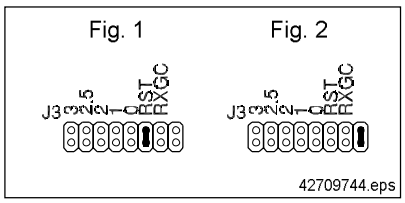
Further procedure is as in section 8.1, from point 1.

Replacement transmitter B is clearly assigned to crane c47 owing to the described actions. Transmitter A cannot control crane c47, if it is available again, since as a consequence of the hardware reset and the setting process with transmitter B the old assignment has been deleted in the receiver.

8.3 Resetting DRC-DC receivers

Resetting the receiver card is necessary, if the assigned transmitter is no longer available. For resetting the assignment saved in the receiver to the lost transmitter, a radio link can no longer be established. In the radio receiver the crane identification is reset to ‘c 0 0’ instead by means of jumper J3 / RST so that a new assignment is possible.





To reset the unit, proceed as follows:

1. De-energize the receiver, remove jumper from the parking position,
2. Apply reset jumper (fig. 1),
3. Switch on the power,
4. Switch off the power,
5. Remove jumper (fig. 2) and re-apply on parking position,
6. Switch on the power again.

The receiver now has crane identification ‘c 0 0’ again and can be treated as for putting into operation for the first time (see section 7.5). Putting a replacement transmitter into operation is described in section 8.2.

Ensure that the jumper is removed again, as otherwise the radio control system is not ready for operation.

21468944.indd/170807

9 BE function

When pole-changing squirrel cage rotor travel motors are switched down from fast to slow speed, unwanted loads on mechanical components and load sway result. It is therefore recommended to use the integral BE (brake application) function in conjunction with the DRC-DC radio remote control system. This ensures that mechanical braking is started when the fast travel speed has been switched off. Only after expiration of an adjustable delay time can the slow travel speed be switched on again.

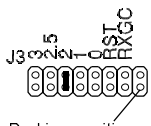
Description of BE function

This BE function is only available for long travel. The time is set on the receiver module by means of jumper J3. It is possible to set deceleration times of 0 (0 = switched off, factory setting), 1, 2, 2.5, 3 seconds.

After the fast speed (V2) signal has been switched off, the fast and the slow speed (V1) contacts open and thus generate mechanical braking. Upon expiration of the time interval set and if the control signal (slow) is available, the slow speed is switched on again for the drive unit. If V2 is switched on again during the braking time, the contacts for V1 and V2 close without delay, i.e. the fast speed is switched on again. Select time interval so that upon expiration of this braking time the travel drive is braked from V2 to V1.

The times can be set as follows by means of the jumper for the parking position:

Fig. 1



1. Switch off the power,
2. Apply jumper of the parking position to the required time (e.g. fig. 1 = 2 seconds),
3. Switch on the power,
4. Switch off the power again,
5. Remove jumper and re-apply on parking position,
6. Switch on the power again.

The time now remains saved until a new value is set, also if a reset has been carried out.

Ensure that the jumper is removed again, as otherwise the radio control system is not ready for operation.

10 Operation of the radio control system

The operator controls the radio-controlled crane by means of the DRC-DC hand-held transmitter.

10.1 Check before starting work

Before starting work, the operator must carry out the inspections and function checks listed in the hoist/crane operating instructions and must be satisfied that the installation is in safe operating condition.

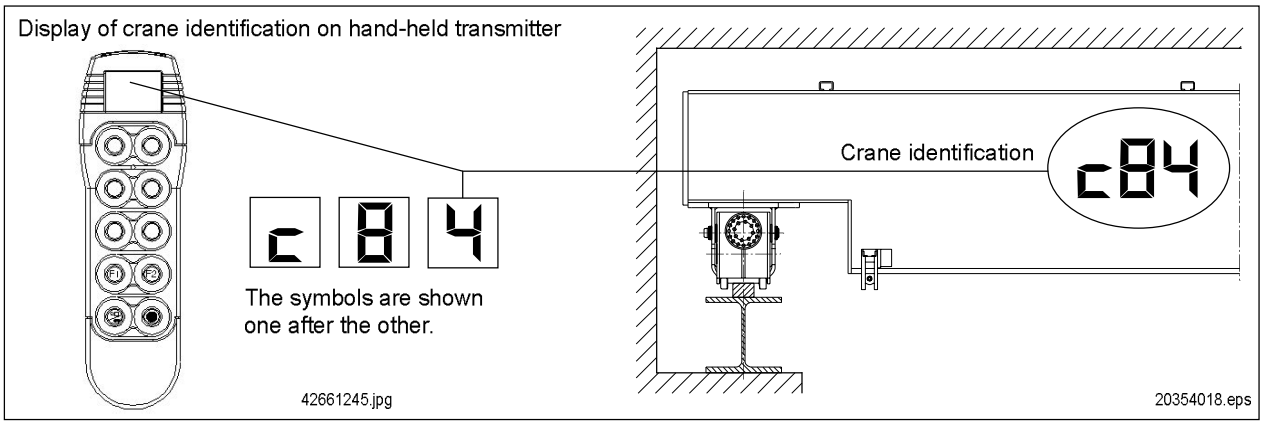
When the unit is switched off, all displays in the display section of the transmitter (LED, 7-segment display) are dark.

To switch on the hand-held transmitter, actuate the Stop key. In the display section of the transmitter all light emitting diodes briefly light up and the buzzer for battery warning sounds for checking. Then the red 'Stop' LED lights up.

The 7-segment display of the hand-held transmitter shows the crane identification three times.

The crane identification provides information about which receiver or which hoist or crane are assigned to the relevant transmitter.

The crane identification displayed in the display section of the hand-held transmitter must be identical with the crane identification on the trolley or on the crane to be controlled.



The radio system performs a self-test when it is switched on. The installation is then ready for operation if no error statuses are displayed. Fault elimination is described in chapter 11.

In addition, the crane operator must check the following before starting work:

- Battery capacity,
- Displayed crane identification and associated crane,
- Horn function,
- Stop key function.

To check functioning of Horn and STOP, crane operation (Run mode) must be switched on.

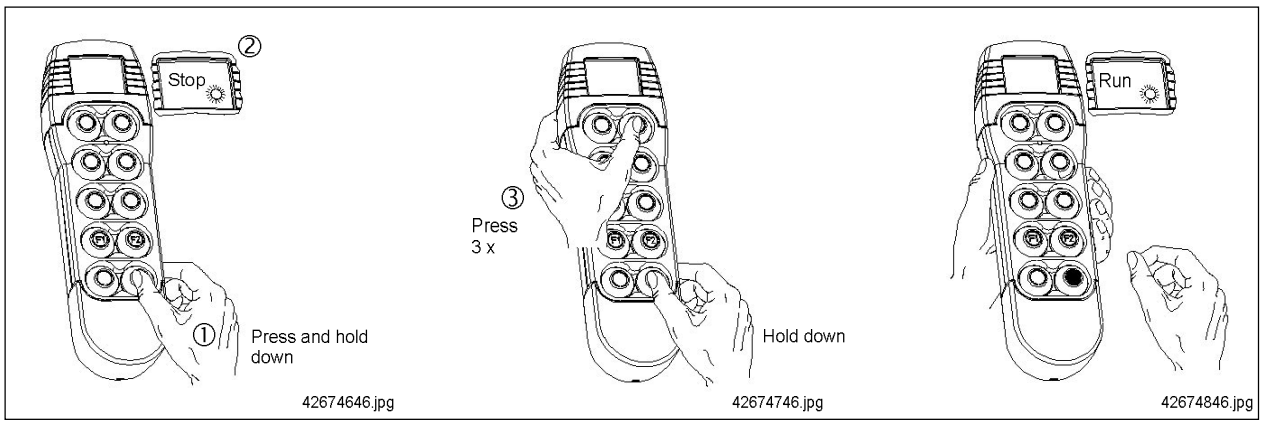
21468944.indd/170807

10.2 Switching on the hand-held transmitter

By entering the key sequence

- Press and hold down the Stop key,
- Actuate the Lift key 3 x,
- Release the Stop key,

the hand-held transmitter is switched from Stop mode to Run mode. In Run mode, wireless control of the hoist and crane is possible.

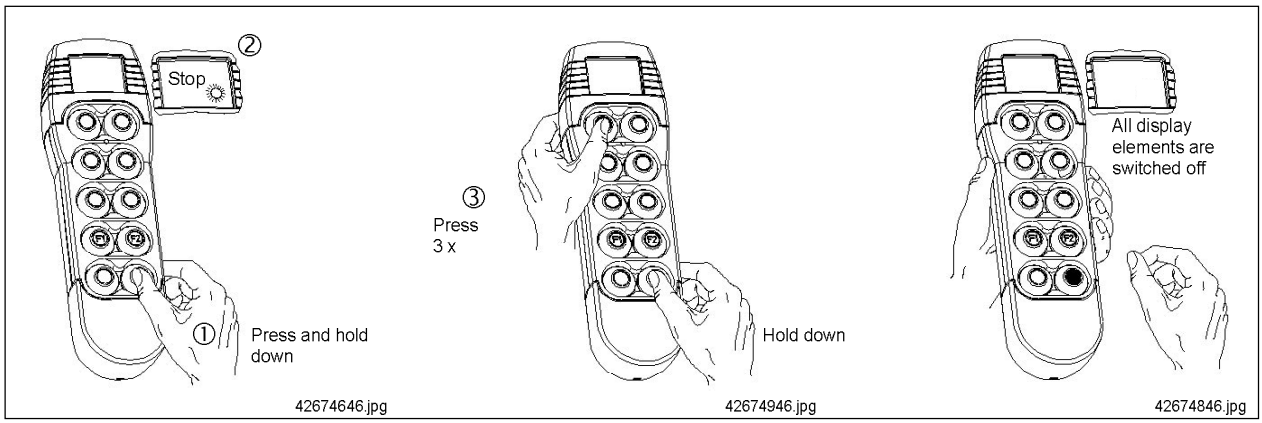


10.3 Switching off the hand-held transmitter

The transmitter is in Stop mode. By entering the key sequence

- Press and hold down the Stop key,
- Actuate the Lower key 3 x,
- Release the Stop key,

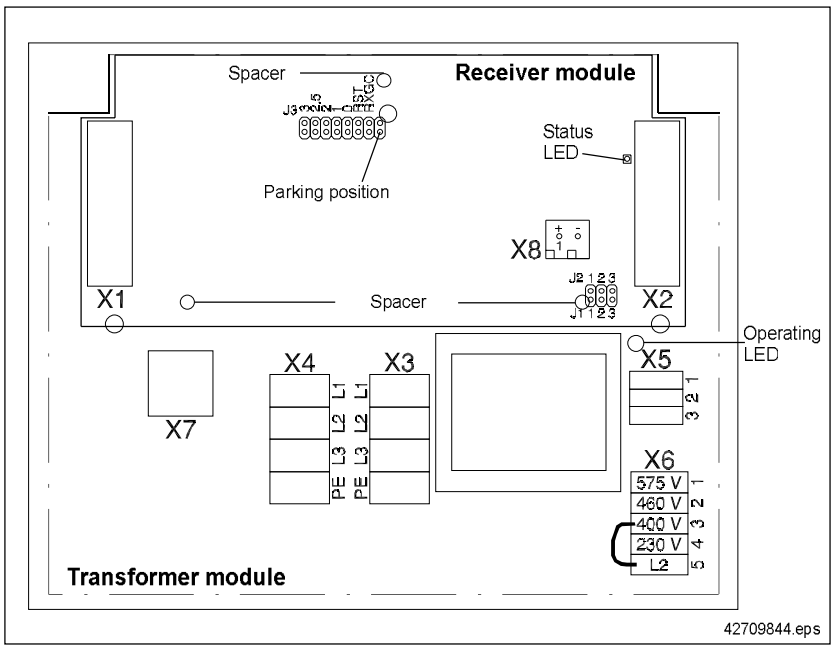
the transmitter is switched off.



The hand-held transmitter automatically switches to Stop mode, if no key is actuated for 30 minutes. After 5 minutes in Stop mode, radio transmission is automatically switched off and the transmitter changes to standby.

11 Fault finding / operating statuses

11.1 DRC-DC with receiver box (DC1 – 10)



General display

Error	Cause	Remedy
Operating LED is off	• no 24 V AC	• Check supply cable • Chain main supply / main fuse
Voltage supply available and operating LED is off	• no 24 V AC	• Check jumper X6 for correct fitting and rupture • Check jumper X5 for correct position
24 V AC external supply and operating LED is off	• no 24 V AC	• Check 24 V AC cable • Measure supply source • Check for interchanging
Operating LED is on but Status LED on receiver card is off	• Card has no supply • Receiver module defective	• Check card for correct fitting and fit correctly, as required • Replace receiver module
Transmitter and receiver have been set up successfully but the units do no receive any control signals	• Jumper J1 not or incorrectly applied	• Apply jumper J1 correctly
Status LED does not start to flash when the Stop key was pressed on the transmitter or Horn does not sound, when the Horn key is actuated	• Jumper J3 is jumperd (applied on a BE time or RST) • Transmitter and receiver have different crane identifications	• Remove jumper and switch power off and on again • Carry out HW reset on the receiver (see section 8.3) and set crane identification 0 on the transmitter (see section 8.1); if this is successful, Status LED starts to flash, crane identification > 0 assigned

Fault indication via Status LED

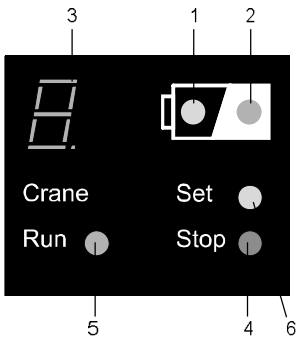
Internal faults of the receiver card are indicated by means of different flash codes of the status LED. A distinction is made between long (1 sec.) and short (0,1 sec.) flash signals. A flash sequence consists of three flash signals. There is a break of 1 sec. between the individual flash signals. Between the sequences, there always is a break (LED off) of 3 sec.

Flash sequence	Error	Remedy
long – long – long	Memory error	Restart the hardware by switching the power off/on; if the error persists, replace receiver
long – short – short	Error emergency-stop circuit	Restart the hardware by switching the power off/on; if the error persists, replace receiver
long – long – short	Supply voltage too low (< 18 V)	Check jumper X6 and correct, as required

11.2 DRC-DC as a module in DC 16 / 25

Error	Cause	Remedy
Status LED on receiver card is off	• Card has no supply • Receiver module defective	• Check card for correct fitting and fit correctly, as required • Check whether dummy plug is applied or the wire jumper is correct • Replace module
Transmitter and receiver have been set up successfully but the units do no receive any control signals	• Jumper J1 not or incorrectly applied	• Apply jumper J1 correctly
Status LED does not start to flash when the Stop key was pressed on the transmitter or Horn (if fitted) does not sound, when the Horn key is actuated	• Jumper J3 is jumpered • Transmitter and receiver have different crane identifications	• Remove jumper and switch power off and on again • Carry out HW reset on the receiver (see section 8.3) and set crane identification 0 on the transmitter (see section 8.1); if this is successful, Status LED starts to flash, crane identification > 0 assigned

11.3 DRC-DC 6 and DRC-DC 10



1 Battery capacity
2 Charge battery
3 Crane ID
4 Stop
5 Run mode
6 Parameter setting mode

Upon detection of an error, the transmitter changes to the error status. The red Stop LED (4) flashes and a warning signal is given. The 7-segment display (3) indicates the detected error. In order to stop the signal sound, a battery must be removed. In the following table, possible errors are listed.

Error	Cause	Remedy
1	Hardware error	Replace transmitter
2	No automatic test	Replace transmitter
3	Flash memory defective	Replace transmitter
4	RAM memory defective	Replace transmitter
5	Error in transmitter module	Switch transmitter off and try restart, if the same error occurs again, replace transmitter
6	Stop key defective	Replace transmitter
Battery charging LED is permanently on, the transmitter cannot be switched on after the charger plug has been disconnected (LEDs remain off)	• 1 or both batteries missing • 1 or both batteries defective	• Insert batteries • Replace rechargeable batteries
Battery charging LED flashes slowly (1 sec. on, 1 sec. off), the transmitter cannot be switched on after the charger plug has been disconnected (LEDs remain off)	• 1 or both batteries are inserted incorrectly in the compartment • 1 or both batteries have short-circuit (are defective) • Ambient temperature is lower than 0 °C or higher than 40 °C	• Insert rechargeable batteries correctly • Replace rechargeable batteries • Charge batteries between 0 °C and 40 °C

12 International postal registration

In the following countries, hand-held transmitters and radio receivers of the DRC-DC range **in the standard delivery form** can be operated without any registration or operating fee:

Countries	Frequency range
Australia	433 MHz ISM band
Austria	
Belgium	
Bulgaria	
Croatia	
Cyprus	
Czech Republic	
Denmark	
Estonia	
Finland	
France	
Germany	
Greece	
Hungary	
Iceland	
Ireland	
Israel	
Italy	
Luxembourg	
Montenegro	
Netherlands	
New Zealand	
Norway	
Poland	
Portugal	
Russia	
Serbia	
Singapore	
Slovak. Republic	
Slovania	
South Africa	
Spain	
Sweden	
Switzerland	
Thailand	
Turkey	
UK	

On request, the relevant approvals and/or certificates are available.

DEMAG Cranes & Components	**EC conformity declaration** **Demag radio control system** **in accordance with EC directive 89/336/EEC, Appendix I, 2006/95/EC, Appendix III and 99/5/EC #**	1 page(s) | Page 1 Ident no. **205 331 44** Issue 0107 | EN

Hereby we,

CE

Demag Cranes & Components GmbH

declare that the product

Demag radio control system RC-10, RC-J, DRC-10, DRC-J, DRC-MP, DRC-DR, DRC-DC 1)

of serial design is in conformity with the provisions of following relevant regulations:

EC EMC directive	**89/336/EEC**
amended by	**92/31/EEC and 93/68/EEC**
EC Low voltage Directive	**2006/95/EC** #
EC radio and TTE directive	**99/5/EC**

Applied harmonised standards:

EN 954 -1	**Safety related parts of control systems**
EN 13557	**Control elements and control positions**
EN 50178	**Electronic equipment for use in electrical power installations and their assembly into electrical power installations**
EN 60204 -32	**Electrical equipment, requirements for hoists**
EN 60529	**Types of enclosure (IP code)**
EN 61000-6-2	**Electromagnetic compatibility – Immunity for industrial environments**
EN 61000-6-4	**Electromagnetic compatibility – Emission standard for industrial environments**
EN 300220 -3	**Electromagnetic compatibility and radio spectrum matters (ERM); Short Range Devices (SRD)**

Wetter, 16 January 2007
Place and date of issue

ppa. Gersemsky
Handling Technology Engineering

ppa. Hoffmann
BU Handling Technology

1) Application of CE symbol in accordance with EC Low Voltage Directive 2006/95/EC: # #
RC-10 1998; RC-J 2000; DRC-10 2004; DRC-J 2004; DRC MP 2005; DRC-DR 2005; DRC-DC 2006.

# = Modifications compared to previous issue	Normung DCC	Class. no. 715 **IS** 975

Notices and Warnings

This equipment complies with part 15 of the FCC Rules and RSS-210 of IC 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. Changes or modifications not expressly approved by Scanreco Industrielektronik AB will void the user's authority to operate the equipment.

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.**