English
22.2.2007

RACON SERIES II RADIO CONTROL
SERVICE MANUAL

R&M
MATERIALS
HANDLING
INC.

R&M Materials Handling, Inc.
4501 Gateway Boulevard
Springfield, Ohio 45502
P.: (937) 328-5100
FAX: (937) 325-5319

Read the instructions supplied with the product before installation and commissioning.

Keep the instructions in a safe place for future reference.

Table of content

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1 MAJOR UPDATE HISTORY (ONLY IN ENGLISH)

Section	Description	Date	Handled by
Hole manual	RADH11 added	22.2.2007	KHHHLE
Description, Installation	BC60K battery charger changed to BC70K	22.2.2007	KHHHLE

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2 SAFETY PRECAUTIONS

- **These instructions must be read carefully prior to any intervention in the system.**
- **This Service Manual is intended for authorized personal, instructed in radio remote control repairing.**
- **Strictly follow to the instructions contained in this manual**
- **Ensure that all site and prevailing safety regulations are fully respected.**
- **When carrying out repairs, only use spare parts supplied by the manufacturer.**
- **Disconnect the receiver cable if soldering/welding work is going to be carried out on the crane.**
- **Never make any changes to the set, which have not been studied and approved by the manufacturer.**

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3 DESCRIPTION

3.1 General

The RADS11, RADF13 and RADH11 push-button transmitter type, radio remote control systems, are designed for the remote control of hoists and cranes, and are particularly suitable for applications when the operator needs to be able to choose the best location from which to carry out an operation.

RADS11 system, colloquially denominated system SINGLE, is made of:
- RAD-TS transmitter
- RAD-RS receiver
- Battery charger BC70K with two NiMH batteries.

RADF13 system, colloquially denominated system FULL, is made of:
- RAD-TF transmitter
- RAD-RF receiver
- Battery charger BC70K with two NiMH batteries.

RADH11 system, colloquially denominated system SINGLE, is made of:
- RAD-TH transmitter
- RAD-RH receiver
- Battery charger BC70K with two NiMH batteries.

3.2 System Specifications

RADS11 / RADF13 / RADH11 Systems		**In EU countries**	**In North America**
	Frequency band	869.7 to 870MHz	902 to 928MHz
	Baud rate	7200 bps	
	Channel separation	12.5 KHz	25 KHz
	Channel Occupation	7.2 KHz	
	Modulation	FM (GMSK)	
	Response Time	100 ms	
	Temperature range	-20ºC to +65ºC	-4F to 150F
The RAD-TS, RAD-TF and RAD-TH transmitters			
	Transmission power	<5 mW	
	Protection	IP65	NEMA 4
The RAD-RS, RAD-RF and RAD-RH receivers			
	Power supply	48 Vac, 115 Vac, 230Vac ± 10%, 50/60 Hz	48 Vac, 115 Vac ± 10%, 50/60 Hz
	Consumption	30 W	
	Relays	230 Vac/8 A	
	Protection	IP55	NEMA 12
	Communication	CL20mA (RAD-RF only)	
	Protection against electric shock	Class II according EN50178 (1997)	
The BC70K battery charger			
	Power supply (± 10%)	230 Vac 50/60Hz	115Vac, 50/60 Hz
The BT06K batteries			
	Voltage	4.8 V	

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	Capacity	700 mAh, NiMH	
	Charging temperature	5ºC to 35ºC	41F to 95F
	Operating Time	12h at 50% RAD-TS and RAD-TH model.	
		8h at 50% RAD-TF model.	

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4 TRANSMITTER

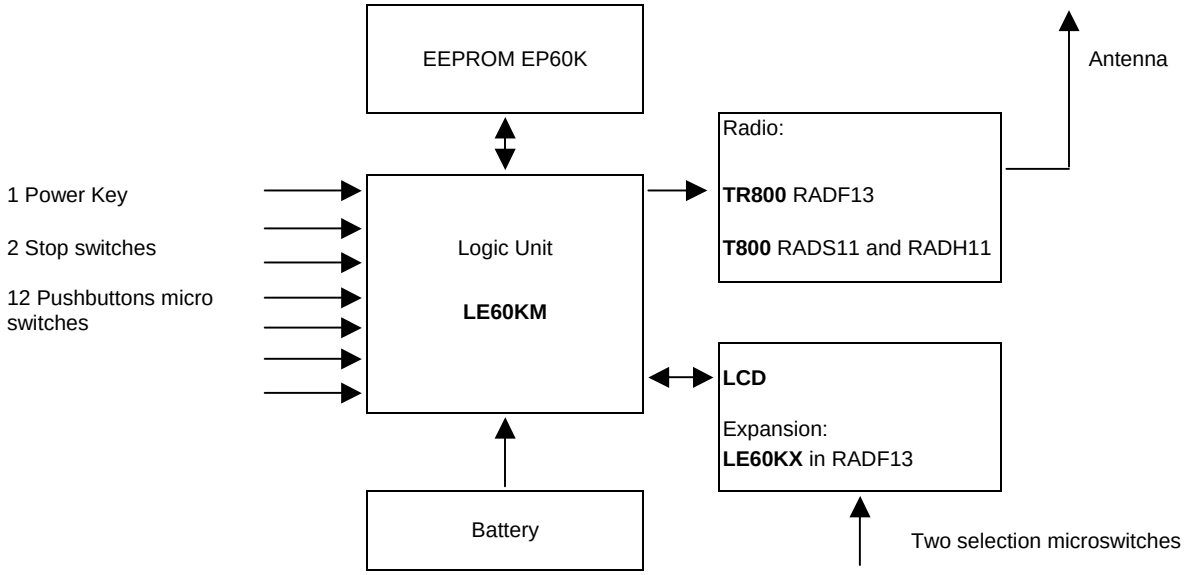
4.1 Transmitter summary

Transmitters RAD-TS and RAD-TH contains the following elements:

- Power ON key-switch, Start Pushbutton, Stop pushbutton and 4 or 6 pieces 2-steps Pushbuttons.
- 4.8V 700 mAh battery.
- Microprocessor driven logic, circuit LE60KM.
- Removable EEPROM memory module EP60K.
- Synthesised radio transmitter T800
- Antenna.

Transmitter RAD-TF also includes:

- Hoist Selector switch and LCD display.
- Expansion unit, circuit LE60KX with LCD and two selector switches.
- Synthesised radio transceiver TR800 instead of transmitter T800.



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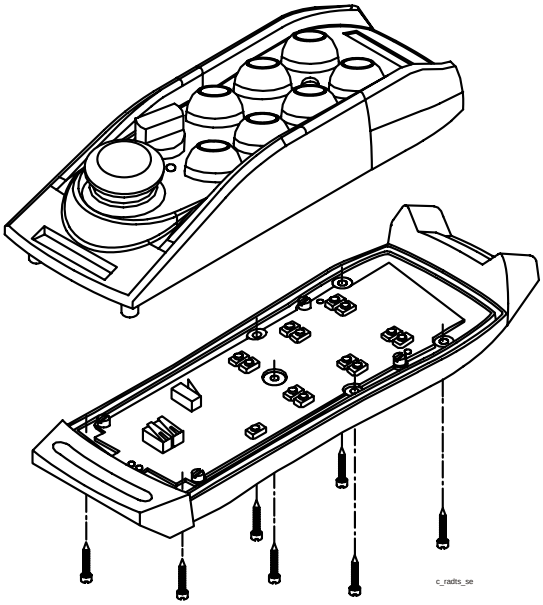
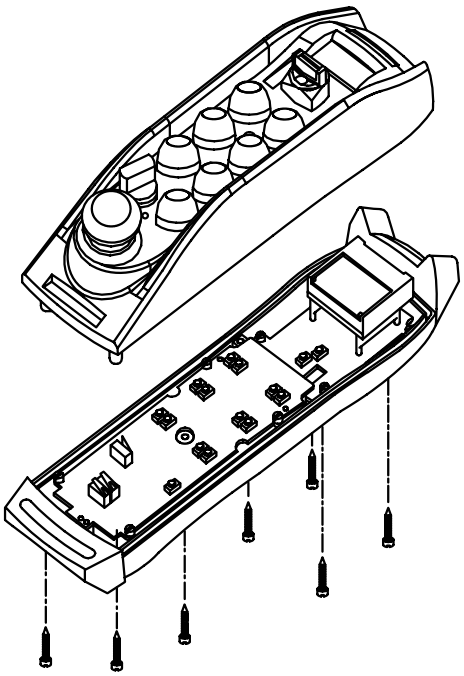
4.2 Exploded RAD-TS Transmitter



☞ Make sure the POWER ON SWITCH is in OFF (0) position when mounting. Otherwise the power switch could be damaged.

4.3 Exploded RAD-TF Transmitter



☞ Make sure the POWER ON SWITCH is in OFF (0) position when mounting. Otherwise the power switch could be damaged.

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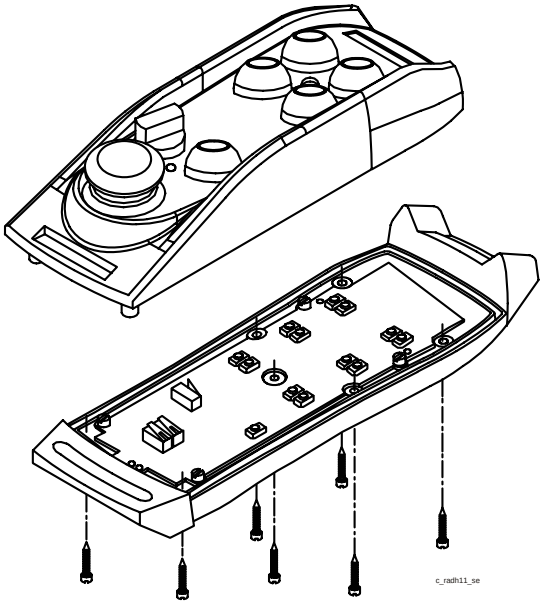
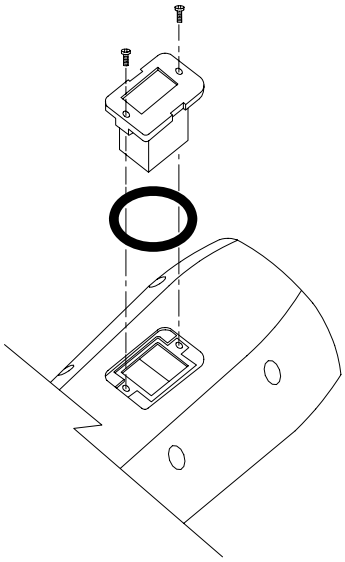
4.4 Exploded RAD-TH Transmitter



☞ Make sure the POWER ON SWITCH is in OFF (0) position when mounting. Otherwise the power switch could be damaged.



RAD-TS, RAD-TF and RAD-TH bottom side. Extracting EEPROM module.

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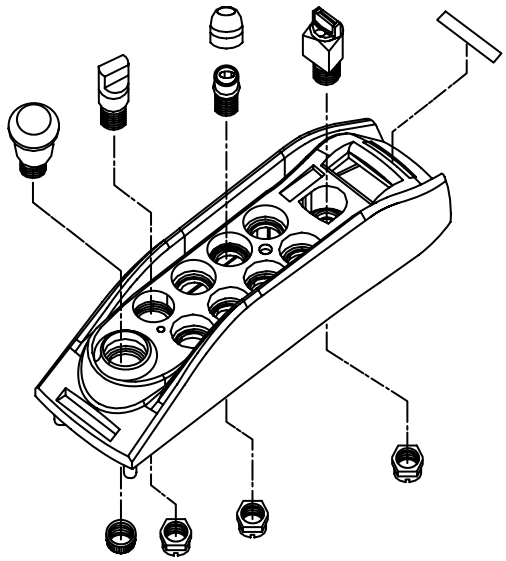

Explosion of mechanisms in RAD-TF upper cover

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5 RECEIVER

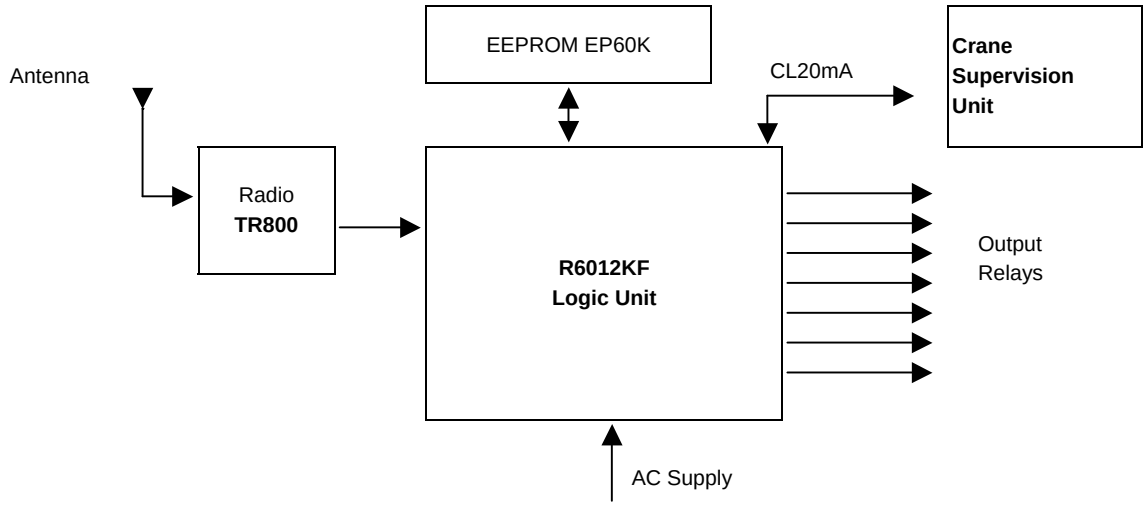
5.1 Receiver Summary

The receivers RAD-RS, RAD-RF and RAD-RH, are contained in a plastic material box, it includes:

- Synthesised radio transceiver TR800
- Antenna
- Microprocessor driven logic R6012KF, which in addition contains the power supply and the relays.
- Removable EEPROM memory module EP60K.

The supply, is alternating current with connections for 230, 115 and 48 VAC. RAD-RF also contains a bi-directional current loop serial port, which allows the communication with the external Crane Supervision Unit, not included in this manual.
It includes the relays:

- START relay
- HORN relay
- SAFETY relay
- Two STOP relays
- Nine operating relays
- Two Hoist selection relays (Only RADF13)



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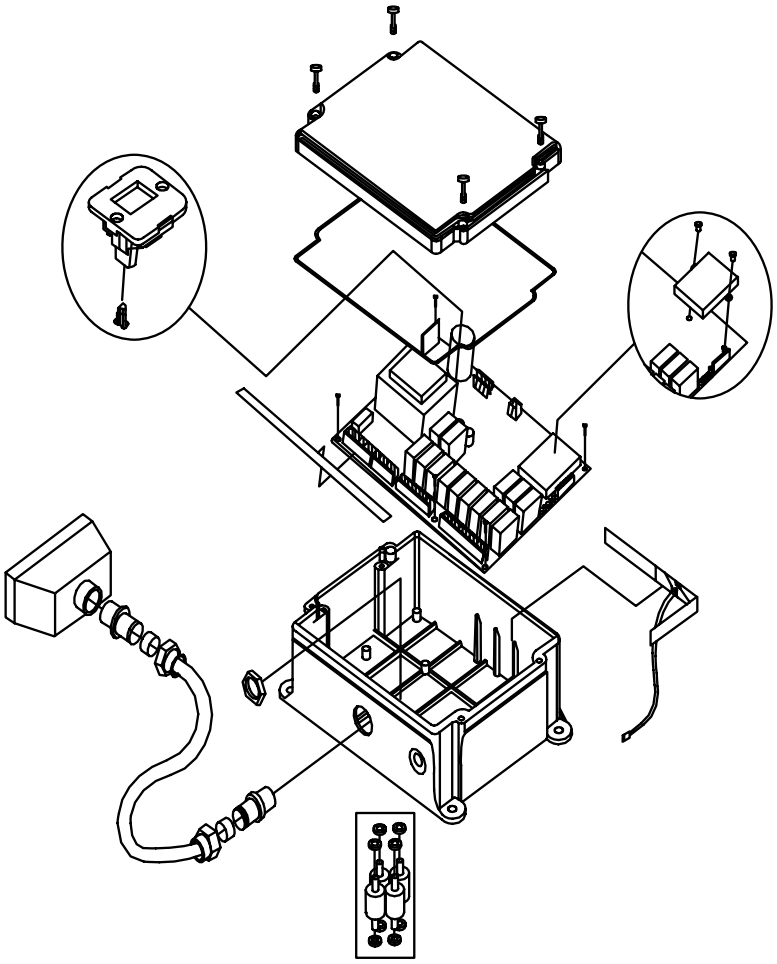
5.2 Exploded RAD-RS, RAD-RF and RAD-RH Receiver



5.3 The BC70K battery charger

Connect the charger to the power source using the power source and the cable supplied. The red LED, in the middle, should light up indicating power ON.

When installing the battery charger, bear in mind that the batteries must be charged at temperatures over 5ºC (41F) and that the power supply must be left on all night. Also remember that the charger must not be left in direct sunlight, as the batteries may not become fully charged at temperatures exceeding 35ºC (95F).

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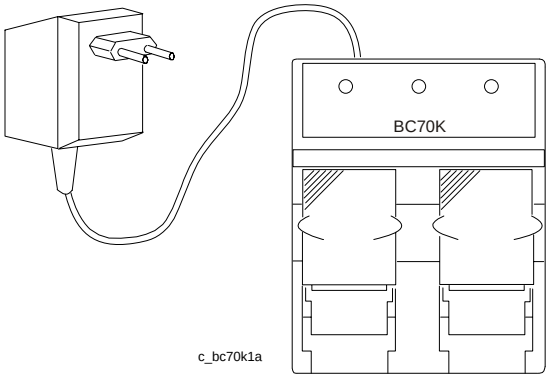

Place the batteries in the charger. There is green LED on top of each battery. Each LED should light up, indicating that recharging is in process. Complete recharging takes approximately 12 hours. After charging process is finished, the green LED is turned OFF. The batteries may remain in the charger for an unlimited period of time.

The capacity of the batteries decrease(s) with use. Their life span is estimated to be 500 recharging cycles, but this depends largely on the conditions of use, for which the following is recommended:

Do not recharge the battery until it is completely empty. The transmitter will indicate this when to recharge the batteries.

Always charge the batteries at temperatures between 5ºC (41F) and 35ºC (95F).

Avoid short-circuits between the battery contacts. Do not carry charged batteries in toolboxes or next to other metal objects (keys, coins, etc.).

Always keep contacts clean.

Never leave batteries in direct sunlight.

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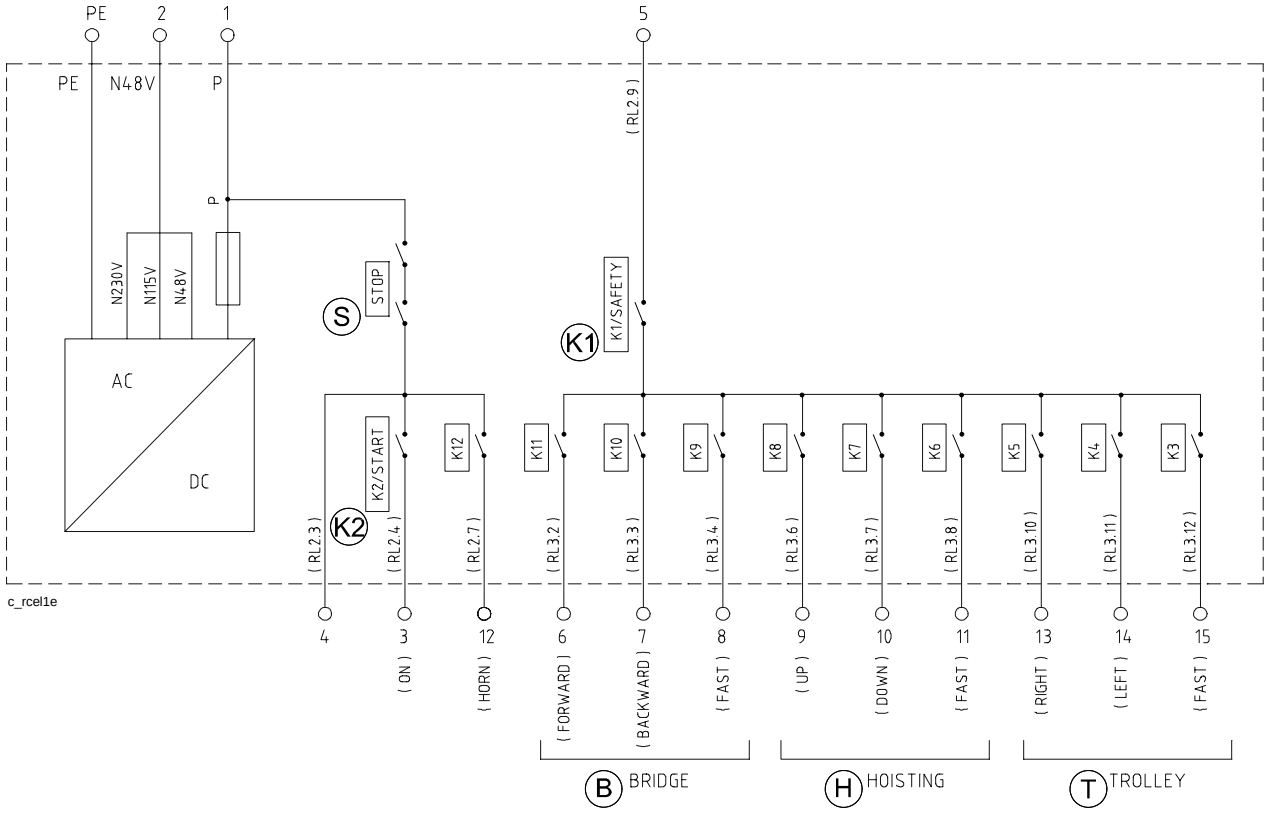
5.4 RADS11 Receiver Connections



S. Stop
K1. Safety
K2. Start
B. Bridge
H. Hoisting
T. Trolley

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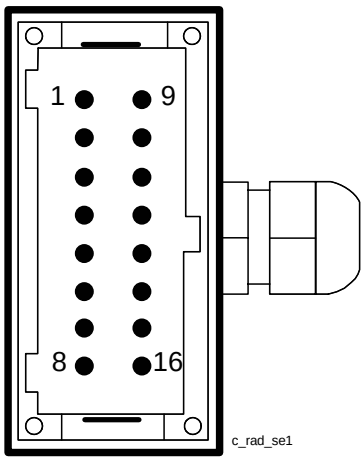
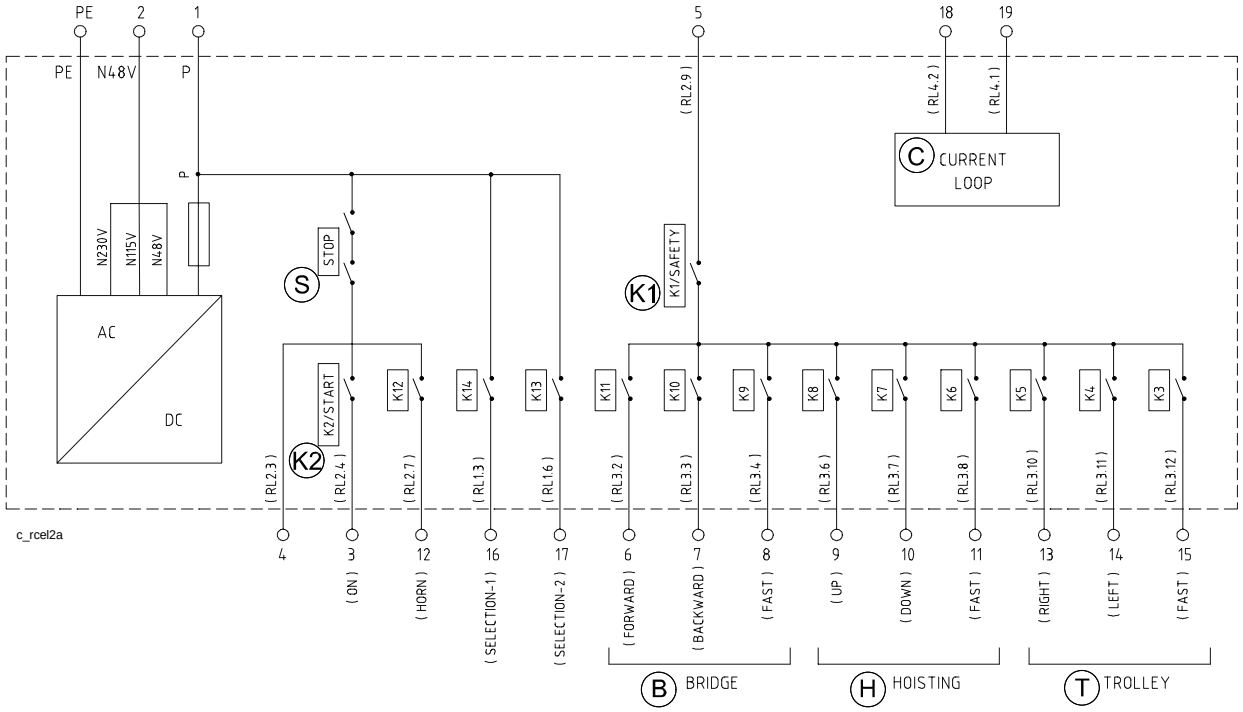
Function	PCB Relay	PCB Terminal	Wire	Pin connector
Phase	-	RL0.1	1	1
Protective earth	-	RL0.2	PE	PE
Neutral 48VAC 115VAC 230VAC	-	RL0.3 RL0.4 RL0.5	2	2
COM Start-horn	-	RL2.3	4	4
Start	K2	RL2.4	3	3
Horn	K12	RL2.7	12	12
Safety	K1	RL2.9	5	5
Bridge forward	K11	RL3.2	6	6
Bridge backward	K10	RL3.3	7	7
Bridge fast	K9	RL3.4	8	8
Hoisting up	K8	RL3.6	9	9
Hoisting down	K7	RL3.7	10	10
Hoisting fast	K6	RL3.8	11	11
Trolley right	K5	RL3.10	13	13
Trolley left	K4	RL3.11	14	14
Trolley fast	K3	RL3.12	15	15



5.5 RADF13 Receiver Connections



C. Current Loop
S. Stop
K1. Safety
K2. Start
B. Bridge
H. Hoisting
T. Trolley

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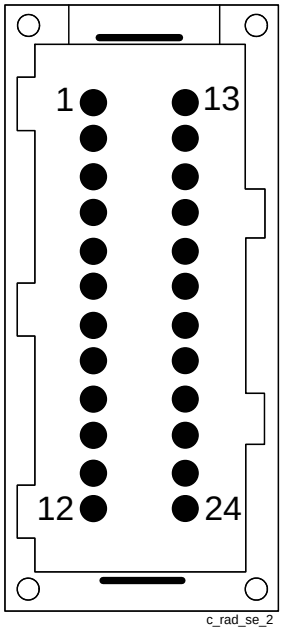
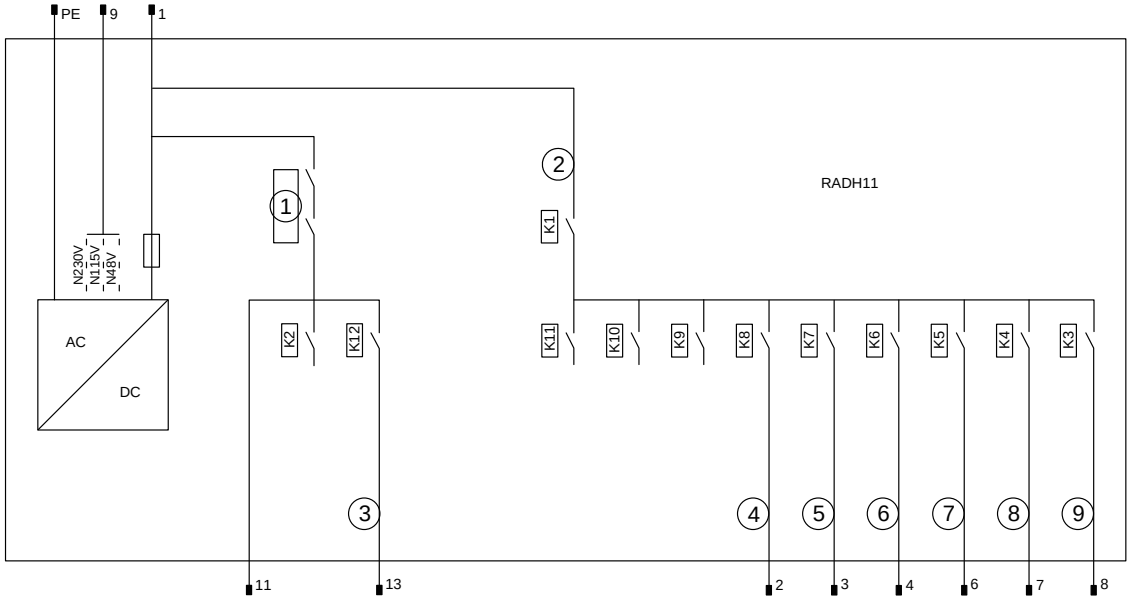
Function		PCB Relay	PCB Terminal	Wire	Pin connector
Phase		-	RL0.1	1	1
Protective earth		-	RL0.2	PE	PE
Neutral	48VAC	-	RL0.3	2	2
	115VAC		RL0.4		
	230VAC		RL0.5		
Selection-1		K14	RL1.13	16	16
Selection-2		K13	RL1.16	17	17
COM. Start-horn		-	RL2.3	4	4
Start		K2	RL2.4	3	3
Horn		K12	RL2.7	12	12
Safety		K1	RL2.9	5	5
Bridge forward		K11	RL3.2	6	6
Bridge backward		K10	RL3.3	7	7
Bridge fast		K9	RL3.4	8	8
Hoisting up		K8	RL3.6	9	9
Hoisting down		K7	RL3.7	10	10
Hoisting fast		K6	RL3.8	11	11
Trolley right		K5	RL3.10	13	13
Trolley left		K4	RL3.11	14	14
Trolley fast		K3	RL3.12	15	15
Current loop		-	RL4.2	18	18
Current loop		-	RL4.3	19	19



5.6 RADH11 Receiver Connections



1.Stop
2.Control voltage
3.Start horn
4.Up
5.Down
6.Fast speed
7.Right
8.Left
9.Fast speed

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6 FREQUENCY MANAGEMENT

6.1 System description

RADS11, RADF13 and RADH11 remote controls are equipped with microprocessor controlled synthesised frequency radio modules in both transmitter and receiver. This allows a simple frequency change in the transmitter, as well as an automatic search by the receiver for the new frequency.

6.2 Definitions

Channel:	Is the reference number of a frequency. See “Frequency lists”.
Allowed channels:	A list of authorised channels (max 70). This is defined in the factory and cannot be changed. The Frequency List could be different from one country to another according to frequency regulations.
Operating channel:	Radio channel that is selected

6.3 Frequency settings

The system comes from the factory with the channel programmed in the EEPROM module.

When needed, the Operating Channel can be modified to another frequency channel within the allowed frequency list, which is included in EEPROM module.

6.3.1 Entering in frequency programming mode

The Operating Channel selection can be carried out through commands, which in the operation mode correspond to orders. Therefore it is of prime importance to follow the sequence described in order to avoid movements of the machine.

To enter into programming mode follow the sequence:

1. Put a charged battery in the transmitter.
2. Move close to the receiver.
3. Turn on the key-switch.
4. Push down STOP pushbutton (See picture below).
5. Pull up STOP pushbutton (See picture below).

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6. Press Down Pushbutton to the second step.

7. Same time press START during 2 seconds (See picture below). During this sequence the LED will flash in red.

8. During next 4 seconds orange pulse in the LED will indicate that Programming mode is entered.
9. Immediately after this, the LED will indicate the Operating Channel selected at this time, though sequence of green and red pulses, in the following way:
    a. Tens, by green pulses
    b. Units, by red pulses
10. As an example, the channel 21 will be indicated by 2 pulses in green, followed by 1 pulse in red.
11. After this, the LED will turn orange and the transmitter will be ready for the introduction of new Operating Channel number (see next paragraph). Otherwise you can leave the programming mode by pressing Stop button.

6.3.2 Frequency programming mode

1. Once Operating Channel in service is indicated, you can select a new frequency from the list of Allowed Channels contained in “Frequency lists” paragraph, by pressing the DOWN button (tens), and the UP button (units). The LED through an orange flash indicates each pulse. (See picture below).

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2. The LED, for checking, as explained in the previous point, indicates a short while after the last pulse, the new Operating Channel. Some orange pulses by the LED indicate that the new Operating Channel is sent to the receiver. When this transmission has finished, the LED remains in orange.
3. If the programming of the new Operating Channel has not been correct, try the process again.
4. If the programming of the new Operating Channel has been correct, press STOP. Restarting again, it will work on the new Operating Channel.
5. If an attempt is made to program a channel outside the Allowed Channel list, the LED will show the error by lighting up in red.

Once the new channel has been selected, the new frequency will be transmitted to the receiver using frames with no orders in the old frequency. If the channel change has been performed when the receiver is switched off, or the receiver has not been able to hear the transmitter, the receiver will SCAN the new frequency selected, and once scanned it will store this new channel in the EEPROM memory.

The receiver will modify its Operating Channel if it receives frames that contain the new frequency channel.

In Full systems the LCD Display will show the selected channel (picture below).

6.3.3 Exiting the frequency programming mode

You can exit the programming mode by pressing the STOP button. The new channel will be then stored in EEPROM.

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6.4 Frequency lists

6.4.1 EU countries

Channel number	Frequency, MHz
1	869,70625
2	869,71875
3	869,73125
4	869,74375
5	869,75625
6	869,76875
7	869,78125
8	869,79375
9	869,80625
10	869,81875
11	869,83125
12	869,84375

Channel number	Frequency, MHz
13	869,85625
14	869,86875
15	869,88125
16	869,89375
17	869,90625
18	869,91875
19	869,93125
20	869,94375
21	869,95625
22	869,96875
23	869,98125
24	869,99375

6.4.2 USA and Canada

Channel number	Frequency, MHz
1	914,15000
2	914,17500
3	914,20000
4	914,22500
5	914,25000
6	914,27500
7	914,30000
8	914,32500
9	914,35000
10	914,37500
11	914,40000
12	914,42500
13	914,45000
14	914,47500
15	914,50000
16	914,52500
17	914,55000
18	914,57500
19	914,60000
20	914,62500
21	914,65000
22	914,67500
23	914,70000
24	914,72500

Channel number	Frequency, MHz
25	914,75000
26	914,77500
27	914,80000
28	914,82500
29	914,85000
30	914,87500
31	914,90000
32	914,92500
33	914,95000
34	914,97500
35	915,00000
36	915,02500
37	915,05000
38	915,07500
39	915,10000
40	915,12500
41	915,15000
42	915,17500
43	915,20000
44	915,22500
45	915,25000
46	915,27500
47	915,30000

Channel number	Frequency, MHz
48	915,32500
49	915,35000
50	915,37500
51	915,40000
52	915,42500
53	915,45000
54	915,47500
55	915,50000
56	915,52500
57	915,55000
58	915,57500
59	915,60000
60	915,62500
61	915,65000
62	915,67500
63	915,70000
64	915,72500
65	915,75000
66	915,77500
67	915,80000
68	915,82500
69	915,85000
70	915,87500

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7 ACCESS TO THE HOIST CONDITION MONITORING UNIT

7.1 General Description of Service Mode

For RADF13 systems, there is a special “Service Mode” of operation for maintenance and set up of the Hoist Condition Monitoring Unit via radio.

This unit is connected to the receiver RAD-RF by a serial data communication CL20mA.

When in Service mode, the transmitter RAD-TF is able to act as a data console for the Hoist Condition Monitoring Unit, sending commands and receiving information, using the radio link and the appropriate software in the transmitter RAD-TF and in the receiver RAD-RF.

During the Service Mode of operation, due to the amount of data being sent in the reverse link, the amount of frames per second in reverse mode is increased such that the feedback in the display is fast enough. The movements of the crane in this mode of operation are inhibited, this is, there are no movement orders being sent by the transmitter or acknowledged by the receiver. The Stop relays are activated.

☞ It could be too slow to enter in service mode by the receiver if the transmitter and the receiver are in different channels. Whenever possible, avoid the scanning of radio channels.

7.2 Entering the Service mode.

To access the Hoist Condition Monitoring Unit mode follow the sequence:

1. Install a charged battery in the transmitter.
2. Move close to the receiver.
3. Turn on the key-switch.
4. Push down STOP pushbutton (If it was in UP position.)
5. Pull up STOP pushbutton.
6. Press Pushbutton UP in second speed, and then, START. The system enters in Service Mode.

While the system is in service mode the “envelope” icon in the display will be switched ON.

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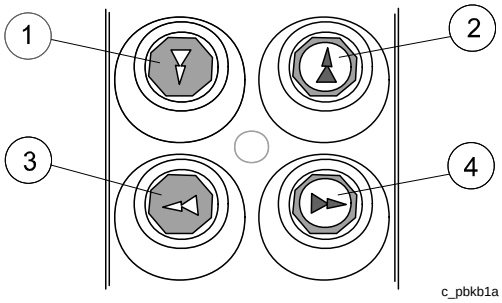
7.3 Keys for moving within the Menus.

The keys for moving within the menu are the following:



1. Button that simulates the **Down** Key (Down button)
2. Button that simulates the **Up** Key (Up button)
3. Button that simulates the **Esc** Key (Left button)
4. Button that simulates the **Enter** Key (Right button)

7.4 Switching from Tared Load to Actual Load.

The actual load is shown in the display unit as the Tared Load, but an “A” is shown below the “t” in the bottom right hand side of the display unit. In order to switch from Tared Load to actual load, this is performed by pressing UP and/or DOWN. Pressing ENTER, the password is requested.

7.5 Resetting the Tared Load.

Pressing the ESC button for several seconds performs the reset of the Tared Load.

7.6 Exiting Service mode.

There are two ways of exiting this mode.

Pressing the STOP button
(The transmitter will be switched OFF and the receiver will switch to standby mode). If the system is switched ON again and the system was switched OFF in a menu within the service mode, when receiving the new frames in normal operation, first of all the following message may appear: “EXITING SERVICE MODE”. The receiver will send as many Escape messages as needed to return to the load message.

Pressing the START button for 3 seconds
The transmitter will switch from Service Mode to Standard mode of operation while the receiver will go to Standard mode passing through the Standby status. The STOP relays are deactivated and activated again. If you exit service mode within a menu in the Hoist Condition Monitoring Unit, the system will exit to the Load status. This may take several seconds where the message “EXITING SERVICE MODE” will be ON.

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7.7 Messages originated in the receiver.

There are three possible messages that may appear apart from the messages originated by the Hoist Condition Monitoring Unit. These are:

“EXITING SERVICE MODE”
This message is originated when the Hoist Condition Monitoring Unit is in Service mode within the menus and the transmitter is in Normal mode of operation. This message will appear prior to show the Load or Fault messages while exiting the Service mode. The receiver will send the Hoist Condition Monitoring Unit as many Escape messages as needed to return to Normal mode.

“RECEIVER FAULT”
This message will appear whenever the receiver RADF13 is not able to open the current loop communications channel. There will be a problem in the receiver.

“CURRENT LOOP NOT AVAILABLE / FAULT”
This message will appear whenever the receiver RADF13 is not able to read any data frame from the Hoist Condition Monitoring Unit. This message can be seen when switching the unit to display mode or by unplugging Hoist Condition Monitoring Unit from the receiver. There is an error in the connection between both systems.
If the transmitter does not receive a valid frame from the receiver within 2.5 seconds, the display will erase the data being displayed. This means that there is faulty link between transmitter and receiver.

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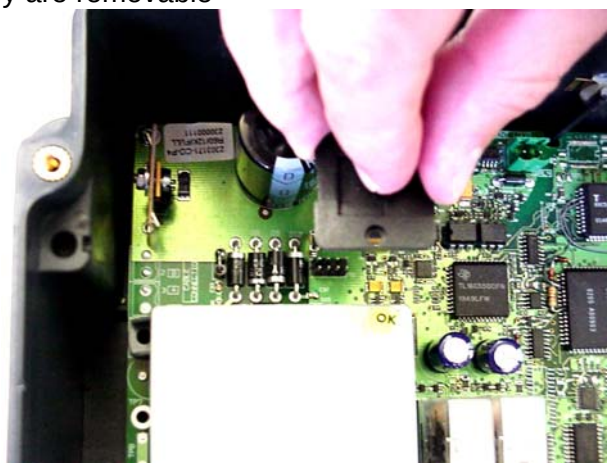
8 EEPROM

8.1 Description

The information in the EEPROM is:

- ID Code
- Allowed Frequency List and Scanning parameters
- Output configuration
- Out of power off time
- Masks

The radio remote control units RADS11, RADF13 and RADH11 have identical EEPROM's, in the transmitter and in the receiver, and in both they are removable



In the transmitter, the EEPROM removing is done from outside of the transmitter, as follows:
1. Remove, from the back of the transmitter the two EEPROM module screws

2. Lift up the EEPROM module using to small screwdrivers

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In the receiver, the process is:
1. Remove the 4 screws from the receiver's cover

2. Take off the receiver's cover.
3. Lift up the EEPROM module

8.2 Replacement EEPROM from Transmitter to Transmitter

The replacement of the EEPROM from a existing OLD transmitter which is controlling a crane to another NEW transmitter, is done as follows:

1. Take the two transmitters and switch them off from the key-switch and the STOP pushbutton

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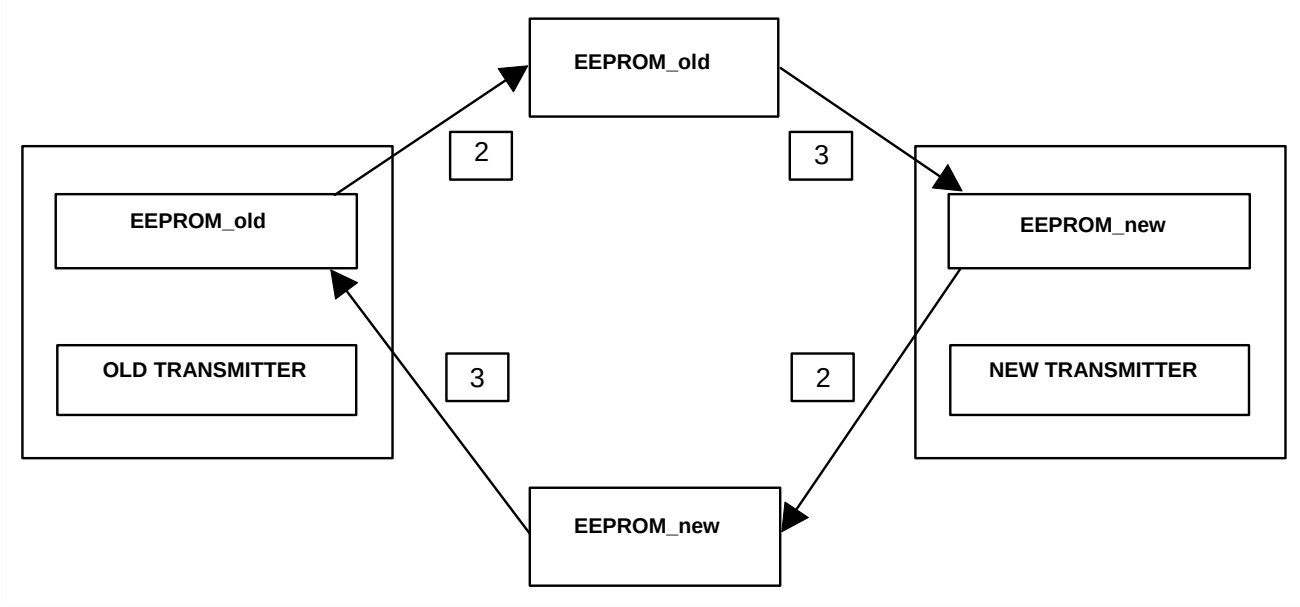

2. Remove the screws and lift up the OLD's EEPROM module as seen before.
3. Plug it in to the NEW transmitter.

4. Close the EEPROM module cover with the two screws.
5. Switch ON the key and pull up the STOP pushbutton.
6. Press START .

8.3 Copying EEPROM from Receiver to Transmitter

The copying of the receiver's EEPROM into the transmitter's EEPROM involve two general processes:
A. The first step consist of copying the receiver's EEPROM data to the transmitter internal FLASH memory.
B. The second step consists of copying data from the internal FLASH memory to a new EEPROM module.

To copy an EEPROM module from one receiver to one transmitter, follow the next steps:

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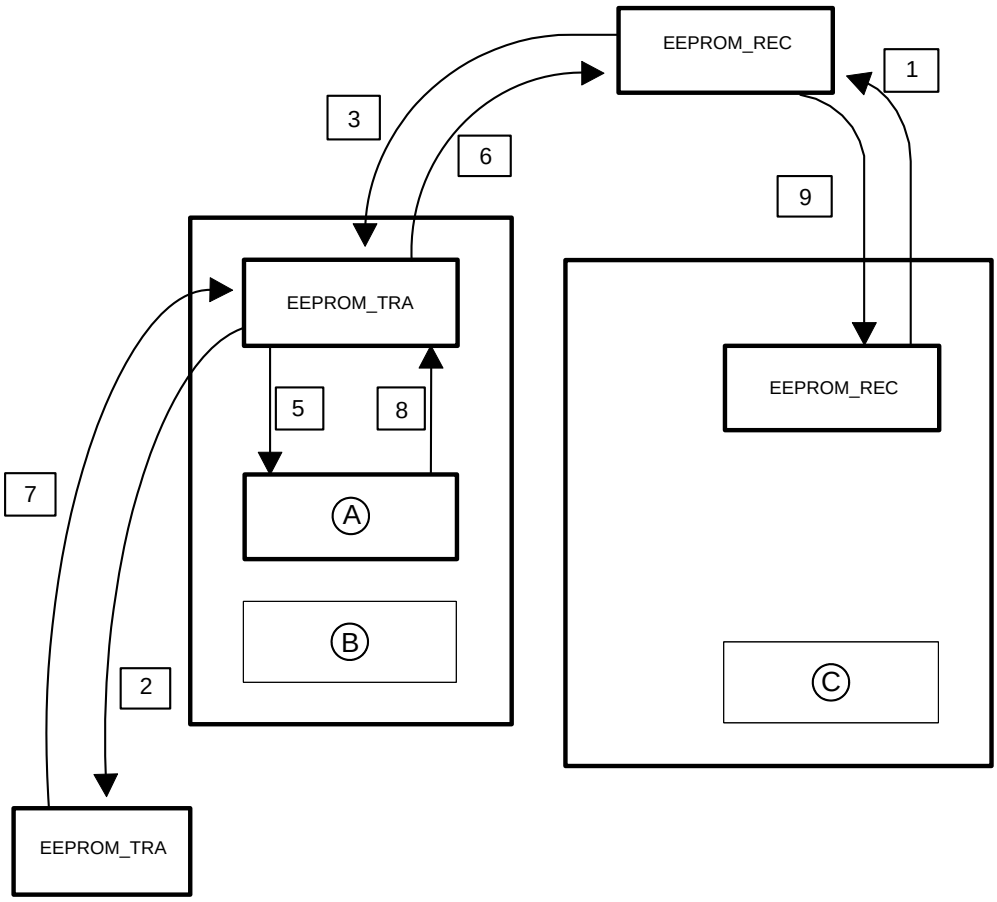

A. Internal FLASH Memory
B. Transmitter
C. Receiver

1. Unplug the EEPROM module from the Receiver as explained before (EEPROM_REC).
2. Unplug the EEPROM module from the Transmitter as explained before (EEPROM_TRA).
3. Plug the receiver's EEPROM_REC in the transmitter in which the data have to be copied.
4. Switch ON the key and pull up the STOP pushbutton.
5. Enter the transmitter in the EEPROM to FLASH Copying mode, by pushing Forward (second speed) and then Start pushbuttons (picture below). The transmitter's LED will start blinking in orange colour, until it finishes copying the EEPROM to the internal FLASH memory. If the copying has been successful, the LED will turns to green. If not the LED will remains in continuous orange. In that case stop the transmitter and repeat steps 4 and 5.

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6. Maintaining the Transmitter ON, unplug the receiver's EEPROM_REC from the Transmitter.
7. Plug the transmitter's EEPROM_TRA module and close the cover with two bolts.
8. Enter the transmitter in the FLASH to EEPROM Copying mode by Pushing Forward button (second speed), until it starts blinking in orange colour (picture below). If the copying has been successful, the LED will turns to green colour and the transmitter will switch OFF automatically. Push STOP to exit the copying mode. In case of an error, the LED will blink in red colour and the transmitter will switch OFF automatically. If this happen, push STOP and proceed repeating procedure 4.

9. Plug the receiver's EEPROM_REC module in the receiver.

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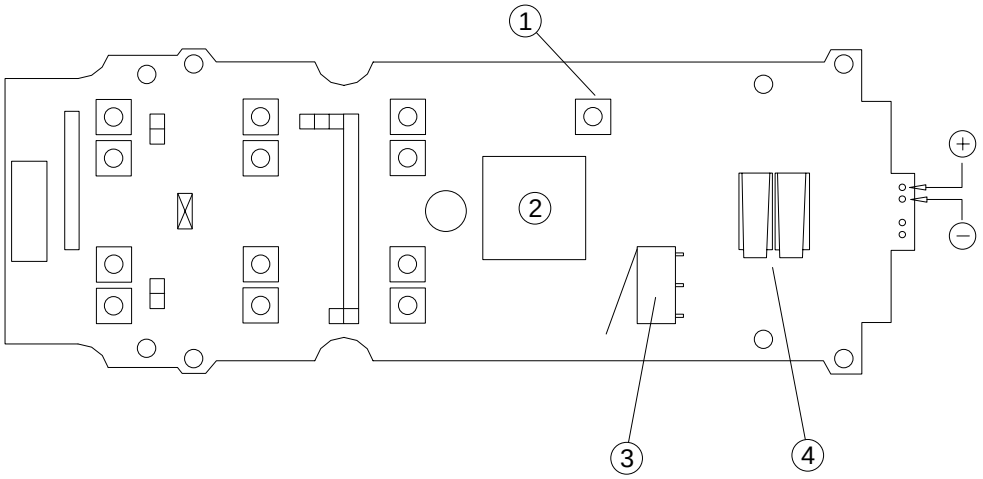
9 TROUBLESHOOTING

9.1 Drawings

9.1.1 Transmitter board



1. Start switch
2. Up
3. Key switch
4. Stop switches

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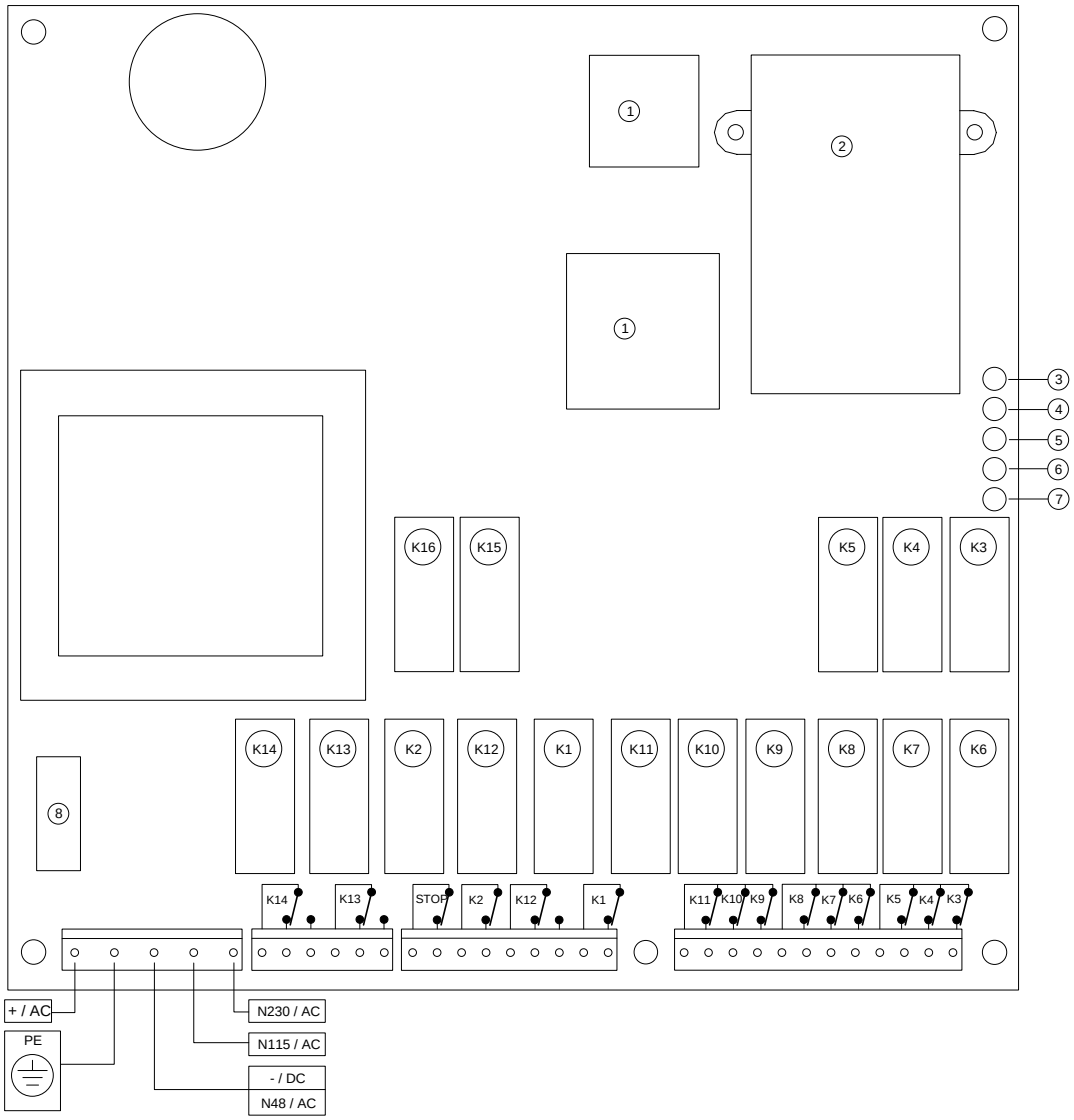
9.1.2 Receiver board



1. Up
2. Radio
3. Signal
4. Power
5. Hard
6. ID
7. Data
8. Fuse

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9.2 LED indications

Once the receiver has been powered up, it enters into the ***SCANNING mode*** while the own transmitter is off.

The following receiver green LEDs should now light up:

SIGNAL:	OFF if all radio channels in the band are free.Flashing ON if the receiver is finding channels with RF signals.
POWER:	ON, indicating that the power supply is correct.
HARDOK:	ON, indicating that the board is OK.
ID:	OFF
DATA:	OFF if none of the radio channels contains signals belonging to a RADF13, RADS11 or RADH11 radio remote control system in the area. Flashing ON if some exists.

On receiving a signal from the transmitter, the receiver will enter into the ***WORKING mode***.

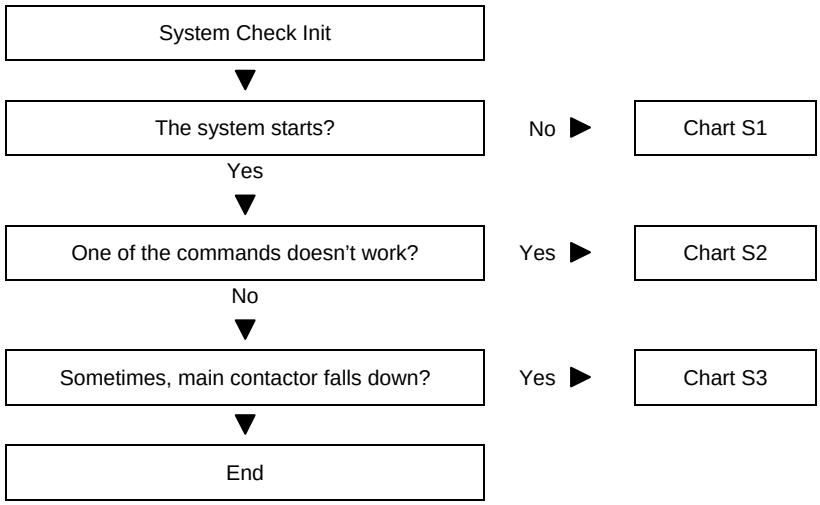
The following receiver LEDs should now light up:

SIGNAL:	Flashing ON, indicating that it is receiving an RF signal at the working frequency.
POWER:	ON, indicating that the power supply is correct.
HARDOK:	ON, indicating that the board is OK.
ID:	Flashing ON each time a good frame is received with ID correct. This means that the receiver has recognised the transmitter's identification code
DATA:	Flashing ON each time a good frame is received not necessary containing the right ID.

9.3 General System Check

9.3.1 Chart S0

System check



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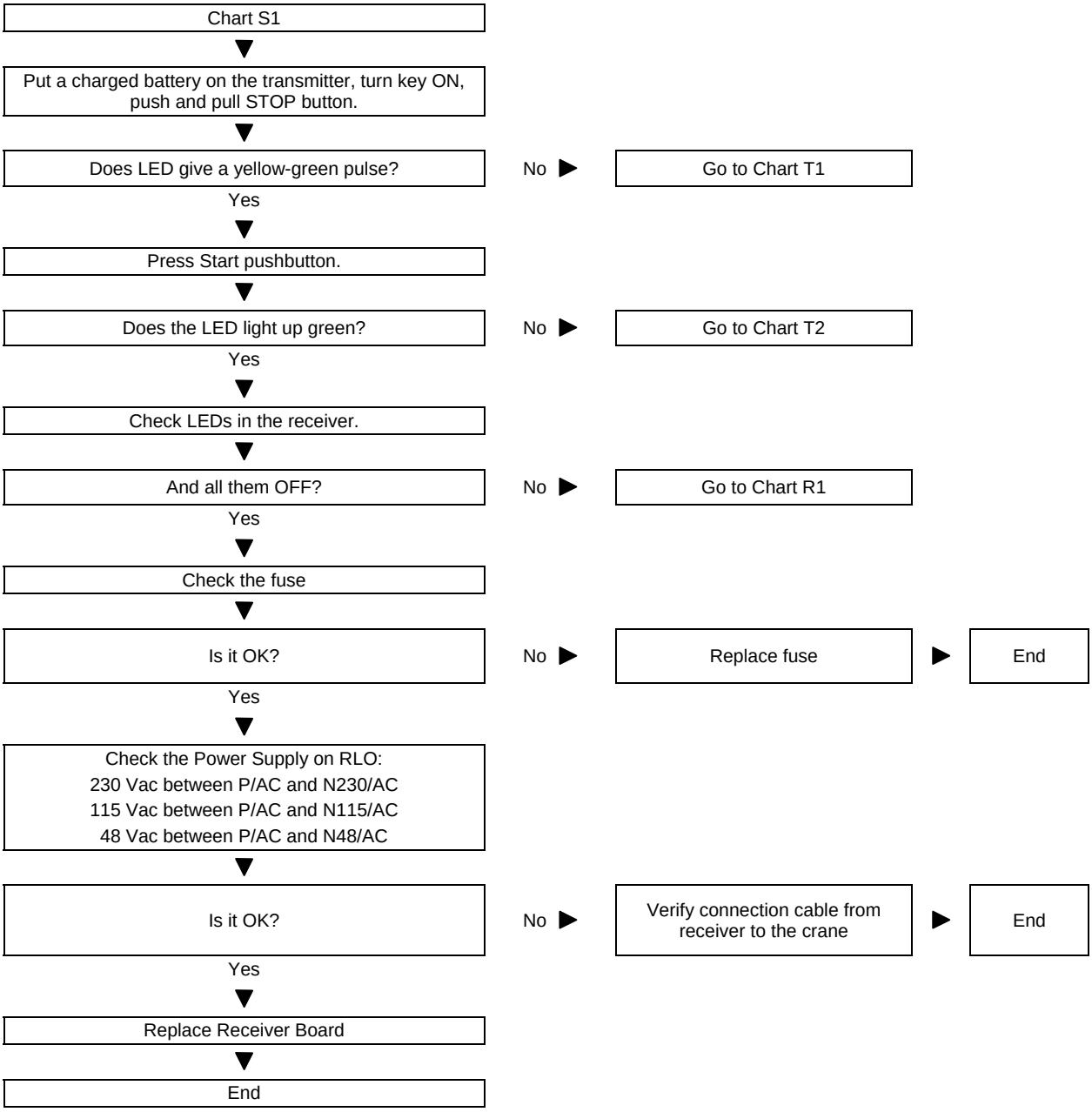
9.4 System totally downs

9.4.1 Chart S1

System doesn't start



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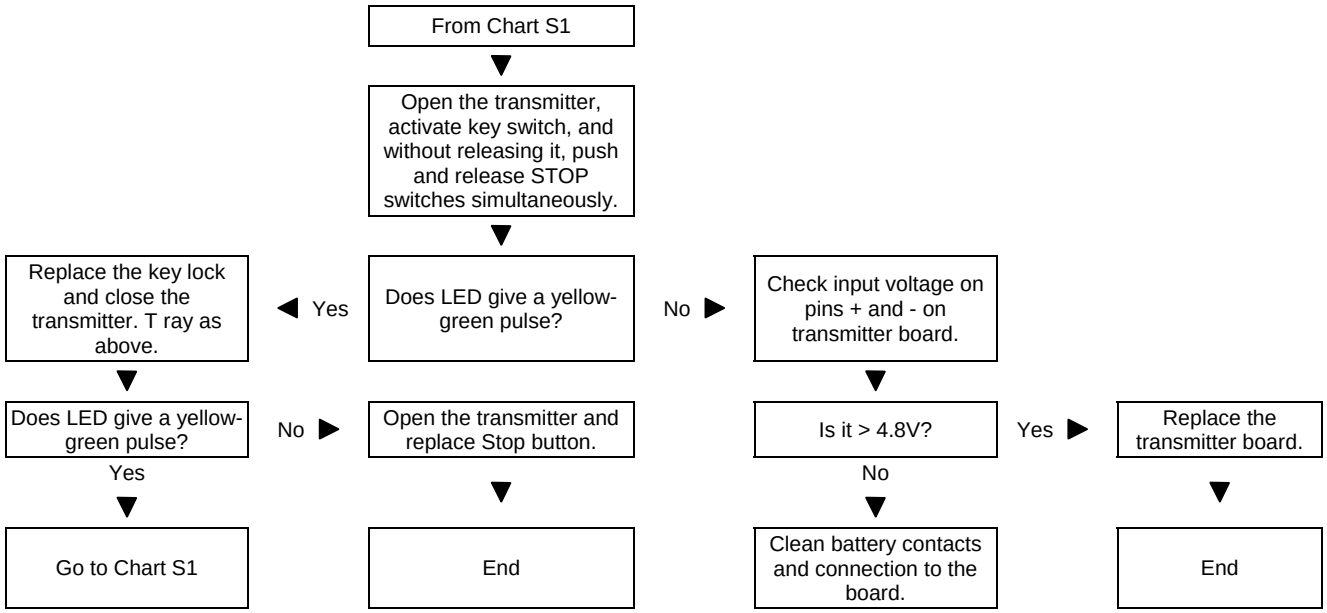
9.4.2 Chart T1

When trying to start the transmitter, LED doesn't give the Stop-checking signal.



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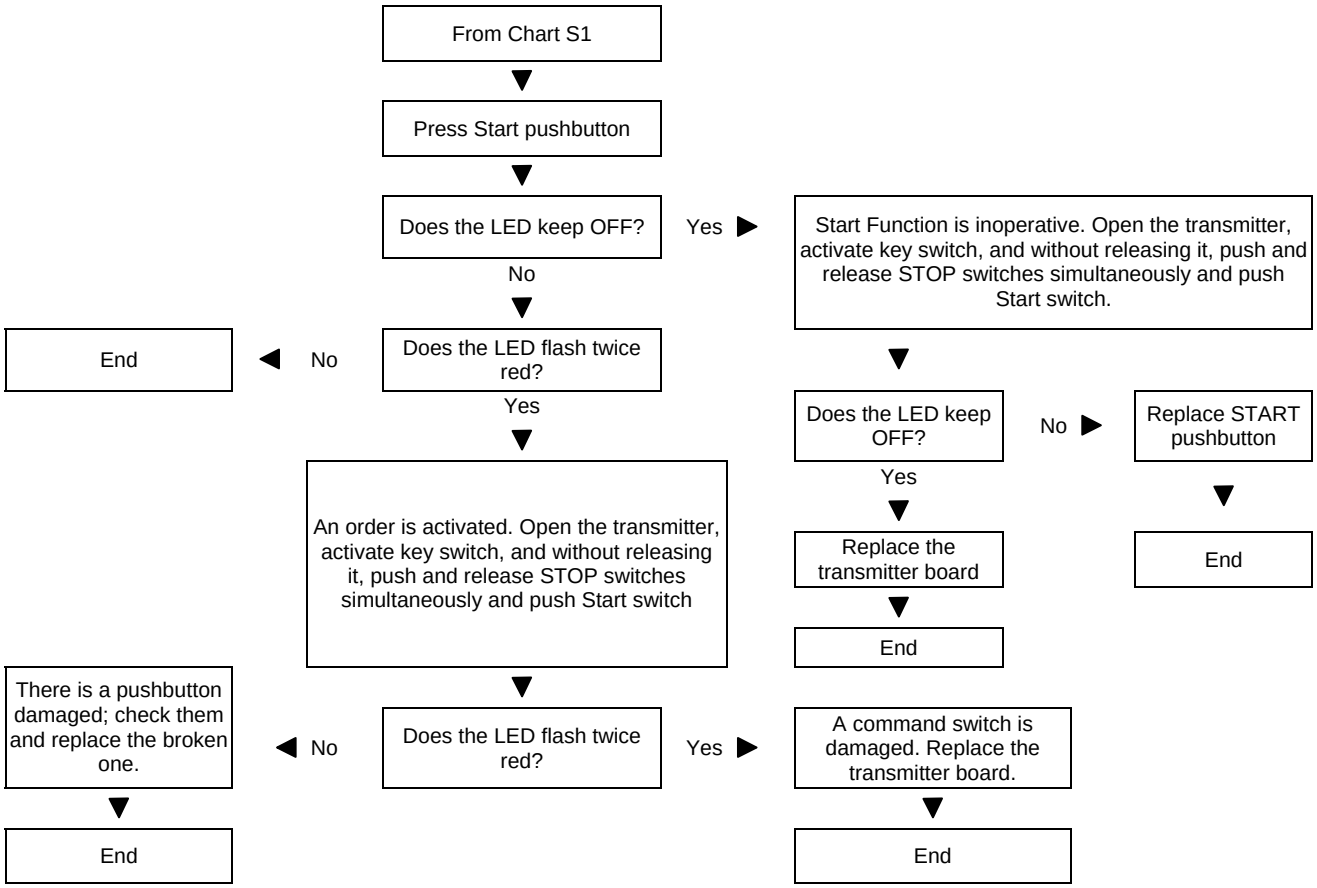
9.4.3 Chart T2

Transmitter doesn't start



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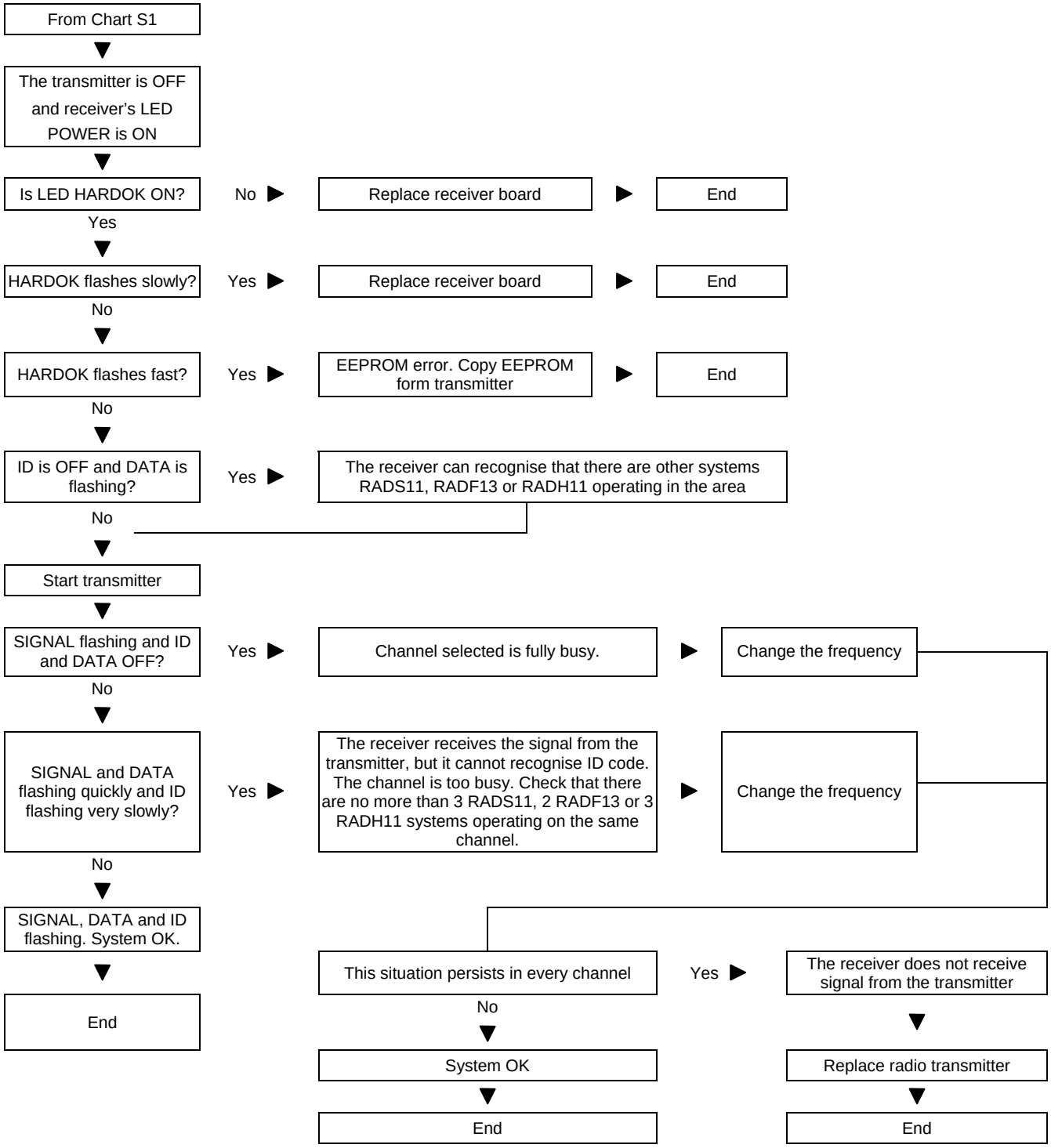
9.4.4 Chart T2

Receiver doesn't start, even having good power supply



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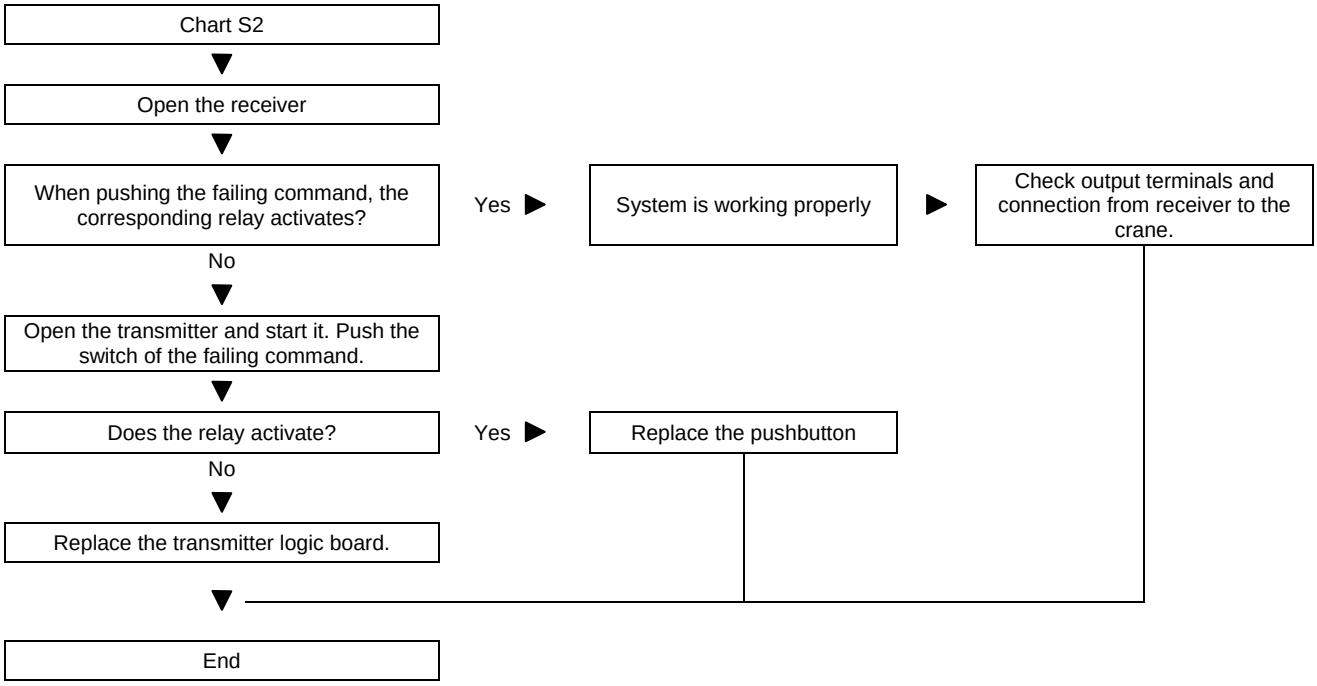
9.5 Failure of one of the functions

9.5.1 Chart S2

System works except one of the commands.



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9.6 Intermittent failures

9.6.1 Chart S3

Sometimes the main contactor falls down.