INMOTION Controls Inc.

INSTALLATION & OPERATION

MANUAL

INMOTION Control Series 1220

February, 2004

INMOTION Series 1220 User's Manual

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Section 1 Operator's Manual

Chapter 1 Warranty

1 – 1 Warranty

INMOTION Controls guarantees that this equipment meets its published specifications at the time of shipment from the factory. This equipment will perform as described if installed properly. However, INMOTION cannot guarantee that the operation of the equipment is absolutely error-free, or without interruption.

1 – 2 Warranty Period

This equipment is warranted against defects in materials and workmanship for a period of one year from the date of shipment. During the warranty period, INMOTION is responsible for necessary repairs as long as the product can be proved to be defective.

For warranty service or repair, this equipment must be returned to a service facility designated by INMOTION. Customer is responsible for shipping charges to INMOTION, while INMOTION will pay return shipping charges.

1 – 3 Excluded Items

This warranty does not include consumable parts such as joystick, batteries, fuses, buttons and relays. Also this warranty does not cover defects caused by incorrect installation, incorrect or insufficient maintenance, unauthorized modification, unavoidable natural interference, incorrect operation, lack of awareness of the environmental specifications and incorrect software/interfacing.

1 – 4 Remarks

1. No other warranty is expressed or implied, except for the above mentioned.
2. The solutions provided herein are the buyers' sole and exclusive solution. INMOTION shall not be liable for any direct/indirect, special, incidental or consequential damages.

Chapter 2 Operating Precautions

2 – 1 Attention

1. Read this manual carefully before operating and installing the equipment.
2. Due to the complex nature of equipment, it is necessary to read the entire manual before installation.
3. Never allow any unauthorized personnel to dismantle equipment as this may cause the equipment to be damaged.
4. This manual is for reference only; please call your distributor if further assistance is required.
5. The equipment has been stringently tested for quality before delivery from our plant. However, it must not be used in extremely dangerous situations, or where damage may result.
6. After operating the Crane, switch off main power as well as the power on the Receiver and remove the Transmitter key.
7. The Transmitter should be safely placed when not in use to avoid accidental pressing of buttons.
8. The Crane should be equipped with a main power Relay, Limit Switch and other required safety devices.
9. The GND (ground) of the Receiver must be connected with the metal part of the Crane or electrical shock will occur.
10. Do not use this device during electrical storm or where there are conditions of high electrical interference.
11. Ensure that the Transmitter batteries are in good condition and the power for Receiver is normal.
12. Installation and maintenance should be done only while the Crane's main power is off and the Receiver's power is off to prevent electrical shock.
13. The contents of the manual may be amended by the manufacturer without notice.
14. The manufacturer may introduce new functions to the equipment as is necessary; therefore, the descriptions may be subject to change.
15. The patent and related documents for this equipment belong to INMOTION Controls and are not allowed to be used by others without written permission.
16. Series 1220 system is manufactured with many patents developed and owned by INMOTION Controls and its related enterprises and may not be copied without written permission from INMOTION Controls.

2 – 2 Precautions

1. After operating Series 1220, please press EMS mushroom to shut off the main power supply on the Crane & the Receiver and remove the Transmitter key.
2. Stop operating when slow-response occurs due to insufficient Transmitter power, beyond the remote control range or severe interference.
3. Remove the batteries when the equipment is not going to be in use for a long period.
4. Operators must be in good health and have good judgement with regards to safety.
5. The remote control operator must have adequate training and related license to avoid danger.
6. The INMOTION Transmitter is durable and weather-resistant, but care should be taken, not to subject it to severe impact or pressure.
7. Series 1220 is suitable for use in diverse industrial environments correct operating and maintenance will extend the system's life.
8. Check EMS mushroom and the other security functions of the system before daily operation.
9. Stop operating if the operator's view is not clear.
10. Press EMS mushroom when malfunctions or abnormal conditions occur.
11. The operator must be familiar with the following Emergency Procedures before operating.

2 – 3 Emergency Procedures

In the case of emergency, please follow the steps below and ask the distributor for service immediately.

1. Press EMS mushroom.
2. Turn the security key to "OFF" position.
3. Remove the battery box and key.
4. Shut off the main power of the Crane and discontinue the operation.
5. Contact the distributor for more information.

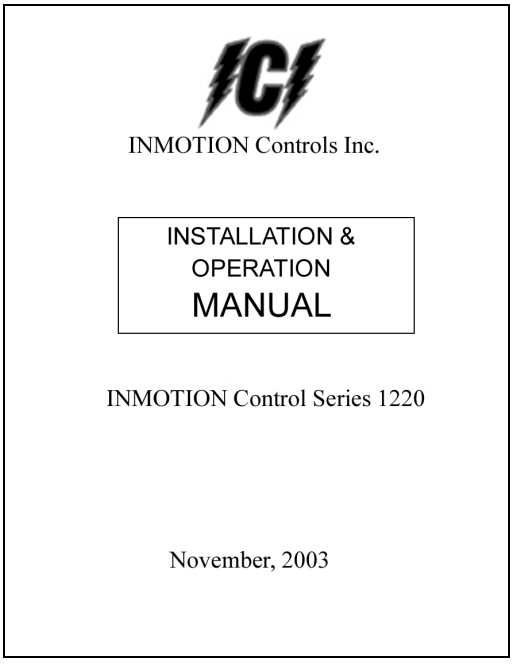
Chapter 3 Standard Accessories

A standard Series 1220 system consists of:

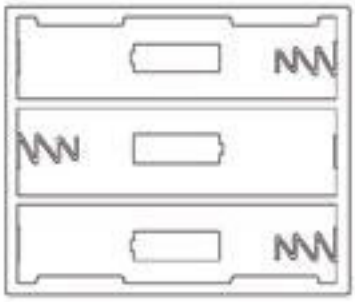
Transmitter (strap included) - 1 unit

Receiver - 1 unit

One User's Manual



Battery Box - 1 unit



Chapter 4 Operation

4 – 1 Transmitter Configuration

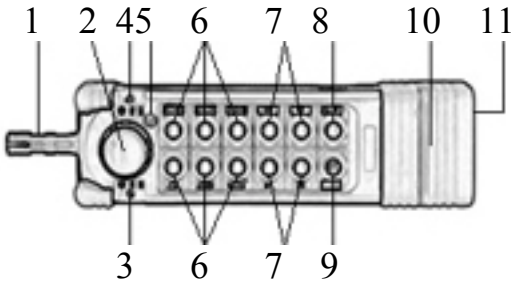


Figure 4-1 Transmitter Configuration

1- Antenna

2- Emergency Stop

3- A Switch

4- B Switch

5- LED Indicator

6- Motion Pushbutton

7- Aux. Pushbutton R1 - R4

8- F1 Pushbutton

9- Start/Alarm Pushbutton

10- Battery Cover

11- Security Key

4 – 2 Receiver Configuration

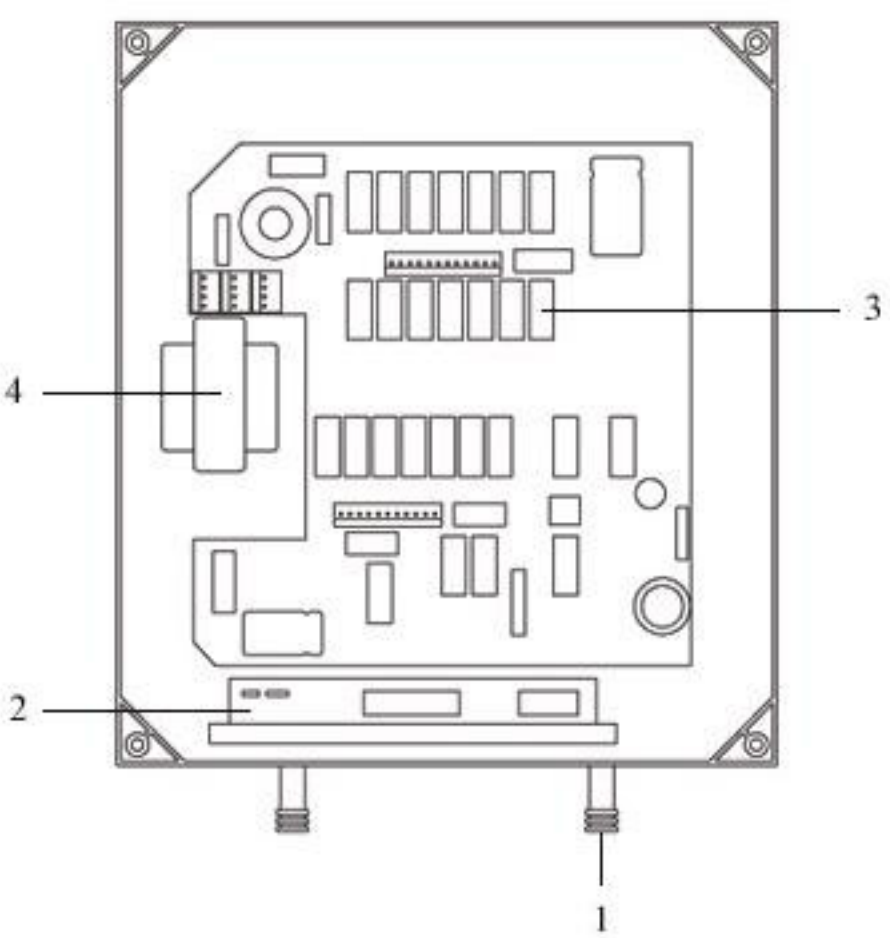


Figure 4-2 Receiver Configuration

1- Antenna
2- Receiver/Decoder Module
3- Relay Module
4- Transformer

4 – 3 General Operation

1. Install 6 new AA-size batteries in the battery box. Make sure the "+" and "-" directions are correct.
2. Put battery box into battery cover then insert into transmitter.
   Note: Transmitter will sound two long sounds to indicate the correct installation.
3. Insert security key in the "OFF" position.
4. Turn on the power according to the "Power-On Modes" (please refer to 4-4-1).
   Note: LED indicator will flash with red color if proper procedures are not followed.
5. Operate transmitter by pressing each pushbutton (including A and B switch).
6. After operation, perform the following procedures in sequence: (1) Press EMS mushroom, (2) rotate security key counter clock wise to the "OFF" position, (3) remove key and keep it in a safe place, (4) remove batteries if not to be used for a long period of time.
   Note: Transmitter has power indication functions with LED display.
   ① "Green color": Sufficient power to operate transmitter. (In order to save power, one can program to turn off LED display when power is sufficient.)
   ② "Yellow color": Power is depleting, warning sound occurs every 4 seconds (can be switched off and sound interval can be set by software). Operation must be stopped immediately (for example: lower the goods to ground) to replace batteries.
   ③ "Red color": Insufficient power. In addition to red LED, warning sound will continue and transmitter is no longer functional. Transmitter will send out an emergency stop signal to the receiver due to insufficient power. The operator should avoid this situation in order to maintain the safety of operation.

4 – 4 Special Functions Operation

4-4-1 Power-On operation

Power-on means that the Main-Relay on the receiver will switch on as soon as the transmitter sends a signal and then the receiver will be on standby for continuous control. There are 4 different ways that the "Power-On mode" can be set.

A. Any pushbutton Power-On Mode

1. Rotate "EMS" mushroom clockwise 45º and pull out.
2. Turn security key clockwise to "ON" position.
3. Press any pushbutton on the transmitter (or A, B switch). This will turn on the power as well as execute the function of pushbutton.

B. "Start" pushbutton Power-On Mode & Note

1. Rotate "EMS" mushroom clockwise 45º and pull out.
2. Turn security key clockwise to "ON" position.
3. Press "Start" pushbutton on the transmitter to turn on power.

Note: When setting is on "Any pushbutton power-on" or "Start pushbutton power-on", the transmitter is in the "non-continuous" mode (i.e. pushbutton must be pressed to operate the function), it can save power.

C. E.U. standard Power-On Mode

1. Rotate "EMS" mushroom clockwise 45º and pull out.
2. Turn security key clockwise to "ON" position.
3. Press "Start" pushbutton on the transmitter to turn on power.
4. After 3 minutes of non-operation, transmitter will send out an emergency stop signal to the receiver. When this occurs, one must turn the magnetic key counter-clockwise to the "OFF" position, then turn the key clockwise to the "ON" position, and press "Start" pushbutton to turn on the power.

Note: When setting is on "E.U. standard" Power-on Mode, the transmitter is in the continuous mode.

D. Software Power-On Mode

This "Power-On" mode is controlled by the software. It consists of (1) Whether the receiver Power-Off automatically when no operation for a period of time. (2) Whether a password is required to turn on power. (3) Whether an "emergency stop" signal will be sent out… etc.

4-4-2 Acceleration/Deceleration Operation

1. "F1" pushbutton is the acceleration pushbutton; "Start" pushbutton is the deceleration pushbutton.
2. When a motion is in the second speed, quick touch of acceleration pushbutton will double the speed. Repeated touch of acceleration pushbutton will increase the speed up to 6 times.
3. To reduce the speed, touch the deceleration pushbutton. Repeated touch of deceleration pushbutton will reduce to the second speed.

Note:

(1) When accelerating/decelerating, the motion pushbutton must be depressed and held in the second speed. If motion pushbutton is released, there will be no acceleration/deceleration and speed will return to zero.

(2) Press "Start" pushbutton which will perform the "Alarm" function if the speed is reduced to the second speed.

4-4-3 Inching Operation

1. "F1" pushbutton is set for "inching" pushbutton.
2. Press and hold inching pushbutton.
3. Press any motion pushbutton to perform the inching motion.

Note: The other pushbutton of transmitter must be released before pressing the inching pushbutton.

4-4-4 Change of Frequency

The remote controller provides 3 operating frequencies. When there is radio wave interference the remote controller can't operate properly, the operator can change the transmitter's frequency according to the following procedures without changing the channel in the receiver. This eliminates the problem of climbing to the receiver.

Note 1: From the transmitter, one can depress the corresponding pushbutton to change operation frequency. In the meantime, LED indicator displays different colors to show the operation frequency as follows:

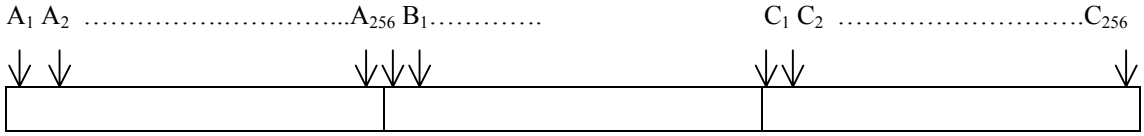
Operation frequency	LED Color	Corresponding pushbutton
Frequency A	Red	"Up" pushbutton
Frequency B	Yellow	"Down" pushbutton
Frequency C	Green	"East" pushbutton

Note 2: From the transmitter, one can follow the procedures mentioned below to check the operation frequency:

1. Press EMS mushroom.
2. Turn security key to "Off" position and then turn security key clockwise from "Off" to "On" position.
3. At this moment, LED indicator will display the corresponding color to show the present operation frequency of transmitter.

Note 3: Both receiver and transmitter must be in the same operation frequency to operate properly. (e.g. both in Frequency A, or B, or C).

Note 4: Channels 1 to 256 can be set by Dip switch in the receiver or set by software.



Dip switch in the receiver is an 8-bit for 256 channels. If current setting is channel 16, one can choose among frequency A_{16}, B_{16}, C_{16}.
Bandwidth of each section and separation between channels can be set by software. e.g. A_1=430.000MHz A_2=430.025MHz…..
A_{256}=436.375MHz; B_1=437.000MHz; B_2=437.025MHz…etc.

4-4-4-1 Procedures for changing operation frequency:

Step	Action	Remark
1	Press EMS mushroom.	1. "Up" pushbutton = Frequency A 2. "Down" pushbutton = Frequency B 3. "East" pushbutton = Frequency C
2	Turn security key to "Off" position.	
3	Depress and hold the pushbutton in accordance with the frequency that you want to change. **Note:** The pushbutton must be depressed and held until step 6 is completed.	
4	Turn security key clockwise from "Off" to "On" position	
5	Turn security key to counter clockwise from "On" to "Off" position once LED indicator was ceased flashing.	
6	Complete	
7	Power-On according to the proper procedure described previously and return to normal operation.	

4-4-4-2 Procedures for setting/forcing receiver to change frequency:

If interference is serious (i.e. The receiver can't receive the command to change the operation frequency due to interference and environment noise to the transmitter.), then one should adopt the following procedure to force the receiver to change frequency to the clear frequency section (i.e. Freq.A, Freq.B or Freq.C) firstly. After the receiver's frequency is changed then follow to the above-mentioned procedure to select the correct transmitter's frequency between Freq.A, Freq.B and Freq.C.

Note: For the receiver, one must follow these orders to change operation frequency: Frequency A→Frequency B→Frequency C→Frequency A→Frequency B - - →. For example: the present operation frequency of receiver is "Frequency B", the operation frequency of receiver will change to "Frequency C" after the following procedure is completed.

Procedures for forcing receiver to change frequency

Step	Action	Remark
1	Press EMS pushbutton.	"West" pushbutton is used to transmit continuous noise signal in order to force the receiver to change the frequency section, not transmitter.
2	Turn security key to "off" position.	
3	Depress and hold "WEST" pushbutton.	
4	Turn security key clockwise from "Off" to "On" position.	
5	Release "WEST" pushbutton. At this time, LED indicator will flash with red, yellow and green color alternately for 5 minutes.	
6	After 5 minutes, LED indicator will turn off and the procedure is completed.	

4-4-5 Enter password operation

1. Rotate “EMS” mushroom clockwise 45º and pull out.
2. Turn security key clockwise to “ON” position.
3. Press the pushbutton sequentially to enter password within 10 seconds. (Remark: This time duration of “Password Complete” can be set by software. At the duration of “Password Complete” the LED indicator will flash with Green color.)
4. The buzzer of transmitter will sound one-long sound to indicate the password is correct. After buzzer turn off, Power-On according to the proper procedure and return to normal operation.
5. If password is incorrect then the buzzer will sound with two short sounds and one long sound. Enter the correct password again after the buzzer is turned off.

Note 1: The function of password can be set by the software in order to avoid unauthorized people using the remote controller.
Note 2: One must re-enter the password to return to normal operation if EMS mushroom has been pressed (or “emergency stop” signal has been transmitted due to transmitter auto power off).

Chapter 5 Inspection and Maintenance

5 – 1 Inspection

Daily inspection is important and will ensure the safety of operation. Inspection should include "emergency stop" and other safety devices and functions. If there is doubt, operation must be stopped immediately and problems must be solved before operation is resumed.

5 – 2 Maintenance

This remote controller is equipped with self-diagnostic device. During the operation and the change of batteries, self-diagnostic device will activate the warning alarm if any malfunction is detected. Operator must understand the malfunction signals and notify the maintenance personnel. Malfunctions and warning alarm are listed as follows:

Note: When "alarm mode" is selected as "Simple alarm mode", alarm signals are shown on the list; when "alarm mode" is selected as "Morse alarm mode", please refer to Technician's Manual.)

Malfunction Part	Error message	Alarm Signal	Remark
Transmitter	Encoder Module malfunction	–	Alarm lasts 0.5 second repeats every 2 seconds
	RF Module malfunction	– –	Refer to Note below
	Insufficient power to operate transmitter	– – –	Refer to Note below
Receiver	Relay Module malfu-nction	–	Alarm lasts 0.5 second repeats every 2 seconds
	Receiver/Decoder Module malfunction	– –	Refer to Note below
	Power failure	– – –	Refer to Note below

Note: Each "–" indicates 0.5 second alarm. Each short interval lasts 0.5 second, and long interval lasts 2 seconds. For example, the error message of RF Module Malfunction:

Short interval (0.5 seconds).
↓
"– – – – – –"
↑
Long Interval (2 seconds).

Section 2 Technican's Manual

Chapter 1 General Characteristic

1 – 1 General Specifications

- Operation Frequency---------- : 410 ~ 490MHz (set by software)
- Hamming Distance ---------- : ≥ 4
- I.D. Code---------- : 2^{32} ; more than 4 billion sets (set by factory, never repeated)
- Temperature Range---------- : -30°C ~ +75°C
- Channel Spacing---------- : 5KC/6.25KC or integral multiple (set by software)
- Maximum Operation Range---------- : Up to 100 Meters
- Structure---------- : Fiber-Nylon
- Protection Degree---------- : IP – 65

1 – 2 Transmitter Specifications

- Power Supply---------- : Six 1.5volts Alkaline or Rechargeable Batteries (AA Size)
- RF Power---------- : < 10 mWatts
- Modulation---------- : ≤ ±2.5KHz; NBFM
- Pushbutton Type---------- : Two-step Mechanical Switch
- Dimensions---------- : 274×77×42 mm (L×W×H)
- Weight---------- : 660 g

1 – 3 Receiver Specifications

- Power Supply---------- : AC 110/220/380V (50/60Hz) (tolerance ± 10%)
- Sensitive---------- : –110DBm (Date Error Rate < 10^{-3})
- Image Rejection---------- : > 60DB
- Rejection of Adjacent Channels-------- : > 80DB (± 20kHz)
- Output Relays---------- : 10A/250VAC; 8A/30VDC
- Dimensions---------- : 253×267×150 mm (L×W×H)
- Weight---------- : 3 Kg

Chapter 2 System Configuration

2 – 1 Transmitter Unit

Transmitter unit consists of Encoder Module and Transmitter RF Module, for transmitting "control data" to the receiver for remote control applications.

2-1-1 Encoder Module:

A micro control unit (MCU) is used for the main processing, MCU reads the pushbutton data and combines with the ID Code, Hamming Code, and Function Setting. After producing control data by encoding, it generates TXFSK signal to transmitter's RF module via FSK circuit.

2-1-2 Transmitter RF Module:

The sequence of RF module is shown as follows:
Encoder→TXFSK→modulates a RF carrier → amplification → antenna.
This RF Module uses Phase Locked Loop (PLL), Voltage Controlled Oscillator (V.C.O.) with lowest side-band noise, SMT advanced technologies. It has power-saving, high efficiency, high reliability and low harmonic NBFM transmitting circuit.

2-1-3 Parts Name and Illustration

Top View Bottom View

Figure 2-1-1 Encoder Module

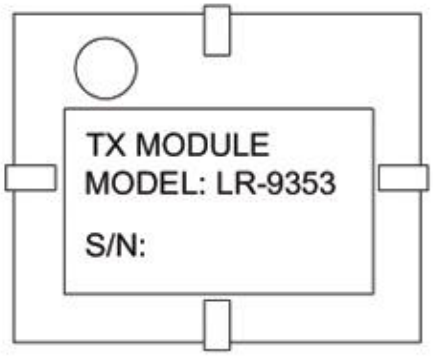


Figure 2-1-2 Transmitter RF Module

2 – 2 Receiver Unit

Receiver unit consists of Receiver/Decoder Module and Relay Module, This unit receives the control data from the transmitter, decodes the data, generates control command, and drives relay circuit to control the motions of cranes (or lifting machines).

2-2-1 Receiver/Decoder Module:

This module consists of high frequency receiver circuit and micro control unit. It's main functions are to receive RF signal from the transmitter, to detect and correct the received data message, to decode and to send commands to the relay module. This module has high-receiving gain, high-signal selectivity, high-image rejection rate, and low-noise figure. In addition, this module uses special design of "Diversity Reception" and "Frequency Deviation Direction Indicator" (FDDI) to eliminate communication dead spots and the adverse effect of environmental change, such as temperature.

2-2-2 Relay Module:

This module receives and processes control commands to drive corresponding relays in order to control the motion of Cranes (or lifting machines). The operation safety is especially important. This module consists of relay contact jammed-detection circuit, relay coil test circuit, relay operating voltage test circuit, and the protection circuit for micro control unit, to ensure operation safety.

2-2-3 Parts Name and Illustration

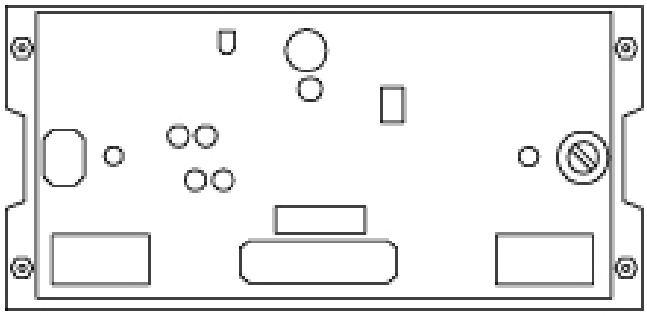


Figure 2-2-1 “Receiver/Decoder” Module

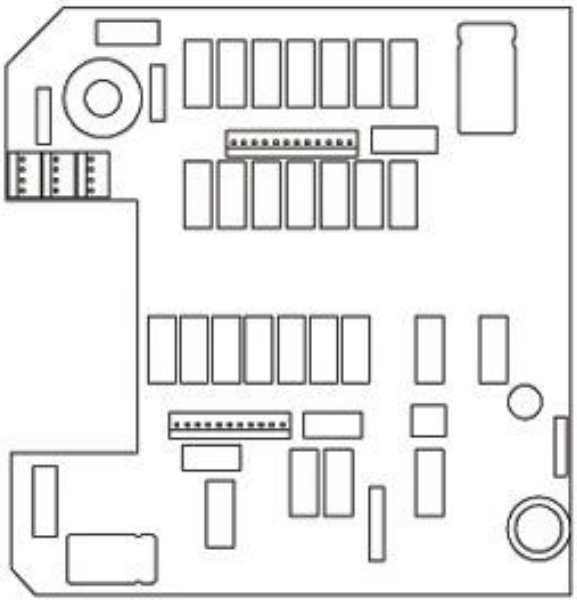
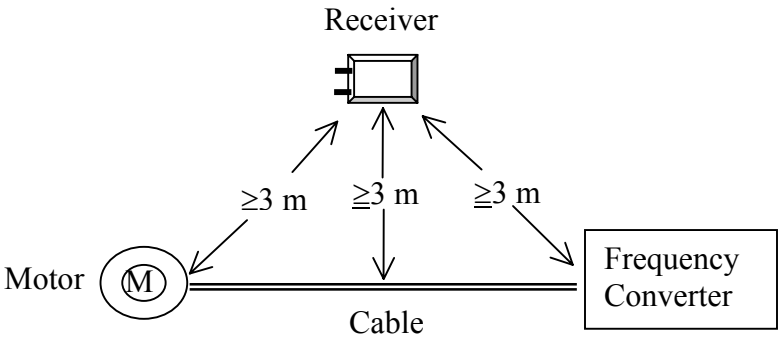


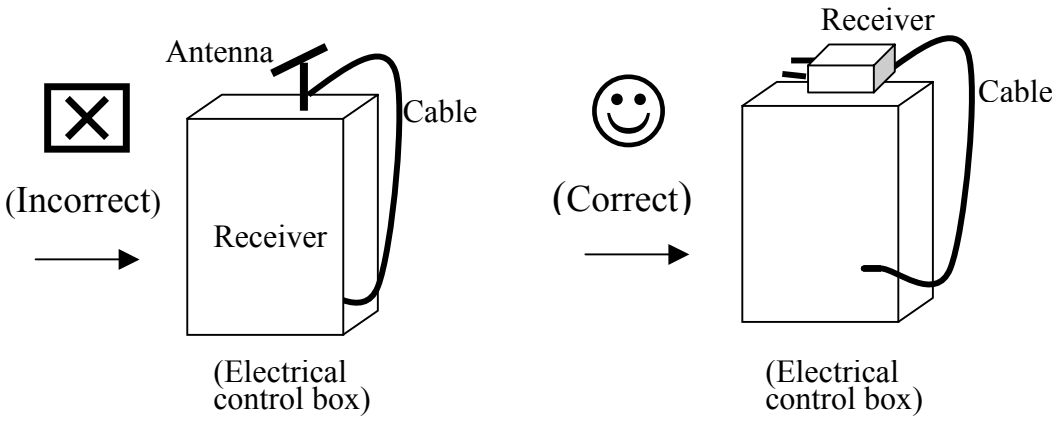
Figure 2-2-2 Relay Module

Chapter 3 Installation and Function Setting

3 – 1 Precautions during installation

1. Observe all safety precautions when climbing the crane.
2. Turn off the main power source of cranes before installation to avoid.
3. Receiver must be installed in such a way that it will not touch any part of the building during operation.
4. Receiver must be fastened safely.
5. Two external antennas must be used when receiver is installed in a metal box.
6. Before installation, inspect the crane's safety devices, and make sure everything is in proper working condition.
7. Make sure you understand the crane circuits and power distribution as well as the function setting of remote controller, to avoid incorrect wiring.
8. To avoid any interference, the receiver must be at least three (3) meters away from the motors, frequency converter and power cable (as shown below).
9. The Receiver should be installed on the top of the electrical control box. To mount the receiver inside the electrical control box is not correct.





3 – 2 Transmitter Installation Instructions

3-2-1 Installation of Batteries in the transmitter:

Insert batteries in proper direction into battery holder. Insert the battery holder into transmitter will sound two long sound ("– –": "–" indicates 0.5 second sound and the short interval lasts 0.5 second) to indicate proper installation.

3-2-2 Installation of function setting software in the transmitter:

When changing a new transmitter or changing remote controller's function settings (such as change receiver's function settings or channel dip switch settings), one must follow the procedures below (please refer to section 3-4) to install the function setting software in the transmitter, in order to pair the transmitter and receiver.

3 – 3 Receiver Installation Instructions

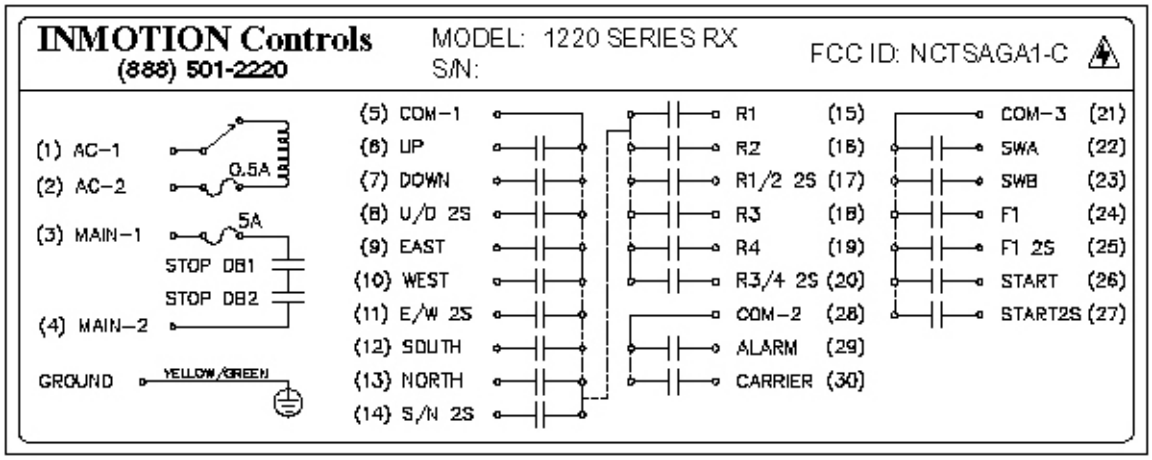
3-3-1 Preparation for Installation

1. Provide all necessary tools.
2. Select a proper location.
   a. Select a stable place.
   b. Select a place where you can see the Receiver or Antenna.
   c. Select a place where there is no spark, e.g. keep away from motors, relays, magnetic switch and power cables.
   d. Keep away from high-voltage wiring and device.
   e. The Receiver's box must be at least 3 cm away from the other obstacles.
3. Installation of proper power source

   The input power source for receiver can be 220VAC, 50/60 Hz or 380VAC, 50/60 Hz. **After power source is confirmed, one must connect the connector of initial coil of transformer to the relay module properly.**

3-3-2 Installation Sequence

1. Turn off the main power for crane.
2. Attach the template (provided) for the receiver to a proper place.
3. Drill the holes for screws, install receiver and then fix the receiver with 6mm ψ screw nut on vibration- Resistant.
4. Attach 2 sets of cable-assembly (provided) to the receiver and tighten the cables.
5. Connect cables to the control circuit of crane according to the receiver's wiring table and control contacts diagram.



Note:

①Inspect and make sure that all wires are connected correctly.

②Earth ground for remote controller and crane must be properly connected to ensure safety.

6. Secure the cables between the receiver and crane so that cable cover (wrapper) will not wear out due to the vibration of the crane.
7. Open the top cover of the receiver and turn Relay module's Run/Test switch to "Test" position.
8. Turn on the main power for the crane.
9. Operate the transmitter to test every function and make sure they are all correct (read by LED indicator).

   Note: When Run/Test switch is set at "Test' position, relay will not function, but LED will display.
10. Turn Run/Test switch to "Run" position and secure the top cover to the receiver with screws.
11. This completes the installation of receiver.

3-3-3 Installation of function setting via software in the receiver:

When changing a new receiver or changing remote controller's function settings (for example: direct loading of function setting software from PC or maintenance kit into the transmitter). One must follow the procedures below (please refer to section 3-4) to install the function setting software in the receiver, in order to pair the receiver and transmitter.

3 – 7 Radio remote setting

The operation procedures mentioned herein refer to the process of the transmitter's remote writing of function setting software into the receiver. It means that to preserve the required setting in transmitter in advance then sends out the radio signal to receiver at workshop. This performance can eliminate the trouble of climbing to the receiver. Radio setting includes "Channel setting" and "Function Setting".

Note:

1. Before operating, one must make sure that all of the relays are at "Off" status (i.e. the receiver is in "Power-Off" mode).
2. Before operating, one must make sure that the communication status between the transmitter and the receiver is in good condition.

3-7-1 "Channel setting" by radio:

1. Using PC or Maintenance Kit to install channel setting into transmitter in advance.
2. Depress EMS mushroom and turn security key to "off" position.
3. Depress and hold "East" & "West" two pushbuttons and turn security key from "off" to "on" position simultaneously.
4. Release "East" & "West" two pushbuttons. At this time, LED indicator will flash with yellow and green color alternately.
5. After the alarm the receiver sounds one long sound "–" (one long sound means that the channel setting is completed), turn the security key from "on" to "off" position.
6. "Power-On" according to the proper procedure and return to normal operation.

3-7-2 “Function setting” by radio:

1. Using PC or maintenance kit to install function setting into transmitter in advance.
2. Depress EMS mushroom and turn security key to “off” position.
3. Depress and hold “Up” & “East” two pushbuttons and turn security key from “off” to “on” position simultaneously.
4. Release “Up” & “East” two pushbuttons. At this time, LED indicator will flash with yellow and red color alternately.
5. After the alarm the receiver sounds two short sound and one long sounds “••–” (two short sounds and one long sound means that function setting is completed), turn security key from “on” to “off” position.
6. “Power-On” according to the proper procedure and return to normal operation.

3 – 8 Software Setting

In addition to the dip switch setting mentioned in section 3-5, this remote control system can be set according to the working conditions and the operator’s need for the following: promotes pushbutton function, “Bypass EMS” function, search function, “Passive EMS” function…etc. This enables the remote controller to perform the most effective operation and to provide the safest operation. Please refer to the manual of software setting.

Chapter 4 Troubleshooting

4 – 1 Self-Diagnostics

In order to simplify the maintenance, this remote control system has been designed with the built-in self-diagnostics circuit in the transmitter and receiver. As long as the micro control unit is in proper working condition, malfunctions in pushbutton, joystick, RF circuit, relay and relay driver circuits (including relay coil and relay contact) can be detected. When malfunction occurs, transmitter or receiver will generate a simple and clear alarm. Not only can the operator and maintenance personnel fully understand the condition of the remote controller, but can also reduce the maintenance time by following the error message for repair.

Note:

1. Malfunction alarm mode can be set by software for the "Simple Alarm Mode" or "Morse Alarm Mode". Simple Alarm Mode was discussed in Operator's Manual. The following explains the "Morse mode" for the error message.
2. Alarm (error message) is shown according to Morse code. "•" Indicates short alarm for a duration of 0.26 second; "—" indicates long alarm for a duration of 0.78 second; interval between alarms is 0.26 second. An example for transmitter pushbutton error message is shown as follows:

0.26 sec 0.26 sec 0.78 sec 1.5 sec

3. When an error message is detected by receiver or transmitter's self-diagnostics, an alarm will sound and "Power-OFF' will be activate. Unless the malfunction has been corrected, it will be impossible to Power-On the controller.
4. Maintenance technicians can use the error message. However, we recommend the technician replace only the module. The defective module should be returned to our distributor for the repair of components. This will eliminate further damage to the controller.
5. If you do not understand the error message from the transmitter or receiver, or the signal is not listed in this manual, please contact our distributor for clarification and recommendation.

4-1-1 Transmitter's Malfunction and Correction

Item	Error Message Morse Code		Description	Correction
1	C	– • – •	Malfunction of E^2PROM memory in the encoder module; can't read /write.	1. Replace encoder module. 2. Perform the installation of software (Refer to section 3-4)
2	D	– • •	E^2PROM in the encoder doesn't have operation software or software is incomplete.	Perform the installation of software (Refer to section 3-4)
3	F	• • – •	Malfunction of pushbutton. (short)	1. Replace encoder module. 2. Perform the installation of software. (Refer to section 3-4)
4	R	• – •	Batteries dead	Replace batteries
5	S	• • •	RF module malfunction	Replace RF module **Note:** RF module's frequency must be set the same as that of the receiver.

Note:

1. If malfunction of the pushbutton has occurred the buzzer will sound and the LED indicator will flash with red color simultaneously when the power is reset (e. g. change batteries).
   During operation the transmitter will perform self-diagnostics when EMS mushroom is pressed. If the malfunction of item 3 has occurred, only LED indicator (flash with red color) will indicate the error message when you press the EMS mushroom.
2. The alarm for other items will sound only when you push the pushbuttons or when the power source is reset (e. g. change batteries).

4-1-2 Receiver's Malfunction and Correction

Item	Error Message Morse Code		Description	Correction
1.	A	• –	"UP" relay coil damage	Replace Relay module
2.	B	– • • •	"U/D" 2S relay coil damage	
3.	C	– • – •	"DOWN" relay coil damage	
4.	D	– • •	"EAST" relay coil damage	
5.	E	•	"E/W 2S" relay coil damage	
6.	F	• • – •	"WEST" relay coil damage	
7.	G	– – •	"SOUTH" relay coil damage	
8.	H	• • • •	"S/N 2S" relay coil damage	
9.	I	• •	"NORTH" relay coil damage	
10.	J	• – – –	"R1" relay coil damage	
11.	K	– • –	"R1/R2 2S" relay coil damage	
12.	L	• – • •	"R2" relay coil damage	
13.	M	– –	"R3" relay coil damage	
14.	N	– •	"R3/R4 2S" relay coil damage	
15.	O	– – –	"R4" relay coil damage	
16.	Q	• – – •	"MAIN" relay coil damage	
17.	U	– – • –	Relay contact is jammed (can't open) at COM 1.	
18.	R	• – •	The voltage of input power is over the tolerance.	1. Disconnect the cable from the receiver. 2. Turn off the main power of crane and check the voltage of input power. 3. Check the voltage select plug in correct position.

				4. Inspect and make sure the power is normal before resuming operation.
19.	S	• • •	RF circuit malfunction	Replace Receiver/decoder" module
20.	Y	– • – –	Interfered by the same model of remote controller	Change to a new frequency
21.	1	• – – – –	Interfered by the same frequency of other radio signal.	1. If interference is not serious, "Power-On" the remote controller when interference is over. 2. If interference is serious, change to new frequency. (Refer to section 4-4-4 at operator's Manual)
23.	Z	– – • •	E^2PROM in the Receiver/ Decoder doesn't have operation software or software is incomplete.	Contact distributor for installation of new operation software

Note:

1. When receiver's self-diagnostics detects a malfunction, alarm will continue, unless the malfunction has been corrected or the power to the receiver has been disconnected.
2. The receiver can be set by the software to alarm or not, when error occurred relating to item 20 ~ 21.
3. The receiver can be set by software to close the relative action (i.e. "Relay-Off") or "Power-Off" automatically, when the error occurred relating to items 20 ~ 22. In the other items, the receiver will enter into the Auto Power-Off mode.
4. This receiver contains Auto Gain Control circuit with high sensitivity; when not in operation, it may receive weak signal from unknown sources. As long as the interference does not occur very often, it will not affect the normal operation. No frequency change is necessary.

4 – 2 Malfunction Identification.

When remote controller cannot function properly (e. g. Receiver can't function correctly after pressing the pushbutton of the transmitter) and there is no alarm for malfunction information, please follow the procedures below to check the malfunctions

Item	Malfunction	Action Required
1.	Transmitter's LED and buzzer do not react at all.	1. Make sure battery power is normal: a. Check battery's direction. b. Check battery box direction. c. Check battery's condition. 2. Make sure micro control unit (MCU) is normal: a. Press EMS mushroom and turn security key to "OFF" position. b. Remove battery cover, wait for 10 seconds, and insert the battery cover again. At this time, buzzer should generate two-long sound. Otherwise, the MCU is out of order or the power connecting wire is abnormal. 3. Return for repair.

2.	Transmitter is normal but receiver's buzzer doesn't react at all.	1. Make sure the receiver's power source is normal: a. Inspect "Receiver/Decoder" to see if the SQ indicating light is on and the Diversity's ANT A and ANT B flash alternatively. b. Inspect AC power fuse and DC power fuse to see if the fuse is blown. If necessary, turn off the main power and replace the fuse. 2. Make sure the "Receiver/Decoder" module and "Relay" module are wired correctly. 3. Make sure the output fuse of the relay is not blown. Replace fuse if necessary. 4. Make sure the Alarm's relay is not out of order. (If the Alarm's LED is on, it means the relay is out of order.) 5. Return for repair.
3.	Certain motion does not work.	1. Make sure the output fuse of the relay is not blown. Replace fuse if necessary. 2. Make sure the original control system of crane works properly. If not, ask for the original manufacturer to repair. 3. Return for repair.