Installation
& Operation Manual

F22-12D *Industrial Radio Remote Controller*

Lee's Hi-tech Ent. Co., Ltd.

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0Safety Considerations

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

Safety Symbols or

The following symbols may be found on the remote control throughout the remote control's documentation.

Refer to Manual

When product is marked with this symbol refer to instruction manual for additional information.

High Voltage

Indicates presence of hazardous voltage. Unsafe practice Could result in severe personal injury.

Protective Earth Ground

Indicates protective earth terminal.

Warning

Denotes a hazard. Included text gives proper procedures. Failure to follow instructions could result in severe personal injury and/or property damage.

Caution

Denotes a hazard. Included text gives proper procedures. Failure to follow instructions could result in minor personal injury and/or properly damage.

Part 1. Operator's Manual

Chapter 1 Warranty

1-1 ***Warranty*** Lee's Hi-Tech Enterprises Co., Ltd. guarantees that this product meets its published specifications at the time of shipment from the factory. Under proper installation it should work as expected.

1-2 ***Warranty Period*** This equipment is warranted against defects in material and manufacturing for a period of one year from the date of shipment. During the warranty period, TELECRANE is responsible for necessary repairs as long as the product can be proved to be defective.

For warranty service or repair this product must be returned to a service facility designated by TELECRANE. Buyer will pay shipping charges to TELECRANE while TELECRANE will pay return shipping charges.

1-3 Excluded Items

This warranty does not include consumptive parts such as batteries, fuses, buttons, relays. Also this warranty does not cover defects caused by improper installation, improper or insufficient maintenance, unauthorized modification, improper operation, ignorance of environmental specifications, or improper software or interfacing.

1-4 Remarks

◎No other warranty is expressed or implied, except for the above mentioned.

◎The remedies provided herein are the buyer's sole and exclusive remedies. TELECRANE shall not be liable for any direct, indirect, special, incidental or Consequential damages.

Chapter 2 Precautions of Operation

2-1 Attention

◎Please carefully read the manual before installing and operating this device.
◎Due to the complex nature of this equipment it is necessary to read the entire manual before installation.
◎Never dismantle the equipment by any unauthorized personnel, or equipment may be damaged.
◎This manual is for reference only. Pleases consult your distributor for further assistance.
◎The equipment has been strictly tested for quality before delivery from our plant. However, this equipment must not be used in dangerous situations or where damage may result.
◎After finishing operation of TELECRANE shut off main power to the crane, power to receiver, and remove transmitter key. If transmitter's power is controlled by "rotary key switch", then need turn the key to "OFF" position and remove it.
◎Transmitter should be placed in a safe area when not in use to avoid accidental pressing of buttons.
◎The crane should be equipped with main power relay, limit switch and other safety devices.
◎The GND (ground) of the receiver must be in contact with the metal part of the crane or electrical shock may occur.
◎Don't use equipment during lightening or high electrical interference conditions.
◎Make sure that the batteries are in good condition and power for receiver is correct.
◎Installation and maintenance should only be done while the crane's main power is off to prevent electrical shock.
◎The contents of this manual may be amended by the manufacturer without notice.
◎The manufacturer may introduce new functions to the equipment as necessary, therefore, the descriptions may change.
◎The patent and related documents for the equipment belong to LEE'S HI-TECH CO., LTD. and they aren't allowed to be used by others without permission.
◎F22 systems adopt many of patents belong to LEE'S HI-TECH CO., LTD. and its associated companies.

2-2 Precautions

☆ Operating in an industrial facility is highly dangerous, therefore, operator must have adequate training in using TELECRANE with this in mind.

☆ Those who operate the machine should be healthy and have good judgment in regards to safety.

☆ Although the F22 transmitter is very durable and weather resistant care should be taken not to expose it to severe impact or pressure.

☆ During operation, if the power supplied from transmitter's batteries is insufficient, the transmitter will send out EMS signal first to de-energize all of motion relays inside the receiver to stop crane's moving (Notice: the motions which are set as "Bypass EMS" will continuously move.), and then the LED indicator and buzzer on transmitter will light and sound continuously. At this time, need to be replaced with AA size alkaline batteries. All four batteries should be replaced at the same time. Don't use manganese-zinc batteries because of their corrosive properties.

☆ If the severe interference occurred you should stop using the equipment at once.

☆ The standard voltage of rechargeable nickel-cadmium battery is 1.2 volts with capacity 500-800 mAH. When they are used in F22 system, the operating time will be shorter.

☆ Please take the battery out when the equipment will not be used for a long time.

☆ Be sure to know the "Procedures of emergency" in case of emergency.

2-3 Procedures of emergency

The F22 system has various protections to guard against different emergencies including strict security code checking and automatic monitoring of parts failure. The F22 system has isolation circuitry to protect from outside voltage surges and interference. In the event of sensing an emergency situation the F22 will perform an emergency stop of the equipment. It is important to properly install the F22 system so it can perform the emergency shutdown properly.

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

1. Press EMS button.
2. Pull the magnetic key out of the transmitter. If transmitter's power is controlled by "rotary key switch", then need turn the key to "OFF" position and remove it.
3. Switch off the main power of crane.
4. Advise the distributor to find out the reason.

Chapter 3 F22 Standard Accessories

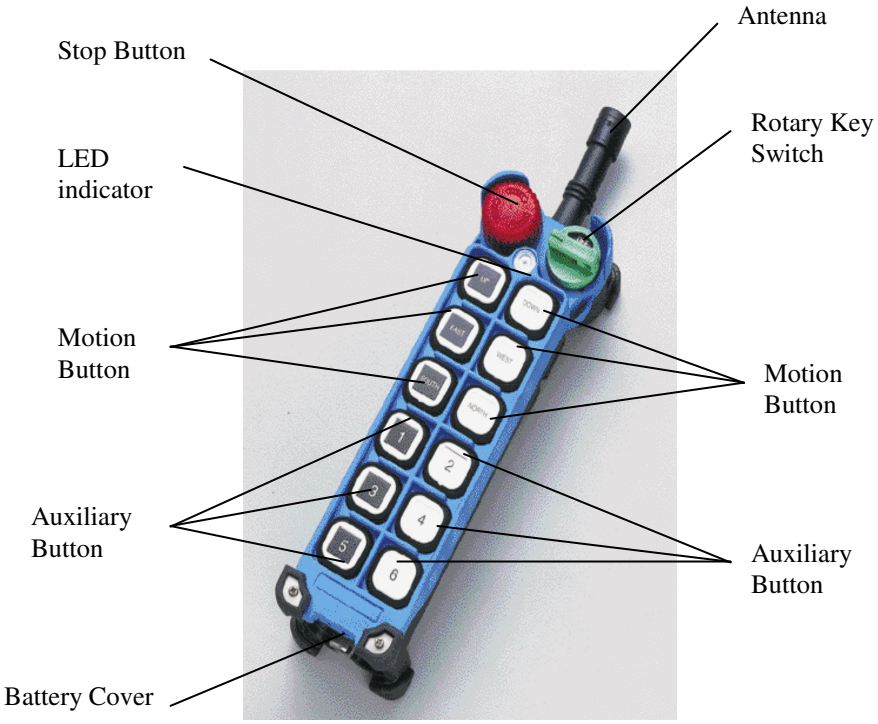
When you get a standard and full set of F22 system, it includes the following item.:

(1)Transmitter, one unit.

(2)Receiver, one unit.

Chapter 4 Operation

4-1 F22 Transmitter's parts



4-2 F22 Receiver's parts

4 – 3 General Operation

1. Remove the cover of battery box.
2. Install 4 Fresh AA-size batteries in the battery box. Make sure the "+" and "-" directions are correct.
3. Attach back the battery cover.
   Note: Transmitter will sound two-long sound to indicate the correct installation.
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.
6. After operation, perform the following procedures in sequence: (1) Press EMS mushroom, (2) rotate key counter-clock-wise to the "OFF" position, (3) remove key and keep it in a safe place, (4) remove batteries if not used for a long period.
   Note: Transmitter has power indicating functions with LED display.
   ← "Green color": Sufficient power to operate transmitter. (In order to save power, one can program to turn off LED display when power is sufficient.)

- ↑ "Yellow color": Power is depleting, warring sound occurs every 4 seconds (can be switched off and sound interval can be set by software). Operation must be stopped immediately (for example: down the goods to ground) to replace batteries.
- → "Red color": Insufficient power. In addition to red LED, warring sound will continue and transmitter is no longer functionable. Transmitter will send out an emergency stop signal to the receiver due to insufficient power. 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 receiver will energize as soon as receiving the control data from transmitter and then receiver keep in condition of standby for continuous control. There are 4 different ways of "Power-On mode" could be setting.

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

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.

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. "R5" pushbutton is the acceleration pushbutton; "R6" 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 accelerate/decelerate, 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 "R6" pushbutton will perform the "Alarm" function if the speed is reduced to the second speed.

4-4-3 Inching Operation

1. "R5" 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 press inching pushbutton.

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 any doubt, operation must be stopped immediately and problems must be solved before resume of operation.

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 dip switch setting is on “Simple alarm mode”, alarm signals are shown on the list; when dip switch setting is on “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 malf u-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 second)

“_ _ _ _ _”

long interval (2 seconds).

Part 2. Technician's Manual

Chapter 1 General Characteristic

1 – 1 General Specifications

- Operation Frequency---------- :425~435MHz(set by software)
- Hamming Distance ---------- : ≧ 4
- I.D. Code---------- : More than 2^{32} sets (set by factory, never repeated)
- Temperature Range---------- : -35℃ ~ +75℃
- Channel Spacing---------- : 12.5KC or integral multiple (set by software)
- Maximum Operation Range---------- : Up to 100 Meters
- Structure---------- : glass-fiber
- Protection Degree---------- : IP 65

1 – 2 Transmitter Specifications

- Power Supply---------- : Four 1.5volts Alkaline or Rechargeable Batteries (AA Size)
- RF Power---------- : < 10 mW
- Modulation---------- : ≤ ±2.5KHz; NBFM
- Pushbutton Type---------- : Two step mechanical switch

1 – 3 Receiver Specifications

- Power Supply---------- : 110/220/380VAC (50/60Hz), ± 10%
- Sensitivity---------- : −110dBm (Date Error Rate < 10^{-3})
- Harmonic Ratio---------- : ≦65dB
- Output Relays---------- : 10A/250VAC; 8A/30VDC

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:

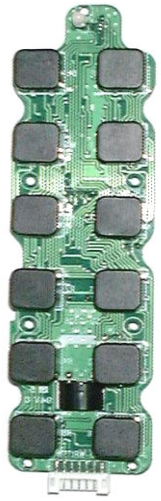
A micro control unit (MCU) is used for the main processing, MCU reads the pushbutton data and combines with the ID Code, Hamming Code, and Function Setting. After producing control data by encoding, it generates TXFSK signal to transmitter's RF module via FSK circuit.

2-1-2 Transmitter RF Module:

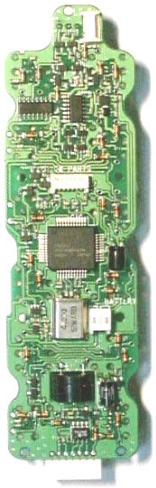
The sequence of RF module is shown as follows: Encoder→TXFSK→ modulates a RF carrier → amplification → antenna.

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 EN-0326

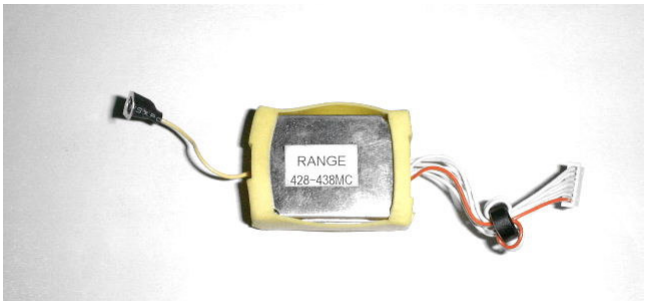


Figure 2-1-2 Transmitter RF Module LR-9359

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 commend, and drives relay circuit to control the motions of cranes (or the lifting machine).

2-2-1 Receiver/Decoder Module:

This module consists of high frequency receiver circuit and micro control unit. Its main functions are to receive RF signal from transmitter, to detect and correct the received data message, to decode and to send commends 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 ate communication dead spot and the adverse effect of environmental change, such as temperature.

2-2-2 Relay Module:

This module receive and process control commends to drive corresponding relay in order to control the motion of cranes (or the lifting machine). 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

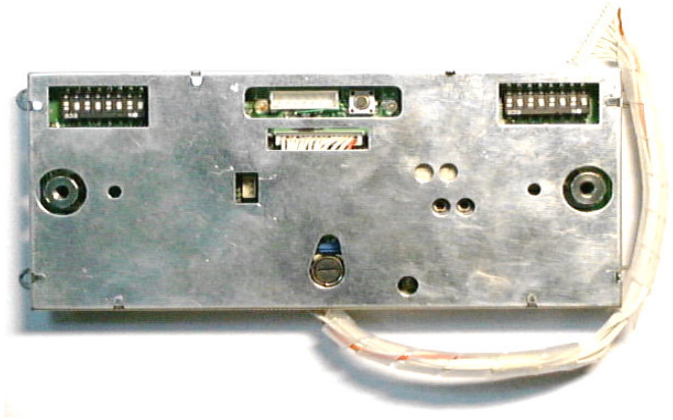


Figure 2-2-1 “Receiver/Decoder” Module RX-1800

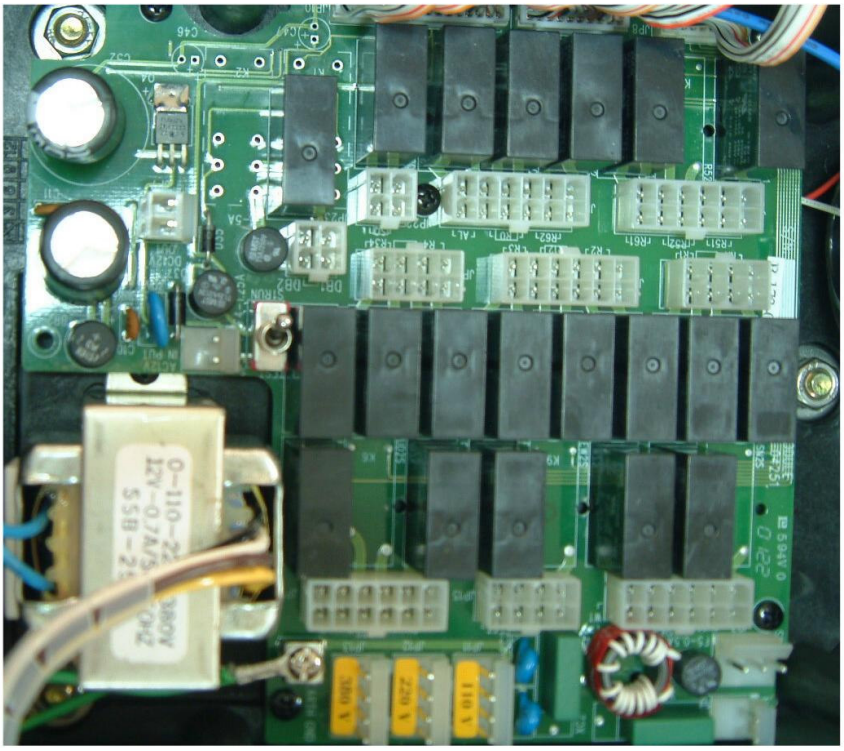
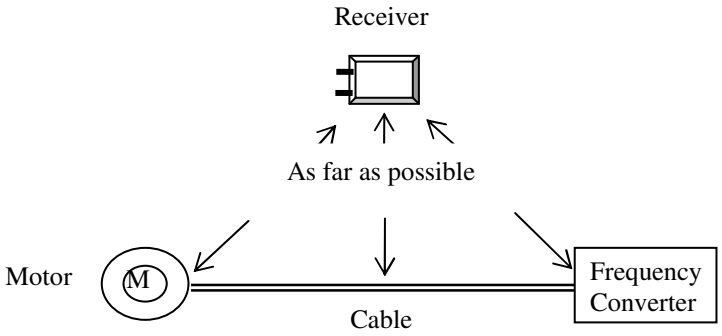


Figure 2-2-2 Relay Module RY-0425

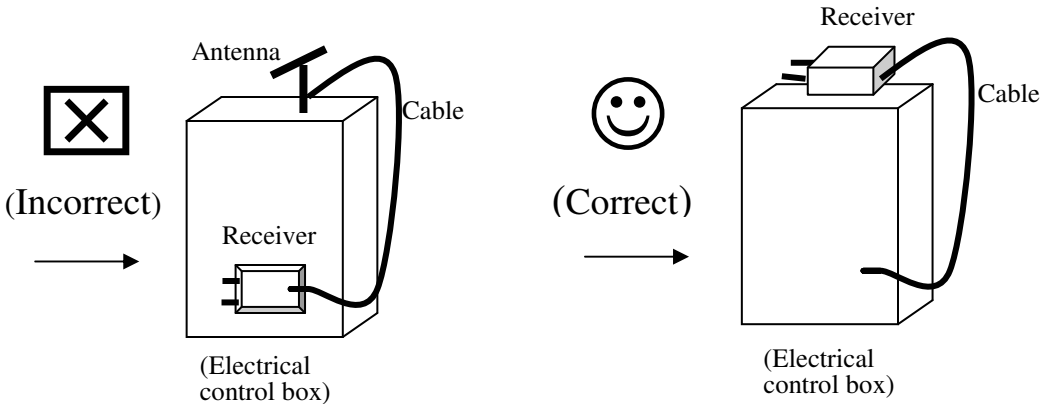
Chapter 3. Installation and Function Setting

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 electric shock.
3. Receiver must be installed in the way that it will not touch any part of the building during the 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 away from motors, frequency converter and power cable (shown as 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 cover. Insert the battery cover into transmitter. 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 change a new transmitter or change 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 110VAC, 50/60 Hz or 220VAC, 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 ϕ 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:

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

   2)Earth ground for roomette 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 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 software in the receiver:

When change a new receiver or change 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 - 4 Setting of Function:

Function setting can be used to set the "Power-On" mode, the function of R5 pushbutton, inching time, acceleration-delayed time, and alarm mode as follows:

1.Use of SW1 and SW2 to set the "Power-On" mode

Dip Switch		Remark
Sw1	Sw2	
OFF	OFF	Any pushbutton Power-On
ON	OFF	Start pushbutton Power-On

OFF	ON	E.U. standard Power-On
ON	ON	Software Power-On: It uses software to set the activity of transmitter and receiver according to the operator's need. 1. Any pushbutton Power-On? Or Start pushbutton Power-On? 2. Transmitter is in the continuous mode? Or non-continuous mode? 3. Transmitter Auto Power-Off? Duration of non-operation before Auto Power-Off? 4. Receiver Auto power-off? Duration of non-operation before Auto Power-Off? **Note:** Pre-setting at factory: (1) Start pushbutton Power-On (2) Continuous mode (3) Transmitter Auto Power-Off after 180 seconds of non-operation, no "emergency stop" signal before Auto Power-Off (4) Receiver Auto Power-Off after 2 hours of non-operation.

Note: When change Power-On mode, you must write the setting from the receiver to the transmitter.

2. Use of SW3 and SW4 to set the function of R5 pushbutton.

Dip Switch		Remark
Sw3	Sw4	
OFF	OFF	R5 pushbutton setting: "Normal" function.
ON	OFF	R5 pushbutton setting: "Toggle" function.
OFF	ON	R5 pushbutton setting: "Inching" function.
ON	ON	R5 pushbutton setting: 'Acceleration" function.

3. Use of SW5 to set "Inching Time"
   SW5 = OFF ⇒ Inching Time = 0.2 sec.
   SW5 = ON ⇒ Inching Time set by software based on operator's need.
   Note: Factory setting is 0.2sec

4.Use of SW6 and SW7 to set Acceleration delayed time

Dip Switch		Remark
Sw6	Sw7	
OFF	OFF	No Acceleration delayed
ON	OFF	Acceleration delayed time : 1 second
OFF	ON	Acceleration delayed time : 3 seconds
ON	ON	Acceleration delayed time set by software based on operation's need. **Note:** Factory setting is 2 seconds.

5.Use of SW8 to set the copying direction

SW8 = OFF ⇒ Copy the function (channel) setting software from RECEIVER to TRANSMITTER.

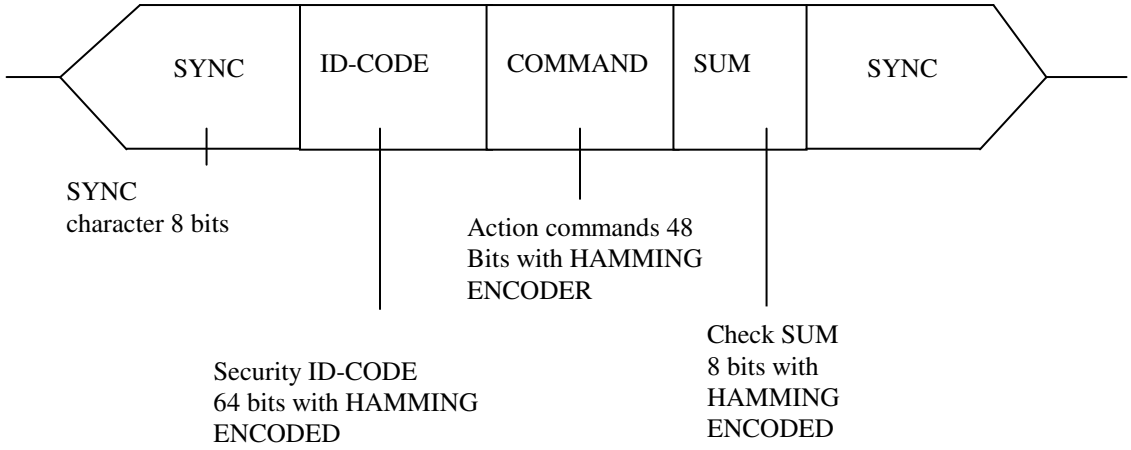
SW8=ON ⇒ Copy the function (channel) setting software from TRANSMITTER to RECEIVER.

3 – 5 Error detection/Error correction by software

F22 system employs the theory of "Error-Control Coding" used on Computer system, and incorporates the "Control Data Code" and the principle of "Error detection/Error correction" of Hamming Distance to edit and complete the "Code Word" was so-called "Hamming Code" which may ensure the control data with accuracy in process of transmission, and also equip with function of automatic "Error detection"/"Error correction" to make sure the safety in operation of F22 system remote control.

3-5-1 Data Stream

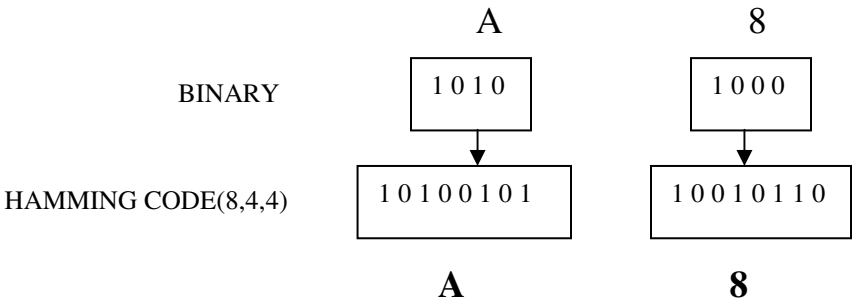
As shown as below, before the receiver's relays output to control the equipment's movement, the data including SYNC, ID-CODE, COMMAND and SUM must be checked twice to further make sure, so the data transmission becomes more safe and reliable.



TOTAL DATA LENGTH=128 bits

3-5-2 Hamming Code

As shown as below, the Code Word length is equal to 8, the Data Bit is equal to 4, the Hamming Distance is equal to 4, it means that HAMMING CODE (8,4,4) can correct single-bit errors and also detect double-bit errors.



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 the operator and maintenance personnel can fully understand the condition of 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 dip switch "SW8" in the "Receiver/ Decoder" module 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. Technicians for maintenance can use 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		Description	Correction
	Morse Code			
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 the malfunction of pushbutton is occurred the buzzer will sound and the LED indicator will flash with red color simultaneously when the power is reset (e. g. change of battery).
   During operation the transmitter will perform self-diagnostics when EMS mushroom is pressed. If the malfunction of item 3 is 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 of battery).

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.	T	—	"SENSE" relay coil damage	
18.	U	• • —	Relay contact is jammed (can't open) at COM 1.	
19.	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 whether the voltage select plug is at the correct position

				4. Inspect and make sure the power is normal before resume to operation.
20.	S	• • •	RF circuit malfunction	Replace “Receiver/decoder” module
21.	Y	— • — —	Interfered by the same model of remote controller	Change to a new frequency
22.	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 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 can't 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 and take out batteries ,press and release any one of pushbuttons on Transmitter, then put batteries into battery compartment and screw up the battery cover . 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 burnt out. 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 burnt out. 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 burnt out. 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.

FCC Caution:

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

2. This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

3. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user authority to operate the equipment.