Part 2. Technician's Manual

Chapter 1 General Characteristic

1 – 1 General Specifications

- Operation Frequency---------- :433.05 ~ 434.79MHz (set by software)
- Hamming Distance ----------: ≧ 4
- I.D. Code---------- : More than 2^{32} sets (set by factory, never repeated)
- Temperature Range---------- : -20℃ ~ +65 ℃
- 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---------- : < 7.85nW (3m)
- Modulation---------- : ≤ ±2.5KHz; NBFM
- Pushbutton Type---------- : Two step mechanical switch
- Dimensions---------- : 186x61x51mm (LxWxH)
- Weight---------- : about 360g (including batteries)

1 – 3 Receiver Specifications

- Power Supply---------- : 48/110VAC (50/60Hz), ± 10%
- Sensitivity---------- : –110dBm (Date Error Rate < 10^{-3})
- Harmonic Ratio---------- : ≦65dB
- Output Relays---------- : 10A/250VAC; 8A/30VDC
- Dimensions---------- : 200x162x107mm (LxWxH)
- Weight---------- : about 1640g(excluding wire cable)

Model: F21-12D1

FCC ID: LWNF21-12D1

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

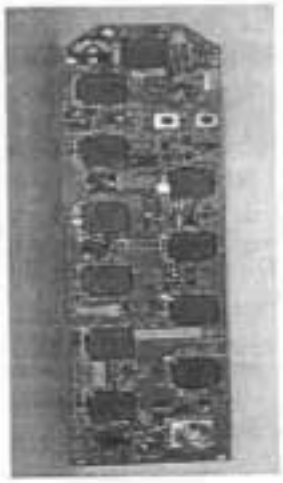


Figure 2-1-1 Encoder Module *JJ-0982*

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 Receiver /Decoder Module, LED Board, SQ Lamp Board, 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 SU-0208

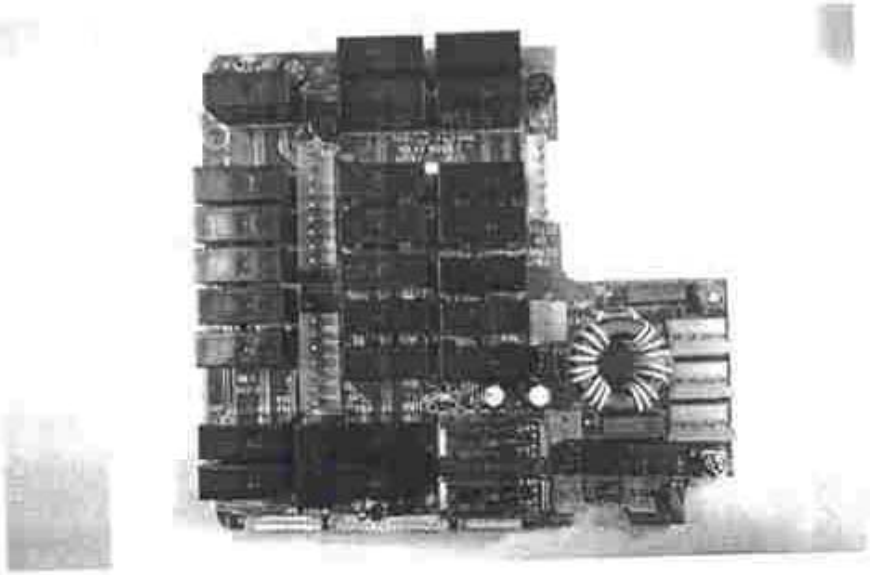
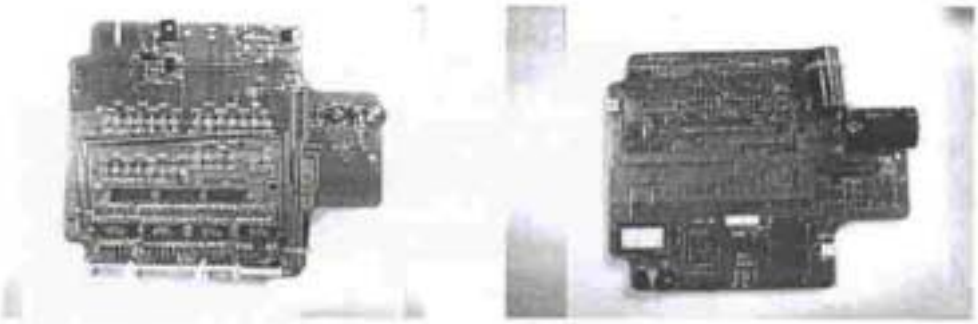


Figure 2-2-2 Relay Module CL-0438



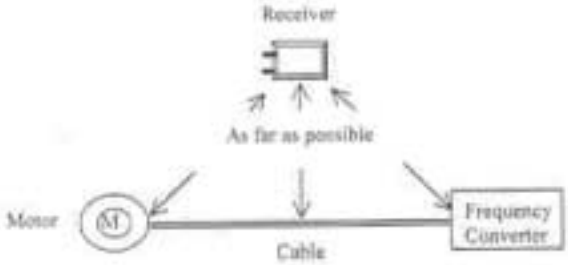
LED Board

SQ Lamp Board

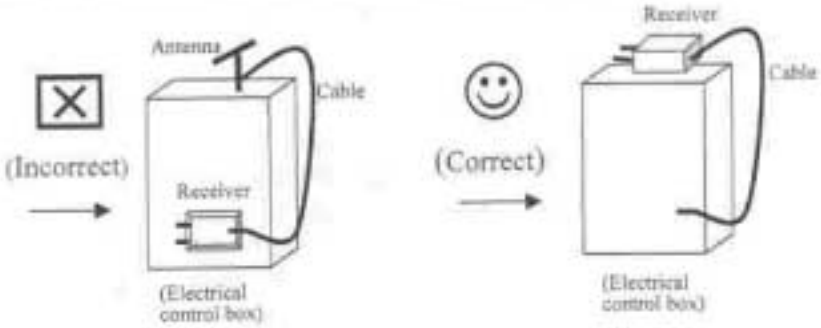
Chapter 3. Installation and Function Setting

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 48VAC, 50/60 Hz or 110VAC, 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 Control Contacts Diagram

3-3-4 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.

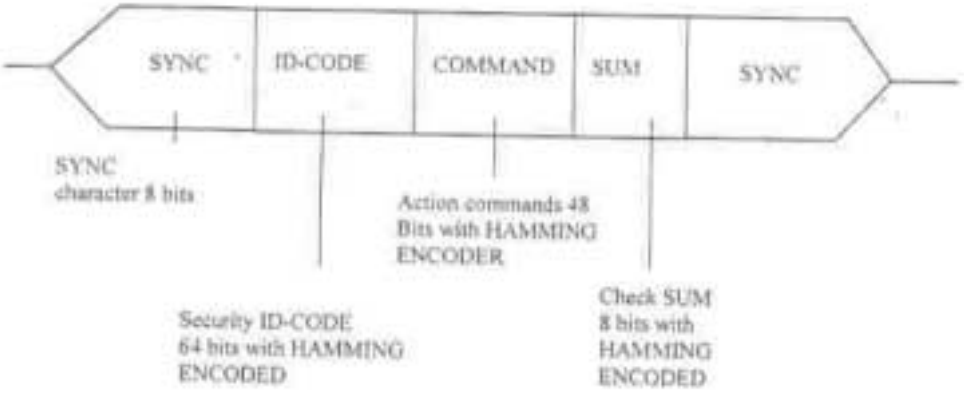
5.Use of SW8 to set the copying direction
   SW8 = OFF ⇒ Copy the function (channel) setting software from RECEIVER to TRANSMITTER.
   SW8=ON ⇒ Copy the function (channel) setting software from TRANSMITTER to RECEIVER.

3 – 5 Error detection/Error correction by software

F21 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 F21 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.