

# TABLE OF CONTENTS

	Page
1. INTRODUCTION .....	1
2. SAFETY INSTRUCTIONS .....	3
3. SYSTEM FUNCTIONS	
3.1 TRANSMITTER JOYSTICK DESCRIPTIONS .....	4
3.2 TRANSMITTER PUSHBUTTON DESCRIPTIONS .....	5
3.3 GENERAL FUNCTION DESCRIPTIONS .....	6
4. TRANSMITTER OUTLINE	
4.1 TRANSMITTER EXTERNAL DESCRIPTIONS .....	7
4.2 TRANSMITTER EXTERNAL DESCRIPTIONS .....	8
5. RECEIVER OUTLINE	
5.1 RECEIVER EXTERNAL & INTERNAL DESCRIPTIONS .....	9~11
5.2 RECEIVER MOUNTING DIMENSION .....	12
6. SYSTEM SETTINGS	
6.1 TRANSMITTER ID CODE SETTINGS .....	13
6.2 TRANSMITTER FREQUENCY CHANNEL SETTINGS .....	13
6.3 RECEIVER LCD STATUS DISPLAYS .....	14
6.4 RECEIVER ID CODE & FREQUENCY CHANNEL SETTINGS .....	15
6.5 FREQUENCY CHANNEL TABLE .....	16~17
7. RECEIVER SYSTEM STATUS DISPLAYS .....	18~19
8. RECEIVER INSTALLATION	
8.1 PREPARATION .....	20
8.2 STEP-BY-STEP INSTALLATION .....	20
8.3 SYSTEM TESTING .....	21
9. OPERATING INSTRUCTION	
9.1 POWER “ON” THE SYSTEM .....	22
9.2 DUAL HOIST/TROLLEY OPERATION .....	23
9.3 TANDEM OPERATION (DUAL-CRANE OPERATION).....	24
9.4 TRANSMITTER SYSTEM STATUS DISPLAYS .....	25
10. BATTERY CHARGING .....	26
11. SYSTEM SPECIFICATIONS .....	27~28
12. PARTS LIST .....	29

# 1. INTRODUCTION

The Twister 2X is a highly sophisticated industrial radio remote control system. The versatile features of Twister 2X permit its usage in a wide range of industrial applications. The system can be used to control all types of industrial cranes, tower cranes, building construction equipment, automatic control systems, mining equipment, and many others.

The Twister 2X incorporates numerous advanced safety features and software programming that will ensure maximum security and safety in the workplace. The major features of Twister 2X industrial radio remote control system are as follow:

- \* The system is equipped with highly evolved software that has redundant error checking and correcting capabilities to ensure 100% error-free transmission, decoding, and control of all output relays. This highly evolved software includes CRC (Cyclical Redundancy Check) and Hamming Codes (Error Recovery) programming.
- \* The encoding system utilizes advanced microprocessor control for 100% error-free data transmission. The availability of 65,536 sets of unique security ID codes + 68 distinct RF channels will ensure that only commands from a matching control transmitter can be carried out without any interference from other radio systems.
- \* The decoding system utilizes dual-microprocessor control, which will ensure 100% error-free calculating, bit checking and correcting of all incoming data.
- \* The system also utilizes an additional central microprocessor for data comparison and crosschecking between the two decoding microprocessors. When faults are detected via this central microprocessor, for maximum safety, the entire system will be shutdown immediately to avoid possibility of any accidents occurring.
- \* The system utilizes PLL synthesized RF transmission. It allows the user to select from 68 sets of frequency channels best suited for the environment. The frequency channel is selected via simple dip-switch settings inside the transmitter unit. The frequency channel for the receiver is selected via simple button setting on the receiver LCD control panel. The receiver also has the ability to auto-scan from these 68 sets of frequency channels. The receiver will search and locked on to the intended matching control transmitter.
- \* For added safety the receiver also utilizes dual Safety Relay for the receiver MAIN relay circuit. If the receiver MAIN relay is defective (example: fails to open or close during operation or not responding to a "Stop" command) a fault will be detected and the system will be shut down immediately to avoid possibility of any accidents occurring.
- \* The Twister 2X is equipped with numerous self-diagnosing functions, which include transmitter low-voltage detection/warning, faulty pushbutton/joystick detection, faulty safety MAIN relays detection, faulty relay boards detection, faulty EEPROM detection, faulty RX module detection, incorrect ID code detection, and receiver MAIN auto-deactivation when transmitter low-voltage is detected, when encountering strong radio interference, and when the transmitter/operator is out of receiving range.

## **2. SAFETY INSTRUCTIONS**

The Twister 2X system is relatively simple to use. However, it is very important to observe the proper safety procedures before, during, and after operation. When use properly the Twister 2X systems will enhance productivity and efficiency in the workplace.

### **The following instructions should be strictly followed:**

1. Make a daily check of the transmitter casing, joysticks and pushbuttons. Should it appear that anything could inhibit the proper operation of the transmitter unit, it should be immediately removed from service.
2. The transmitter voltage should be checked on a daily basis. If the voltage is low, the battery pack should be recharged or replaced (refer to page 23 for battery power status LED display).
3. The emergency stop button (EMS) should be checked at the beginning of each shift to ensure they are in the proper working order.
4. In the event of an emergency, activate the emergency stop button immediately by pressing the red EMS button down. This will immediately disconnect the transmitter power and receiver MAIN relays. Then turned the power “off” from the main power source of the equipment.
5. The transmitter power key, which is located on the right side of the transmitter box, should be turned “off” after each use and should never left the power key in “on” position when the unit is unattended.
6. Do not use the same frequency channel and ID code as any other unit in use at the same facility or within distance of 300 meters.
7. Ensure the waist belt and the shoulder strap is worn at all time during operation to avoid accidental damages to the transmitter box.
8. Never operate a crane or equipment with two (2) transmitter units at the same time with same frequency channel and ID code.

### 3. SYSTEM FUNCTIONS

#### 3.1 Transmitter Joystick Descriptions

All transmitter units are equipped with two joysticks, in single or double axis configurations. The table below illustrates the number of steps or speeds available for the Twister 2X in relation to each speed's output contact relay configuration:

TYPE	FUNCTION
1-Speed	1 speed output contact relay for both forward and reverse motion (total of 2 output relays per axis or motion)
2-Speed	Shared 2 <sup>nd</sup> speed output contact relay for each forward and reverse motion (total of 3 output relays per axis or motion)
2-Speed*	Separate 2 <sup>nd</sup> speed output contact relay for each forward and reverse motion (total of 4 output relays per axis or motion)
3-Speed	Shared 2 <sup>nd</sup> and 3 <sup>rd</sup> speed output contact relays for each forward and reverse motion (total of 4 output relays per axis or motion)
4-Speed	Shared 2 <sup>nd</sup> , 3 <sup>rd</sup> and 4 <sup>th</sup> speed output contact relays for each forward and reverse motion (total of 5 output relays per axis or motion)
5-Speed	Shared 2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> and 5 <sup>th</sup> speed output contact relays for each forward and reverse motion (total of 6 output relays per axis or motion)
0-Speed**	Addition of 0-speed (neutral position) output contact relay for connection to crane's braking system

\* Separate 2<sup>nd</sup> speed output contact relay - For travel motion that required individual output contact relay for the 2<sup>nd</sup> speed function (example: hoist motion with dual motors).

\*\* By adding a 0-speed output contact relay, when the joystick is at center or neutral position, this 0-speed relay will be energized. This feature is best suited for cranes or equipment with special breaking system.

### 3.2 Transmitter Pushbutton Descriptions

There are many different types of pushbuttons and switches available for the Twister 2X, please refer to the chart below.

TYPE	FUNCTION
1-Step Pushbutton	Pushbutton with momentary output contact relay
1-Step Electronic Toggled Pushbutton	Resets itself when the transmitter unit is turned "off" or when EMS button is activated
Mechanical Toggled Pushbutton	Maintained toggled even after transmitter unit is turned "off" or when EMS button is activated
2-Stage Mechanical Rocker Switch	0-T (refer to note 1 & 2)
2-Stage Mechanical Rocker Switch	0-R (refer to note 1)
3-Stage Mechanical Rocker Switch	T-0-T (refer to note 1 & 2)
3-Stage Mechanical Rocker Switch	R-0-T (refer to note 1 & 2)
3-Stage Mechanical Rocker Switch	T-0-R (refer to note 1 & 2)
3-Stage Mechanical Rocker Switch	R-0-R (refer to note 1)
2-Stage Mechanical Selector Switch	0-T (refer to note 1 & 2)
2-Stage Mechanical Selector Switch	0-R (refer to note 1)
3-Stage Mechanical Selector Switch	T-0-T (refer to note 1 & 2)
3-Stage Mechanical Selector Switch	T-0-R (refer to note 1 & 2)
3-Stage Mechanical Selector Switch	R-0-T (refer to note 1 & 2)
3-Stage Mechanical Selector Switch	R-0-R (refer to note 1)
"ON/OFF" 1-Step Pushbuttons	Will reset to "off" position when transmitter unit is turned "off" or after EMS reset

Note 1: 0 → Neutral position.  
 T → Maintained position (toggled contact).  
 R → Retract back to 0-position (momentary contact).

Note 2: 1-step pushbuttons, 2 & 3 stage mechanical rocker and selector switches with maintained toggled function (T) will remained energized (or closed) even when the power of the transmitter is turned off or when EMS is activated (Receiver Hold function).

### **3.3 General Function Descriptions**

#### **Emergency Stop Button (Standard Equipped)**

In case of an emergency, press down the red emergency stop button (EMS) will immediately deactivates the transmitter power and the receiver safety MAIN contact relays (refer to section 4.1 on page 7).

#### **Transmitter Power Key (Standard Equipped)**

All transmitters are equipped with two detachable power keys (one for spare) for turning the transmitter power “on” and “off” (refer to section 4.1 on page 7).

#### **START button (Standard Equipped)**

All transmitters are equipped with a START button for purpose of activating the receiver MAIN contact relay after turning on the transmitter power. After turning “on” the transmitter unit via the transmitter power key, press and hold the START button for up to a second will activate the receiver MAIN contact relay.

After resetting the EMS button, by twisting the button 1/4 turn clockwise, the operator must also press and hold the START button for up to a second to reenergize the receiver MAIN contact relay.

Also, when the system is left unattended for 5 minutes or longer (system will go into sleep mode), the operator must again press and hold the START button for up to a second to reenergize the receiver MAIN contact relay.

#### **Removable Relay Cards (Standard Equipped)**

Special designed relay cards provided easy service maintenance and as well as for simplifying the inventory of spare parts.

#### **Auto-Scanning Receiver (Standard Equipped)**

When transmitter’s frequency channel (from channel 01 ~ 20) is changed via simple dip-switch setting inside the transmitter belly box, the receiver will search and locked on to the intended matching transmitter.

#### **Tandem Feature / Dual-Crane Operation Feature (optional)**

This feature allows two operators controlling two crane systems independently or one operator controlling two crane systems simultaneously (Crane A, Crane B, Crane A+B).

#### **“Pitch And Catch” Feature (optional)**

This feature allows two operators controlling one crane system from opposite ends of a long or cross travel.

#### **Random Access Feature (optional)**

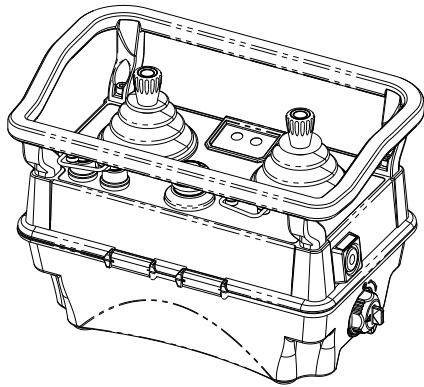
This feature allows for up to 8 operators randomly accessing up to 8 crane systems via a 16-position mechanical selector switch and operate pitch/catch function via START/PITCH button.

#### **Infrared Initial Startup Feature (optional)**

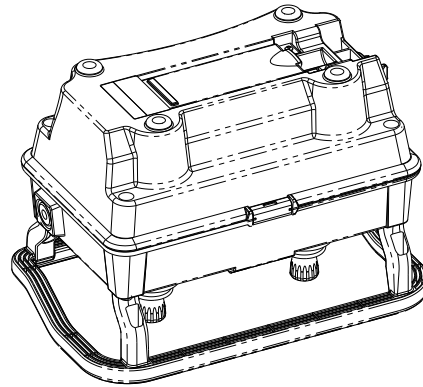
The feature allows system activation under or in close proximity to the crane or receiver via infrared transmission. After infrared initial system activation, the frequency transmission will take over.

## 4. TRANSMITTER OUTLINE

### 4.1 Transmitter External Descriptions

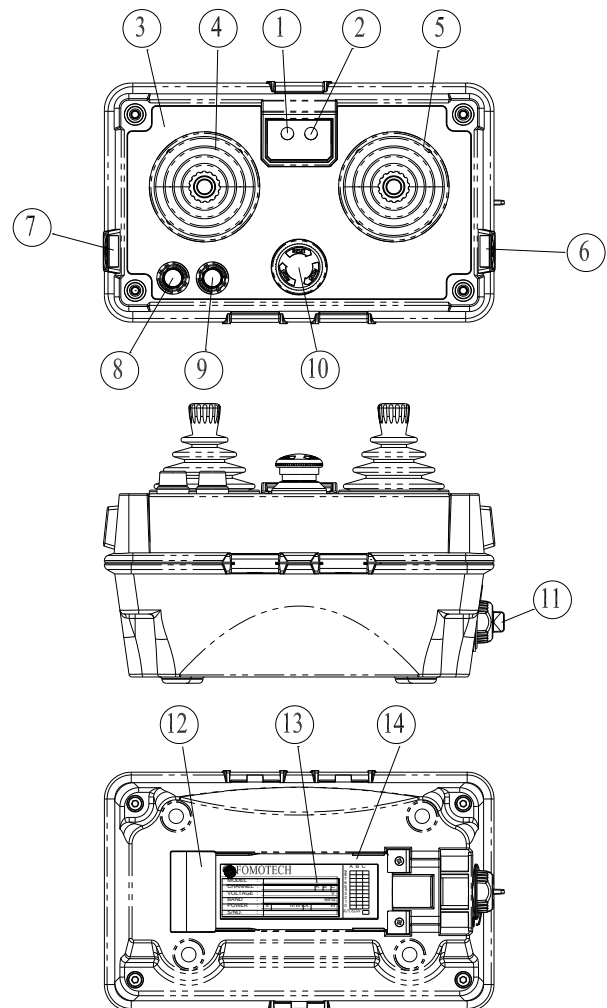


(Fig. 1) Transmitter Top View



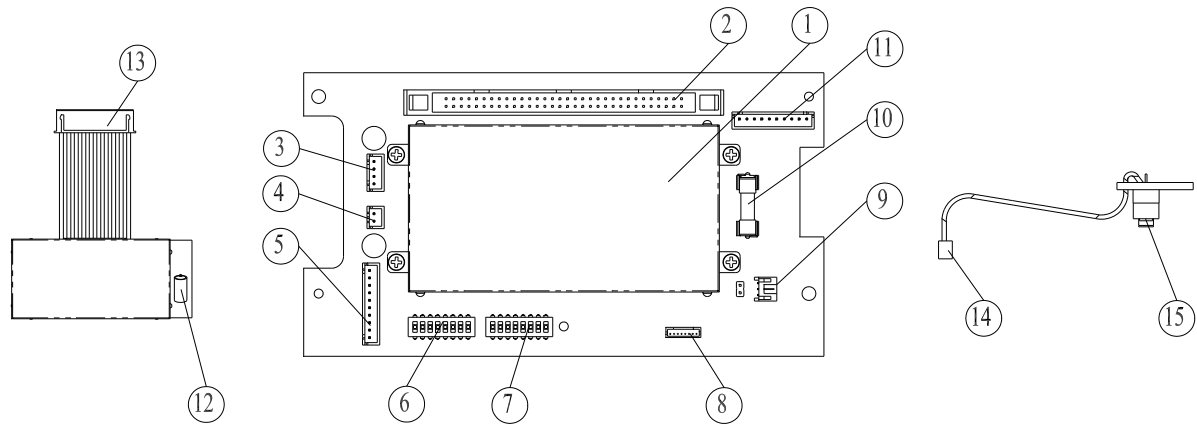
(Fig. 2) Transmitter Bottom View

1. Battery Power LED Display
2. Status LED Display
3. Information Top Plate (engraved)
4. Left Joystick
5. Right Joystick
6. START Pushbutton
7. AUX/RES Pushbutton (side panel)
8. AUX/RES Pushbutton (top panel)
9. AUX/RES Pushbutton (top panel)
10. Emergency Stop Button (EMS)
11. Power Key (detachable)
12. Battery Contact (gold-plated)
13. System Information
14. Battery slot



(Fig. 3) Transmitter Exterior Views

## 4.2 Transmitter Internal Descriptions



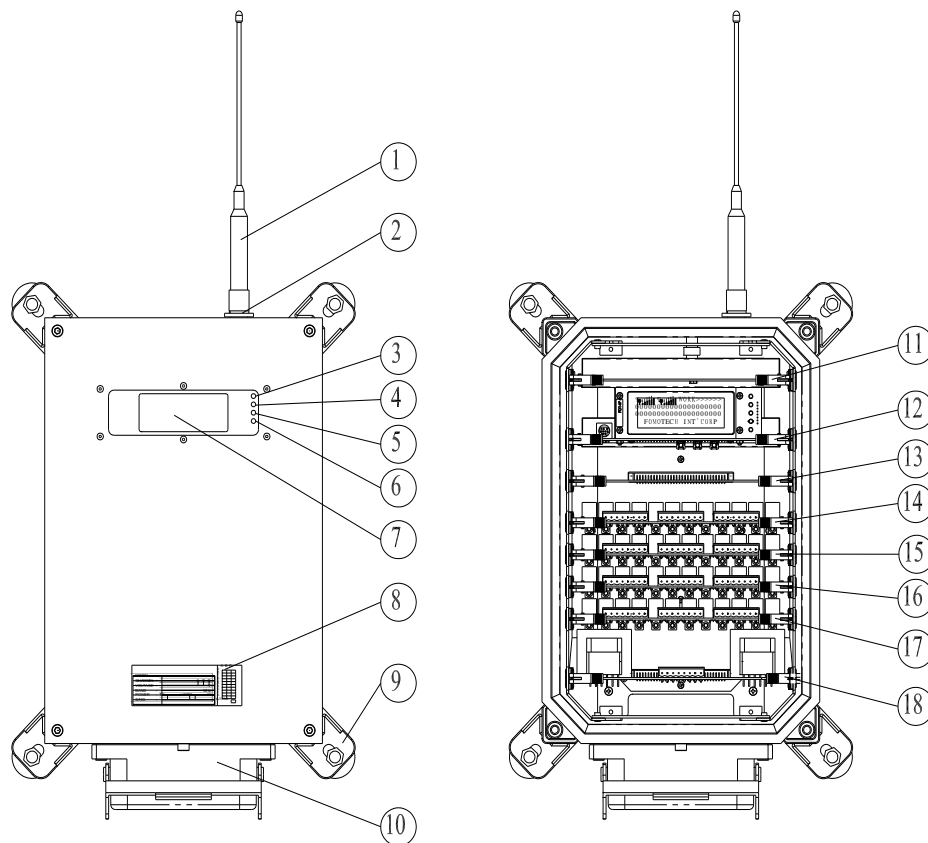
(Fig. 4) RF Module, Encoder Board and Power Switch Views

- |                                 |   |
|---------------------------------|---|
| 1. Encoder Shielding Plate      | 9. Power Key Switch Connector Port              |
| 2. Ribbon Type Connector Port   | 10. Power Fuse: 0.5A; with infrared feature 1A. |
| 3. Power Input Connector Port   | 11. Infrared Startup Interface Port             |
| 4. Charger Connector Port       | 12. Antenna Port                                |
| 5. TX Module Connector Port     | 13. TX module Connector                         |
| 6. ID Code Dip-Switch           | 14. Power Key Switch Connector                  |
| 7. Frequency Channel Dip-Switch | 15. Power Key Switch                            |
| 8. External Programming Port    |   |



## 5. RECEIVER OUTLINE

### 5.1 Receiver External and Internal Descriptions

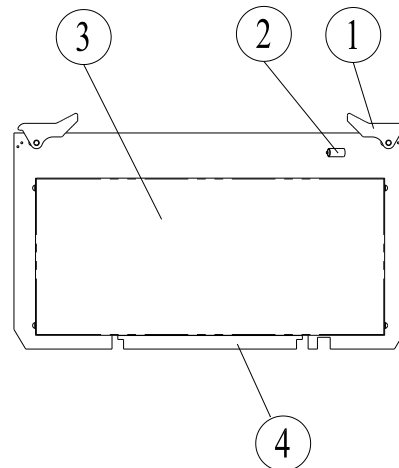


(Fig. 5) Receiver External and Internal View

- |                                       |  |
|---------------------------------------|--|
| 1. Antenna                            | 10. Multi-Pin Cable Connector (optional) |
| 2. Antenna Port                       | 11. RX Module Card                       |
| 3. AC Power Display                   | 12. Decoder Card                         |
| 4. SQ-1 Display (for RX-1)            | 13. Reserved Relay Card Slot             |
| 5. SQ-2 Display (for RX-2 / optional) | 14. Relay Card #1                        |
| 6. Central CPU Status Display         | 15. Relay Card # 2                       |
| 7. System LCD Display                 | 16. Relay Card # 3                       |
| 8. System Information Plate           | 17. Relay Card # 4                       |
| 9. Mounting Bracket + Shock Absorber  | 18. Power Supply Card                    |

## RX Module Card

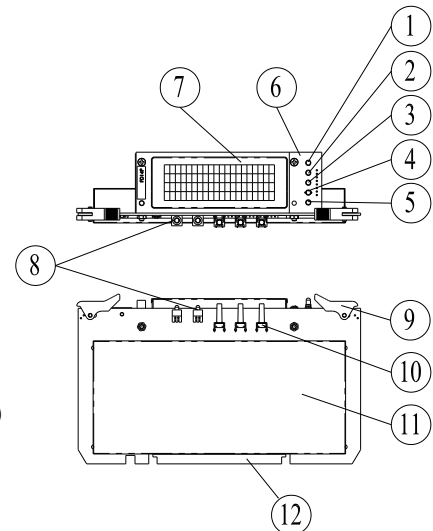
1. RX Module Card Release Clip
2. RX-1 Antenna Port
3. RX module Shielding Plate
4. RX Module Card-to-Motherboard Connector



(Fig. 6) Receiver RX Module Card

## Decoder Card

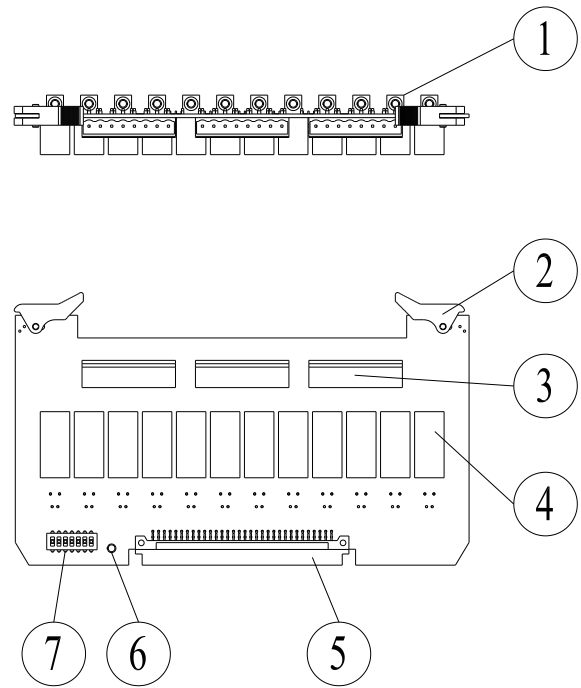
1. Power Display (LED #1)
2. SQ-1 Display (LED #2)
3. SQ-2 Display (LED #3)
4. Central CPU Status Display (LED #4)
5. Reserved Function Display (LED #5)
6. LED Display Panel
7. LCD Screen
8. Dual Decoding CPU Status Display (LED #6 and LED #7)
9. Decoder Card Release Clip
10. Function Settings Buttons
11. Decoder Shielding Plate
12. Decoder Card-to-Motherboard Connector



(Fig. 7) Receiver Decoder Card

## Output Relay Card

1. Relay LED Display
2. Relay Card Release Clip
3. Relay Output Contact Connector Port
4. Contact Relays
5. Relay Card-to-Motherboard Connector
6. Relay Power LED Display
7. Relay Card Position/Address Dip-Switch (see note below).



(Fig. 8) Receiver Output Relay Card

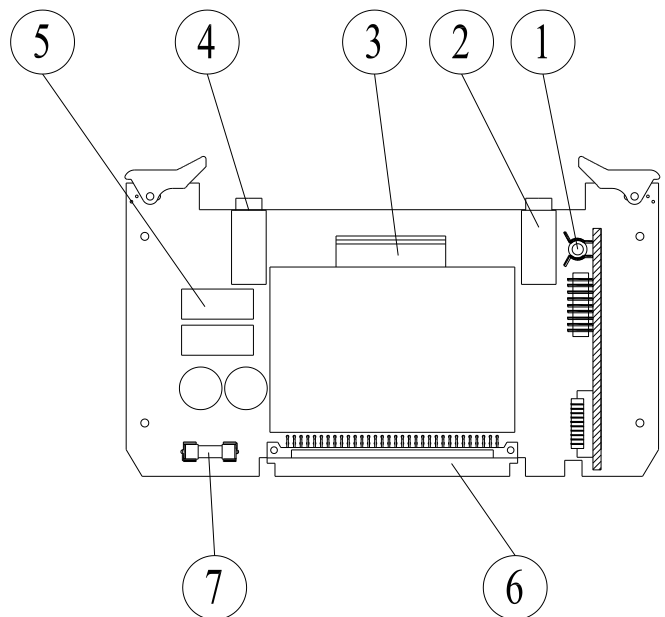
Note: The relay card position (address) dip-switch must be adjusted according to the wiring diagram sheet located on the last page of this manual and on the backside of the receiver cover plate.

Relay Card Position 1 → Address: 0000000  
 Relay Card Position 2 → Address: 0000001  
 Relay Card Position 3 → Address: 0000010

Relay Card Position 4 → Address: 0000011  
 Relay Card Position 5 → Address: 0000100

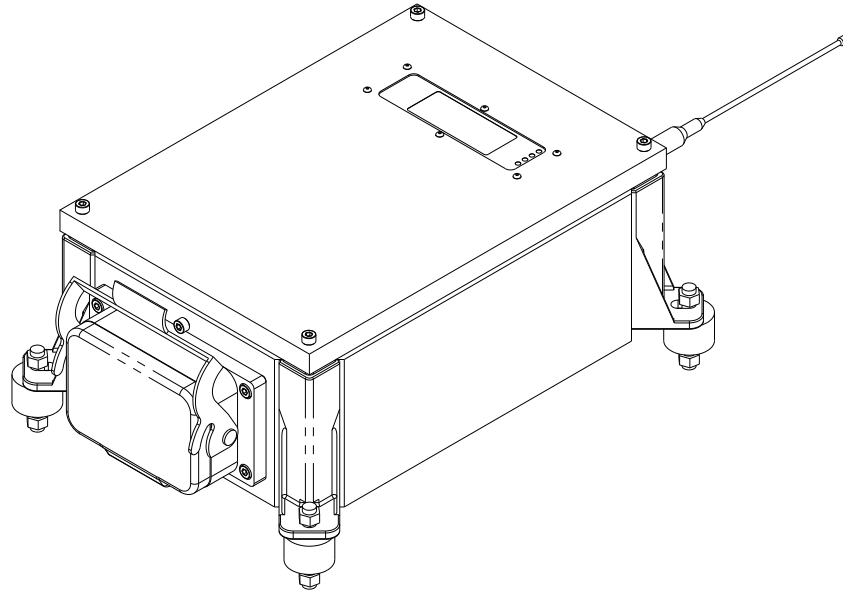
## Power Supply Card

1. Power AC Fuse #1 (2.0A)
2. Power AC Fuse #2 (2.0A)
3. VAC Input / VDC Output Connector
4. MAIN Contact Relay Fuse (3.0A)
5. Dual MAIN Contact Relays
6. Power Supply Card-to-Motherboard Connector
7. VDC Fuse

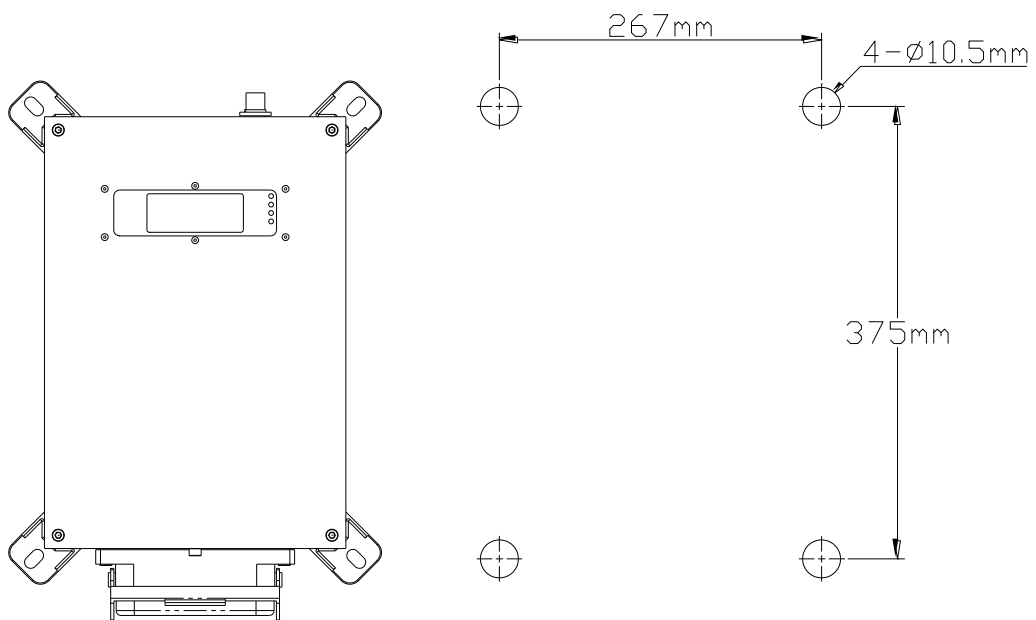


(Fig. 9) Receiver Power Supply Card

## 4.2 Receiver Mounting Dimension



(Fig. 10) Receiver Exterior View



(Fig. 11) Receiver Mounting Dimension

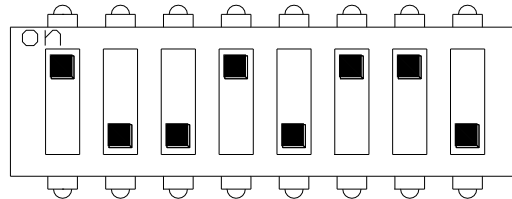
## 6. SYSTEM SETTINGS

### 6.1 Transmitter ID Code Settings

Transmitter ID code are set via an 8-position dip-switch located on the encoder board (refer to fig. 4 on page 8). For receiver ID code settings please refer to section 6.3 & 6.4.

Example: ID code → 10010110

Top location : “1”  
Bottom location : “0”

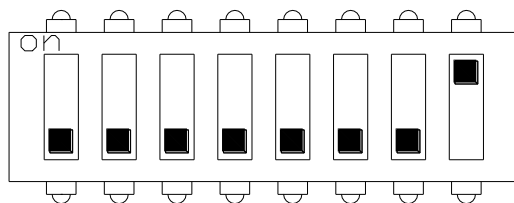


Note: When transmitter ID code is altered please also make sure to readjust the receiver ID code accordingly. System will not operate if the ID code on both the transmitter and receiver are different.

### 6.2 Transmitter Frequency Channel Settings

The transmitter frequency channel is also set via an 8-position dip-switch located on the encoder board (refer to fig. 4 on page 8). For receiver frequency channel settings please refer to section 6.3 & 6.4.

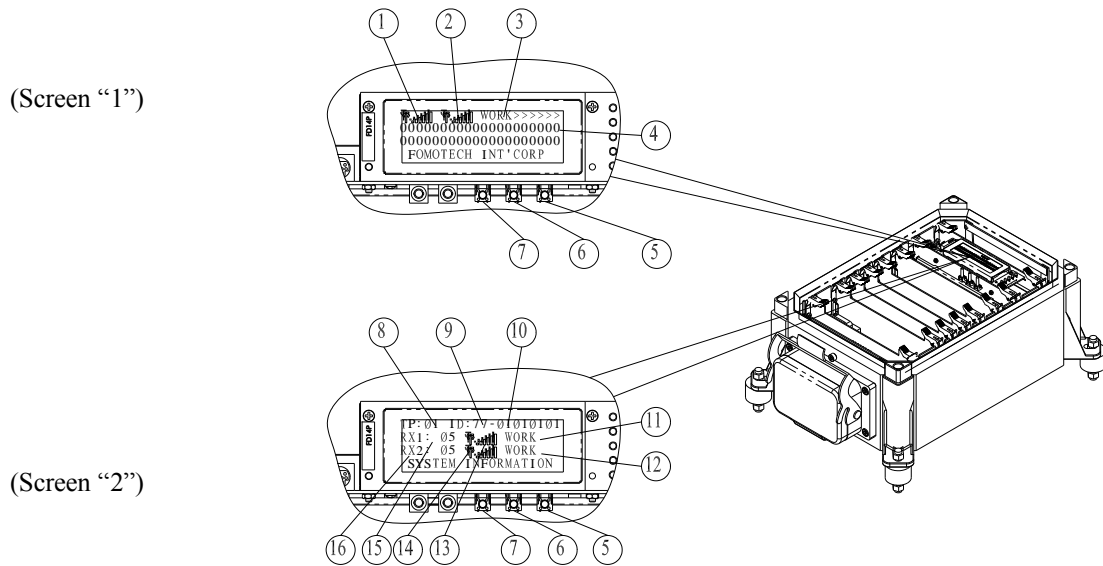
For the below dip-switch with 00000001 setting, the RF channel is “01”, which also represents frequency “433.075MHz” (refer to frequency channel table on page 16).



Top location : “1”                      Bottom location : “0”

Note: When the frequency channel of the transmitter is altered please also make sure to readjust the receiver frequency channel accordingly. System will not operate if the frequency channel on both the transmitter and receiver are different.

## 6.3 Receiver LCD Status Displays



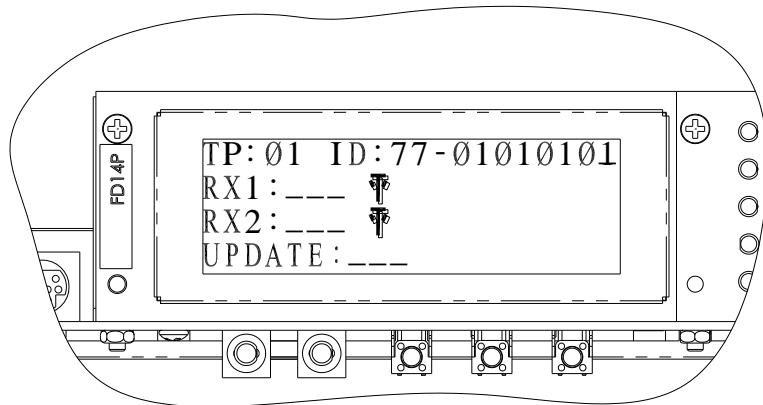
(Fig. 12) Receiver LCD Screen

- |  |                                       |
|--|---------------------------------------|
| 1. RX-1 Signal Strength  | 9. ID Code-1 (regional code)          |
| 2. RX-2 Signal Strength (optional)                                   | 10. ID Code-2 (system ID code)        |
| 3. System at Work  | 11. Decoder System-1                  |
| 4. Contact Relay Activation Display<br>"0"→ relay OFF; "1"→ relay ON | 12. Decoder System-2                  |
| 5. EXIT/DOWN (-) Button (PS1)  | 13. RX-1 Signal Strength              |
| 6. EDIT/UP (+) Button (PS2)  | 14. RX-2 Signal Strength (optional)   |
| 7. MODE/ENTER Button (PS3)   | 15. RX-1 Frequency Channel            |
| 8. System Type   | 16. RX-2 Frequency Channel (optional) |

## 6.4 Receiver ID Code & Frequency Channel Settings

Unlike the dip-switch setting on the transmitter, the receiver ID code and frequency channel can be easily adjusted via the LCD control panel on the receiver unit. Please follow the step-by-step instructions illustrated below on how to change receiver ID code and frequency channel.

(Screen “3”)



- 1) To enter into screen “2”, press MODE/ENTER button one time.
- 2) To enter into Screen “3”, press EDIT/UP (+) button for up to 5 seconds.
- 3) TP (System type) and Country code cannot be changed (manufacture preset).
- 4) Press EXIT/DOWN (-) button and EDIT/UP (+) buttons to change the ID code.
- 5) Press MODE/ENTER button to proceed to the RX-1 setting column.
- 6) Press EXIT/DOWN (-) button and EDIT/UP (+) button to change frequency channel of RX-1.
- 7) Press MODE/ENTER button to proceed to RX-2 setting column.
- 8) Press EXIT/DOWN (-) button and EDIT/UP (+) button to change frequency channel of RX-2.
- 9) Press MODE/ENTER button to proceed to the UPDATE setting column.
- 10) Press EDIT/UP (+) button to input “YES” as to save changes.
- 11) Press EXIT/DOWN (-) button to input “NO” as to cancel changes.
- 12) Press MODE/ENTER button to exit screen “3”.

Note A: If new values are not inputted within 25 seconds, the system will exit the setup screen (screen “3”) and returned to screen “1”.

Note B: If your system is not equipped with dual RX module, please skip step 7 through 8 described above.

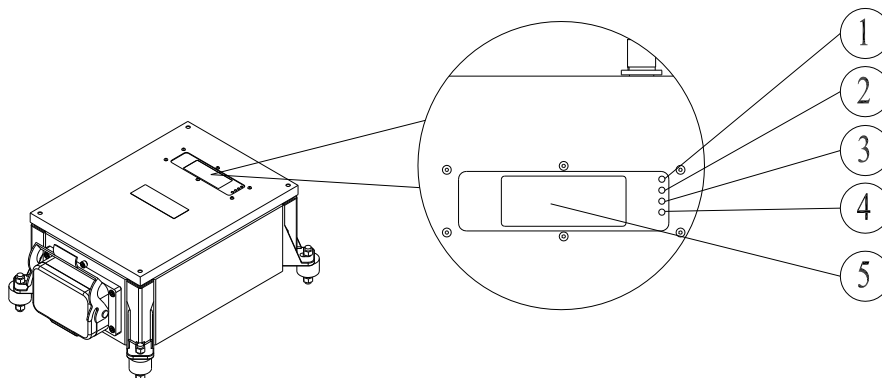
## 6.5 Frequency Channel Table

FREQUENCY	DIP-SWITCH SETTING	CHANNEL
433.075 MHz	00000001	01
433.100 MHz	00000010	02
433.125 MHz	00000011	03
433.150 MHz	00000100	04
433.175 MHz	00000101	05
433.200 MHz	00000110	06
433.225 MHz	00000111	07
433.250 MHz	00001000	08
433.275 MHz	00001001	09
433.300 MHz	00001010	10
433.825 MHz	00001011	11
433.850 MHz	00001100	12
433.875 MHz	00001101	13
433.900 MHz	00001110	14
433.925 MHz	00001111	15
433.950 MHz	00010000	16
433.975 MHz	00010001	17
434.000 MHz	00010010	18
434.025 MHz	00010011	19
434.050 MHz	00010100	20
434.075 MHz	00010101	21
434.100 MHz	00010110	22
434.125 MHz	00010111	23
434.150 MHz	00011000	24
434.175 MHz	00011001	25
434.200 MHz	00011010	26
434.225 MHz	00011011	27
434.250 MHz	00011100	28
434.275 MHz	00011101	29
434.300 MHz	00011110	30
434.325 MHz	00011111	31
434.350 MHz	00100000	32
434.375 MHz	00100001	33



<b>FREQUENCY</b>	<b>DIP-SWITCH SETTING</b>	<b>CHANNEL</b>
434.400 MHz	00100010	34
434.425 MHz	00100011	35
434.450 MHz	00100100	36
434.475 MHz	00100101	37
434.500 MHz	00100110	38
434.525 MHz	00100111	39
434.550 MHz	00101000	40
434.575 MHz	00101001	41
434.600 MHz	00101010	42
434.625 MHz	00101011	43
434.650 MHz	00101100	44
434.675 MHz	00101101	45
434.700 MHz	00101110	46
434.725 MHz	00101111	47
434.750 MHz	00110000	48
434.775 MHz	00110001	49
433.325 MHz	00110010	50
433.350 MHz	00110011	51
433.375 MHz	00110100	52
433.400 MHz	00110101	53
433.425 MHz	00110110	54
433.450 MHz	00110111	55
433.475 MHz	00111000	56
433.500 MHz	00111001	57
433.525 MHz	00111010	58
433.550 MHz	00111011	59
433.575 MHz	00111100	60
433.600 MHz	00111101	61
433.625 MHz	00111110	62
433.650 MHz	00111111	63
433.675 MHz	01000000	64
433.700 MHz	01000001	65
433.725 MHz	01000010	66
433.750 MHz	01000011	67
433.775 MHz	01000100	68

## 7. RECEIVER STATUS LED DISPLAYS



(Fig 13) Receiver Status LED Display

- |                               |                                   |
|-------------------------------|-----------------------------------|
| 1. Receiver Power Display     | 4. Central CPU Status Display     |
| 2. SQ-1 (RX-1) Status Display | 5. LCD System Information Display |
| 3. SQ-2 (RX-2) Status Display |                                   |

### Receiver Power Display

Should be lighted at all time when the system is turned on, if not, please check the input power source.

### SQ-1 and SQ-2 Status Displays

Lights “on” → Transmitted signals detected and received.

Lights “off” → No transmitted signals detected.

Blinking lights when transmitter is turned “off” → Other radio interference.

### Dual Decoding CPU Status Display (refer to Fig. 7 on page 10)

Lights “on” 0.1 second and “off” 1.0 second → Decoders on Standby.

Lights “on” 0.1 second and “off” 0.1 second → Decoding in Process.

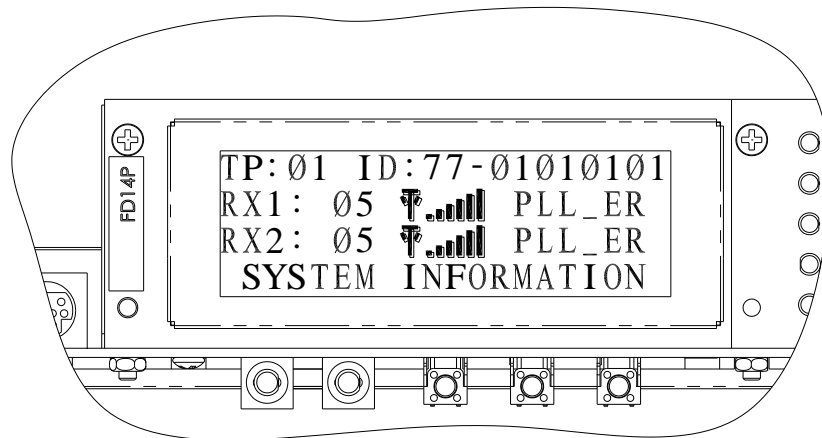
### Receiver Central CPU Status LED Display

LED INDICATION	REASON
Slow Blinks (Green)	Standby
Fast Blinks (Green)	Transmitted signals received
Fast Blinks (Red)	MAIN contact relays jammed or defective
3 Fast Blinks (Red)	RX module defective
4 Fast Blinks (Red)	EEPROM error
5 Fast Blinks (Red)	Incorrect transmitted ID code
6 Fast Blinks (Red)	Incorrect system type

### Receiver Central CPU Status LCD Display

Some of the system status indications described on page 17 are also displayed on the receiver LCD screen for easy readout (screen “2”).

- |            |   |   |
|------------|---|---|
| 1) ID_ER   | → | Incorrect transmitted ID code             |
| 2) MAIN_ER | → | Defective MAIN contact relay or relays    |
| 3) PLL_ER  | → | Defective RX module                       |
| 4) WORK    | → | Transmitted signals received and decoded  |
| 5) SEARCH  | → | System on standby                         |
| 6) SCAN    | → | System scanning for new frequency channel |



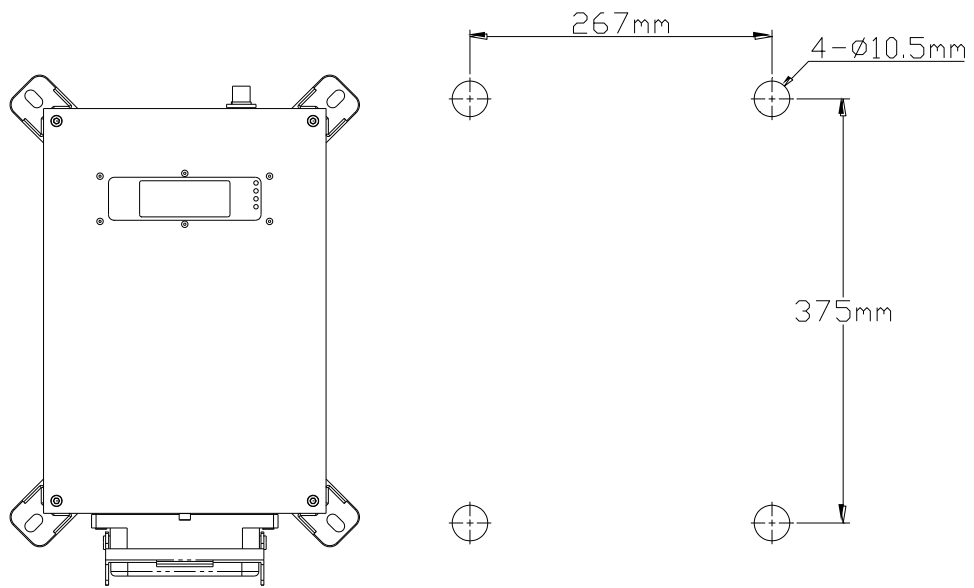
## **8. RECEIVER INSTALLATION**

### **8.1 Preparation**

1. Required Tools:
  - 1) Flat Head Screwdriver (-)
  - 2) Phillips Head Screwdriver (+)
  - 3) Multi-Meters
  - 4) 14 mm Wrench X 2
  - 5) Power Drill with 10.5 ~ 11mm Drill-Bit
  - 6) Output Cables
2. Ensure receiver is not set to the same frequency channel and ID code as any other units in use at the same facility or within distance of 300 meters.
3. Prior to installation, make sure that the crane system itself is working properly.
4. Use the multi-meter to check the voltage source available and ensure receiver voltage setting is correct for this voltage.
5. Prior to installation, switch off the main power source to the equipment.

### **8.2 Steps-By-Steps Installation**

1. Select a suitable location to mount the receiver.
2. As much as possible, the location selected should have the antenna visible from all areas where the transmitter is to be used.
3. The location selected should not be exposed to high levels of electrical noise.
4. Ensure the selected location has adequate space to accommodate the receiver enclosure.
5. The distance between the antenna and the control panel should be as far apart as possible.
6. Drill four holes on the control panel (10.5mm).
7. Tightened all screws provided.
8. For system wiring, please refer to the wiring diagram located on the last page of this manual and on the backside of the receiver cover plate.
9. Ensure all wiring is correct and safely secured and all screws are fastened.



(Fig. 16)

### 8.3 System Testing

1. Connect the power source to the receiver and test the operation of each function to ensure it operates in the same manner as the pendant controller.
2. Ensure the MAIN contact relay can be properly controlled by the remote control.
3. Ensure the limit switches on the crane that limit all travels are working properly.
4. Ensure the pendant controller is located in a safe location where it would not interfere with remote operation.

## 9. OPERATING INSTRUCTION

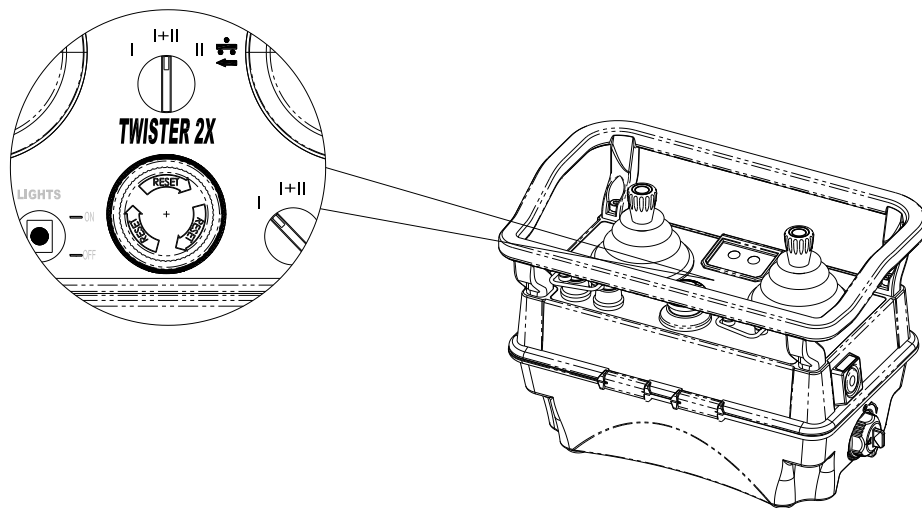
### 9.1 Power “ON” the System

1. Insert the transmitter power key into the key-switch slot located on the right side of the transmitter belly box.
2. Push the transmitter power key inward and then rotate it clockwise to “1” position.  
“1” → “ON”                      “0” → “OFF”
3. Make sure both joysticks are in their neutral (0-speed) position when transmitter power is turned “on”. If the transmitter is turned “on” with the joystick in a non-neutral position, the transmitter will be temporarily disabled to avoid any unexpected crane movement at system startup. If this situation occurs, just turn the transmitter power key “off” and then back “on” again with joystick in neutral position.
4. Make sure that the red emergency stop button (EMS) is elevated before the transmitter power is turned on.
5. To activate the receiver MAIN relay, press and hold the “START” pushbutton for up to 1.0 second. The START pushbutton is located on the right side of the belly box, above the transmitter power key switch.
6. After receiver MAIN relay activation (relay closed), if the operator did not give any command by pressing any pushbuttons or moving the joysticks to a non-neutral position, after 5 minutes of inactivity, the transmitter unit will go into “sleep mode” with receiver MAIN relay temporarily deactivated (relay opened). To resume operation after 5 minutes of inactivity, just press and hold the “START” pushbutton again to reactivate the system.
7. After 1 hour of inactivity, the transmitter power will be temporarily deactivated to save power.
8. If the frequency channel of the transmitter unit is altered via simple dip-switch setting inside the transmitter (refer to page 13), you must then also change the frequency RF channel in the receiver (refer to page 15~16). Since the receiver is equipped with frequency channel auto-scanning feature, after changing the frequency channel in the transmitter, you must then press and hold the START pushbutton for up to 20 seconds after turning “on” the transmitter power in order for the auto-scanning receiver to identify the newly selected channel.

## 9.2 Dual Hoist/Trolley Operation

For system with dual hoist/trolley operation, use the 3-stage mechanical selector switch located between the two joysticks (refer to diagram below) to select which hoist and/or trolley to operate. At position “I”, the main hoist and/or trolley are activated. At position “II”, the auxiliary hoist and/or trolley are activated. At position “I+II”, both main and auxiliary hoists and/or trolleys are activated with simultaneous travel movement.

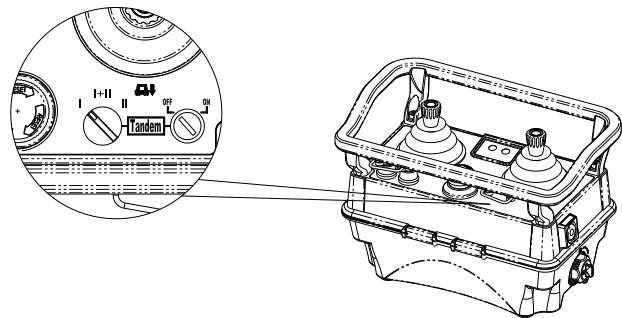
During system wiring, make sure to connect the Select-I output to the main hoist and/or trolley and Select-II output to auxiliary hoist and/or trolley. When the selector switch is at position “I”, Select-I contact relay will close. At position “II”, Select-II contact relay will close. At position “I+II”, both Select-I and Select-II contact relay will close. For system wiring, please refer to the system wiring schematic located on the last page of this manual or on the inner side of the receiver cover.



### 9.3 Tandem Operation (Dual-Crane Operation)

Each Tandem system is equipped with two transmitters and two receivers for dual-crane operation. Both transmitters are designed to be able to control both cranes either independently or simultaneously, that is, both master transmitters. In order for a transmitter to be able to control both cranes simultaneously, a special Tandem Key is provided and must be inserted and turned to on position. To avoid both transmitters operating both cranes at the same time, only one set of Tandem key is provided per two transmitters. Only the transmitter with the Tandem key is allowed to operate both cranes at the same time (Crane A, B, A+B operation). Please see below for Tandem Mode general operating procedures.

1. When Tandem key is not inserted and turned to “on” position, both cranes can be controlled independently by the two transmitters; that is, with transmitter-A controlling crane-A and transmitter-B controlling crane-B. If transmitter-A wants to control both cranes at the same time (dual-crane operation), then transmitter-B would have to first turn its transmitter power off, which releases its control of crane-B completely, then with transmitter-A inserting the Tandem key, turn to “on” position and press START pushbutton for up to 1.0 second. This procedure will allow transmitter-A to take over both crane-A and crane-B at the same time. Or vice versa, if transmitter-B wants to control both cranes at the same time, just follow the same procedure described above for transmitter-A.

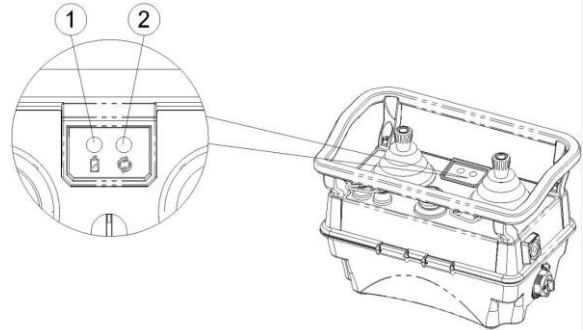


2. Once you are in the Tandem mode, that is, with Tandem key inserted and turned to “on” position, to choose which crane to operate (independently or simultaneously), use the Tandem Selector Switch located to the left of the Tandem key slot (refer to the diagram above). The Tandem selector switch is ineffective if the Tandem key is not inserted and turned to “on” position.
3. When transmitter-A is controlling both cranes (Tandem key inserted and turned to “on” position) at the same time, transmitter-B will be blocked from accessing any cranes; this is to prevent any radio interference by the two transmitters. In order for transmitter-B to gain access to any crane, transmitter-A must first release its command of both cranes by turning the transmitter power off. Then have transmitter-B press and hold the START pushbutton for up to 1.0 second; this will allow transmitter-B to gain access of crane-B.
4. Always take the Tandem key out of the transmitter when not using dual-crane operation



## 9.4 Transmitter System Status Displays

1. Battery Power LED Display
2. Transmitter Status LED Display



### Transmitter Battery Power LED Display

POWER DISPLAY	REASON
Constant Green	Battery level normal
Slow Blinking Red	Low battery power (1 <sup>st</sup> warning)
Fast Blinking Red	Low battery power (2 <sup>nd</sup> warning) Transmitter unit will stop transmitting at anytime
Constant Red	Low battery power (3 <sup>rd</sup> warning) Transmitter power and receiver MAIN relay deactivated

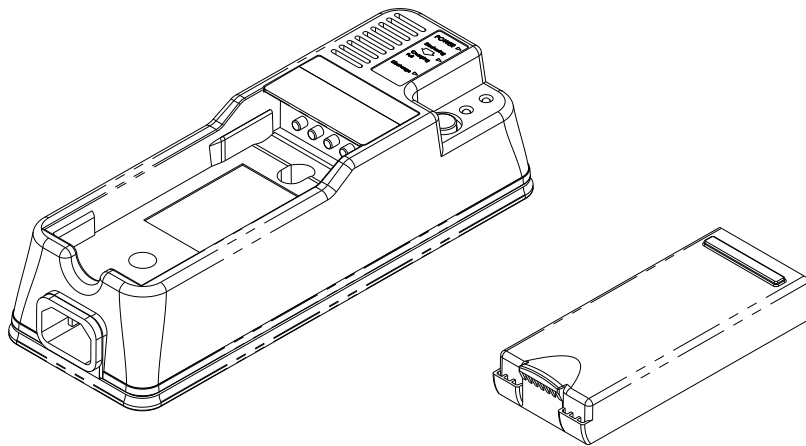
### Transmitter Status LED Display

STATUS DISPLAY	REASON
No Light Displayed	Transmitter in sleep mode with receiver MAIN relay deactivated
Slow Blinks (Green)	Transmitter on standby
Fast Blinks (Green)	Transmitter active
Constant Red Light	Jammed or defective pushbutton, switch or joystick contacts
Fast Blinks (Red)	The contact point currently in use is operative (refer to note A)
3 Fast Blinks (Red)	PLL TX module defective
4 Fast Blinks (Red)	EEPROM error

**Note A:** When there is a defective or jammed pushbutton, switch or joystick contacts, the transmitter status LED will display a constant red light without flashes. To find out which contact is defective or jammed, activate each pushbuttons, switches or joysticks a step at a time by holding at each position for up to 2 seconds. If a flashing red light (blinks rapidly) is displayed at a specific position, it means that the contact point for that particular position is operative. If the lights remained constantly red at a certain position, then it means that this position's contact is either jammed or defective. The main purpose of function is to let the user realize which contact on the transmitter is not working properly and required service immediately.

## 10. BATTERY CHARGING

1. Plug in the power cord and the power indicator will light up.
2. When a battery pack is inserted, the constant orange charging light will appear and then change to constant red to indicate charging is taking place at the current moment.
3. The charging time for a 2000mAh NiMH battery pack is approximately 3~6 hours.
4. When charging is completed, a constant green light will appear to indicate that the battery pack is fully charged. (The battery pack temperature will be slightly higher.)
5. When the battery pack is at 90% charged state, trickle charging will take over to ensure the longevity of the battery pack and as well as to ensure the battery pack is 100% charged.
6. When the battery pack's temperature exceeds 50°C, the charger will go into protective mode and charging will be discontinued.



# 11. SYSTEM SPECIFICATION

## Transmitter Unit

Frequency Range	:	PLL 433 ~ 434 MHz
Transmitting Range:	:	100 Meters
Continuous Operating Time	:	25+ Hours (2000mAh)
Charging Current	:	approx. 400mA
Security ID Code	:	65,536 sets (16 + 1 bit)
Channel Spacing	:	25KHz
Hamming Distance	:	$\geq 6$
Frequency Control	:	Synthesizer (PLL)
Frequency Drift	:	$< 3\text{ppm @ } -10^{\circ}\text{C} \sim 70^{\circ}\text{C}$
Frequency Deviation	:	$< 1\text{ppm @ } 25^{\circ}\text{C}$
Spurious Emission	:	$> 60\text{dBc}$
Transmitting Power	:	1.0mW
Emission	:	F1D
Antenna Impedance	:	50 ohms
Enclosure Rating	:	IP-66
Source Voltage	:	7.2 V (2000mAh)
Current Drain	:	$\sim 80\text{mA}$
Operating Temperature	:	$-10^{\circ}\text{C} \sim 70^{\circ}\text{C}$
Dimension	:	247mm X 154mm X 182mm
Weight	:	1,600g (with 2000mA battery pack)

## Receiver Unit

Frequency Range	:	PLL 433 ~ 434 MHz
Channel Spacing	:	25KHz
Hamming Distance	:	$\geq 6$
Frequency Control	:	Synthesizer (PLL)
Frequency Drift	:	$< 3\text{ppm @ } -10^{\circ}\text{C} \sim 70^{\circ}\text{C}$
Frequency Deviation	:	1ppm @ 25°C
Sensitivity	:	-125dBm
Decoding Reference	:	FSK
Antenna Impedance	:	50 ohms
Data Decoder Reference	:	Quartz Crystals
Responding Time	:	100mS ~ 300mS
Enclosure Rating	:	IP-66
Source Voltage	:	100 ~ 240VAC @ 50/60 Hz. (standard equipped)
Power Consumption	:	36VA
Operating Temperature	:	$-10^{\circ}\text{C} \sim 70^{\circ}\text{C}$
Output Contact Rating	:	250V @ 10A
Output MAIN Relay Rating	:	250V @ 5A
Dimension	:	417mm X 309mm X 167mm
Weight	:	8,800g (without the output cable)

## 12. PARTS LIST

1. TX module	TX5000
2. RX module card	RX5000
3. Encoder board	EN5000
4. Decoder card	DE5000
5. Relay card	RY5000
6. Power supply card (100 ~ 240VAC)	PS5000
Power supply card (48VAC)	PS5001
Power supply card (24VDC)	PS5002
Power supply card (380VAC)	PS5003
Power supply card (400 ~ 420VAC)	PS5004
7. Single axis joystick unit (complete)	
2 speeds / steps	JOY-12
3 speeds / steps	JOY-13
4 speeds / steps	JOY-14
5 speeds / steps	JOY-15
8. Double axis joystick unit (complete)	
2 speeds / steps	JOY-22
3 speeds / steps	JOY-23
4 speeds / steps	JOY-24
5 speeds / steps	JOY-25
9. 1-step pushbutton (side panel)	PB-1S
10. 1-step pushbutton (top panel)	PB-1T
11. 2-stage selector switch	SW-2T
12. 3-stage selector switch	SW-3T
13. 2-stage toggle switch	TW-2T
14. 3-stage toggle switch	TW-3T
15. Emergency stop button	EM5000
16. Transmitter casing (complete)	TC5000
18. Transmitter protective guardrail	PG5000
19. Transmitter power key	PW5000
20. 2000mA NiMH battery pack	BAT2000
21. Receiver antenna (433 MHz ~ 434 MHz)	ANT433
22. Receiver enclosure (complete)	RC5000
23. Intelligent charger (please specify voltage)	CH5000
24. Waist Belt	WB5000
25. Shoulder Strap	SS5000