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# 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 + 20 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 20 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 20 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)**

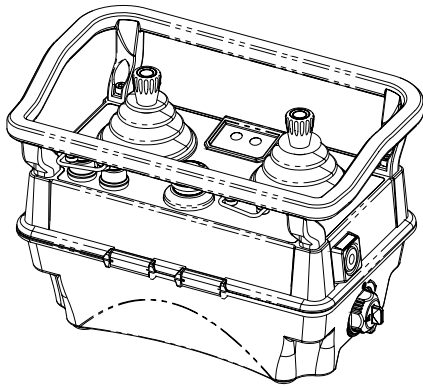
This feature allows for up to 8 operators randomly accessing up to 8 crane systems via a 16-position mechanical selector switch and operate pitch/catch function via START/PITCH button.

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

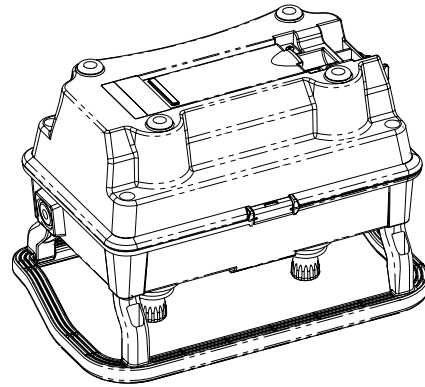
The feature allows system activation under or in close proximity to the crane or receiver via infrared transmission. After infrared initial system activation, the frequency transmission will take over.

## 4. TRANSMITTER OUTLINE

### 4.1 Transmitter External Descriptions

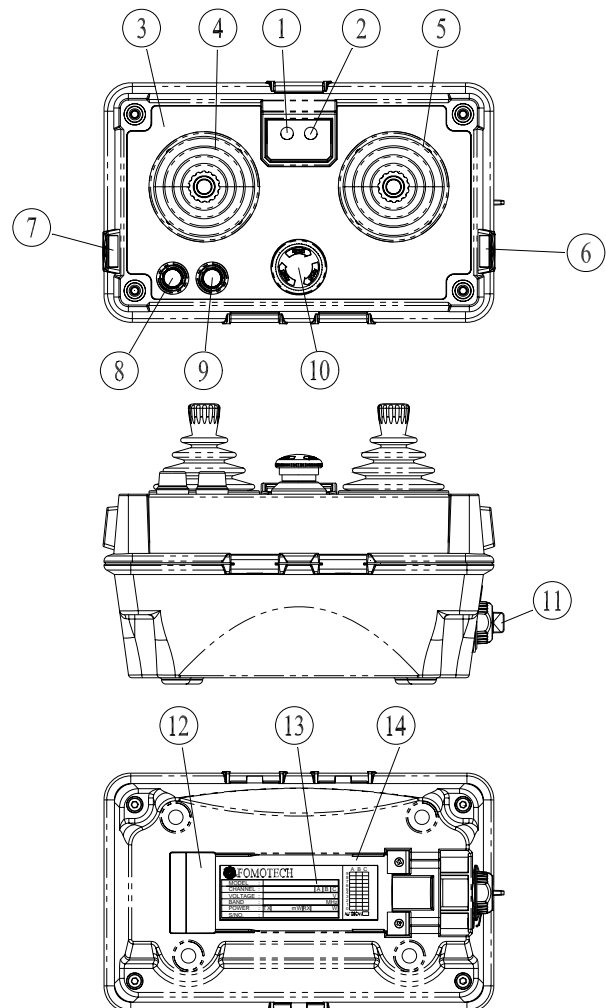


(Fig. 1) Transmitter Top View



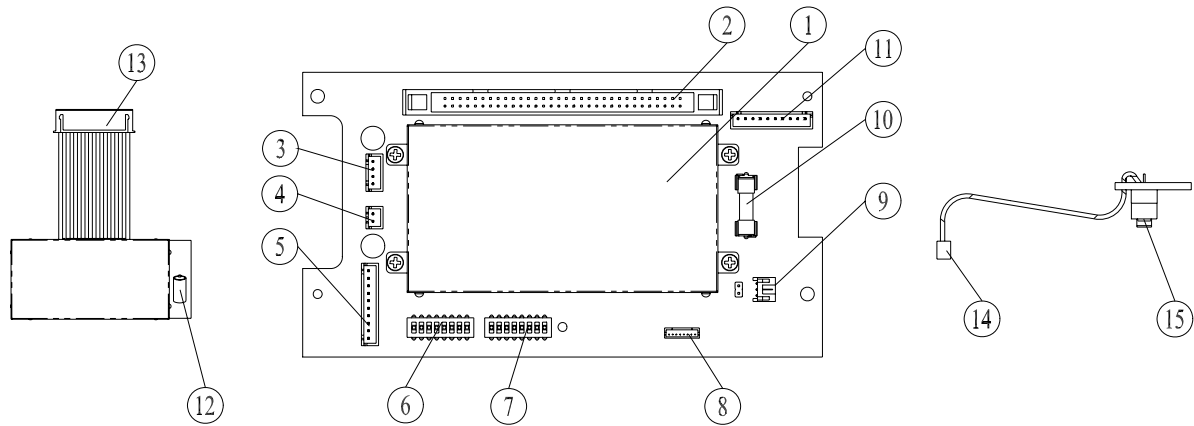
(Fig. 2) Transmitter Bottom View

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



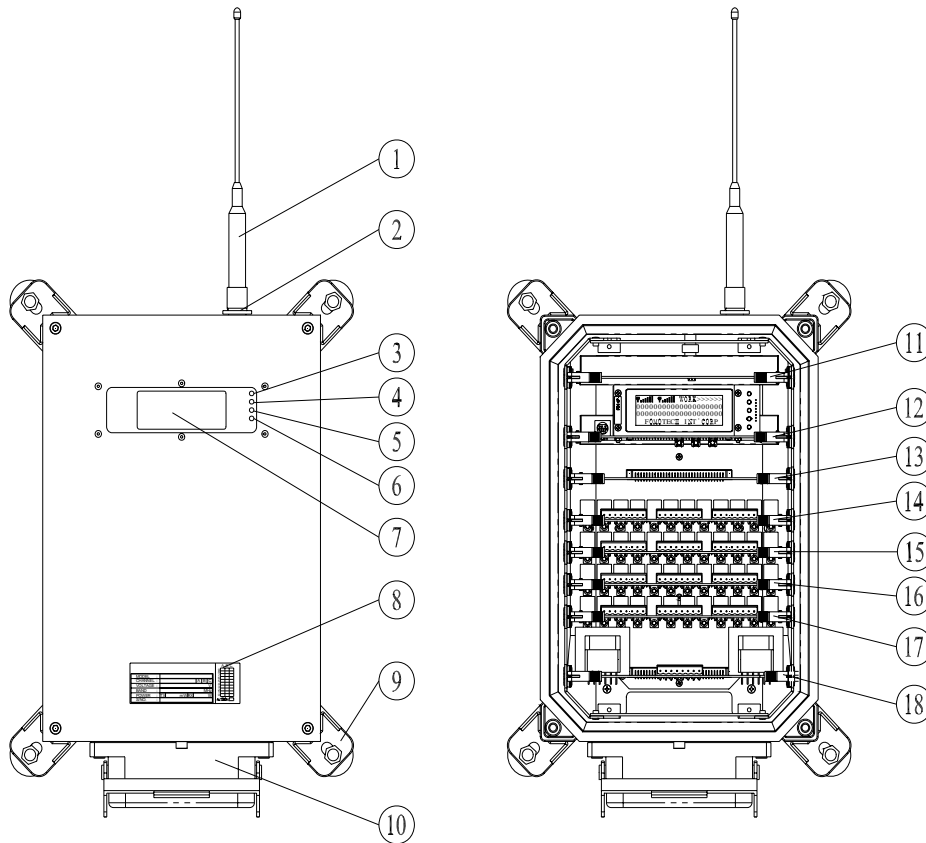
(Fig. 4) RF Module, Encoder Board and Power Switch Views

- |                                 |                                     |
|---------------------------------|-------------------------------------|
| 1. Encoder Shielding Plate      | 9. Power Key Switch Connector Port  |
| 2. Ribbon Type Connector Port   | 10. Power Fuse (0.5A)               |
| 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

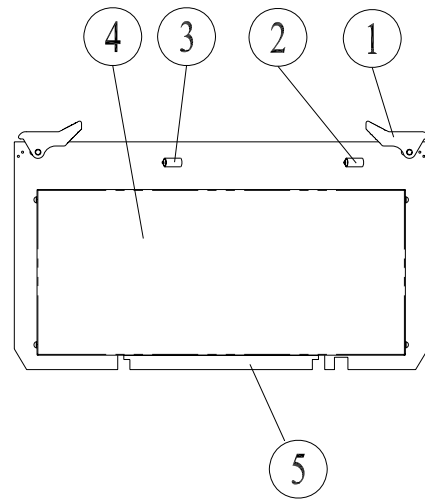


(Fig. 5) Receiver External and Internal View

- |                                       |  |
|---------------------------------------|--|
| 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

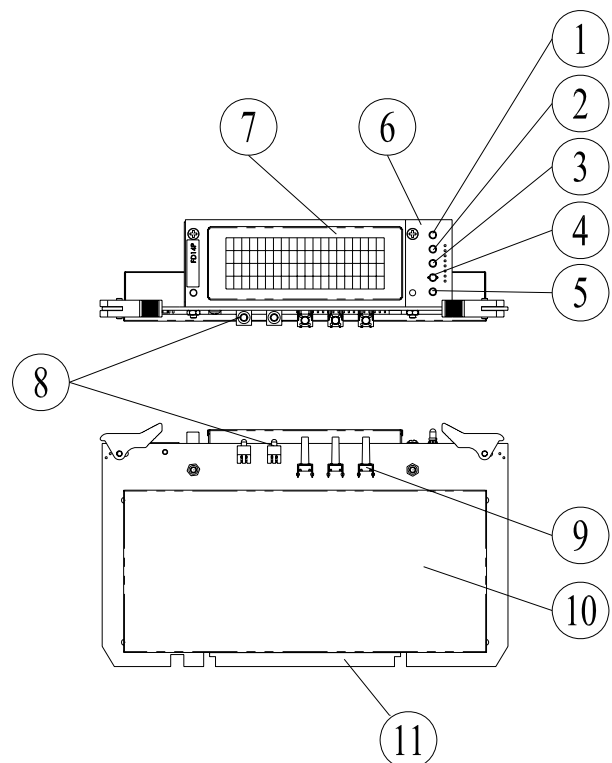
1. RX Module Card Release Clip
2. RX-1 Antenna Port
3. RX-2 Antenna Port (optional)
4. RX module Shielding Plate
5. RX Module Card-to-Motherboard Connector



(Fig. 6) Receiver RX Module Card

## Decoder Card

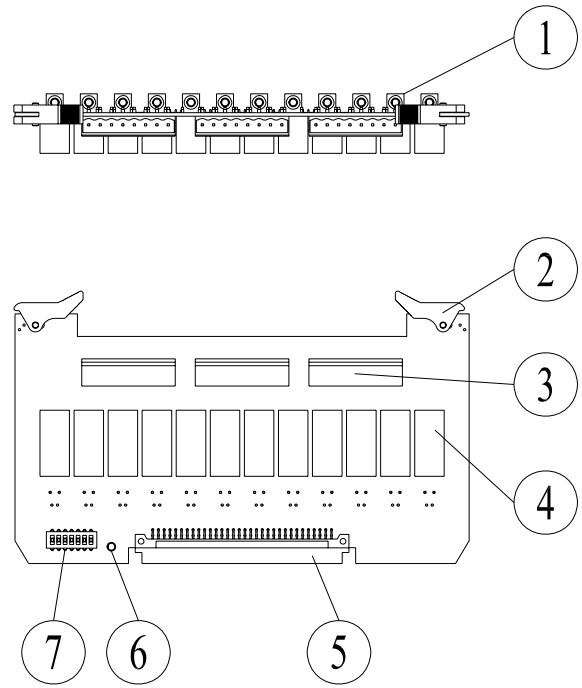
1. Power Display (LED #1)
2. SQ-1 Display (LED #2)
3. SQ-2 Display (LED #3)
4. Central CPU Status Display (LED #4)
5. Reserved Function Display (LED #5)
6. LED Display Panel
7. LCD Screen
8. Dual Decoding CPU Status Display (LED #6 and LED #7)
9. Function Settings Buttons
10. Decoder Shielding Plate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

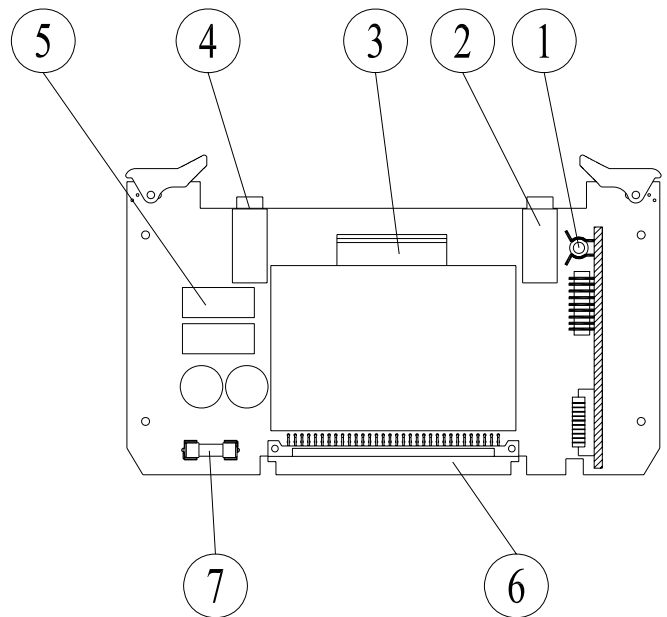
Note: The relay card position (address) dip-switch must be adjusted according to the wiring diagram sheet located on the last page of this manual and on the backside of the receiver cover plate.

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

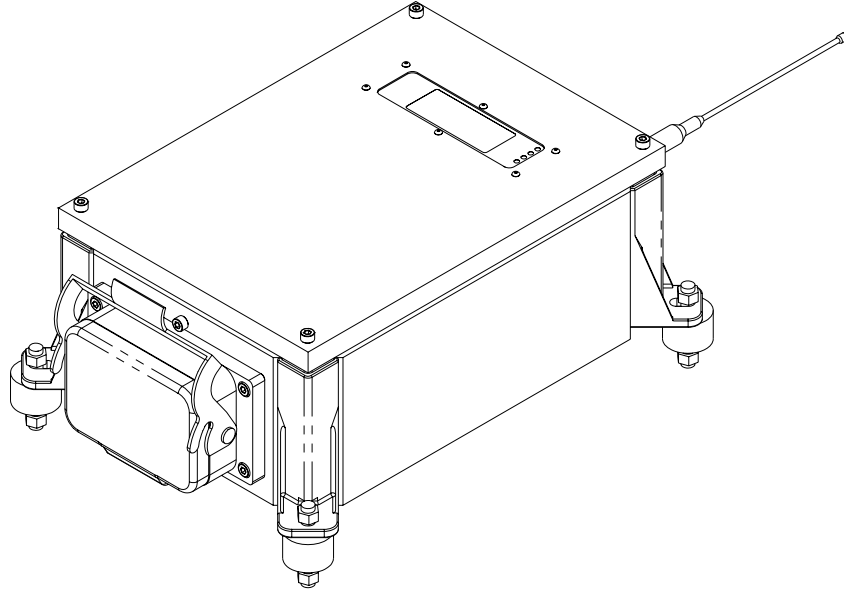
## Power Supply Card

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

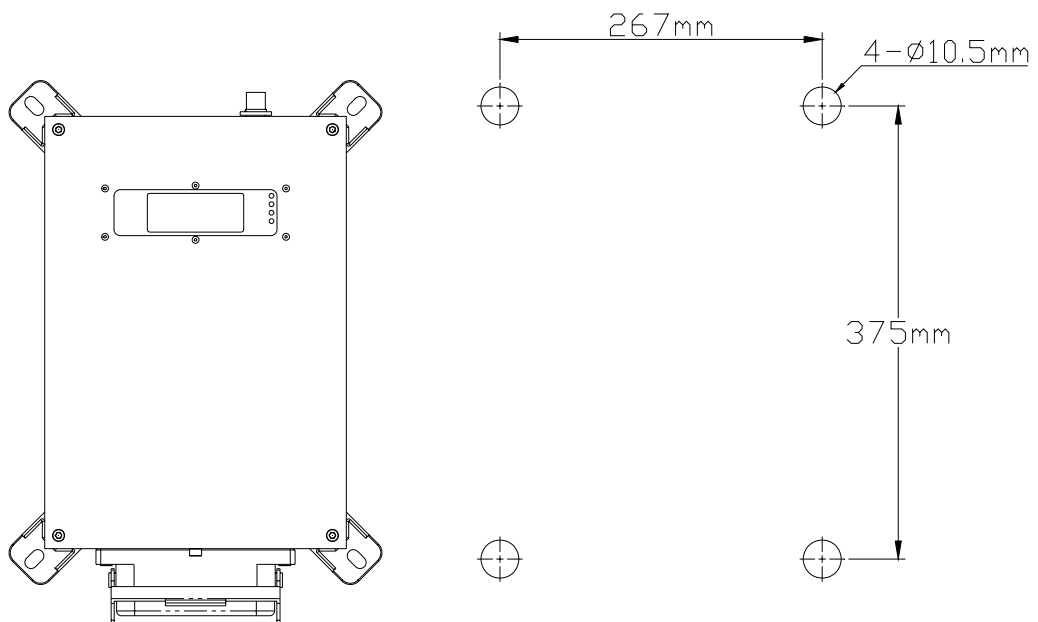


(Fig. 9) Receiver Power Supply Card

## 5.2 Receiver Mounting Dimension



(Fig. 10) Receiver Exterior View



(Fig. 11) Receiver Mounting Dimension

## 6. SYSTEM SETTINGS

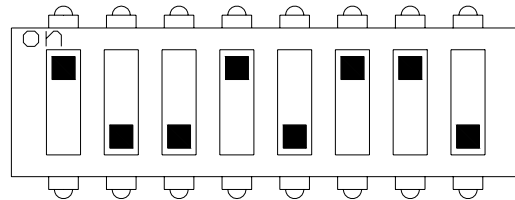
### 6.1 Transmitter ID Code Settings

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”

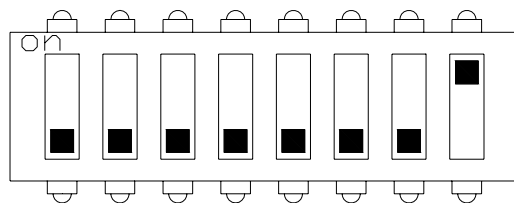


Note: When transmitter ID code is altered please also make sure to readjust the receiver ID code accordingly. System will not operate if the ID code on both the transmitter and receiver are different.

### 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 “910.500MHz” (refer to frequency channel table on page 16).

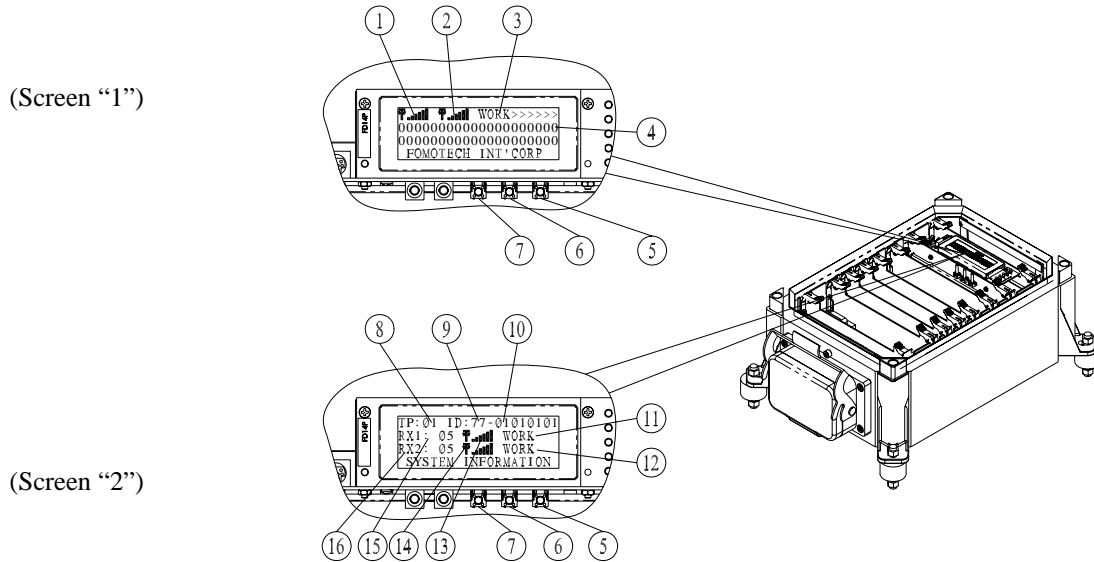


Top location : “1”

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



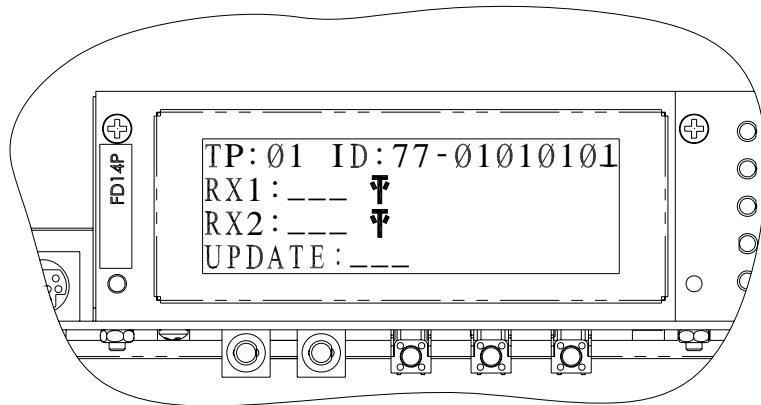
(Fig. 12) Receiver LCD Screen

- |  |                                       |
|--|---------------------------------------|
| 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

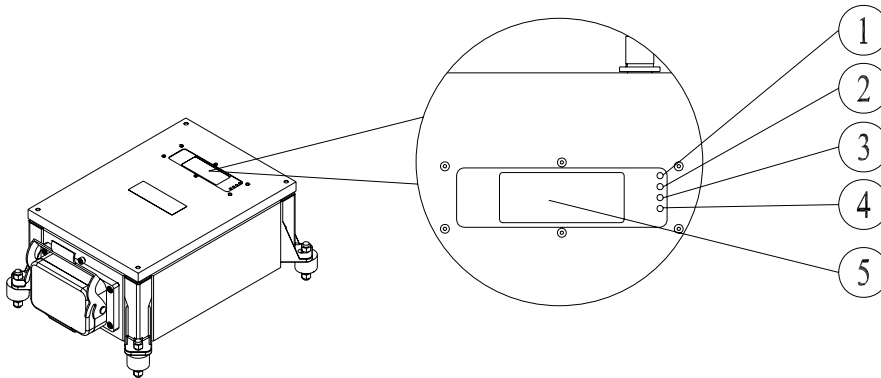
FREQUENCY	DIP-SWITCH SETTING	CHANNEL
910.500 MHz	00000001	01
910.550 MHz	00000010	02
910.600 MHz	00000011	03
910.650 MHz	00000100	04
910.700 MHz	00000101	05
910.750 MHz	00000110	06
910.800 MHz	00000111	07
910.850 MHz	00001000	08
910.900 MHz	00001001	09
910.950 MHz	00001010	10
911.000 MHz	00001011	11
911.050 MHz	00001100	12
911.100 MHz	00001101	13
911.150 MHz	00001110	14
911.200 MHz	00001111	15
911.250 MHz	00010000	16
911.300 MHz	00010001	17
911.350 MHz	00010010	18
911.400 MHz	00010011	19
911.450 MHz	00010100	20
911.500 MHz	00010101	21
911.550 MHz	00010110	22
911.600 MHz	00010111	23
911.650 MHz	00011000	24
911.700 MHz	00011001	25
911.750 MHz	00011010	26
911.800 MHz	00011011	27
911.850 MHz	00011100	28
911.900 MHz	00011101	29
911.950 MHz	00011110	30
912.000 MHz	00011111	31
912.050 MHz	00100000	32
912.100 MHz	00100001	33



<b>FREQUENCY</b>	<b>DIP-SWITCH SETTING</b>	<b>CHANNEL</b>
912.150 MHz	00100010	34
912.200 MHz	00100011	35
912.250 MHz	00100100	36
912.300 MHz	00100101	37
912.350 MHz	00100110	38
912.400 MHz	00100111	39
912.450 MHz	00101000	40
912.500 MHz	00101001	41
912.550 MHz	00101010	42
912.600 MHz	00101011	43
912.650 MHz	00101100	44
912.700 MHz	00101101	45
912.750 MHz	00101110	46
912.800 MHz	00101111	47
912.850 MHz	00110000	48
912.900 MHz	00110001	49
912.950 MHz	00110010	50
913.000 MHz	00110011	51
913.050 MHz	00110100	52
913.100 MHz	00110101	53
913.150 MHz	00110110	54
913.200 MHz	00110111	55
913.250 MHz	00111000	56
913.300 MHz	00111001	57
913.350 MHz	00111010	58
913.400 MHz	00111011	59
913.450 MHz	00111100	60
913.500 MHz	00111101	61
913.550 MHz	00111110	62
913.600 MHz	00111111	63
913.650 MHz	01000000	64
913.700 MHz	01000001	65
913.750 MHz	01000010	66
913.800 MHz	01000011	67
913.850 MHz	01000100	68
913.900 MHz	01000101	69
913.950 MHz	01000110	70

<b>FREQUENCY</b>	<b>DIP-SWITCH SETTING</b>	<b>CHANNEL</b>
914.000 MHz	01000111	71
914.050 MHz	01001000	72
914.100 MHz	01001001	73
914.150 MHz	01001010	74
914.200 MHz	01001011	75
914.250 MHz	01001100	76
914.300 MHz	01001101	77
914.350 MHz	01001110	78
914.400 MHz	01001111	79
914.450 MHz	01010000	80
914.500 MHz	01010001	81
914.550 MHz	01010010	82
914.600 MHz	01010011	83
914.650 MHz	01010100	84
914.700 MHz	01010101	85
914.750 MHz	01010110	86
914.800 MHz	01010111	87
914.850 MHz	01011000	88
914.900 MHz	01011001	89
914.950 MHz	01011010	90
915.000 MHz	01011011	91
915.050 MHz	01011100	92
915.100 MHz	01011101	93
915.150 MHz	01011110	94
915.200 MHz	01011111	95
915.250 MHz	01100000	96
915.300 MHz	01100001	97
915.350 MHz	01100010	98
915.400 MHz	01100011	99

## 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.

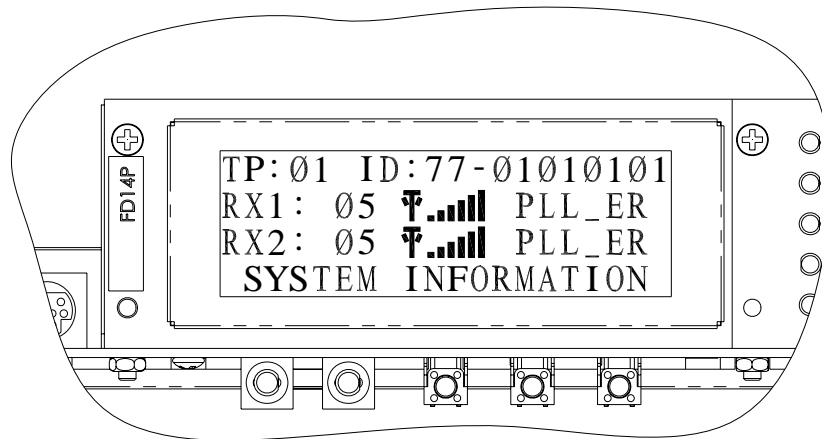
### Receiver Central CPU Status LED Display

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 |



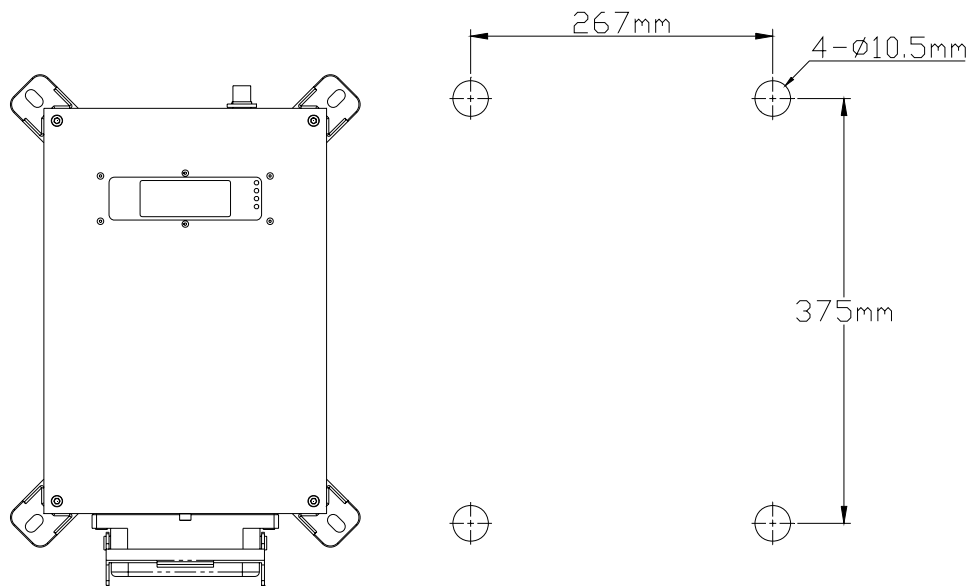
## **8. RECEIVER INSTALLATION**

### **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.



### 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

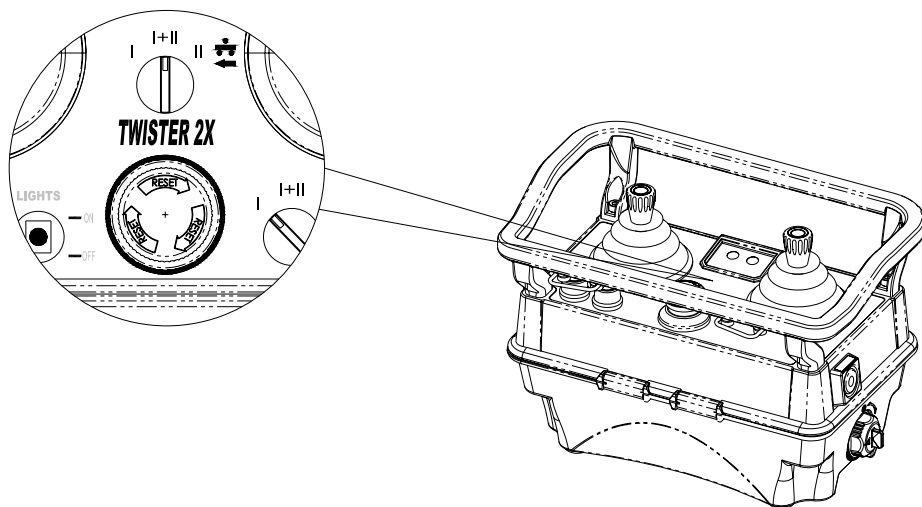
### 9.1 Power “ON” the System

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.

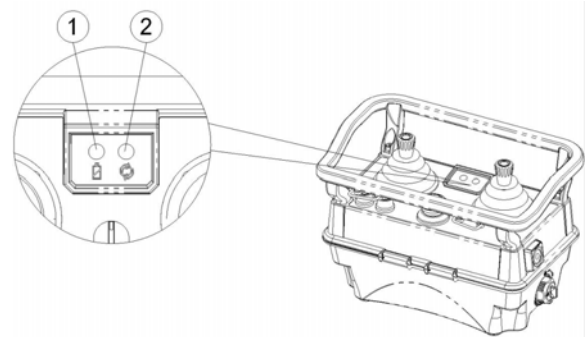
During system wiring, make sure to connect the Select-I output to the main hoist and/or trolley and Select-II output to auxiliary hoist and/or trolley. When the selector switch is at position “I”, Select-I contact relay will close. At position “II”, Select-II contact relay will close. At position “I+II”, 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 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

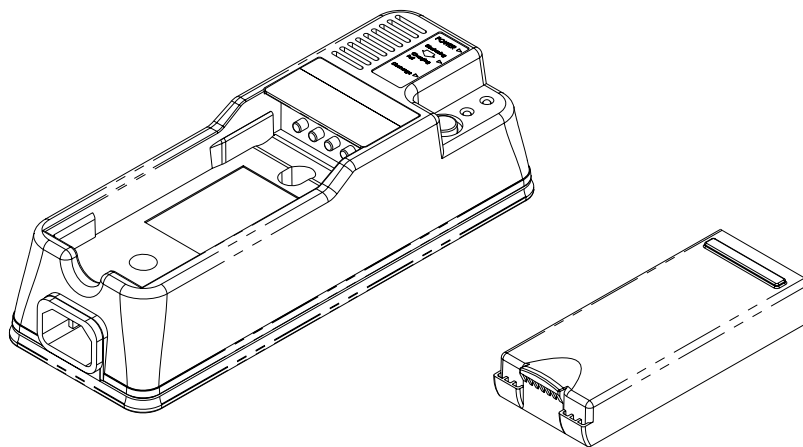
### Transmitter Status LED Display

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 green charging light will blink to indicate charging is taking place at the current moment.
3. If discharging of battery pack is desired (strongly recommended for 600mA NiCd battery pack), press the “DISCHARGE” button. At discharging mode, the green blinking light will now turned into a constant red light indicating that the battery pack is now being discharged. If you want to cancel the discharge, just press “DISCHARGE” button again.
4. When discharging is completed, the charger will automatically switch to the charging mode where the green blinking light will reappear again.
5. The charging time for a 600mA NiCd battery pack is approximately 3 ~ 6 hours. As for the 1450mA NiMH battery pack, the charging time is approximately 7 ~ 9 hours.
6. When charging is completed, a constant green light will appear to indicate that the battery pack is fully charged.
7. 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.
8. When the battery pack’s temperature exceeds 50°C, the charger will go into protective mode and charging will be discontinued.
9. To prolong the life of the battery pack (600mA NiCd battery pack), it is recommended that the battery pack be fully discharged prior to every re-charging.



# 11. SYSTEM SPECIFICATION

## Transmitter Unit

Frequency Range	:	PLL 910.500 ~915.400 MHz
Transmitting Range:	:	100 Meters
Continuous Operating Time	:	37.7+ Hours (1650mA)
Security ID Code	:	65,536 sets (16 + 1 bit)
Channel Spacing	:	50KHz
Hamming Distance	:	$\geq 6$
Frequency Control	:	Synthesizer (PLL)
Frequency Drift	:	$< 3\text{ppm @ } -25^{\circ}\text{C} \sim 75^{\circ}\text{C}$
Frequency Deviation	:	$< 1\text{ppm @ } 25^{\circ}\text{C}$
Spurious Emission	:	$> 60\text{dBc}$
Transmitting Power	:	0.043mW
Emission	:	F1D
Antenna Impedance	:	50 ohms
Enclosure Rating	:	IP-66
Source Voltage	:	7.2 V (1650mA)
Current Drain	:	$\sim 80\text{mA}$
Operating Temperature	:	$-10^{\circ}\text{C} \sim 75^{\circ}\text{C}$
Dimension	:	247mm X 154mm X 182mm
Weight	:	1,600g (with 1650mA battery pack)

Note: Longer or shorter transmitting ranges are available upon request.

## Receiver Unit

Frequency Range	:	PLL910.500 ~915.400 MHz
Channel Spacing	:	50KHz
Hamming Distance	:	$\geq 6$
Frequency Control	:	Synthesizer (PLL)
Frequency Drift	:	$< 3\text{ppm @ } -10^{\circ}\text{C} \sim 75^{\circ}\text{C}$
Frequency Deviation	:	1ppm @ 25°C
Sensitivity	:	-115dBm
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	:	$-10^{\circ}\text{C} \sim 75^{\circ}\text{C}$
Output Contact Rating	:	250V @ 10A
Dimension	:	417mm X 309mm X 167mm
Weight	:	8,800g (without the output cable)

Note: Other types of source voltages are available upon request.

## 12. PARTS LIST

1. TX module (please specify frequency band)	TX5000
2. RX module card (please specify frequency band)	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. 1650mA NiMH battery pack	BAT1650
21. Receiver antenna (433 MHz ~ 434 MHz)	ANT433
22. Receiver antenna (910.500 ~915.400 MHz)	ANT910
23. Receiver enclosure (complete)	RC5000
24. Intelligent charger (please specify voltage)	CH5000
25. Waist Belt	WB5000
26. Shoulder Strap	SS5000

### FCC Caution:

1. The 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.