

APPENDIX A

OWNERS MANUAL



REMOTE CONTROL AND TELEMETRY SYSTEMS



Radio Remote Control System

User's Manual

This manual covers the following Remtron models:

Transmitters

Receivers

- 21T10
- 21T14
- 21T18
- 21T20
- 21T23
- 21T34
- 21T44

- 21R10
- 21R14
- 21R22

WARNING!

Read all Safety and Warnings before installing and operating this system

AVERTISSEMENT !

Lire toutes les consignes de sécurité et tous les avertissements avant de faire fonctionner ce système.

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WARNING INSTRUCTIONS

WARNING!**READ ALL INSTRUCTIONS**

Failure to follow the SAFETY RULES may result in serious personal injury.

INSTALLATION

- * **GROUND THE RECEIVER CASE.** In order to insure safety of the system, the receiver case must be firmly connected to earth ground.
- * **PROVIDE A SAFETY CUTOFF SWITCH.** If maintenance is required, the radio must be disconnected from power to prevent accidental activation.
- * **USE PROPER WIRING.** Loose or frayed wires can cause accidental activation of machinery.
- * **DO NOT INSTALL IN HOT AREAS.** This apparatus can be damaged by heat in excess of 160 F.
- * **DO NOT INSTALL IN HIGH VIBRATION AREAS.** The life of this apparatus may be shortened through long exposure to intense shaking or vibration.
- * **DO NOT INSTALL IN AREAS WHERE WATER OR CONTAMINENTS CAN ENTER THE RECEIVER.** The receiver is enclosed in a NEMA 12 rated enclosure, however direct spraying of liquids or exposure to caustic environments may result in malfunction of the unit.

PERSONAL SAFETY

- * **MAKE SURE MACHINERY IS CLEAR BEFORE OPERATING.** Do not activate the remote system unless it is safe to do so.
- * **TURN OFF THE RECEIVER POWER BEFORE WORKING ON MACHINERY.** Always disconnect the remote system before doing any maintenance to prevent accidental operation of the machine.

CARE

- * **KEEP DRY.** If water or other liquids get inside, immediately dry the unit.
- * **KEEP ANTENNAS CLEAN.** Keep antenna connections clean and free of corrosion.

CONSIGNES DE SÉCURITÉ

AVERTISSEMENT !**LIRE TOUTES LES CONSIGNES**

Le non respect des CONSIGNES DE SÉCURITÉ peut causer des blessures sérieuses.

INSTALLATION

- * **RACCORDER LE BOÎTIER À LA MASSE.** Pour que le système fonctionne en toute sécurité, le boîtier du récepteur doit être solidement raccordé à la masse.
- * **FOURNIR UN INTERRUPTEUR DE SÉCURITÉ.** Lors de travaux d'entretien du dispositif, déconnecter le poste radio afin d'éviter une mise en marche accidentelle..
- * **UTILISER LES FILS APPROPRIÉS.** Des fils découverts ou usés peuvent provoquer un démarrage accidentel de la machinerie.
- * **NE PAS INSTALLER DANS DES ENDROITS CHAUDS.** Des températures supérieures à 160 °F (71°C) peuvent endommager l'appareil.
- * **NE PAS INSTALLER DANS LES ENDROITS SOUMIS À DE FORTES VIBRATIONS.** L'exposition prolongée de cet appareil à des vibrations ou des secousses intenses peut en réduire la durée de vie.
- * **NE PAS EXPOSER LE RÉCEPTEUR À L'EAU OU À TOUT AUTRE CONTAMINANT.** Bien que le récepteur soit entouré d'une enceinte répondant à la norme NEMA 12, l'exposition directe à un liquide ou à un environnement caustique peut entraîner un mauvais fonctionnement de l'appareil.

SÉCURITÉ

- * **S'ASSURER QUE LA MACHINERIE EST DÉGAGÉE AVANT DE LA FAIRE FONCTIONNER.** Ne pas faire fonctionner le système de téléguidage à moins que cela puisse être fait en toute sécurité.
- * **METTRE LE RÉCEPTEUR HORS TENSION AVANT D'EFFECTUER DES TRAVAUX SUR LA MACHINERIE.** Afin de prévenir la mise en marche accidentelle de la machinerie, toujours débrancher le système de téléguidage avant de d'effectuer des travaux d'entretien.

ENTRETIEN

- * **GARDER AU SEC.** Sécher immédiatement l'appareil, s'il est exposé à de l'eau ou tout autre liquide.
- * **GARDER LES ANTENNES PROPRES.** Garder les raccordements d'antenne propres et exempts de corrosion.

SECTION 1: SYSTEM DESCRIPTION

1.1 INTRODUCTION

The Remtron **Command Pro** Radio Remote Control Systems are designed for control of industrial rated machinery. This system complies with requirements for operation under part 15 of the FCC rules and regulations. This means neither the operator nor the company need apply or register for a license to operate this equipment.

The basic system consists of a transmitter and a receiver. The transmitter sends commands to the receiver by means of radio waves in the 900 MHz band. Receivers operate from 115 VAC 50/60 Hz power. Operation from 220 VAC is also available.

1.2 TRANSMITTER DESCRIPTION

The **Command Pro** hand held transmitters are housed in rugged cases molded from a modified polymer plastic that stands up to extremely rugged use. A key feature of the hand held transmitters is Remtron's patented switch assembly for control inputs. This long life elastomeric keypad is ergonomically designed to provide easy operation over long periods of time with exceptional reliability.

The **Command Pro** lever and joystick transmitters provide rugged yet lightweight housings that allow daylong use without a strain on the back.

All the transmitter functions are controlled by a microprocessor with a special memory for configuration information. This offers a great degree of capability and versatility while at the same time providing simplicity of operation and maintenanc.

The antenna is internal to most transmitter cases, protecting it from damage. An indicator LED provides a quick visual check of the transmitters status.

The transmitter sends data at two rates. When a switch is pressed or released, three rapid commands are generated to insure a fast system response. The transmitter then reverts to a 1/3 rate to conserve battery power. The crane control transmitters are designed to be very efficient. Only two AA batteries are needed to provide

power for the 21T10 or 21T14 transmitters for a month's normal use. Other transmitters contain additional batteries for even longer operating time between battery changes. An additional feature automatically shuts the transmitter off after a preset time interval of inactivity to further extend the battery life.

Refer to Section 5 for details on the specific transmitter supplied with your system.

1.3 RECEIVER DESCRIPTION

The **Command Pro** receivers consist of two subassemblies, an RF/Decoder board and a Relay board, mounted inside a NEMA 12 cabinet. They are equipped with two safety relays in addition to the control relays.

RF/Decoder Board

The RF/Decoder Board contains the Radio Receiver and the Microprocessor based control system. Signals are received by an advanced synthesized RF module that operates in conjunction with the microprocessor. Commands are received on one of 87 possible frequencies and are checked against a 16 bit address code for proper identity and further tested against a 16 bit CRC check code. This insures only valid information meant only for the particular unit is decoded.

The microprocessor contains a nonvolatile memory that retains the frequency, address and particular operating parameters for the system. The receiver is programmable by means of PC compatible computers equipped with an RS-232 serial port or by an independent programming unit.

Relay board.

The Relay board contains the output relays and the power supply. Two (2) relays form part of the safety system. All outputs include spike snubbers to remove transient voltages from the control lines. For convenience, the interface terminal strips are unpluggable. The relay board can be easily removed without the necessity of tracking wire numbers and positions.

The power is from 115 VAC, 50/60 Hertz. Optional

1.1

SECTION 1: SYSTEM DESCRIPTION

220 VAC, 50/60 Hertz, 250 VDC and other power inputs are available. The input is protected by a fuse.

The following options are only available on the 21R22 receiver:

Safety Features

Stepless (proportional) Outputs:

Controlling heavy industrial equipment requires that the remote control system be reliable with built-in safety features. Each transmission goes through several checks to insure that the information being received is error free.

External Hard Wire Inputs.

Extra Relay Outputs.

Pilot Lights.

The safety interlocks for the crane's Main Line Contactor (MLC) consist of the operate (OPR) and operate inhibit (OPI) relays. These relays are controlled by the microprocessor and by a hardware circuit. Further, one relay has normally open contacts while the other has normally closed contacts. This provides three levels of safety in controlling the Main Contactor for the crane.

Intermediate Relay Panel.

DC Power Supply.

Transfer Switch.

Over 5 million combinations of frequencies and address codes means that no two systems will ever be produced with the same frequency and address code, thereby insuring that no transmitter will ever be able to unintentionally control another crane.

Refer to Section 6 for more information on the options.

Diagnostics

Even though the receivers are technically very complex, it is exceptionally easy to maintain and troubleshoot. Diagnostic LEDs plus an LED for each output relay are all that are required to isolate a problem should one occur. Both the transmitter and receiver assembly monitor and indicate their status on a continuous basis.

1.4 OPTIONS

The following options are available on all receivers:

First Come-First Serve.

Pitch and Catch.

SECTION 2: INSTALLATION

2.1 INSTALLATION PLANNING

To ensure reliable and safe operation of the system, the following points must be considered before installing the receiver assembly.

If the receiver cabinet is to be installed outdoors, connections to the cabinet must be water tight.

If the receiver is installed in a corrosive environment, consult the factory for optional NEMA 4X cabinets, or house the receiver cabinet in a secondary protective enclosure.

If the receiver is to be installed in environments where the ambient temperature drops below -20°F (-7°C) or rises above $+160^{\circ}\text{F}$ ($+70^{\circ}\text{C}$) measures must be taken to maintain the interior of the enclosure to within these temperature limits.

2.2 MOUNTING LOCATION

Refer to section 6, **Receiver Description**, for the receiver cabinet dimensions and layout. When planning the location for mounting the receiver, observe the following rules:

1. Allow sufficient room to swing the cabinet door open for ease of wiring and service.
2. If the antenna is mounted directly on the receiver cabinet, allow a minimum of 8 inches below the cabinet for clearance. Refer to 2.3 ANTENNA MOUNTING for more information.
3. If possible, avoid mounting the receiver on a surface where excessive vibration or shock is present. If this is not possible, appropriate shock mounts must be used.
4. Allow for positive earth ground to the receiver cabinet.

2.3 ANTENNA MOUNTING

The antenna is one of the most important parts of a radio receiving system. The receiver is designed with a specially tuned antenna to provide excellent operating reliability under most conditions. Care in placing the receiver antenna will ensure reliable operation under the most severe conditions.

A direct "line-of-sight" between the transmitter and receiver antenna will provide the best performance. The radio signal will often "bounce" off metallic objects and reach the receiver even when the antenna is directly shielded from the transmitter.

In most cases the antenna may be mounted directly on the receiver cabinet. If the receiver cabinet location is not suitable and the antenna must be mounted at a remote location, the p/n 600038 antenna kit should be used. The remote mounting kit includes a right angle bracket with antenna mount and a coaxial extension cable.

It is recommended that the receiver not be connected to power lines where large transients are present. These transients are typically caused by motors, contactors and other large inductive loads.

2.4 RECEIVER INSTALLATION

Inspect all items to insure they have been received in good condition. The following items are included unless otherwise noted on the packing list.

- Transmitter
- Transmitter leather holster
- Transmitter shoulder strap
- Receiver assembly
- Receiver antenna

SECTION 2: INSTALLATION

Mounting**WARNING!**

The receiver cabinet must be connected to earth ground to insure proper safety. Verify the presence of earth ground before operating the receiver system.

AVERTISSEMENT !

Le boîtier du récepteur doit être raccordé à la masse afin de respecter les conditions de sécurité. Vérifier le raccordement à la masse avant de faire fonctionner le récepteur.

Mount the receiver cabinet securely to a solid surface. Use appropriate locking type hardware to prevent loosening. Refer to Figure 6.1.

Mechanical

1. Connect the conduit or raceway to the receiver cabinet and route the wiring into the cabinet.
2. The receiver cabinet should be properly grounded. Make sure all paint is removed from the bonding surfaces.

Electrical Connections.**WARNING!**

Verify that the main input power is off before attempting to make any connections.

AVERTISSEMENT !

S'assurer que l'arrivée principale de courant soit hors tension avant de faire quelque raccordement que ce soit.

If you have any questions regarding the installation, call Remtron applications engineering.

When wiring the receiver, it is recommended the wires be dressed along the sides of the cabinet. This will allow easy troubleshooting and maintenance should it be required. Some receiver cabinets are provided with a pre-punched hole for ease of conduit installation.

Refer to the diagram in Appendix A for typical wiring installation of the receiver. The configuration sheet provided with your equipment will have the specific relay assignments for your system.

1. Power/Transfer Switch Wiring.**WARNING!**

The safety of this system depends on the proper wiring of this switch. Call Remtron Applications Engineers if you have any questions regarding the wiring of this switch.

AVERTISSEMENT !

La sécurité de ce système dépend du raccordement approprié de cet interrupteur. Contacter les ingénieurs de Remtron spécialisés dans les applications pour toute question concernant le raccordement de cet interrupteur.

A three pole transfer switch is normally provided with each receiver. Wiring of this switch will depend on the electrical configuration of your crane. Appendix A shows wiring of the switch for a single phase crane with a common control circuit for all motions. Additional switch poles can be used for systems with isolated control circuits for the motions.

The switch should be wired so that the crane's main line contactor (MLC) is controlled by the radio OPI and OPR relays when in the radio position, and by the pendant

SECTION 2: INSTALLATION

controls when the switch is in the pendant position. It should also be wired to transfer control between the pendant and the radio circuits.

2. Output Relay Connections.

The relay contacts are rated for 16 Amp, 240 VAC to provide maximum reliability and life. It is recommended that the load applied to the output circuits be limited to 5 Amps to achieve best system life. Connection to equipment or contactors with higher voltage or current ratings requires an auxiliary relay.

The receiver has been pre-wired for a single phase control system. If you have multiple phase control lines you must wire the relay commons accordingly.

Refer to the configuration sheet supplied with your system for the specific relay assignments.

3. Power Connections.

The receiver is normally provided for 115 VAC, 50/60 Hz power. Make sure the receiver is ordered for the correct operating voltage of your power system. Connect line and return connections directly to the terminal strip X1 and X2. Observing the polarity of the connections as shown in Appendix A will prevent conflicts with any other wiring on the crane system.

3. Installation Testing.

Before putting the system into service, the following tests must be performed.

Apply power to the receiver and verify the power and OPI indicators light.

Turn on the transmitter and verify the OPI indicator goes off. Verify the OPR indicator lights and the Signal indicator flashes.

Verify voltage is present at the receiver output to the Main Line Contactor. Verify no voltage is present at any of the relay outputs.

WARNING !

If voltage is present at any output, the receiver grounding is not adequate. Make sure the cabinet is grounded before operating the crane.

AVERTISSEMENT !

La présence de tension à l'une ou l'autre des sorties indique un raccordement inadéquat du récepteur à la masse. S'assurer que le boîtier est raccordé à la masse avant de faire fonctionner la grue.

SECTION 3: TROUBLESHOOTING

3.1 GENERAL

The following procedures are for diagnosing problems within the system and isolating them down to the module level. No special test equipment is required.

Both the transmitter and receiver have built in test and diagnostic devices to aid in troubleshooting. In the event of a system malfunction, the following guide presents a logical approach to pinpointing the cause and quickly restoring the equipment to operation.

Due to the rough treatment it may be subjected to, most problems are likely to occur in the transmitter. The transmitter should be thoroughly diagnosed before proceeding to the receiver.

3.2 TRANSMITTER TESTING

WARNING!

When testing the transmitter, the receiver may become active resulting in system operation. Always assume the system is working and will respond when testing a transmitter.

AVERTISSEMENT !

Lors des essais du transmetteur, le récepteur peut s'activer et entraîner la mise en marche du système. Prendre en considération que le système fonctionnera et répondra toujours aux commandes lors des essais du transmetteur.

When the transmitter is OFF the LED should be off.

Press and release the ON/ALARM button. The LED should flash at a low rate. Press a command switch. The LED should flash at a high rate.

If the batteries are getting low, the LED will flash on-off. (1/2 second on and 1/2 second off) while the transmitter is ON. The batteries should be changed at the next convenient opportunity.

If the LED remains on continuously there is either a switch activated at the time the transmitter is turned on, or a general failure that requires factory service. If the LED remains lit continuously on power-up, insure that no other switches are pressed while attempting to turn the transmitter on.

If the test LED does not light at all, replace the batteries. If this does not fix the problem, the transmitter is inoperable and must be repaired.

3.3 RECEIVER TESTING

Receiver LEDs. Refer to Section 6 for the locations of the decoder diagnostic LEDs inside the receiver cabinet.

On 21R10 and 21R14 receivers, the **Power**, **Address** and **Signal** LEDs are on the RF/Processor board which is mounted below the Relay board.

On 21R22 receivers the **Power** and **Signal** LEDs are on the RF/Processor board which is mounted on top of the Relay board.

POWER - Indicates the +12 VDC, receiver operating voltage is present.

ADDRESS - This will flash each time a signal received matches the decoders address. This is not used for the 21R22 receiver.

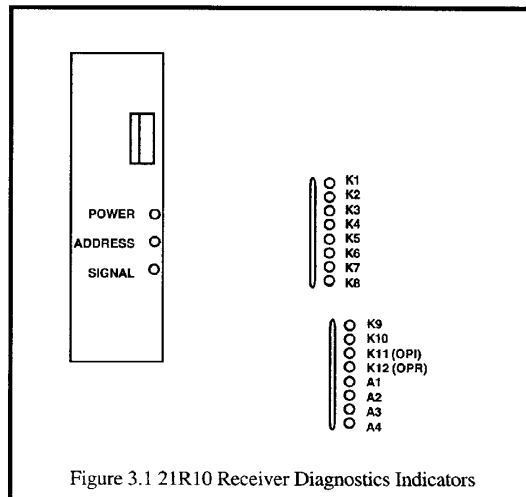


Figure 3.1 21R10 Receiver Diagnostics Indicators

3.1

SECTION 3: TROUBLESHOOTING

are firmly snapped in place and that the RF/Decoder board is firmly attached to the back of the Relay board.

Check antenna connections.

7. If Operating Range is short, Check all antenna connections and the transmitter operation.

On new installations, verify the receiver antenna is placed properly. If necessary, use an antenna mounting kit to relocate the antenna to a more favorable location.

Replace the RF/Decoder board.

8. If any of the Contact Sense (Relay Sense) indicators are lit (21R22 only), a difference between the intended output command and the relay (or contactor) state occurred. This is usually caused by a failed relay contact.

The indicator will remain illuminated even after the transmitter is turned off. The next time the transmitter is turned on, or if the receiver power is cycled, the indicator will turn off unless the problem remains.

If external inputs are used for contact sensing, examine and repair if appropriate the wiring between the back contacts of the directional contactor and the receiver input. Also examine the contactor for a problem.

SECTION 4: MAINTENANCE

4.1 PERIODIC MAINTENANCE

Once a year inspect the transmitter for damage to the keypad and case.

Once a month all electrical and antenna connections should be inspected. Make sure all antenna and electrical connections are clean and tight and that all terminal strips are firmly in place.

4.2 TRANSMITTER & RECEIVER REPAIRS

Refer to section 5: TRANSMITTER or Section 6: RECEIVER for details on transmitter and receiver repairs.

4.3 PROGRAMMING

Each transmitter and receiver can be programmed for any operating frequency, address code and specific operating parameters required by the particular system. Each system is fully programmed and tested before shipment from the factory and should require reprogramming only in the case of spares.

Programming Hardware Requirements

The RAC17, a computer based programming system, is available that consists of an RS-232 interface box and a computer program for PC compatible computers. This system allows storage of configurations for each system

Table 4.1 Frequency codes

<u>FREQ.</u>	<u>CODE</u>	<u>FREQ.</u>	<u>CODE</u>	<u>FREQ.</u>	<u>CODE</u>	<u>FREQ.</u>	<u>CODE</u>
902.1	00	908.7	16	915.3	2C	921.9	42
902.4	01	909.0	17	915.6	2D	922.2	43
902.7	02	909.3	18	915.9	2E	922.5	44
903.0	03	909.6	19	916.2	2F	922.8	45
903.3	04	909.9	1A	916.5	30	923.1	46
903.6	05	910.2	1B	916.8	31	923.4	47
903.9	06	910.5	1C	917.1	32	923.7	48
904.2	07	910.8	1D	917.4	33	924.0	49
904.5	08	911.1	1E	917.7	34	924.3	4A
904.8	09	911.4	1F	918.0	35	924.6	4B
905.1	0A	911.7	20	918.3	36	924.9	4C
905.4	0B	912.0	21	918.6	37	925.2	4D
905.7	0C	912.3	22	918.9	38	925.5	4E
906.0	0D	912.6	23	919.2	39	925.8	4F
906.3	0E	912.9	24	919.5	3A	926.1	50
906.6	0F	913.2	25	919.8	3B	926.4	51
906.9	10	913.5	26	920.1	3C	926.7	52
907.2	11	913.8	27	920.4	3D	927.0	53
907.5	12	914.1	28	920.7	3E	927.3	54
907.8	13	914.4	29	921.0	3F	927.6	55
908.1	14	914.7	2A	921.3	40	927.9	56
908.4	15	915.0	2B	921.6	41		

SECTION 4: MAINTENANCE

as well as programming of application information. This is recommended for larger installations that must maintain systems with a variety of configurations.

A stand alone programmer, RAC16, is available for most applications. It provides a convenient method for changing the identity code and making basic application changes to the transmitters and receivers.

Programming Levels

Most programming changes involve only the assignment of the identity code. The identity code is a six digit alphanumeric number that contains the operating frequency and address of the unit. This level of programming is described in this manual.

Higher levels of programming, those that allow changing of time constants, relay assignments and decoding logic are covered in a separate manual.

Identity Code

The unit identity code consists of a six digit alphanumeric number such as 2E005B. The range of numbers is 0 through 9 and A through F.

The first two numbers designate one of the 87 frequencies that are used for these systems. In a plant with many units located in a close area, each system can be assigned a different frequency. For reference, table 4.1 lists the frequency for each code.

The last four numbers designate one of the 65,536 possible address codes. Again, the range of numbers is 0 through 9 and A through F.

Each system in a plant must have a separate identity code. Two systems with the same identity code will be able to "talk" to each other. All systems are shipped from the factory with a unique identity code. It is highly recommended that the receiver identity code not be changed, rather a transmitter identity code be made to match that of a receiver.

Programming

The transmitter and receiver are programmed using the same method.

Transmitters have a four position connector with one pin removed for keying. Receivers may have a four position or a six position connector with one pin removed for keying. The programmer has a six position connector with one position blanked.

Locate the programming connector on the transmitter board or the RF/Decoder board in the receiver and connect the plug from the programmer. Note that the plug is polarized and must be connected with the plug aligned with the position of the blank pin.



6 pos connector



4 pos connector

If programming a transmitter, make sure the batteries are installed. If programming a receiver, make sure power is applied to the RF/Decoder board (power LED is ON). Note that an RF/Decoder board with the six position



programming connector can be powered from the



programming box and does not need external power.

If the programmer is not already on, turn the programmer power on by pressing the ON button. The display will show what the programmer is connected to for 5 seconds and then will read and display the ID CODE of the unit.

SECTION 4: MAINTENANCE

Enter a new six digit unit identity number using the keypad on the programming unit. Verify the number on the LCD display. Press the PRG push-button on the programming unit.

For additional programming instructions refer to the manual supplied with the programmer.

4.4 PARTS LISTS

Accessories available for the remote control system include:

<u>Item</u>	<u>Part Number</u>
Antenna mounting kit (9 Ft.)	600038-1
Antenna mounting kit (18 Ft.)	600038-2
Programmer (Stand Alone)	RAC16
Programmer (PC Based)	RAC17

Tables 5.1 and 6.1 list the spare parts available from Remtron for field repair of the transmitter and receiver. Detailed parts lists and schematics are available to support depot level maintenance activities.

4.5 ORDERING & REPAIRS

Ordering

When ordering a Remtron product use the appropriate Remtron part number or model number, ID Code and any other applicable information.

Orders for standard Remtron products may be placed with an authorized representative, distributor or direct with the factory.

Orders for special products or modified standard products may also be placed with an authorized representative, however, close coordination with the factory is recommended.

Repairs

All products in need of repair should be sent directly to the factory at the address listed below. We recommend calling the factory for a Return Material Authorization (RMA) number prior to sending in the equipment. A note should be included describing the nature of the problem and the conditions under which the problem occurred. Also included with the returned product, should be the name, address and phone number where the product is to be returned and the name and phone number of a person familiar with the problem, who we may contact should the need arise. Products should be returned to:

**Remtron, Inc.
1916 W. Mission Rd.
Escondido, CA 92029**

PH 760-737-7800

4.6 Warranty

Remtron, Inc. warrants its material handling products to be free from defects in material and workmanship for a period of two (2) years from the date of the original invoice. This warranty is void if the product was used in other than its normal and customary manner or subjected to misuse, neglect, accident, physical damage or was altered or tampered with by unauthorized personnel.

Remtron further warrants its Command Pro "hand-held" Radio Remote Control products against malfunction or breakage, excepting total destruction of the internal circuit board, for a period of two (2) years and thirty (30) days from the date of the original invoice.

In event of a defect or failure to perform as specified, Remtron will, at its discretion, repair or replace the product. This warranty does not cover the cost of shipping and handling of the product from the customers' location to the factory.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

SECTION 5: TRANSMITTER

5.1 TRANSMITTER DESCRIPTION

The crane control transmitters are housed in a rugged case molded from a modified polymer plastic that stands up to extremely rugged use. A key feature is Remtron's patented switch assembly for control inputs. This long life elastomeric keypad is ergonomically designed to provide easy operation over long periods of time with exceptional reliability.

All the transmitter functions are controlled by a microprocessor with a special memory for configuration information. This offers a great degree of capability and versatility while at the same time providing simplicity of operation and maintenance.

The antenna is internal to the transmitter case, protecting it from damage. An indicator LED provides a quick visual check of the transmitters status.

The crane control transmitters are designed to be very efficient. Only two AA batteries are needed to provide power for the transmitter for a month's normal use. An additional feature automatically shuts the transmitter off after a preset time interval of inactivity to further extend the battery life.

The 21T18 employs two speed rocker switches allowing convenient one handed operation for two speed cranes and for cranes equipped with variable speed drives.

The microprocessor contains a nonvolatile memory that retains the frequency, address and particular operating parameters for the system. It is programmable by means of PC compatible computers equipped with an RS-232 serial port or by an independent programming unit.

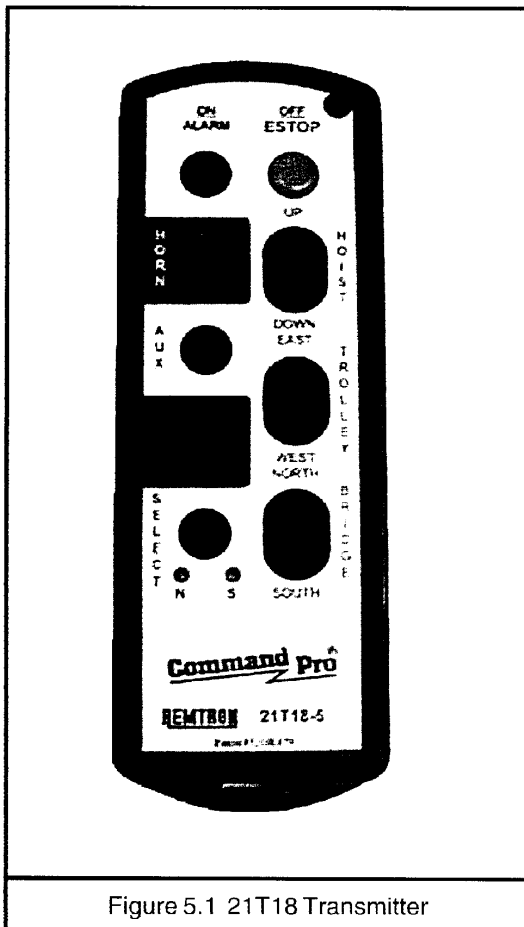


Figure 5.1 21T18 Transmitter

5.2 TRANSMITTER FUNCTIONS

WARNING

Do not operate the system until you are familiar with radio controlled crane operation. If you are not familiar with radio controlled crane operation, contact your supervisor before attempting to use the radio control system.

AVERTISSEMENT !

Ne pas faire fonctionner le système avant de bien connaître le fonctionnement d'une grue par téléguidage. Contacter le superviseur avant de faire toute tentative de mise en marche par téléguidage, si le fonctionnement n'est pas connu.

5.1

SECTION 5: TRANSMITTER

The following describes the functions, operational features and characteristics of the 21T18 transmitter. Refer to Figure 5.2.

ON/ALARM. Puts the system into the active mode. The transmitter will remain active until the OFF/ESTOP is pressed or the transmitter turns itself off (see Auto Off).

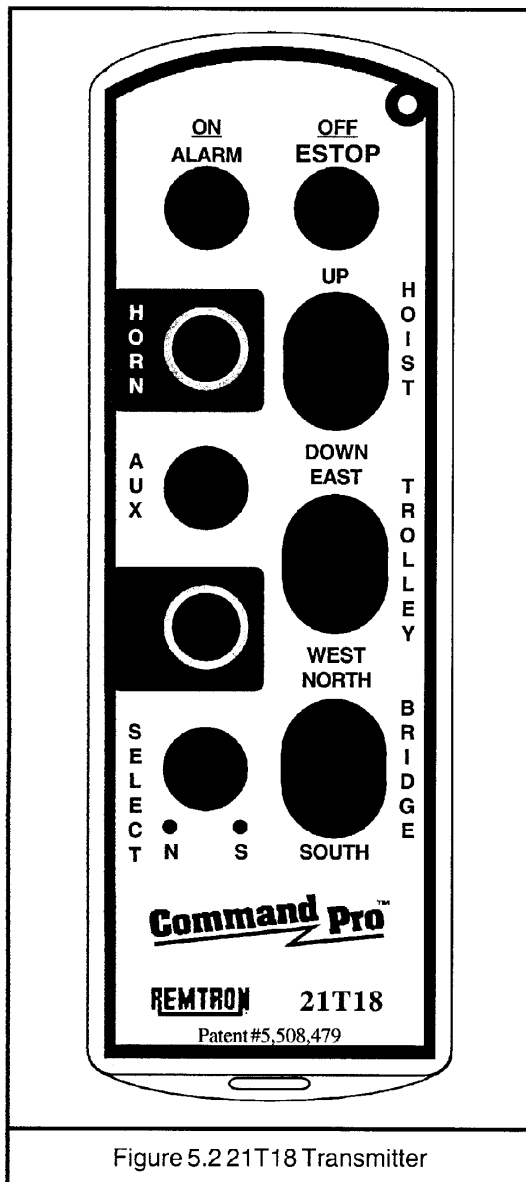


Figure 5.2 21T18 Transmitter

Sends an ALARM command to the receiver while the button is depressed.

OFF/ESTOP. While depressed, sends an Emergency Stop command to the receiver. The transmitter does not need to be in the active mode to send this command.

After this button is released the transmitter will be turned off.

Test LED. The Test LED provides an indication of the transmitter operation.

When the transmitter is OFF the LED will be off. When the transmitter is ON, the LED will flash at a low rate when no command is being sent and at a high rate when a command is being sent.

If the batteries are getting low, the LED will flash on-off. (1/2 second on and 1/2 second off) while the transmitter is ON. The transmitter may still be used, however the batteries should be changed at the next convenient opportunity.

If the LED remains on continuously there is either a switch activated at the time the transmitter is turned on, or a general failure that requires factory service. If the LED remains lit continuously on power-up, insure that no other switches are pressed while attempting to turn the transmitter on.

Auto Off. The transmitter will turn itself off if no commands have been sent for a predetermined time. Normally this time is set to 15 minutes, however it may be programmed for other times.

Selecting Cranes. On cranes that have multiple hoists or multiple trolleys, a selector switch is provided that selects crane 1, crane 2 or both crane 1 and crane 2.

Momentarily pressing the selector switch will cycle the selection between functions. If crane 1 LED is lit, pressing the selector switch causes crane 1 LED to go out and crane 2 LED to light. Pressing the switch again will cause crane 1 LED to light in addition to the crane 2 LED. Pressing the switch again will cause crane 2 LED to go out.

5.2

SECTION 5: TRANSMITTER

Command Switches. The command switches are labeled according to their function. The switches are active only while depressed. Releasing the switch stops a motion or function. The following points apply to the use of the command switches on the transmitter:

1. If opposing commands are attempted, i.e., two commands that conflict with each other, no movement will result.
2. If more than one speed command is sent for the same function, the lower speed will predominate.
3. Maintained on or off functions require separate commands for on and off.

5.3 TRANSMITTER OPERATION

IMPORTANT

The EMERGENCY STOP button for the system is the "OFF/ESTOP" button. Press and hold this button to stop all functions.

IMPORTANT !

Le bouton d'arrêt d'urgence (EMERGENCY STOP) pour ce système est le bouton OFF/ESTOP. Appuyer et maintenir le bouton pour arrêter toutes les fonctions.

1. Press and release the ON/ALARM button. Verify that the test LED starts flashing at a low rate. If equipped, the Alarm on the crane should sound.
2. Press the required switches to operate the desired crane motion. Note that more than one motion can be controlled at any time.
4. To stop any function, release the switch.
5. To turn the transmitter off, press the OFF button. Note that the transmitter will turn itself off if no commands are changed for a predetermined time.

5.4 OPTIONS

First Come-First Serve (FCFS). The FCFS option allows one receiver to be controlled by more than one transmitter, but only one at a time.

When all the transmitters in the system are off, the receiver will scan (look for) the frequency of each of the transmitters in the system. When the receiver detects the signal of a valid transmitter, it will stop scanning and lock on to that transmitter. So long as it continues to receive signals from that transmitter, it will not scan. If another transmitter or transmitters are turned on, their signals will not be detected by the receiver.

If your transmitter is the first one turned on, it will take control of the receiver. If another transmitter was turned on prior to yours, your transmitter will have no effect on the system until the other transmitter is turned off. When the other transmitter is turned off, the receiver will automatically resume scanning and lock on to the frequency of the next transmitter that comes on. If it's yours, then you will then have control until you turn your transmitter off.

Pitch and Catch. Pitch and Catch is similar to First Come-First Serve. There are two significant differences between the two. First, with Pitch and Catch when the transmitter that has control is turned off, the receiver will NOT scan, looking for another transmitter. It will remain locked on to that transmitter. Second, when a transmitter wishes to give up control of the receiver, it must send a Release command to the receiver. This tells the receiver to begin scanning and immediately lock on to the next transmitter whose frequency it detects. If another transmitter is on, or is turned on, it will assume control. If no other transmitters are on, the receiver will wait 10 seconds from the time it received the Release command then revert to the FCFS mode.

Magnet Control. Additional safety is built into systems that use a lifting magnet. Two methods are used for the magnet control buttons.

The **two button** design uses one button marked MAG LIFT and the second button marked MAG DROP. Pressing the MAG LIFT energizes the magnet. To de-energize the magnet and drop the load, MAG LIFT and MAG DROP must be pressed at the same time. A time delay is built into

SECTION 5: TRANSMITTER

Command Switches. The command switches are labeled according to their function. The switches are active only while depressed. Releasing the switch stops a motion or function. The following points apply to the use of the command switches on the transmitter:

1. If opposing commands are attempted, i.e., two commands that conflict with each other, no movement will result.
2. If more than one speed command is sent for the same function, the lower speed will predominate.
3. Maintained on or off functions require separate commands for on and off.

5.3 TRANSMITTER OPERATION

IMPORTANT

The EMERGENCY STOP button for the system is the “OFF/ESTOP” button. Press and hold this button to stop all functions.

IMPORTANT !

Le bouton d’arrêt d’urgence (EMERGENCY STOP) pour ce système est le bouton OFF/ESTOP. Appuyer et maintenir le bouton pour arrêter toutes les fonctions.

1. Press and release the ON/ALARM button. Verify that the test LED starts flashing at a low rate. If equipped, the Alarm on the crane should sound.
2. Press the required switches to operate the desired crane motion. Note that more than one motion can be controlled at any time.
4. To stop any function, release the switch.
5. To turn the transmitter off, press the OFF button. Note that the transmitter will turn itself off if no commands are changed for a predetermined time.

5.4 OPTIONS

First Come-First Serve (FCFS). The FCFS option allows one receiver to be controlled by more than one transmitter, but only one at a time.

When all the transmitters in the system are off, the receiver will scan (look for) the frequency of each of the transmitters in the system. When the receiver detects the signal of a valid transmitter, it will stop scanning and lock on to that transmitter. So long as it continues to receive signals from that transmitter, it will not scan. If another transmitter or transmitters are turned on, their signals will not be detected by the receiver.

If your transmitter is the first one turned on, it will take control of the receiver. If another transmitter was turned on prior to yours, your transmitter will have no effect on the system until the other transmitter is turned off. When the other transmitter is turned off, the receiver will automatically resume scanning and lock on to the frequency of the next transmitter that comes on. If it's yours, then you will then have control until you turn your transmitter off.

Pitch and Catch. Pitch and Catch is similar to First Come-First Serve. There are two significant differences between the two. First, with Pitch and Catch when the transmitter that has control is turned off, the receiver will NOT scan, looking for another transmitter. It will remain locked on to that transmitter. Second, when a transmitter wishes to give up control of the receiver, it must send a Release command to the receiver. This tells the receiver to begin scanning and immediately lock on to the next transmitter whose frequency it detects. If another transmitter is on, or is turned on, it will assume control. If no other transmitters are on, the receiver will wait 10 seconds from the time it received the Release command then revert to the FCFS mode.

Magnet Control. Additional safety is built into systems that use a lifting magnet. Two methods are used for the magnet control buttons.

The **two button** design uses one button marked MAG LIFT and the second button marked MAG DROP. Pressing the MAG LIFT energizes the magnet. To de-energize the magnet and drop the load, MAG LIFT and MAG DROP must be pressed at the same time. A time delay is built into

SECTION 5: TRANSMITTER

the circuit so that the buttons must be held for nearly a second before the magnetic controls are activated.

The **three button** design uses a safety button marked MAG and separate buttons for LIFT and DROP. In order to energize the magnet, MAG and LIFT switches must be pressed at the same time. To de-energize the magnet and drop the load MAG and DROP must be pressed at the same time. A time delay is built into the circuit so that the buttons must be held for nearly a second before the magnetic controls are activated.

An additional switch may be provided for fan drop of the load. Labeled FAN, or MAG FAN, pressing this switch along with MAG or MAG LIFT as appropriate, will activate the fan drop function. Again, a time delay is built into the circuit so that the buttons must be held for nearly a second before the magnetic controls are activated.

5.5 TROUBLESHOOTING

The transmitter has an LED to aid in troubleshooting.

Due to the rough treatment it may be subjected to, most problems are likely to occur in the transmitter. The transmitter should be thoroughly diagnosed before proceeding to the receiver.

WARNING

When testing the transmitter, the receiver may become active resulting in system operation. Always assume the system is working and will respond when testing a transmitter.

AVERTISSEMENT !

Lors d'essais de fonctionnement du transmetteur, le récepteur peut être activé et provoquer la mise en marche du système. Toujours considérer que le système fonctionne et qu'il répondra aux essais du transmetteur.

When the transmitter is OFF the LED should be off.

Press and release the ON/ALARM button. The LED should flash at a low rate. Press a command switch. The LED should flash at a high rate.

If the batteries are getting low, the LED will flash on-off. (1/2 second on and 1/2 second off) while the transmitter is ON. The batteries should be changed at the next convenient opportunity.

If the LED remains on continuously there is either a switch activated at the time the transmitter is turned on, or a general failure that requires factory service. If the LED remains lit continuously on power-up, insure that no other switches are pressed while attempting to turn the transmitter on.

If the test LED does not light at all, replace the batteries. If this does not fix the problem, the transmitter is inoperable and must be repaired.

5.6 TRANSMITTER REPAIRS

Refer to figure 5.3.

CAUTION

The transmitter electronic components are exposed when the back of the case is removed. Take caution to prevent dirt or other contaminants from entering the case. Do not allow the circuit to be scraped or damaged in any way.

AVERTISSEMENT !

Lorsque l'endos du boîtier est enlevé, les composants électroniques sont à découvert. Prendre soin d'éviter de laisser la saleté ou tout autre contaminant entrer dans le boîtier. Éviter d'érafler ou d'endommager le circuit de quelque façon que ce soit.

SECTION 5: TRANSMITTER

Battery Replacement.

1. Remove the four screws in the back of the transmitter and remove the back of the case.
2. Replace with two AA Alkaline or Lithium batteries.
3. Replace the back of the case and the screws. Tighten the screws snugly.

Changing the Transmitter Keypad.

1. Remove the four screws in the back of the transmitter and remove the back of the case.
2. Remove the batteries from the holder.
3. Remove the two screws holding the printed circuit board assembly and remove it from the case.
4. Remove the rubber keypad from the metal backing plate.
5. Install the new rubber keypad onto the backing plate making sure the tabs are pulled through each slot.
6. Reassemble the transmitter in reverse order. Make sure the battery wires do not get pinched between the case halves.

Changing the Transmitter Identity Code

1. Remove the four screws in the back of the transmitter and remove the back of the case.
2. Attach the programming plug to the four pin connector on the circuit board.
3. Load the Identity Code (see section 4.3, PROGRAMMING).
3. Replace the back of the case and the screws. Tighten the screws snugly.

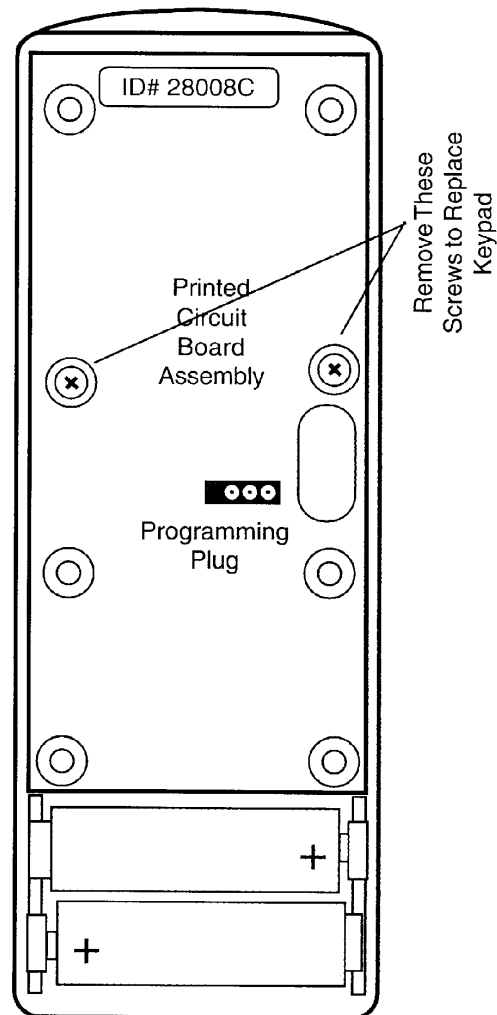


Figure 5.3 Transmitter with Back Removed

SECTION 5: TRANSMITTER

5.7 TRANSMITTER SPECIFICATIONS

Operating frequency band	902 - 928 MHz
Channel spacing	300 KHz
Modulation	Digital Frequency Modulation based on Manchester Code. Contains 16 bit address plus 16 bit CRC check.
Command functions	Up to 18
Power, input	2 AA cell batteries. Alkaline or Lithium recommended.
Output power	Meets FCC part 15 requirements for license free operation.
Antenna	Internal circuit board.
Switch Type	Patented Elastomeric Keypad
Indicators	Self test LED indicator.
Transmitter case dimensions	2.75" x 8.0" x 1.0"
Transmitter Weight	9 Oz.
Ambient Operating Conditions	- 20° F to +160° F

**Table 5.1 21T18
Transmitter Spare Parts List**

<u>ITEM</u>	<u>PART NUMBER</u>
Spare transmitter (complete)	21T18
Shoulder Strap	620008
Leather Holster	620007
Rubber Key Pad	752308

UNCERTAINTY TOLERANCE

DNB Engineering's Fullerton Facility is within acceptable uncertainty tolerances per ANSI C63.4 (1992) sections 5.4.6.1 and 5.4.6.2.

ANSI C63.4 (1992)

5.4.6.1 Site Attenuation. A measurement site shall be considered acceptable for radiated electromagnetic field measurements if the horizontal and vertical NSA derived from measurements, i.e., the "measured NSA," are within ± 4 dB of the theoretical NSA (5.4.6.3) for an ideal site.

5.4.6.1 NSA Tolerance. The ± 4 dB tolerance in 5.4.6.1 includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies. These errors are analyzed in ANSI C63.6-1988 [3], wherein it is shown that the performance of a well-built site contributes only 1 dB of the total allowable tolerance.

INFORMATION PERTAINING TO EQUIPMENT MANUFACTURED AFTER COMPLIANCE TESTING

It is prudent that manufacturers have an established Quality Assurance program to spot check their products on a periodic basis, either based upon time or quantities produced. Obviously, a change in the engineering design should be sufficient justification for a re-test.

The Quality assurance test need not be formal Verification or Certification such as required during the initial production of the product. However, it should be sufficient in scope to assure that the EMI characteristics of the product have not changed to the degree that the product exceeds the FCC limits. If a new model of a product is produced, it must undergo full Verification or Certification testing and, in case of Certification, be filed with the FCC.

It is expected that the FCC will place greater emphasis and resources in spot checking commercially available products. If a product is found not to be compliant with the Limits specified in Part 15, Subpart B. the manufacturer will be subject to the appropriate penalties imposed by the Commission. The initial Certification or Verification is sufficient to justify initial production. The additional quality assurance testing performed is the manufacturer's responsibility to assure continued compliance.