

ROBINSON
ENGINEERING COMPANY

Operation & Maintenance Manual

Crane Boss®

TITAN 500

**900 MHz
Digital Radio
Remote Control System**

April, 2011

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12-1608	OUTLINE, CRANE RADIO CONTROL

SECTION 1

GENERAL INFORMATION

1.1 SCOPE

This manual contains information necessary to install, operate and maintain TITAN 500 Radio Remote Control Systems. The information is generally applicable to all TITAN 500 systems manufactured by Robinson Engineering Company.

1.2 SYSTEM DESCRIPTION

- 1.2.1 General – The TITAN 500 system is equipped with controls and accessories required for reliable electrical operation of a crane or other machinery from a portable wireless control transmitter.

1.2.2 Control functions provided:

Off/Emergency Stop

(Transmitter) On

‘B’ - 5-step reversing

‘T(1)’ - 5-step reversing

‘H(1)’ - 5-step reversing

‘Aux 1’ / ‘Aux 2’ (Maintained)*

‘Aux 3’ / ‘Aux 4’ (Momentary & Interlocked)

‘Aux 5’ (Momentary: used in conjunction with ‘Aux 3’ & ‘Aux 4’)

Start/MLC/Indicating Light/Horn(Sig)

1.2.3 Characteristic features are:

1. Each system consists of a portable control transmitter which operates in conjunction with receiving equipment installed on the machinery structure and electrically connected to the magnetic controllers and/or variable frequency drives.
2. “Fail-safe” circuits are used throughout the system.
3. The command link is capable of handling all motions simultaneously.
4. The system uses digital pulse code frequency modulation. It was developed specifically for industrial control.
5. The system utilizes fully solid state electronic circuits, with heavy duty relay contact output circuits.
6. Maintenance requirements are greatly reduced by modular design and use of digital switching circuits. No special test equipment is required.
7. Radio control of several units in the same plant without interference is entirely practical. Each transmitter transmits a unique address code, which prevents response by other than the intended unit. In addition, the operating frequencies of different units are staggered within the frequency band to prevent interference. Proper selection of address codes and operating frequencies with respect to physical separation provides control of multiple installations with no practical limitation on the number at one location.

1.2.4 SPECIFICATIONS

Operating Range: 300 Feet

Operating Temperature: -40° F to 150° F

Frequency Band: 902 to 928 MHz

Transmitter Housing: ABS Plastic

Transmitter Dimensions: 12 ¼” L x 3 ¼” x 2 ½” D

Transmitter Weight: 2 lbs

Batteries: 4 Alkaline AA (1.5 Volt each)

Transmitter Automatic Power Down after 30 minutes of non use.

Maintained Aux 1 & Aux 2 Circuits

Receiving unit: Nema 12/4 (Indoor/Outdoor)

Relay Contact Rating: 10 Amp Maximum

Receiving unit: Maximum current draw 0.25 Amps or 30VA

FCC Certification (Part 15.249) USA & Canada

FCC ID: NQHGCRFHRH9TX

IC: 4527A-CRANEBOSS

- 1.2.5 Transmitter – The transmitter is a portable unit that is carried by the operator. A shoulder strap is provided to enable the operator to conveniently carry the unit while leaving hands free to operate controls. Switches on the transmitter controls all functions as labeled.

The portable transmitter weight is approximately 2 pounds. The transmitter includes an internal antenna and has a battery assembly attached. The battery assembly uses 4 “AA” cells that may be disposable (alkaline, carbon zinc, etc.). The TITAN 500 transmitter can run for up to approximately 120 Hours of continuous operation, depending on the batteries that are used.

Rechargeable (NiCd), that may be recharged on commonly available charger (not furnished by Robinson Engineering Company), are also usable.

- 1.2.6 Receiving Equipment – The receiving equipment cabinet is mounted on the machinery and contains the radio receiving unit, decoding equipment and relays to convert the radio signal from the transmitter to signals suitable for operation of (magnetic) controls’ contactors and variable frequency drives.

1.3 GUARANTEE

Manufacturer warrants the delivered remote control system to be free of defective material and workmanship and agrees to remedy any such defect within two years of first party purchase at no charge to the purchaser upon return of defective parts to factory. Defects caused by improper installation, maintenance, misuse, tampering, neglect, accident, or use in violation of manufacturer's written instructions, shall not be covered by this warranty. Manufacturer guarantees that remote control system will perform as outlined in this manual.

Transferring of this warranty is acceptable and recommended. Please notify this factory of any and all transfers.

SECTION 2

OPERATION

2.1 RECEIVING EQUIPMENT

Normal operating procedures is to leave receiving equipment energized at all times. (Power switch “On”, neon indicator lighted). The unit can then be readily placed in operation by means of the portable control transmitter.

2.2 TRANSMITTER

The transmitter should be stored in a secure location when not being used, with the transmitter ‘Off’. (Transmitter LED’s off). Remove Batteries for prolonged length of non use.

2.3 OPERATING PROCEDURE

To place the unit in operation, proceed as follows:

1. Suspend transmitter on the operator by means of shoulder strap. Make sure all attachments are secure to prevent accidental dropping of the unit.
2. Operator should position himself so as to have a clear view of the motions and actions.
3. Verify batteries are installed properly, and press the green ‘Start’ switch. A green LED will illuminate (labeled ‘ON’). Green ‘ADD’ LED will light on Controller Board.
4. With all operating controls in neutral position, push ‘Enable’ pushbutton. Master indicating light (Red) will light and remain on. ‘EN’ light (Amber) will remain on while ‘Enable’ pushbutton is depressed. Master Relay and Mainline Contactor on Crane are energized.

5. Operating desired control operators can now move machinery. All motion controls are spring loaded to neutral.
6. In the event of an emergency situation press the Red 'E-Stop' pushbutton and remove the batteries.
7. Upon completion of use, replace transmitter in designated storage location with transmitter 'Power' off (Press 'E-Stop'). Remove batteries for prolonged length of non use.

2.4 MISCELLANEOUS OPERATING INFORMATION

Abnormal electrical conditions during operation will de-energize control circuits, stopping motion. This can be caused by any one of a number of abnormal conditions. Among these are:

1. Weak or improper radio signal.
2. Interruption of power to receiving equipment.
3. Radio interference.
4. Malfunction of radio equipment.
5. Malfunction of machine electrical equipment.

If the abnormal condition is temporary, control can be resumed by repeating steps 3 through 6 of paragraph 2.3. The exact sequence of operation must be followed to accomplish operation of safety circuits in the receiving equipment.

SECTION 3

PRINCIPLE OF OPERATION

3.1 RADIO CONTROL SYSTEM

The TITAN system is simple to operate. The transmitter unit incorporates easily operated pushbuttons for each crane motion. Depressing the appropriate pushbutton from the neutral position moves the crane in that direction. A Green 'Start' pushbutton powers up the transmitter and energizes the Address Relay, followed by the Master Circuit after depressing an 'Enable' pushbutton, and hence the Main Line Contactor. All motion control pushbuttons return to neutral (dead-man action) when released, and motion stops. Fail-safe features are used throughout the circuitry. All crane motion stops in case of malfunction.

The transmitter(s) in your Crane Boss system transmit unique digital crane address codes to each crane. This prevents any mix-up in crane response. Only one crane responds to one special code when transmitted. Hundreds of these address codes are available. For added protection, operating frequencies of each transmitter in the same area can be staggered within the frequency band to prevent interference. The proper selection of digital address codes and operating frequencies relative to physical separation permits control of an unlimited number of cranes in the same plant, area or city.

3.2 TRANSMITTER

The Transmitter is a battery operated frequency modulation radio transmitter. Incorporated with the transmitter is an antenna and disposable batteries. Transmitter carrier frequency is programmed by dip switch. When the various control switches are actuated, coded control signals are sent to the receiving equipment via the antenna. A block diagram of the transmitter is shown by Fig. 3-1.

The RF Assembly generates the radio frequency signal radiated by the antenna, and is frequency modulated by a pulse code modulation signal. This modulation signal is generated by the Motherboard and consists of a series of synchronizing pulses determined by the position of the various function controls, which are actuated by the operator. All RF Boards for the same frequency band are identical and interchangeable and frequency is programmable by dip switches on motherboard.

Motherboard Assembly used in all TITAN 500 transmitters is identical in function and is interchangeable. Variation in code format between systems is accomplished by means of dip switches.

Aux Board Assembly contains the Aux Pushbuttons, a 6-position dip switch for primary Address Code and battery connections.

Start/Stop assembly controls the power to the transmitter and allows the RF signal to be generated. It contains LED's which provide visual notification of the status of the transmitter. The 'Start' pushbutton turns 'On' the transmitter and the 'E-Stop' pushbutton turns 'Off' the transmitter (stopping all signals to the receiving unit).

In multiple system installations a given transmitter may be converted from control of one crane to another by changing the dip switches on the Motherboard and Aux Board. The Scanning Receivers used in multiple systems installations are normally supplied with capability of receiving all transmitting frequencies used at that installation.

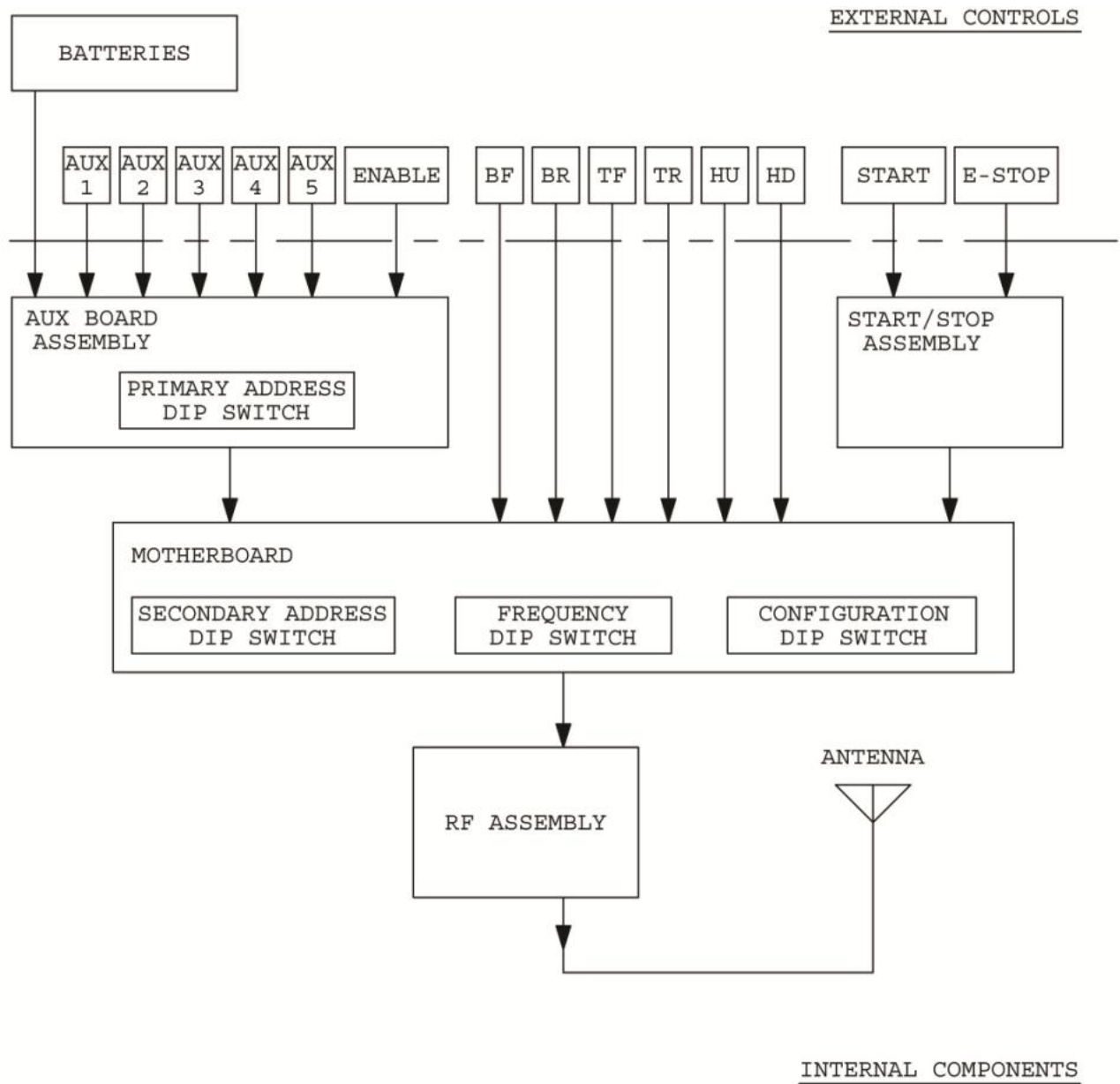


FIG. 3-1 (T) : BLOCK DIAGRAM, TRANSMITTER

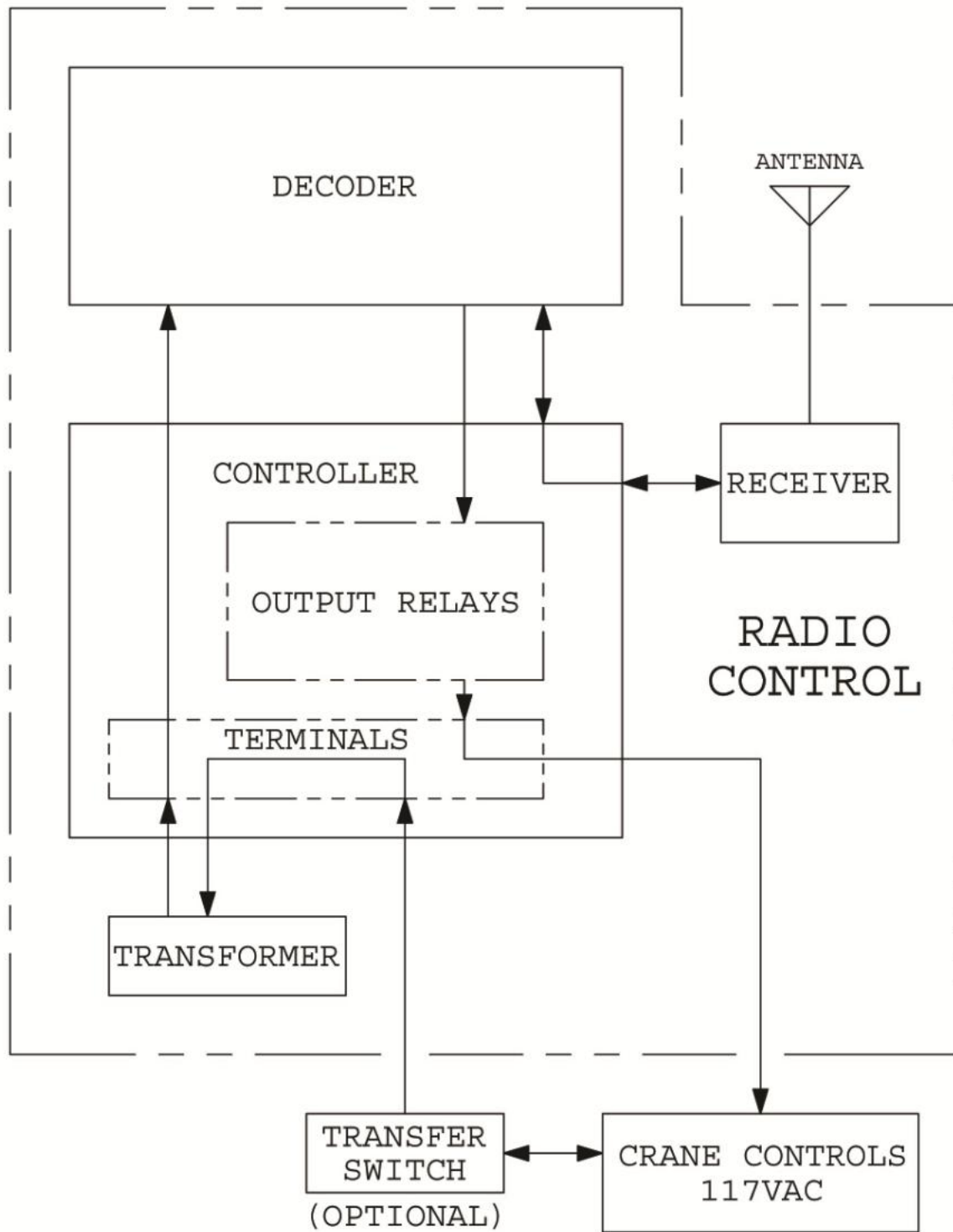


FIG. 3-2: BLOCK DIAGRAM, RECEIVING EQUIPMENT

3.3 RECEIVING EQUIPMENT

Figure 3-2 shows a block diagram. The radio signal from the transmitter is received by the antenna, which is connected to the Receiver by coaxial cable. Receiver data output is fed to the Decoder, where it is decoded and signals suitable for operation of the output relays are generated. The output relays provide heavy-duty control circuits to the basic machine electrical controllers.

3.3.1 Antenna - The Antenna is pre-tuned for the frequency band used.

3.3.2 Receiver - The Receiver amplifies and detects the frequency modulated pulse code signal and includes filtering and shaping circuits to process the signal.

The Receiver is a synthesized frequency controlled scanning type receiver, which continuously scans all selected channels until a signal is received which contains the proper address code. When proper address code is received, scanning stops and, the receiver remains “locked-on” that channel for as long as the code remains.

Channels can be turned “Off” when unused or turned “On” when other equipment is added.

3.3.3 Voltage Regulator module conditions the 12VDC voltage to the receiver module, protecting the receiver from voltage spikes.

3.3.4 Decoder - The receiver data output is connected to the Decoder through the Controller, where it is processed into form suitable for operation of the Relays. The Decoder also performs certain synchronization, safety interlock, and digital filtering and noise rejection functions. All DC voltages originate in the Decoder.

3.3.5 Address Code - The address is a two digit hexadecimal number that is set at the factory. The number for each system is shown in the “Code” number block in the lower right corner of the Controller.

3.3.6 Output Relays - Relay contact logic circuits provide additional safety sequencing and interlocking functions. Output circuits are connected to terminal blocks for connection to magnetic controllers and/or variable frequency drives. Output relay circuits are rated for operation of up to NEMA size 4 contactors at a maximum coil voltage of 125 volts A.C.

SECTION 4

INSTALLATION INFORMATION

4.1 SCOPE

This section is intended as aid to preparing for mounting and interconnection of the TITAN 500 to crane or monorail. The examples and suggestions made as to mounting and interconnection are based upon typical uses and past experience; depending upon application, these may or may not be applicable or appropriate.

The installer is cautioned to assure that requirements of applicable Codes and Ordinances are complied with.

4.2 MOUNTING – RECEIVING EQUIPMENT

4.2.1 Refer to Outline Drawing for mounting dimensions and clearances required.

4.2.2 Rigidly mount, as for any control panel, the Receiving Cabinet to the structure of the equipment to be remotely controlled. Allow access for conduit entry as noted on the Outline Drawing.

4.2.3 Mounting of the Indicating Light (if used) is accomplished by normal electrical wiring procedures. Be sure of visibility from operating area. Also, that it be conveniently accessible for service (changing bulb, etc.). Terminals IL and X2 are used for the Indicating Light.

4.2.4 The antenna is installed by screwing into the Antenna Cable. The Antenna Cable is then screwed into the Receiver Module.

4.2.4.1 Proper mounting and location of antenna is imperative for signal to reach decoding and output circuits. (See Notes on Outline Drawing).

4.2.5 Wherever the “other” means of control (console, pendant, etc.) is located (trolley, bridge) is probably the simplest wiring location for the radio control cabinet. The only distinct difference between pushbutton and radio control is that 117 VAC must be available for radio power supply. Pushbuttons will have as a common the “hot” lead. The other leg of the transformer (X2) must often be added by conductor bar, festooning, or by other means.

4.3 TRANSFER SWITCH

4.3.5 Mutually exclusive transferring of control modes is often used: “Pushbutton-Radio”, “Cab-Radio”, “Pendant-Radio”, “Console-Radio”, etc. The mutual exclusivity is most simply obtained by appropriately defeating the other mode’s power feed, as well as, opening any normally closed circuits. See Fig. 4-1.

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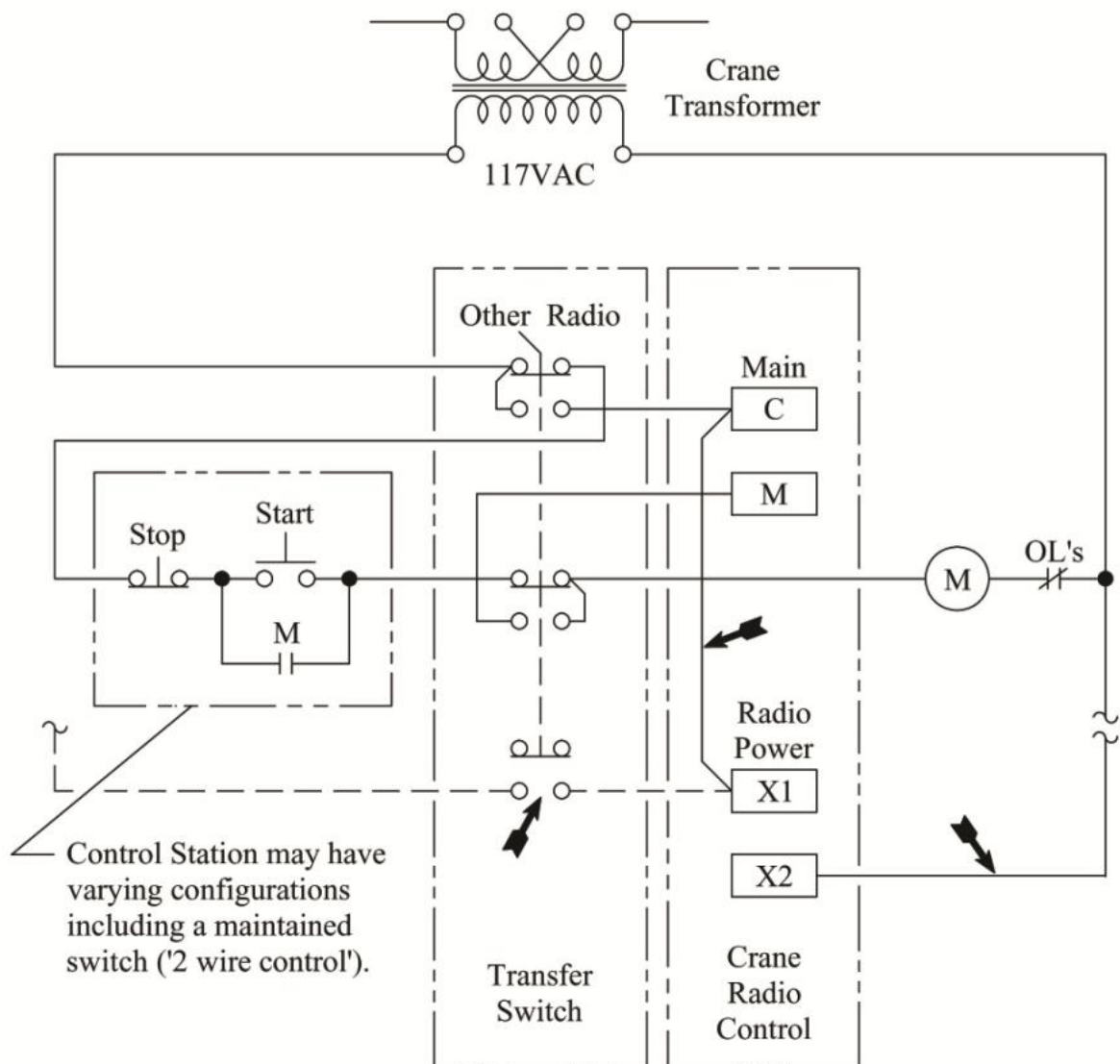
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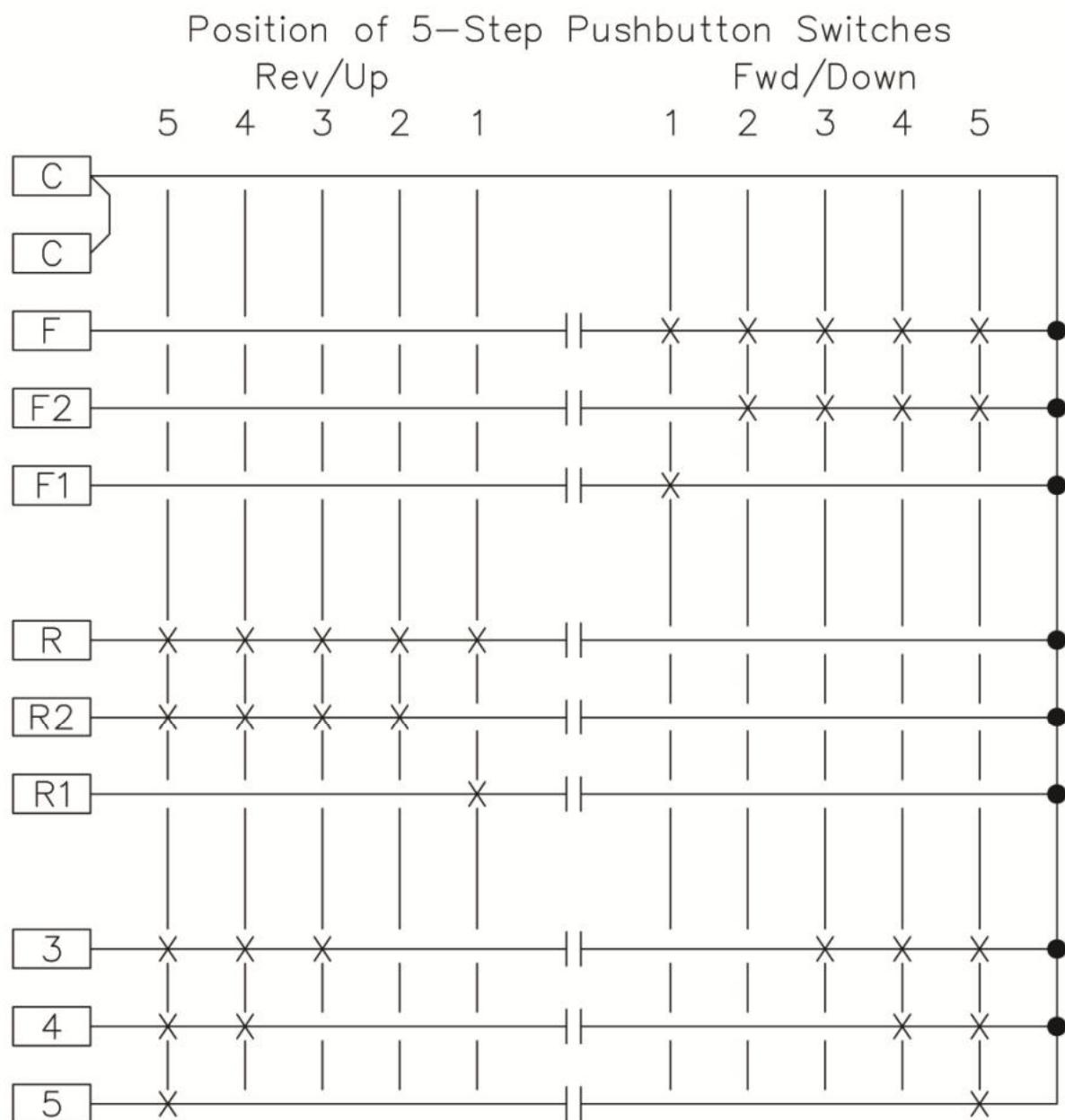
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➡ If Radio Power is to be separate from Main Power, omit jumper from C (Main) to X1 and add Transfer Switch contact with dashed line connection as shown. X1 and X2 must be connected to the same 110-120VAC Control Transformers' Secondary.

NOTE: This diagram is an example only. Equipment control circuits may vary greatly. Control connections should be carefully considered to provide proper operation and avoid feedback circuits.

FIG. 4-1:
TYPICAL TRANSFER SWITCH & MAIN LINE CONTACTOR CIRCUIT

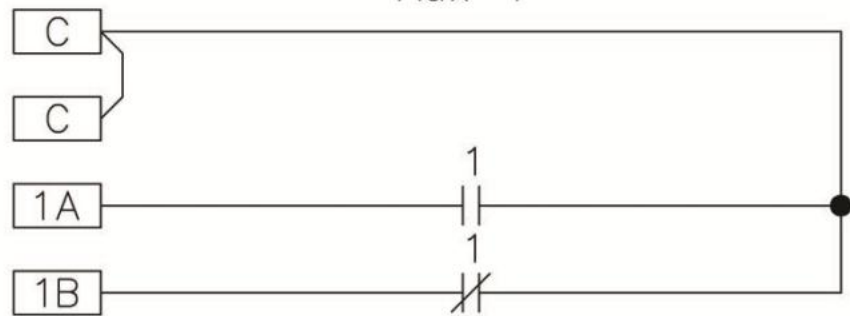


X: Indicates Closed Circuit

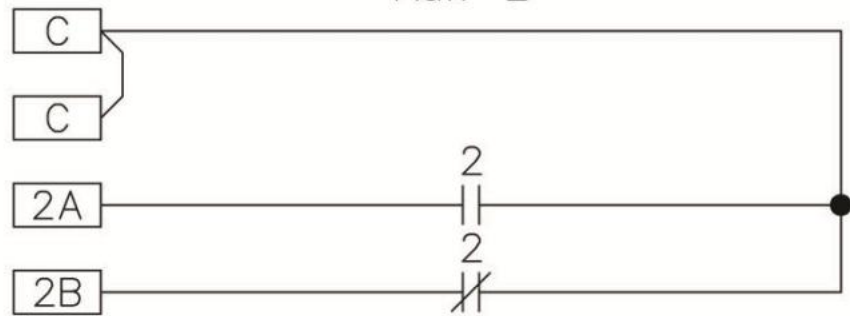
Fig 4-2(T5): Output Circuit Functional Diagram
(Relay Contacts Simplified)

Aux Pushbuttons

Aux '1'



Aux '2'



Aux '3', Aux '4', Aux '5'

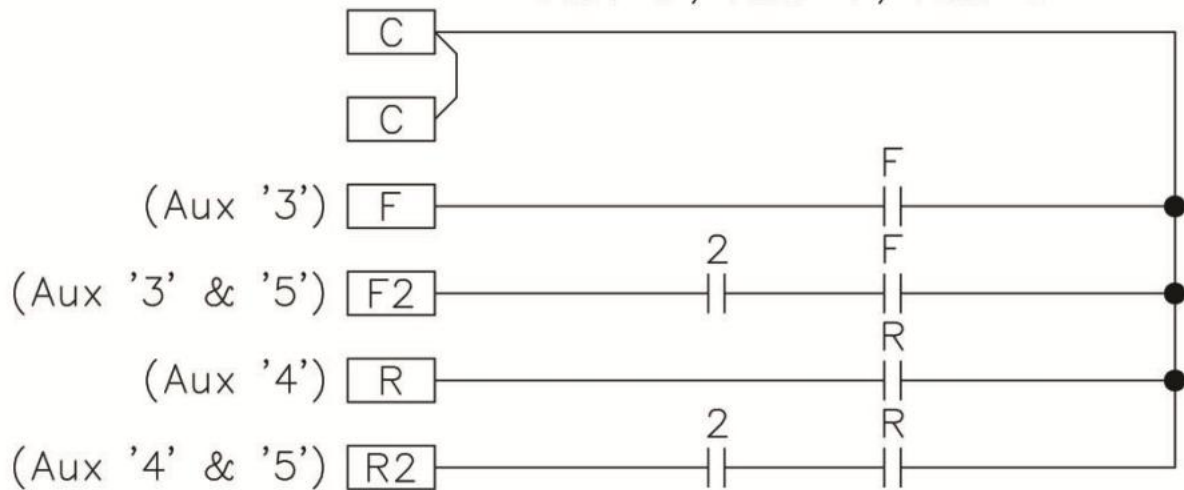


Fig 4-4(T5): Output Circuit Functional Diagram
(Relay Contacts Simplified)

4.4 OUTPUT CIRCUITRY

- 4.4.1 Main circuit - connect Main Contactor (M) in a manner similar to Fig. 4-1. The circuit should provide for the Main Contactor to be energized when the circuit from “C” (Main) to “M” terminals is closed. Be certain to use a Transfer Switch if any “other” control exists.

A “Stop” circuit (momentary), from “C” (Main) to “Stop” terminals, is available to unlatch a latching main contactor or similar applications.

Safeties, such as N.C. master switch contacts in series between “M” terminal and Main Contactor coil should be employed whenever practical.

- 4.4.2 The output of the TITAN 500 digital radio remote control is by heavy-duty relay contacts. One normally open circuit is available for each function direction and each speed output. See Fig. 4-2(T5) and Output Circuits Drawing for logic of internally, pre-wired circuits.
- 4.4.3 Motion Circuits - each motion pushbutton on the transmitter (B, T(1), H(1)) has respectively labeled output circuitry which provides:
1. Separate common (X1) for each motion.
 2. Direction outputs maintained through full-throw of switch in the respective direction.
 3. Separate ‘Lo’ contacts for each direction of Hoist. These open at 2nd step.
 4. Separate 2nd contacts for each direction of Hoist. These close at 2nd step.
 5. 3rd, 4th, and 5th outputs close respectively and cumulatively.
- 4.4.4 Auxiliary circuits* - ‘Aux 1’ & ‘Aux 2’ have separate commons (X1), having separate output contacts and terminals, for both normally open (N.O.) and normally closed (N.C.) contacts. See figure 4-4(T5) and Output Circuit drawings for logic of internally, prewired circuits.
- 4.4.5 Auxiliary circuits - ‘Aux 3’, ‘Aux 4’ & ‘Aux 5’ use (1) common (X1), having separate output contacts and terminals. ‘Aux 3’ & ‘Aux 4’ are electrically interlocked. ‘Aux 5’ is used in conjunction with ‘Aux 3’ & ‘Aux 4’, having separate outputs for each pairing. See figure 4-4(T5) and output circuits drawing for logic of internally, prewired circuits.

* See “Options” Appendix.

4.5 INTERFACE LOGIC PANELS

4.5.1 Required uses:

4.5.1.1 Contactor control voltage exceeds 120 VAC (cab masters are often full voltage) - See 4.5.2.

4.5.1.2 Contactors larger than size NEMA 4, or multiple contactor coils are simultaneously operated, or inrush current exceeding 10 Amps per relay contact.

4.5.1.3 Contactors with DC coils are used.

4.5.2 Upgrading Contact Rating

4.5.2.1 When voltage or current rating of output contacts is insufficient to operate a contactor directly, an interposing relay must be used.

4.5.2.2 The coil of the interposing relay used should be operable within the output contact ratings:

120 VAC, maximum size NEMA 4 contactor. Maximum 10 Amp inrush current.

4.5.3 Logic Expanding

4.5.3.1 When more than one contact closure per output is required or additional logic through combinations requires more output contacts than available at the terminal strip, additional contacts must be made available through the use of interposing relays.

4.5.3.2 The addition of a logic panel can also simplify pendant, pushbutton, or cab master wiring. Assure isolation of all operating modes by the application of the Transfer Switch. Equipment control circuits may vary greatly. Control connections should be carefully considered to provide proper operation and avoid feedback circuits.

4.6 START-UP PROCEDURE

4.6.1 Before Power-up Check List:

- ☐ 1. Cabinet mounted per Outline Drawing and Manual paragraph 4.2
- ☐ 2. All conduit entry thru gland plate on bottom of cabinet.
- ☐ 3. Receiving Antenna must be visible from operating area, in all directions and over entire range of operation with Antenna mounted vertically pointed down.
- ☐ 4. Internal components and connections are tight and secure.
- ☐ 5. Channel(s) for transmitter(s) to operate unit are selected on the Scanning Control Receiver. See tag(s) on transmitter(s) for frequency & channel.
- ☐ 6. Transfer Switch, if used, is in "Radio".

4.6.2 Receiving Power-up Check List: (Transmitter off)

- ☐ 1. With "On/Off" Toggle Switch to "Off" position, turn on supply power to radio (and control-voltages of crane). Measure 100 to 140 VAC between radio terminals 'X1' & 'X2'.
- ☐ 2. Smoke Test: Press Toggle Switch to "On" position. Neon Indicator, next to Toggle Switch, lights and Control Receiver scans thru all selected channels continuously and Receiver flashes green LED.

4.6.3 Operational Check List:

- ☐ 1. Perform system Functional Test (5.2.3.4) on Manual page 5-5 using Operating Procedure (2.3 on Manual Page 2-1); ALL functions, even if not used on this application.
- ☐ 2. Range Test:
Employing proper safety precautions, operate from the extreme locations in the area.
- ☐ 3. Leave the Operation & Maintenance Manual on-site.

4.6.4 Problems

See Section 5 in the Operation & Maintenance Manual. If perplexed, call the Robinson Engineering factory from on-site. Have serial number of unit and Manual ready !

SECTION 5

MAINTENANCE

The system is of modular design, with plug-in type electronic sub-assemblies and readily replacing electrical components. Trouble can be corrected by locating and replacing the defective part, using the substitution method. It is suggested that spare parts be obtained for replacement purposes. Field repair of electronic sub-assemblies is not recommended. Improper techniques can result in damage to components and voiding of warranty. The factory will provide prompt test and repair or replacement of returned defective or questionable parts, including the complete transmitter, at nominal cost, or at no cost under warranty.

5.1 PREVENTIVE MAINTENANCE

No preventive maintenance is required except for periodic inspection for security of hardware, harnessed internal wiring and to check for intrusion of dirt or foreign matter. Relay contacts may be checked for excessive arcing by cycling through all motions. Replace parts as necessary.

5.2 CORRECTIVE MAINTENANCE

- 5.2.1 General - In case of suspected Radio Remote Control System trouble, activate the back-up controls and check for normal machine operation. If back-up system operation is not normal, locate and correct trouble in basic equipment before proceeding to radio equipment.
- 5.2.2 Transmitter - (See Block Diagram, Transmitter, Fig. 3-1(T), and Transmitter Components Fig. 5-1(T5)).
 - 5.2.2.1 Replaceable Batteries - If the voltage is low with transmitter on (Start Pushbutton Depressed, Green LED Illuminated), a 'Low' 'Red' LED will light on the transmitter, indicating the batteries need replacing. The transmitter will operate a short period of time before the transmitter will shut itself down. Do not continue using the transmitter without replacing the batteries.

5.2.2.2 Transmitter Test - A simple qualitative check of transmitter operation may be made by monitoring the receiver. With the transmitter On, (Start Pushbutton Pressed and Green LED Illuminated), the Green LED on the Receiver Module will stop flashing and remain illuminated.

CAUTION: When the Master Relay (and Main Contactor) is energized, any energized motion relay will cause crane motion.

5.2.2.3 Multiple System Applications - A transmitter may be converted from operation of one unit to another by changing the Address Code, Frequency and Function Settings in the transmitter.

Access to the Address Code, Frequency and Function Settings Dip Switches of the transmitter is made by removing the eight Phillips head screws retaining the back case and removing the back. Figure 5-2(T) shows internal arrangement of parts. Separate the Bottom Case from the Top Case carefully; the battery wires and antenna wire connect the two halves.

CAUTION: In opening the case, use care to lift the Bottom Case apart to prevent breaking the Power wires and Antenna wire.

Match the dip switch settings in the new transmitter with the old transmitter, or the appropriate "Transmitter Dip Switch Setting Chart," Figure 5-3. A copy of the chart can be obtained by contacting the factory (have the transmitter serial number available when requesting chart).

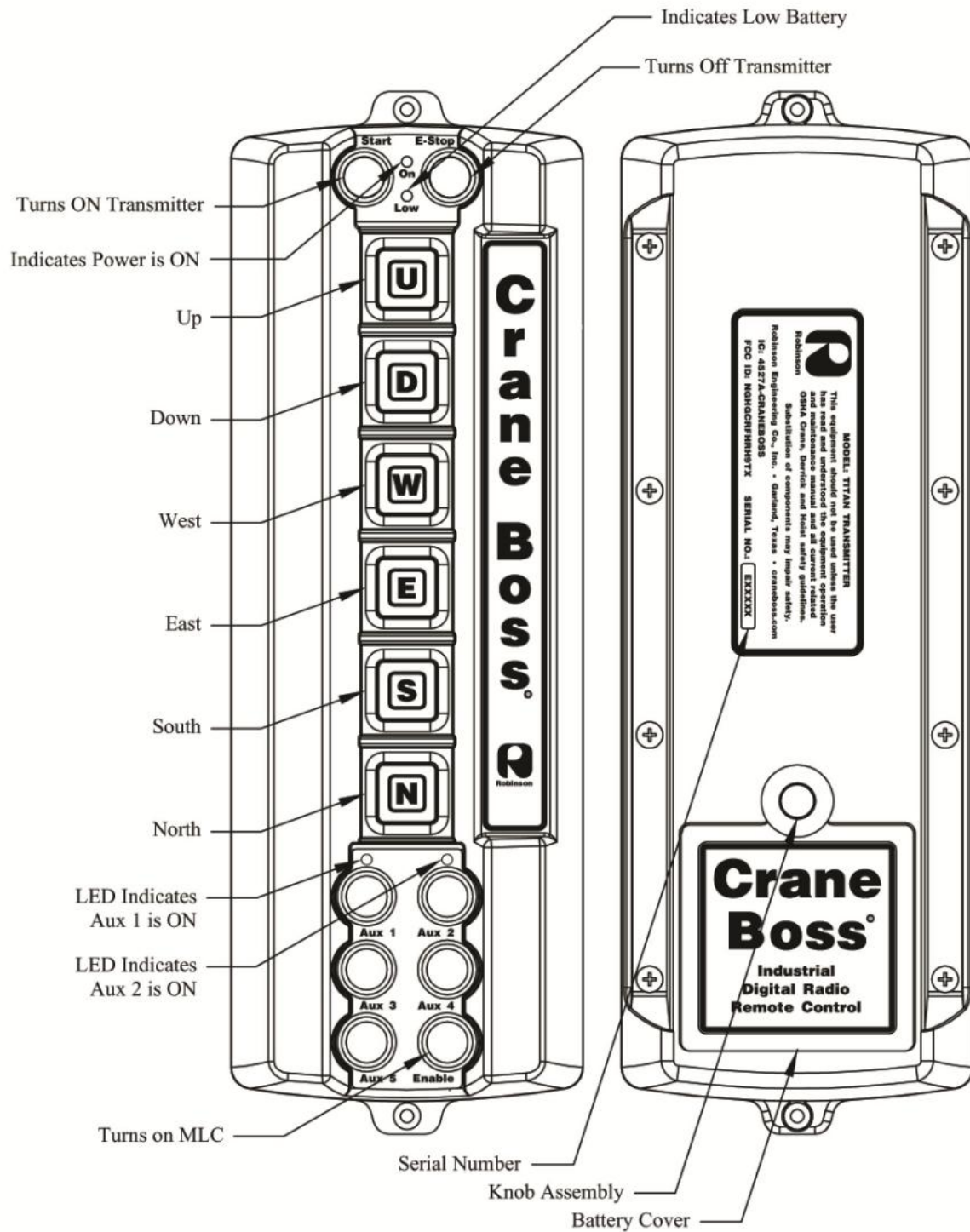


Fig 5-1(T5): Transmitter External Components

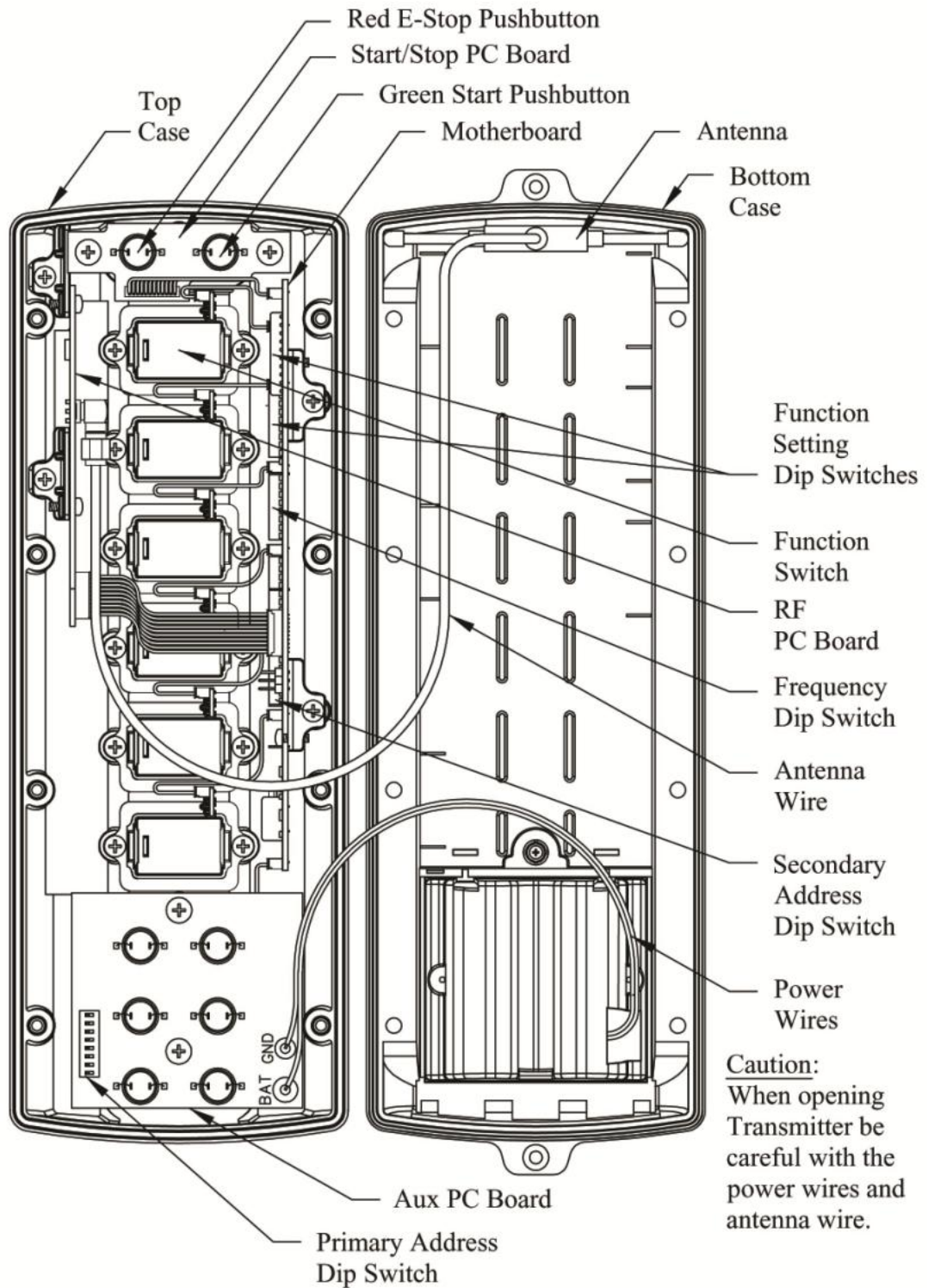


Fig 5-2(T): Transmitter Internal Components

Dip Switch Settings Titan Transmitter

Job _____
S/N _____
Date _____

Job _____
S/N _____
Date _____

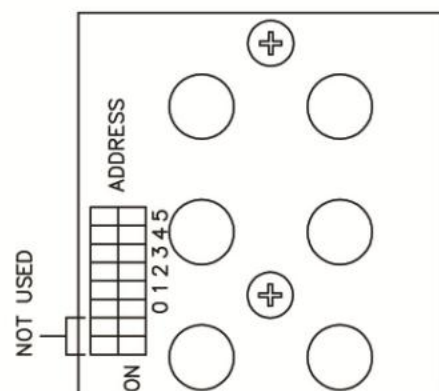
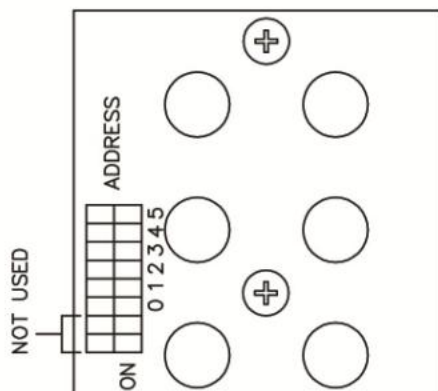
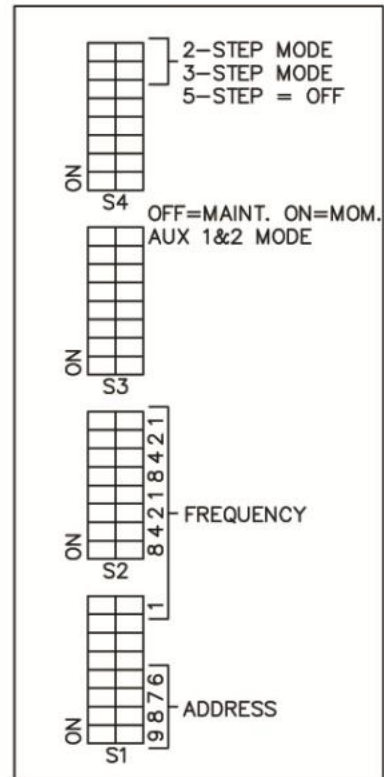
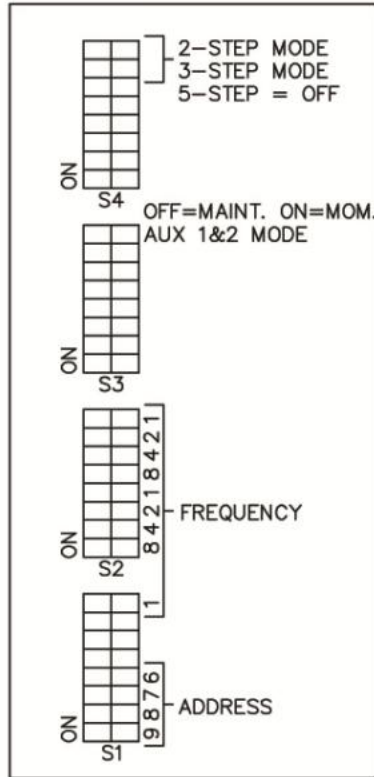


Fig 5-3: Transmitter Dip Switch Chart

5.2.3 Receiving Equipment – The receiving equipment consists of a Receiver, a Controller, a Decoder and miscellaneous components (transformer, antenna, enclosure, etc.).

5.2.3.1 Receiver – The transmitter command signals transmitted to the Receiver are processed by the Receiver and are conducted to the Decoder via the Receiver Cable and the Controller board. The Decoder will return a command to the Receiver to lock onto a radio RF channel from which a valid address code has been received.

5.2.3.2 Decoder – The Decoder contains the DC power supplies and the logic processing circuits to convert the signals from the Receiver into output signals to drive the required relays. All of the relays on the Controller except the Master Relay are operated directly from the Controller.

5.2.3.3 Controller – The Controller contains the relays and terminal strips to provide isolation circuits to the Crane Controls. Each of the relays has an indicating light (LED and dropping resistor parallel to its coil to provide an indication of the operation in progress.

WARNING: The set of DIP switches next to the Decoder connection are used to set the Receiving equipment Address at the factory. DO NOT attempt any alteration!

WARNING: The set of DIP switches next to the 'Ad' relay are used to set the Receiving equipment safety circuits at the factory. DO NOT attempt any alteration!

CAUTION: Keep fingers off of the board!

CAUTION: Keep fingers off of the fuse!

CAUTION: Use extreme care when probing the board with voltmeter probes, etc.!

MAINTENANCE CHECKS

CAUTION: MAKE CERTAIN THAT THE POWER SWITCH IS 'OFF' WHILE PLUGGING OR UNPLUGGING, CONNECTING OR DISCONNECTING ANY COMPONENT. Non-observance may result in damage and void the warranty.

CAUTION: When the Master Relay (and Main Contactor) is energized, any energized motion relay will cause crane motion.

Refer to Block Diagram, Fig. 3-2 and Schematic, Controller, to assist in tracing trouble.

5.2.3.4 System Functional Test -

CAUTION: REMOVE MASTER WIRING BEFORE PERFORMING THIS TEST TO AVOID INADVERTENT CRANE MOTION.

This test is performed with Transmitter in view of the Controller so that the LED indicators and relays may be observed. Have all modules in place, Transfer Switch in "Radio" and Power Switch "On" (Neon Indicator lit).

<u>Action</u>	<u>Anticipated Result</u>
1. Turn Transmitter 'On'. (Green Start Pushbutton)	Address relay will energize and remain energized until the E-Stop is pressed. (observe indicator).
2. Depress Enable/Sig pushbutton.	Enable Relay will operate momentarily until pushbutton is released. (Observe indicators). Master relay will energize and remain energized until Address relay de-energizes. (indicator will light and remain on until the (Red) E-Stop Switch is pressed).
3. Operate 'Aux' switches* '1' and '2' in turn.	'Aux' '1' and '2' relays will operate.
4. Operate "Aux" switches '3', '4' and '5' in turn.	Aux '3' (T2-F), Aux '4' (T2-R) and Aux '4' (T2-2) Relay will operate.
5. Operate motion switches	Each function relay is energized forward (down) and reverse (up) in turn. 2 nd , 3 rd , 4 th & 5 th speeds Energize in either direction.

* See "Options" Appendix.

If any relay and its LED indicator fail to operate, replace the Decoder. (See “CAUTION”, top of Page 5-7).

This test provides an opportunity to observe the relays operate mechanically and an opportunity to detect a defective relay. It may also be used as an aid in locating problems in the output circuits to the crane.

NOTE: If step 1 does not provide any of the indications noted and all voltage checks of paragraph 5.2.3.5 are correct, replace the Address relay. (See ‘CAUTION’, top of Page 5-7).

5.2.3.5 Voltage Checks:

<u>Test Points</u>	<u>Voltage</u>	<u>Test for</u>
Terminals “X1”, “X2”	117 VAC	<u>Input power</u>
Terminals “117 VAC”	117 VAC (Neon indicator lighted)	Power <u>switch</u> ”ON”, <u>Fuse</u> OK.
Terminals “24 VAC” (2) and “CT”	24 VAC between designated Terminals), 12 VAC between “CT” and each of the above terminals.	<u>Transformer</u> Output.

If any of the above checks fail to provide the noted voltage reading, the component involved should be repaired or replaced. (See “CAUTION”, top of Page 5-7).

Controller board OV and +5V (left and above “Ad” relay)*	5 \pm .2 VDC	Decoder 5 VDC logic power
Controller board OV and +12V (left and above “Ad” relay).*	15 to 18 VDC no load. 9.5 to 11.0 VDC under max. relay load.	Decoder 12 VDC relay Power
Controller board OV and +12 VDC (below receiver connector).	15 to 18 VDC	Decoder 12 VDC Receiver power

* Note:

- 1) Transformer may need to be loosened from mounting.
- 2) The type of meter used will vary the “no load” readings
considerably.

If any of the above checks fail to provide the noted voltage readings,
The Decoder should be replaced. (See “CAUTION”, top of Page 5-7).

5.2.3.5 Receiver – use the Transmitter qualitative test, paragraph 5.2.2.2 to check the Receiver. If receiving range appears to be reduced, check antenna for defects and proper connections.

NOTE: The cable connecting the Receiver to the Controller should not be ignored. A continuity test may be appropriate. (See “CAUTION”, top of Page 5-5).

5.2.3.7 Decoder – The only check for a suspected defective Decoder is substitution of a spare module.

5.2.3.8 Controller – Refer to Schematic, Controller, for assistance in circuit tracing.

CAUTION: When the Master (and Main Contactor) is energized, any energized motion relay will cause crane motion.

With Transmitter “OFF”, all relays (and LEDs) should be de-energized.

Main Circuit – This circuit is designed to operate in the following sequence:

1. Transmitter “Off”, all relays de-energized.
2. Transmitter “ON”, Address relay energized.
3. Address and Enable relays energize Master Relay (M) if all Transmitter motion controls are “OFF”. Address relay must be energized before any other function relay may be energized.
4. De-energizing the Address Relay by turning the Transmitter “OFF” de-energizes the Main Contactor, Enable and Master relays.

Relay contact circuits only control the Master Relay. An examination of the Schematic will reveal a series of normally closed circuits. If any of these relays are energized, the circuit will open, not allowing the master relay to energize.

This is also true if any of these relays are missing or have a defective contact.

Also note, if the Address and Enable relays are not energized, the Master Relay cannot energize.

Safety Circuit - This circuit is a comparison circuit between the Address relay and the Enable relay condition providing for a system shut down in the event of a mismatch of more than a fraction of a second duration.

5.3 REPLACEABLE PARTS

When purchasing parts from the factory, please provide the Serial Number of your equipment (See nameplate on Transmitter or Receiving Equipment).

5.3.1 Transmitting Equipment:

Part Number	Description	Qty System	Recommended Spare Parts	Qty/ Spare Kit
12-1996-00	Transmitter, Model TITAN 500*	1	1	
12-1856-00	Shoulder Strap	1		
12193803	Battery Cover	1	1	
12193807	Knob Assembly, Battery Cover	1	1	
12193901	5-Speed Switch Assembly	6		
	Aux Pushbutton (Black)	6		
	Start Pushbutton (Green)	1		
	E-Stop Pushbutton (Red)	1		

5.3.2 Receiving Equipment:

Part Number	Description	Qty System	Recommended Spare Parts	Qty/ Spare Kit
12-1982-00	Control Receiver	1		
12-1602-01	Receiver Cable	1		
12-1985-15	Antenna Cable	1		
ANT-916-CW-QW	Antenna	1		
12-1740-00	Decoder	1		
LY3-12VDC	Relay, 12VDC, Mini, 10A	29		
PYC-P	Relay Retainer	29		
362002	Fuse, 8 AG-2A (Not instrument rating)	1		
P-8662	Transformer, 117/24VAC (CT) (50 VA)	1		
12-1734-00	Controller (Relay PC Assembly) with Relays.*	1		

* Need Transmitter Serial Number

OPTIONS

- Variances per Option

1.2.2 “Functions” (1-1), see Aux. pushbutton

4.4.4 “Auxiliary Circuits” (4-5), see Aux pushbutton

5.2.3.4 “Aux Switches” (5-7), see Aux. pushbutton

OPTIONS

Available Options:

Aux Pushbutton:

Aux '1' & Aux '2' Maintained/Non-Interlocked (Default Setting).

Push once to turn On Relay (Red LED on transmitter will light)

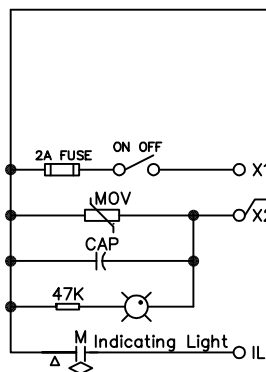
Push again to turn Off Relay (Red LED will turn Off)

Optional:

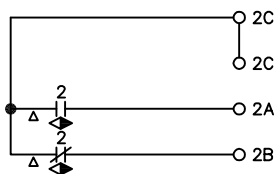
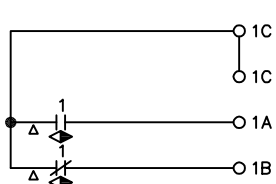
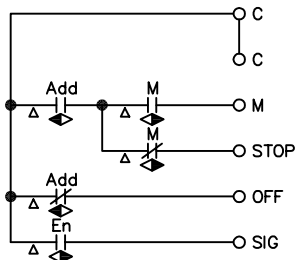
Aux '1' & Aux '2' can be re-programmed for momentary (Non-Interlock) operation.

Consult factory for dip switch setting changes in the field.

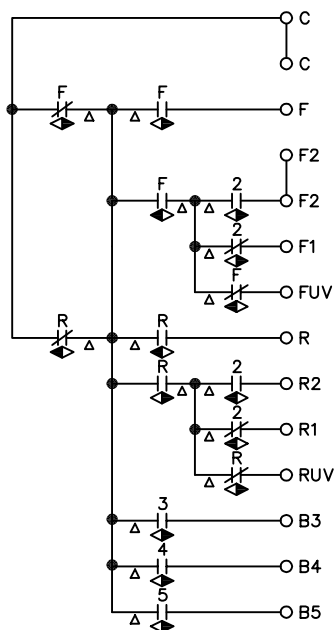
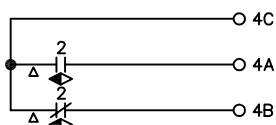
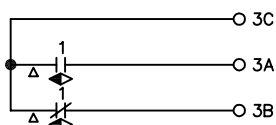
Note: Notify factory of any changes in the field.



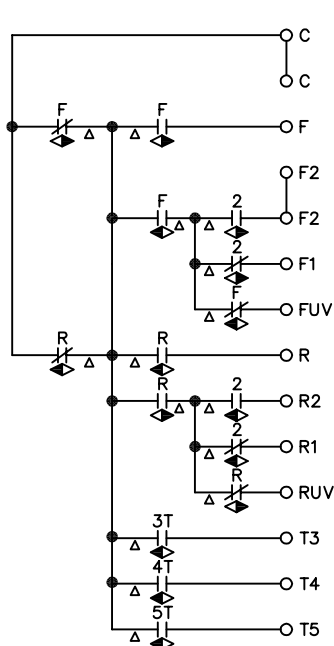
MASTER



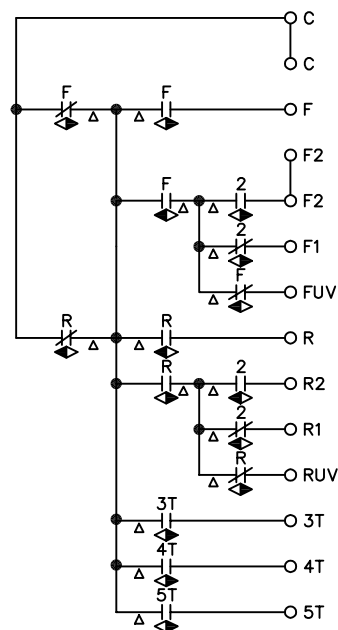
AUX



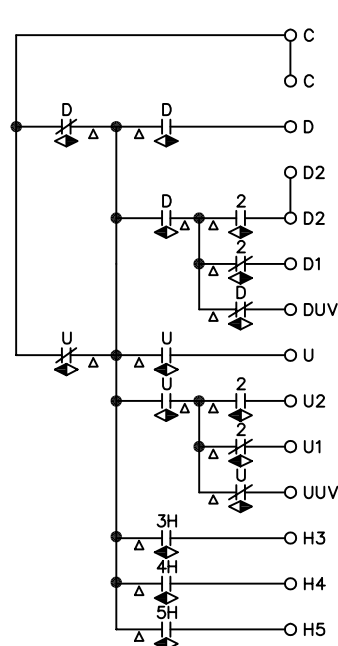
B



T1



T2

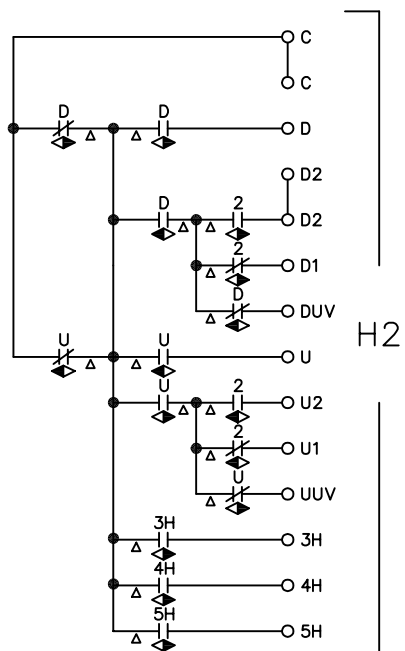


H1

FILE NO.	SCALE	THIS DRAWING IS THE PROPERTY OF ROBINSON ENGINEERING CO. AND IS SUBJECT TO RETURN UPON DEMAND. IT SHALL BE CONFIDENTIAL AND SHALL NOT BE USED IN ANY MANNER THAT IS DETRIMENTAL TO THEIR BEST INTERESTS.		ROBINSON ENGINEERING COMPANY Garland, Texas
DATE 4-15-11	ASSY. REF. 12-1734	Schematic, Controller		
RELEASE	CUST. NO.	TITAN 500		
DRAWN Scott Booker	DATE 4-15-11	Dwg. No. 12-2081		REV.

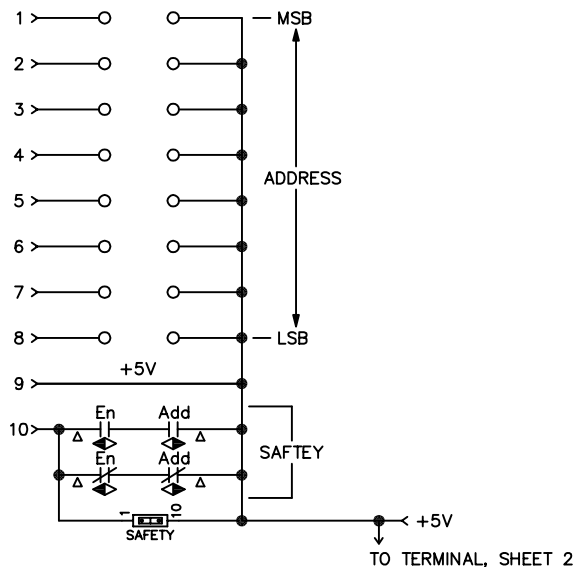
SEE
SHEET
1

X1-S
X2



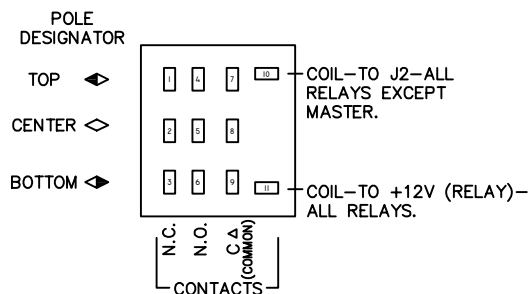
H2

J1-

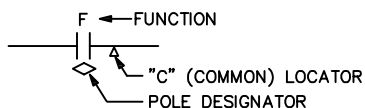


TO
DECODER
J1

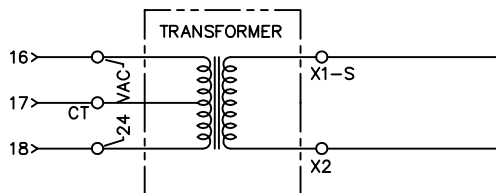
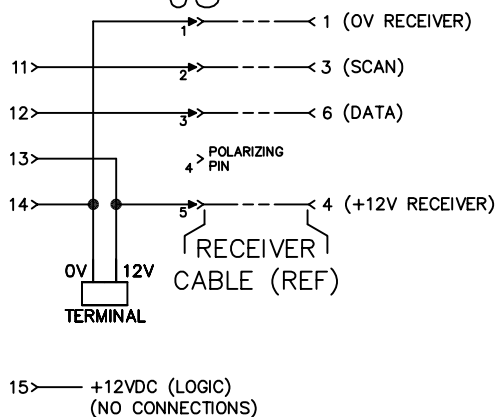
CONTACT LOCATOR (FACE VIEW OF SOCKET)



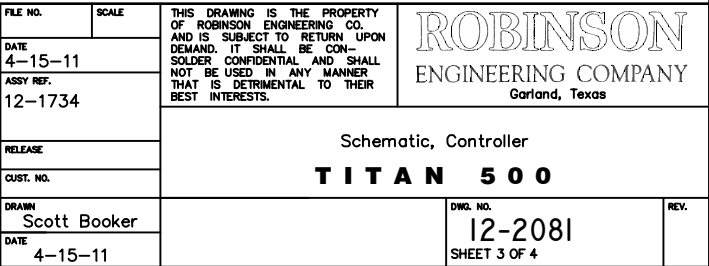
CONTACT SYMBOL



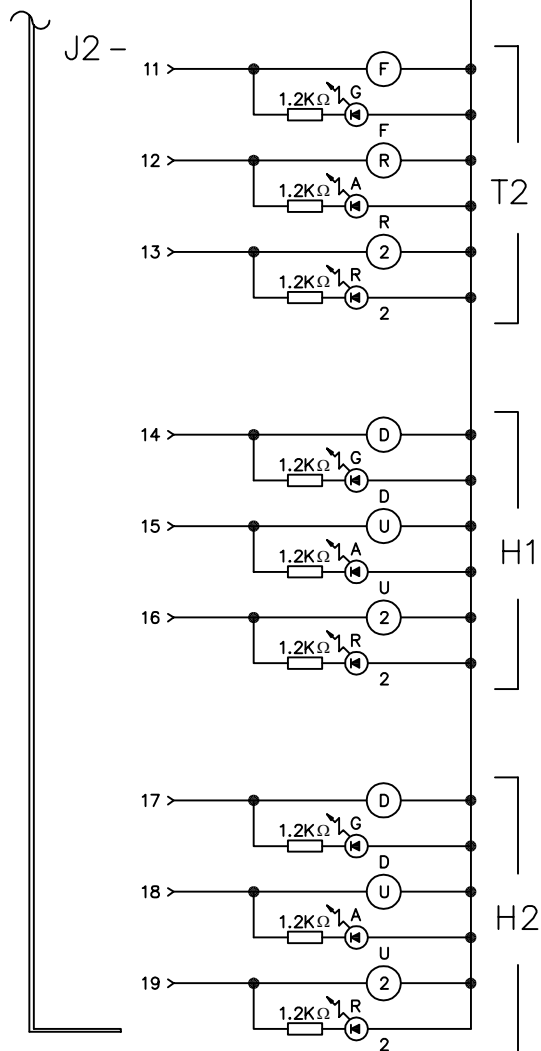
J3



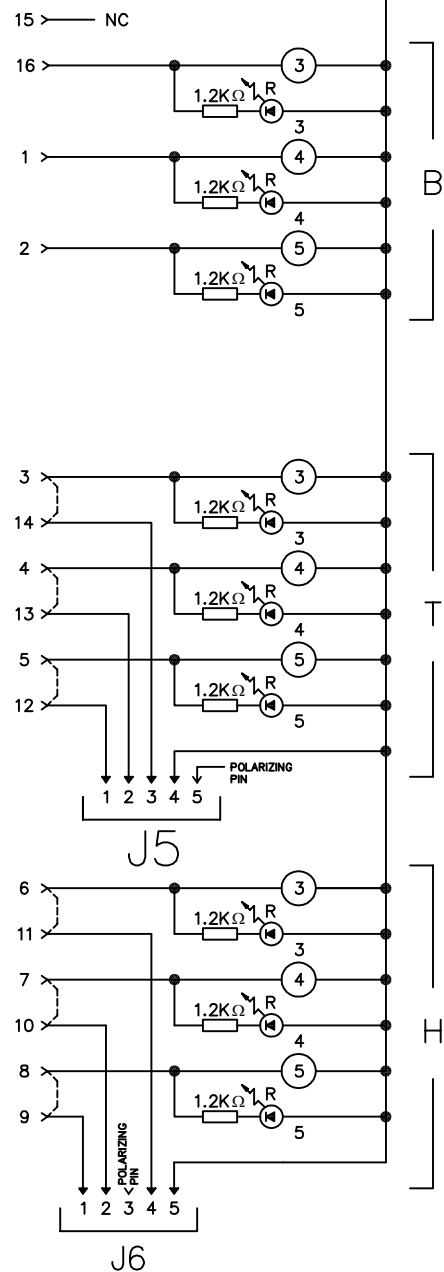
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DATE				
4-15-11				
ASSY REF.				
12-1734		Schematic, Controller TITAN 500		
RELEASE				
CUST. NO.				
DRAWN	Scott Booker		DWG. NO.	REV.
DATE	4-15-11		12-2081 SHEET 2 OF 4	



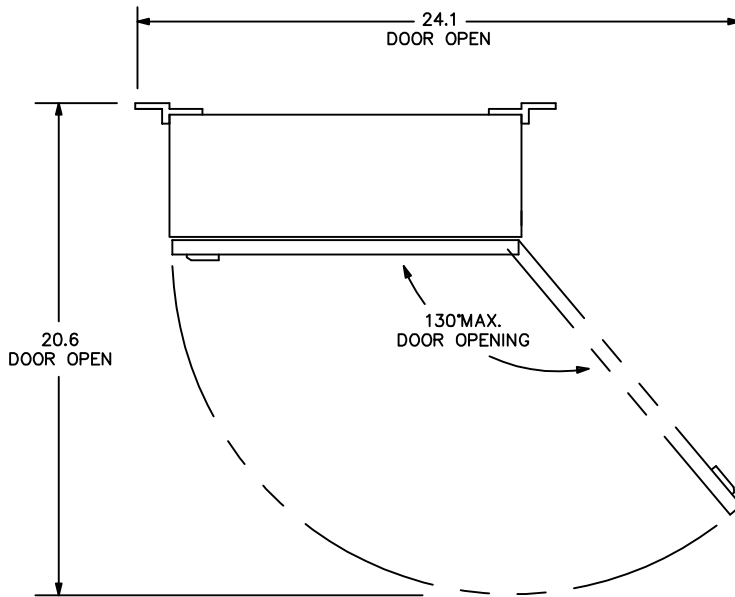
SEE
SHEET
3



TO
DECODER
J1A

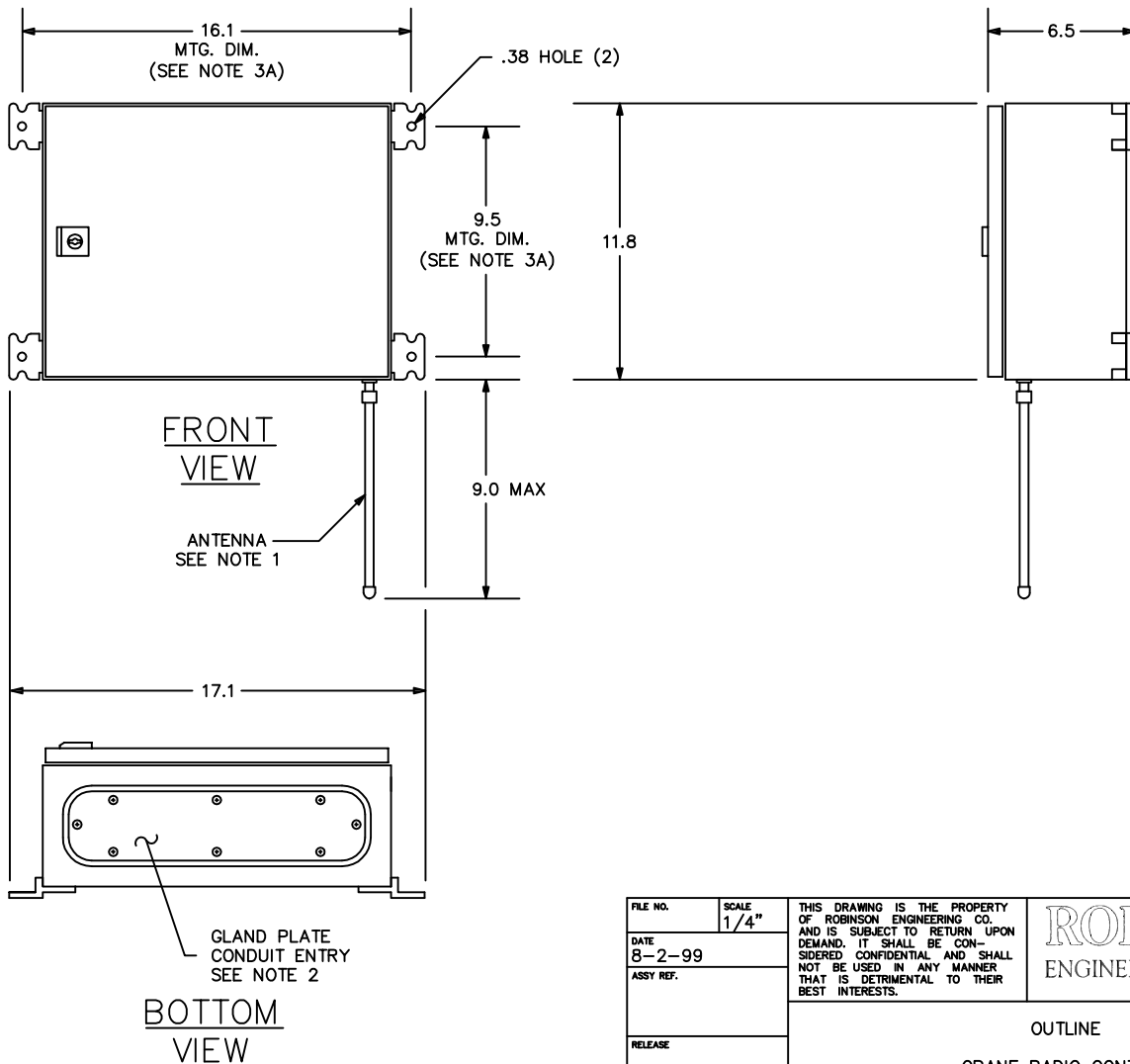


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DATE 4-15-11			
ASSY. REF. 12-1734			
RELEASE			
CUST. NO.		Schematic, Controller	
DRAWN Scott Booker		TITAN 500	
DATE 4-15-11		DWG. NO. 12-2081	REV.
		SHEET 4 OF 4	



NOTES:

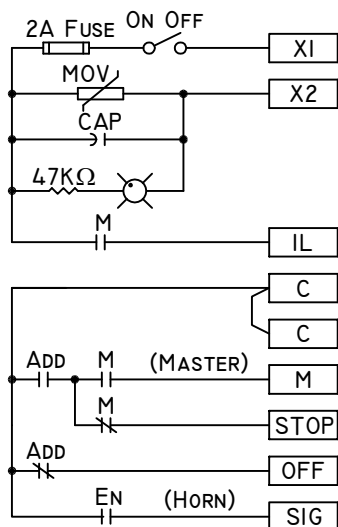
- ENCLOSURE SHOULD BE LOCATED SO THAT ANTENNA IS VERTICAL AND CLEAR OF LARGE METAL OBJECTS AND CRANE ELECTRIFICATION. FOR ANTENNA LOCATED REMOTELY, CONTACT ROBINSON ENGINEERING COMPANY FOR REMOTE ANTENNA INSTALLATION KIT. PREFERABLY, ANTENNA SHOULD BE IN VIEW OF OPERATOR.
- CONDUIT ENTRY MUST BE CONFINED THRU GLAND PLATE ON THE BOTTOM AND NO CONDUCTORS SHOULD BE ROUTED ABOVE THE TERMINAL STRIP AREA.
- STAINLESS STEEL OPTION (NEMA 4X):
 - MOUNTING DIMENSIONS ARE 10.375 X 16.563.
 - GLAND PLATE IS OMITTED.



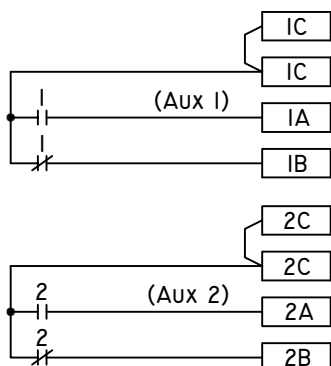
FILE NO.	SCALE 1/4"	THIS DRAWING IS THE PROPERTY OF ROBINSON ENGINEERING CO. AND IS SUBJECT TO RETURN UPON DEMAND. IT SHALL BE CON- SIDERED CONFIDENTIAL AND SHALL NOT BE USED IN ANY MANNER THAT IS DETRIMENTAL TO THEIR BEST INTERESTS.		ROBINSON ENGINEERING COMPANY Garland, Texas	
DATE 8-2-99	ASSY REF.				
RELEASE	CUST. NO.				
OUTLINE CRANE RADIO CONTROL					
DRAWN Scott Booker	STANDARD TOLERANCES EXCEPT AS NOTED: .XXX DECIMALS ± .010 FRACTIONS ± 1/32 .XX DECIMALS ± .020 ANGLES ± 1° ALL DIMENSIONS IN INCHES			DWG. NO. 12-1608 SHEET 1 OF 1	REV. D
DATE 8-2-99					

D	REVISED NOTE 3A	2-2-07
C	REVISED & REDRAWN	8-2-99
REV.	DESCRIPTION	DATE

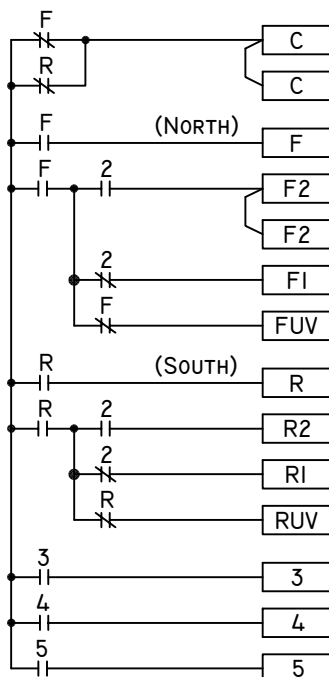
MASTER



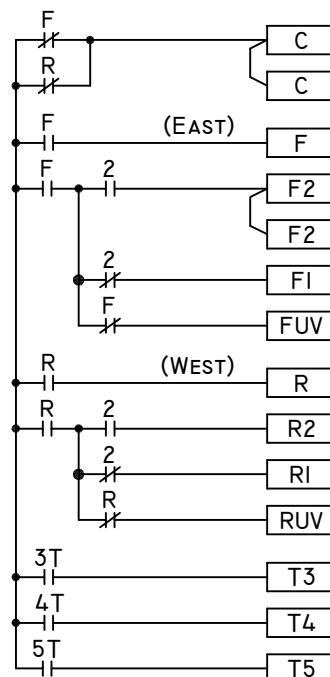
AUX (Aux 1 & 2)



B (NORTH/SOUTH)

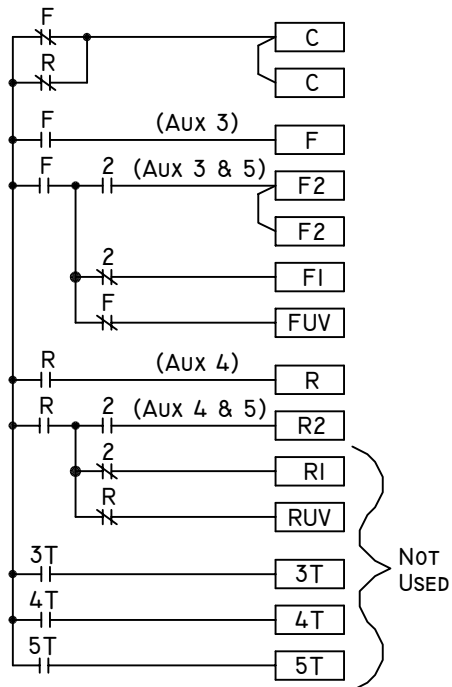


TI (EAST/WEST)

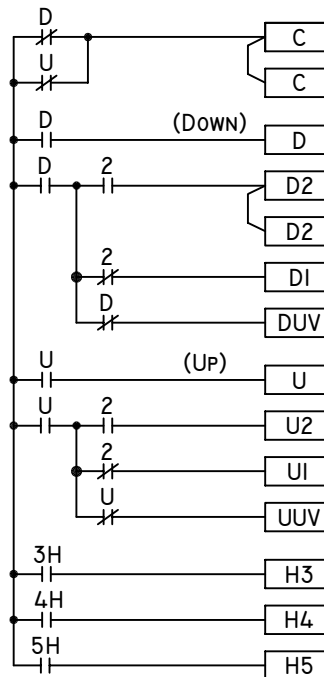


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DATE 4-16-11			
ASSY. REF. 12-1734			
RELEASE			
CUST. NO.		Output Circuits	
DRAWN Scott Booker		TITAN 500	
DATE 4-16-11		DWG. NO. 12-2080	REV.
		SHEET 1 OF 2	

T2 (Aux 3, 4 & 5)



H1 (DOWN/UP)



H2 (NOT USED)

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DATE 4-15-11			
ASSY. REF. 12-1734			
RELEASE			
CUST. NO.		Output Circuits	
TITAN 500			
DRAWN Scott Booker		DWG. NO. 12-2080	REV.
DATE 4-15-11		SHEET 2 OF 2	