

EXHIBIT D
INSTRUCTION MANUAL

A. USER'S MANUAL

The user's manual for this product has been included as Exhibit D.

Section 1 contains statements that warn users against unapproved modifications.

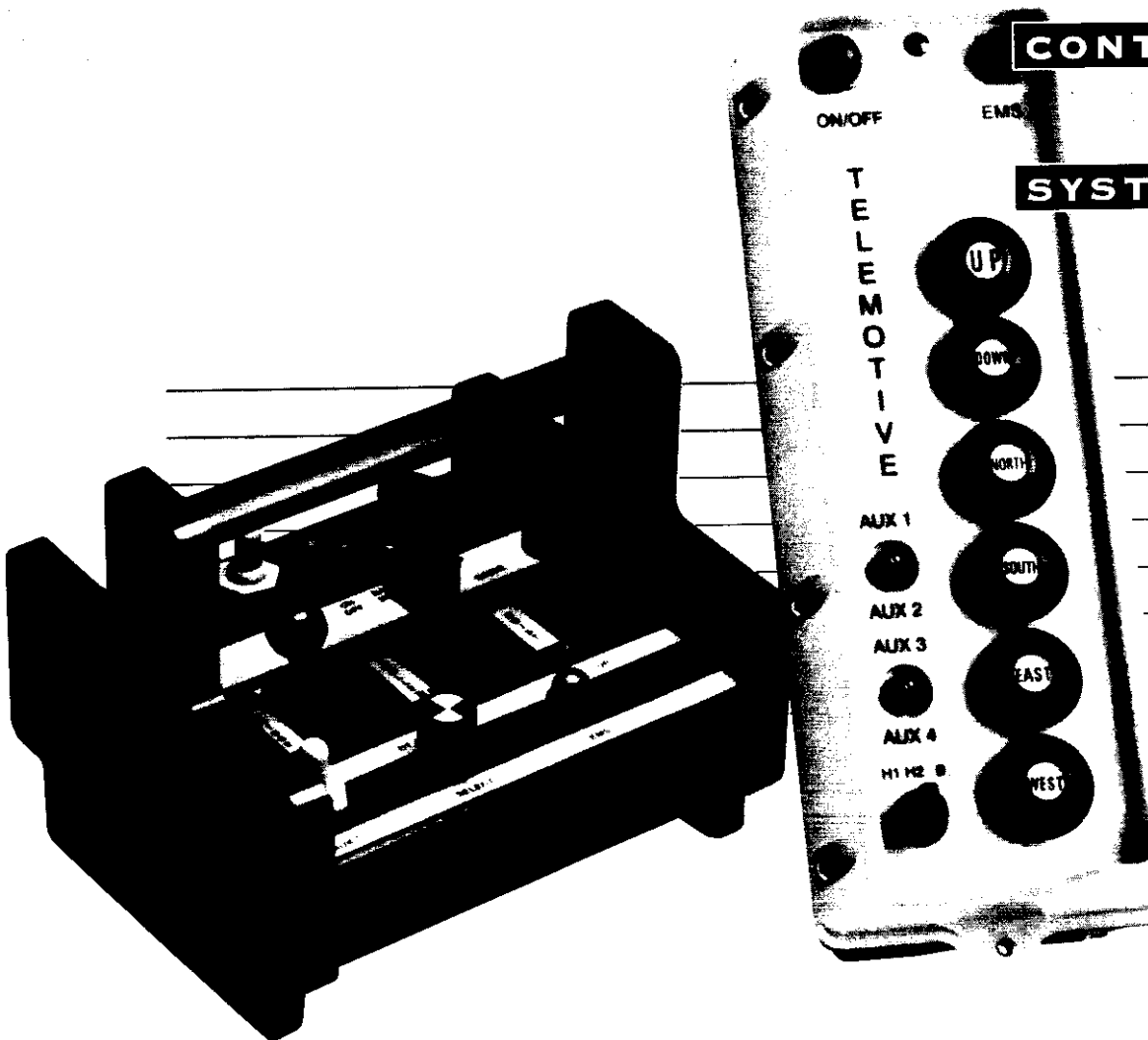
Federal Communications Commission
Equipment Approvals Services
P.O. Box 358315
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TELEMOTIVE SERIES 10K16/24

RADIO

CONTROL

SYSTEM



telemotive®
Industrial Controls

Toll Free: 888-687-4400

FCC ID: GXEE13653-P

D(2)

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Section 1

Service Information

1-1. Service Information.

For questions regarding service or technical information, contact the Telemotive Field Service Department.

For ordering replacement parts, contact the Telemotive Parts Department.

Telephone: (630) 582-1111

Toll Free: (888) 687-4400

Website: www.telemotive.com

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Telemotive Industrial Controls Division
175 Wall Street
Glendale Heights, IL 60139-1985

1-2. FCC Information.

NOTE:

Any modification or changes not expressly approved by Telemotive Industrial Controls could void the user's authority to operate this device.

Section 2

General System Specifications

2-1 System Specifications.

Channel Designations:

AK1- 439.8 Mhz	AK11- 437.8 MHz
AK2- 439.6 Mhz	AK12- 437.6 MHz
AK3- 439.4 Mhz	AK13- 437.4 MHz
AK4- 439.2 Mhz	AK14- 437.2 MHz
AK5- 439.0 Mhz	AK15- 437.0 MHz
AK6- 438.8 Mhz	AK16- 436.8 MHz
AK7- 438.6 MHz	AK17- 436.6 MHz
AK8- 438.4 Mhz	AK18- 436.4 MHz
AK9- 438.2 Mhz	AK19- 436.2 MHz
AK10- 438.0 Mhz	AK20- 436.0 MHz

Operating Frequency Tolerance - 0.001%. Twenty available channels, expandable to fifty.

Channel Spacing - 200 KHz

Modulation - Wideband FM

Ambient Operating Conditions - -22°F to +158°F
(-30°C to +70°C)

Humidity - 0 to 95% RH

Typical Operating Range - 200 feet

Four Transmitter Units (maximum) may operate on the same frequency while in close proximity (not less than six feet) to each other.

2-2. Transmitter Unit Specifications:

2-2.1 General Specifications

Battery Life - 120 Hours (approximate)

Battery - 7.5 VDC Alkaline battery pack. Ni-Cads also available.

Source Voltage - 7.5 VDC @ 50 mA.

2-2.2 Pendent Specifications

Construction - ABS/G.E. Cycolac, grade "GSM"

Weight - 2.4 pounds

Dimensions - 10.5"L X4.0"W X 3.25"H

The Transmitter Unit complies with FCC Part 15 requirements

2-2.3 SLTX Specifications

Construction Frame & Handle: Extruded 6063-T6
ALuminum
EndCaps: ABS/GE.CYCOLAE
Grade GSM

Weight - 4.5 pounds

Dimensions - 7.3"L X 6.6"W X 6.5" H

The Transmitter Unit complies with FCC Part 15 requirements

2-3. Receiver Unit Specifications:

Line Requirements - 120/240 VAC, 0.2 Amps AC

Antenna - 1/4 wave stainless-steel whip; mounted and connected to Receiver Unit using a BNC connector.

Sensitivity - Less than 1.0 microvolt (12 dB SINAD)

Dynamic Range - 80 dB

Data Rate - 9600 baud

Response Time - 60 milliseconds (typical)

Weight - 30 pounds (approximate)
Dimensions - 16.5"W X 17.5"L X 5.75H, NEMA 4,
Black

Section 3

Radio Controlled Crane Safety

3-1. Introduction.

The safety rules in this section are not intended to replace any rules or regulations or any applicable local, state, or federal governing organizations. The following information is intended to be used with other rules or regulations already in existence. It is important to read all of the safety information contained in this section before operating the Radio Control System.

3-2. General.

Radio controlled overhead cranes and other material handling equipment operates in several directions. They are large, bulky pieces of equipment that handle heavy loads efficiently at high speeds. Quite frequently, the equipment is operated in areas where people are working on the floor below. The crane operator must always exercise extreme caution. Workers must constantly be alert to avoid accidents. The following rules have been included to show how your careful and thoughtful actions may prevent injuries, damage to equipment, or even save a life. If radio controlled material handling equipment is operated from the cab, take special care to secure the transmitter. Refer to paragraph titled "Boarding The Crane" for specific safety rules.

3-3. Persons Authorized To Operate Radio Controlled Cranes.

Only properly trained persons designated by management should be permitted to operate radio controlled cranes.

Radio controlled cranes should not be operated by any person who cannot read or understand signs, notices and operating instructions that pertain to the crane.

Radio controlled cranes should not be operated by any person with insufficient eyesight, hearing.

Radio controlled cranes should not be operated by any person suffering from any disorder, illness or is taking medication that may cause loss of crane control.

3-4. Training Checklist For Operators Of Radio Controlled Cranes.

Anyone being trained to operate a radio controlled crane should possess the following knowledge and skills before operating:

Knowledge of hazards pertaining to crane operation.

Knowledge of safety rules for radio controlled cranes.

Ability to judge distance or moving objects.

Knowledge of the radio transmitter.

Limit switch test procedure.

Where authorized, instructions for plugging crane motions.

Observing crane signal lights.

Avoid striking any obstructions.

Proper clearance of lifts or hooks before moving bridge or trolley.

Proper storage space for radio control transmitter when not in use.

Transferring radio control transmitter to another person.

Reporting unsafe or unusual operating conditions.

Caution in approaching bridge or trolley bumpers.

Equipment capacity.

Making lifts below floor level.

Making side pulls.

Keeping body clear of lifts and avoiding "pinch" points.

Cable and hook inspection.

Procedures for testing hoist, trolley, and bridge brakes.

3-5. Operating Area.

Aisles between equipment, stock, etc., should be free of obstructions so the crane operator can move freely. These aisles should be at least 3 feet wide, or meet local regulations.

Crane operators should always position themselves for the best view of the crane they are controlling. The crane should never be operated blindly. The operator should stay as close to the crane load as possible. Operators should never position themselves in a "pinch" point.

3-6. Transmitter Unit.

Transmitter switches should never be mechanically blocked ON or OFF for any crane motion. When not in use, turn the transmitter OFF. A secure storage space should be provided for the transmitter unit, which should always be placed there when not in use. This precaution will prevent unauthorized people from operating the crane.

3-7. Operating The Crane.

The crane limit switches should be checked at the beginning of each shift or when a new operator takes control of the crane. When checking limit

switches, the hoist should be centered over an area free of personnel and equipment. The limit switches should never be used as a regular stopping device. They are intended to be protective devices.

The bridge and trolley brakes should be tested at the beginning of each shift or when a new operator takes control of the crane. On Transmitter Units equipped with two speeds, use the "low" speed when testing braking devices. When lifting maximum loads, the crane operator should test the hoist brakes by raising the load a few inches from the floor. If the brakes do not hold, the load should immediately be lowered to the floor and a report made to the supervisor.

Do not make lifts more than the equipment rated capacity.

Center the bridge and trolley directly over the load when the load is raised to prevent swinging when making lifts.

Side pulls should be made by a crane designed for this purpose and only with supervisor permission. When a lift is being made, the crane operator should not be positioned in the line of travel. The crane or hoist should be operated from a position either to the side or opposite from the direction of travel.

When raising or lowering a load, proceed slowly and insure the load is under control. Tag lines should be used for handling unusual lengths or bulky loads. Remove slack from chains or slings gradually. Before making a lift, make certain all personnel are clear.

The crane operator should keep all body parts away from the lift and should never be positioned under the lift.

Do not make a lift or move a load if anyone is in a location where they could be struck by the crane or the load.

If the crane operator is being helped, the crane should not be moved until the helper signals they are clear of the crane and its load.

Runway stops or other When a load is hanging from the crane hook and the crane is being moved, the crane operator should sound all warning devices frequently.

Loads should not be carried over workers heads. If a worker is in the path of crane travel, the crane operator should stop the crane and clear the area before proceeding.

Runway stops or other cranes should never be bumped into.

When moving the crane, the crane operator should be sure that the hook block and attachments or cables will not catch on nearby equipment. Slings, chains, or cables should never be dragged along the floor.

Unless required for operator safety, gloves should not be worn when operating the transmitter unit.

All loose materials or parts should be removed from the load before starting the lift.

The crane operator should always hoist lifts high enough to clear all equipment and workers.

The crane operator should never allow anyone to ride on the load or hook unless authorized by the supervisor.

When a stationary crane with a hanging load is on the same runway, the crane operator should maintain a safe distance between the two cranes.

If power to the crane is removed, the crane operator should turn the transmitter unit OFF and keep it OFF until power is restored.

If the crane fails to respond properly, the crane operator should stop operation, turn the transmitter unit OFF and immediately report the condition to their supervisor.

Outdoor cranes that are subject to movement by wind should be securely anchored when left unattended. If the crane is equipped with bridge

brakes, the parking brake should be set immediately.

3-8. Boarding The Crane.

The crane should not be boarded without permission of the supervisor.

The crane operator should turn off the transmitter and take it with them when boarding the crane.

If more than one person is on board the crane, one person should be made responsible for ensuring all others are off before returning the system to operation.

3-9. Crane Repair.

Minor repairs include routine maintenance and repairs such as greasing, cleaning and control troubleshooting. All other repairs should be considered major. If the repair crew consists of more than one person, one person should be designated as the repair crew leader with the following responsibilities.

If the repair crew consists of only one person, that person has the following responsibilities:

"Warning" signs should be placed on the floor beneath the crane or suspended from the crane. For major repairs, the floor area below the crane should be roped off.

When major repairs are to take place, all persons operating other cranes on the same or adjacent runways, if any, must be notified before starting repairs. Notification should include the nature of the repair, safeguards provided, and movement limitations while repairs are in progress.

If practical, radio controlled cranes that cannot be moved during repairs must be protected against being bumped by other cranes on the runway. Bumpers should be installed on the exposed side or sides of the crane under repair. They should be placed as far away as possible. The location of these bumpers should be shown by red lights placed so that they are clearly visible to other crane operators traveling on the same runway.

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When not possible to use bumpers, red lights must be placed clearly visible to other crane operators traveling on the same runway to show the restricted travel zone. All crane operators, who are on the same runway, must be informed of the repair effort. They must be thoroughly instructed about what their operations are limited and then notified when repairs are completed.

If any hazard involving the repairers exists when there is a runway next to the crane under repair, the adjacent runway should be blocked off as described above. When it is necessary to continue crane operation on the adjacent runways warning lights must be installed and be visible to operators of cranes on those runways. All cranes should come to a complete stop before entering the restricted area. They should go through this area only after receiving permission from a signal person designated for this purpose. Access of persons to and from the crane being repaired should be under control of the repair crew leader. When boarding the crane, the transmitter should be turned OFF and the transmitter should remain with the repair crew leader. The leader should board the crane first to open and lock out the main switch. Then signal the other members of the crew it is safe to board the crane. If work on the crane is to be done in areas not protected by standard handrails, approved safety belts should be worn by the repair crew. All tools and equipment should be moved onto the crane by using hand lines. The tools and equipment should be adequately secured to the hand lines. If it is necessary to have the crane control circuits energized, all power circuits for crane movement must be opened before energizing the control circuits.

All personnel and tools should be moved to a safe spot before moving the crane during repairs. Head room is at a minimum in some crane cabs and on some crane walkways. Caution should be exercised when boarding or working on cranes. Hard hats should be worn whenever possible.

When repairs are finished, all personnel, tools and repair equipment should be removed before energizing the crane circuits.

3-10. Using The Crane As a Work Platform.

When the crane is to be used as a stationary work platform, follow all rules provided in "Crane Repairs" section.

When it is necessary for the crane to be moved from time to time, the crane operator should board the crane with the transmitter unit. The crane operator should ensure all personnel working on the crane are in a secure position before moving the crane to the next work station. It should also be the crane operator's responsibility to ensure the main switch is open and locked down before work is resumed.

WARNING

THE CRANE OPERATOR SHOULD NOT ATTEMPT TO MAKE ANY OF THE REPAIRS STATED BELOW. THE CRANE CONDITION SHOULD BE REPORTED TO THE SUPERVISOR.

3-11. Condition Of The Radio Controlled Crane.

If the crane fails to respond properly, the crane operator should notify their supervisor. When serious conditions are noticed (conditions that make the crane unsafe to operate), the crane should be shut down immediately and the supervisor notified. A report should be written to include the following:

Condition of hoisting cable and hook block (broken strands, clipped sheave wheels, etc.).
Condition of brakes (hoist, trolley, and bridge).
Alignment of bridge (screaming or squealing wheels, shows the bridge is out of line).

Broken, cracked, or chipped rails on trolley or runway.

Condition of limit switches.

Condition of electrical and mechanical control.

Electrical or mechanical defects can cause faulty operation. Such as unbidden stopping or starting of any crane motion, warning devices, lights, or auxiliary functions.

Condition of gears. Grinding or squealing may show foreign materials in gear teeth or a lack of lubrication.

Frequent relay tripping of power circuits.

Mechanical parts loosened by vibration (loose rivets, covers, bolts, etc.).

Uneven riding (worn wheels).

Condition of collector shoes or bars.

Condition of warning or signal lights (burned out or broken).

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Section 4

Installation Information

4-1. Pre-Installation Considerations.

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

If the Receiver Unit is installed outdoors or in a corrosive environment, the Receiver Unit cabinet must be housed in a protective enclosure. The receiver unit should not be subjected to moisture.

CAUTION

THE RECEIVER UNIT OR RELAYS ARE NOT RATED AS EXPLOSION PROOF. THE RECEIVER UNIT MUST NOT BE INSTALLED IN EXPLOSIVE ENVIRONMENTS UNLESS APPROPRIATE SECONDARY ENCLOSURE MEASURES ARE TAKEN.

4-2. Receiver Unit Mounting Location Considerations.

The receiver unit requires a mounting area or approximately 17" wide by 18" long, and a depth of at least 18" to allow the cabinet door to open.

Ensure that the mounting location is as far as possible from exposed trolley wires and sources of electromagnetic or radiated noise.

The mounting surface must be smooth and continuous. Mounting the cabinet on uneven surfaces could cause warping or stress internal components.

The Receiver Unit may be mounted in any position. Greatest radio control range is

obtained when the Receiver Unit is mounted with the antenna pointed straight up.

If possible, avoid installing the Receiver Unit to a surface where high vibration or shock is present. If this cannot be avoided, use appropriate shock mounts.

CAUTION

IF PERIODIC VIBRATION IS ENCOUNTERED, AND SHOCK MOUNTING MUST BE USED, CONSIDER THE MASS OF THE RECEIVER UNIT AND FREQUENCY OF THE VIBRATION TO AVOID RESONANCE.

CONSULT FACTORY FOR RECOMMENDATIONS

4-3. Antenna Mounting Considerations.

The antenna is mounted by placing it in the antenna socket. If mounting the antenna directly in the antenna socket is not possible, the antenna may be mounted remotely using an optional cable, antenna and antenna mounting bracket.

Contact Telemotive for optional antenna information. In either type of installation, the following must be considered:

An unobstructed line of sight should be provided between the Receiver Unit and the area where the Transmitter Unit is normally used.

The antenna must be a minimum of 6 feet (1.9 M) from equipment power lines.

The antenna must not contact equipment chassis, power lines, or structural components during operation.

4-4. Line Input Considerations.
The receiver unit has direct connect provisions for operation from 110 - 220 VAC (nominal), 50-60 Hz power, or as indicated on the label on the Power Input Module. For best results, it is recommended that the Receiver Unit operate from an isolated and conditioned 110 VAC line. Note, on early production units, there is no label specifying the operating voltage. These units must use 110 VAC only.

For applications where line voltage deviation exceeds 20% of nominal values or if 440 VAC power is required, a step-up or a step-down transformer must be used. Since the output section is totally isolated from the Receiver Unit power supply, all outputs may be directly connected to 110 - 220 VAC loads.

Avoid connecting the Receiver Unit to power lines containing excessive transients or continuous commutator noise. A line conditioner may be necessary in some installations.

4-5. Isolation of Output Power and Receiver Unit Power.

All outputs of the 10K16/24R Receiver System are totally independent and isolated from each other. This allows for interfacing to systems with multiple power sources. Each Output Module in the Receiver Unit is wired with all relay input lines (J3's) jumped. These jumpers may be removed or cut as needed to simplify your wiring of the system. The Power Input Assembly (A10160-0) should be wired, with its own set of conductors, directly across the 120 to 220 VAC secondary winding of a properly suppressed control transformer. All power switched by the relays in this system require connecting to their power sources with separate conductors. DO NOT "DAISY CHAIN" THE POWER CONNECTIONS WITH THE POWER GOING TO THE POWER INPUT BOARD (A10160-0). The Master Power Relay in the Receiver Unit has two normally open dry contacts used as needed for interfacing.

4-6. Receiver/Material Handling Equipment Interface Considerations.

All receiver output relay contacts are rated at 16 A, 250 VAC. However, to protect against in-rush currents the system rating for the contacts is 5 A. Connection to equipment or contactors with higher voltage or current requirements will require intermediate relays.

All relay outputs are normally open, momentary contacts, and totally isolated from each other and the rest of the system. A relay closure is only active while the Transmitter Unit push-button is pressed and held. Devices such as lights or lifting magnet must use a mechanical auxiliary latching relay. Two functions may be set as electronic latches and SHOULD NOT be used with lifting magnets or other similar applications. Refer to Section 7-3, DIP Switch SW 1 for instructions.

If cab control is to remain functional, it is recommended that a transfer switch (available through Telemotive) be installed. A transfer switch is used to manually switch the crane control lines between either the cab controls, or the outputs of the Receiver Unit. This is necessary for safety reasons to insure that concurrent control is not possible, and to provide isolation between the controls.

An optional RC Suppressor Network Module to be used across the output relay contacts is available. Large line transients or noise may cause a contact monitoring error if high impedance contacts or relays are used.

Also thoroughly read chapters 5 and 6 to become completely familiar with all of the various output options that may be configured.

4-7. Receiver Unit Cabinet Mounting.

Prepare a template or scribe marks directly on the surface for mounting the Receiver Unit cabinet. Drill four 9/32" holes.

Recommended mounting hardware is four - 1/4-20 hex machine screws of appropriate length, and four 1/4-20 x 7/16 "KEPS" or elastic stop nuts.

Flat washers should be used in front of nuts when the Receiver Unit is mounted to a non structural surface.

Mount the Receiver Unit enclosure securely to mounting surface.

NOTE

Contact Telemotive for information on interfacing systems with high impedance inputs, or questions on interfacing requirements or options.

Section 5

General System Information

5-1. General System Description

The Series 10K16/24R Radio Control System provides remote control of overhead cranes using radio signals. This system consists of a portable, hand held battery operated Transmitter Unit and a fixed station Receiver Unit. The system can control up to 24 separate outputs.

Both pendent and small lever style transmitter (SLTX) are available for use with the receiver unit. The pendent and small lever (SLTX) unit are functionally equivalent and interchangeable.

The fixed station Receiver Unit is divided into seven basic modules.

- 1) RF UHF Converter/Receiver Module (E10151-X)
- 2) Master CPU Module (E10153-X)
- 3) Interface Control Module (E10103-0)
- 4) Relay Output Modules (E10104-0)
- 5) Optional RC Snubber Modules (E10106-0)
- 6) Power Supply Assembly (A10160-0)
- 7) Power Supply (A5656-0)

This allows easy modules replacement and diagnostics

5-1.1 Access Code.

The system Access Code consists of two bytes (16 bits). This allows more than 65,000 possible addresses to be transmitted at the beginning of each frame. Any transmitted signal with an access code not matching the receiver Access Code is considered invalid. An invalid signal will not be accepted by the receiver.

5-1.2 Time Multiple Shared (TMS) System Software.

The system software is structured to minimize "on the air" transmission time of any transmitter. This allows for multiple transmitters to share a common frequency. The TMS system is designed so that a

transmitter will send a signal for a predetermined ON time, and will then turn OFF. The length of the transmitter ON time is called a data burst or packet. The packet length depends on the quantity of data to be sent, and the data rate (baud). Once the packet is sent, the transmitter will turn OFF. This allows for other transmitters to time share the same frequency when a transmitter has turned OFF. The OFF period and repetition rate of the ON period are determined by the TMS system software. This allows up to 4 TMS systems to share and have equal access to the same frequency. It also allows for reduced Transmitter Unit power consumption, and extended battery life.

Each transmitter, operating on the same frequency, may operate in close proximity (not less than six feet) to each other.

5-1.3 Inter-Integrated Circuit Bus (I²C).

The master CPU Module communicates with the Receiver Interface Control Module via an Inter-Integrated Circuit bus (I²C). The I²C bus is the two-line synchronous serial data system that allows two-way communication between the Master CPU Module and the Interface Control Module.

5-1.4 MultiBox Control Systems.

An advanced feature of the 10K16/24R is the implementation of Multibox. With multibox up to 4 transmitters may access a single receiver. Only one transmitter may control a receiver at a given time. Access is on a first come first serve basis. Once a transmitter has gained control, no other transmitter may access the receiver until the controlling transmitter relinquishes control by transmitting a OFF command to the receiver or the receiver times out due to transmitter inactivity. The first transmitter to send an ON command after the receiver has been released will then gain control of the receiver.

The number of transmitters allowed to control a receiver (1-4) is dip switch selectable on the Receiver Master CPU Module.

A special Output Module (E10161-0) with 4 relay output closures is available for the displaying of the active box. These relay closures may be used to drive an external light display.

All transmitter access codes must be selected from a bank of 4 consecutive addresses. These addresses are assigned by the factory and should not be changed. The RECEIVER ACCESS CODE SWITCHES must be set to the lowest member of this group of access code addresses.

5-1.5 Automatic Power Down

A power down feature turns the Receiver Unit or the Transmitter Unit OFF if no commands are received or transmitted for an extended (approximately 15 minutes for the transmitter and approximately 12 minutes for the receiver unit) period. Configurations of the Receiver Unit and transmitter Unit are also available without automatic time out.

5-1.6 Latched Outputs

Auxiliary Outputs 1, 2 and 3 may be configured to be latched ON or OFF by toggling the transmitter auxiliary function keys.

5-1.7 Available Channels

There are twenty available UHF frequencies between 436.0 and 439.8 MHz on which the system can operate. These are preselected at the factory.

5-2. Transmitter Units

The Transmitter Units are lightweight, portable, and hand held. Several types of transmitters are available. A Pendant style transmitter and a Lever (SLTX) style transmitter.

5-2.1 Pendant Transmitters:

The major feature of the pendant transmitter are:

- 1) Bi-direction 3-speed push-button switches for motion control.
- 2) Bi-directional momentary toggle switches for auxiliary functions

- 3) A rotary selector switch for the selection of aux trolleys and aux hoists

In addition, there are

- 4) An ON/OFF push-button switch
- 5) Emergency Stop (EMS) push-button switch used to immediately disable all relay outputs.
- 6) A Battery/Data monitoring LED for diagnostics.

The Pendant style transmitter comes in the following versions.

- 1) 3 motor, 3 speed with 4 or 6 auxiliary outputs
- 2) 3-5 motor, 3 speed with 4 auxiliary outputs and rotary select for hoist/aux hoist and trolley/aux trolley.
- 3) 7 motor 3 speed with no auxiliary outputs and 3 rotary select controls.

5-2.2 SLTX Transmitters:

The major feature of the Lever transmitter are:

- 1) Bi-direction 3-speed or 5-speed Lever Action Switches for motion control.
- 2) Bi-directional momentary toggle switches for auxiliary functions
- 3) A rotary selector switch for the selection of aux trolleys and aux hoists

In addition, there are

- 4) An ON/OFF push-button switch
- 5) Emergency Stop (EMS) push-button switch used to immediately disable all relay outputs.
- 6) A Key switch for additional security
- 7) A Battery/Data monitoring LED for diagnostics

Optionally a transmitter with an access code plug is available which may be easily removed from the transmitter.

The SLTX style transmitter comes in the following versions.

- 1) 3 motor, 3 speed with 4 or 6 auxiliary outputs
- 2) 3-5 motor, 3 speed with 4 auxiliary outputs and rotary select for hoist/aux hoist and trolley/aux trolley.
- 3) 3-5 motor 5-speed with 4 auxiliary outputs and rotary select outputs for hoist/aux hoist and trolley/aux trolley.

In addition to the various versions of transmitters each transmitter may be configured via internal dip switches to provide output closures tailored to many standard crane controls and configurations

The Transmitter Units are frequency modulated, low power, and certified under part 15 of FCC rules and regulations. Neither the transmitter nor the operator requires a license. The Transmitter Unit uses crystal controlled oscillators to set the operating frequency. The Transmitter Unit antenna is built-in.

5-3. The Receiver Unit.

The fixed station Receiver Unit is divided into seven basic modules.

- 1) RF UHF Converter/Receiver Module (E10151-X)
- 2) Master CPU Module (E10153-X)
- 3) Interface Control Module (E10103-0)
- 4) Relay Output Modules (E10104-0)
- 5) Optional RC Snubber Modules (E10106-0)
- 6) Power Supply Assembly (A10160-0)
- 7) Power Supply (A5656-0)

5-3.1 UHF Converter/ Receiver Module.

This module is a dual conversion receiver operating in the 436.0 to 439.8 MHz band. The module is a wideband digital receiver working at 9600 baud and is specifically designed for TMS transmission. The received signal is dual superheterodyne converted to the 10.7 MHz intermediate frequency range. It is then demodulated to recover the audio, and then signal conditioned to recover the digital data.

5-3.2 Receiver Master CPU Module.

The Receiver Master CPU Module receives the recovered data from the UHF Converter/Receiver Module. It tests for errors in the data stream before

sending the decoded output information to the Interface Control Module.

The system Access Code switches for the receiver are located on this module. They must match the Access Code of the companion Transmitter Unit to correctly receive data.

Some System Configuration Switches are also present on this module.

5-3.3 Receiver Interface Control Module.

The Interface Control Module receives command and control data, via the I²C serial data link., from the Master CPU Module. Data is tested and then sent to the Relay Output Modules.

Two Safety Relays are used to disable the outputs if the slave microcomputer detects a problem or fails. These are the Security Relay (K2) and the Main Control Relay (K1).

The MCR relay (K1) drives the Master Power Relay. The Master Power Relay is located in the Receiver Enclosure.

This module also provides additional control functions such as Auto-Alarm and Latched Auxiliary functions by the setting of a dip switches.

The Interface Control Module holds fuses for power protection to the Receiver RF module, the Master CPU Module, the digital circuitry of the Interface Control Module and the Relay Output Modules

5-3.4 Receiver Relay Output Modules.

The Receiver Relay Output Modules plug into the Receiver Interface Control Module, and contain eighth (8) Electro-mechanical Relays per module.

Each output is individually fused, and is suppressed with an MOV. An optional RC snubber network is available. Each module can provide eight (8) outputs of ON/OFF control.

The left most module (A Module) may be configured to provide an Auto Alarm function which automatically turns ON the Alarm F8 (Aux#4) for approximately five seconds when the system is turned ON.

Three (3) additional functions Aux#1 Aux#2 and Aux#3) may be configured as latched outputs. These may be toggled ON and OFF by the pressing

of their associated toggle switches on the transmitter.

5-3. 5 Power Input Assembly.

The Power Input Assembly controls and distributes the power required to operate the Receiver Unit. This unit may operate from 110 - 220 VAC (nominal) 50-60 Hz power, or as indicated on the label on the Power Input Module. For best results, it is recommended that the Receiver Unit operate from an isolated and conditioned 110 VAC line.

The supply for this assembly must be wired with a separate pair of leads going directly to the power transformer. These Leads may or may not be isolated from the users control lines that operate the crane. If the Receiver Unit chassis is not grounded to the same structure to which the neutral line is grounded, a separate ground lead must also be installed. The Power Input Assembly is grounded to the Receiver Unit cabinet through the lower left mounting hole. It also contains a 2 Ampere circuit breaker (with a release for controlling the input power), a transient voltage suppresser (MOV), and connectors for the input and output power.

Section 6

Operating Instructions

6-1. Transmitter Unit Operating Instructions.

6-1.1 Push-Button Switches

Power ON/OFF Switch

The transmitter is turned ON by pressing the ON/OFF push-button switch. The transmitter is turned OFF by pressing the ON/OFF push-button switch again.

Emergency Stop (EMS) Switch.

For all Transmitter Unit configurations, there is a push-button switch marked EMS. When pressed, all equipment movement immediately stops. After the EMS push button is pressed, only the ALARM (Aux.#4) function can be transmitted, if JU2 is set accordingly on the Interface Control Module.

Reset the system for normal operation by turning the transmitter OFF then ON again.

NOTE

The ALARM command has a special jumper provision located on the Interface Control Module (JU2) allowing the ALARM on the Relay Output Module to be either enabled or disabled during an EMS shutdown

(See Section 7-2.2 for more information on the setup of this jumper)

6-1.2 Auxiliary Toggle Switches

Auxiliary function 1&2, 3&4 and 5&6 are bidirectional. switch pairs ordered as follows.

For the 10K24

- 1) Aux 1 & Aux 2
- 2) Aux 3 & Aux 4

and 10K16 Extended Mode

- 3) Aux 5 & Aux 6

For Aux 5 & Aux 6 Mode to be available the receiver needs to be a 10K24R to be able to output the additional output functions.

6-1.3 Rotary Select Switch

The rotary select switch is used to route the trolley and hoist motion control switches to the hoist/aux-hoist and trolley/aux-trolley receiver outputs in mode 1 and to generate the select outputs in mode 2.

(See Section 7 and Appendix B and Appendix C for more information on these modes)

6-1.4 Motion Function Pendant Push-buttons Switches.

To activate transmitter motor functions, press and hold the push button that corresponds to the desired motion. To activate the 2nd, or 3rd speed function press the motion control switch a little further to energize additional speeds. The 2nd, and 3rd speed detente can be clearly felt for each desired speed.

6-1.5 Motion Function Lever Switches.

To activate transmitter motion functions, push or pull the lever that corresponds to the desired motion. To activate the 2nd, or 3rd, (or 4th and 5th) speed function push or pull the motion lever control switch a little further to actuate the additional speeds.

Functions are configured to have lockouts between motion directions. This prevents two opposing motions from being active simultaneously.

6-1.6 Transmitter Unit LED

Indicator.

Battery voltage is monitored by an LED mounted on the Transmitter Unit front panel. A slow flash rate shows an idle state with no transmission. If the transmitter is turned OFF or total battery voltage is less than 5.8 VDC, the indicator will not illuminate the LED. The LED also provides data transmission status. When the transmitter circuitry is transmitting data, the LED flashes at a faster rate.

6-2. Transmitter Unit Internal

Switch Settings.

6-2.1 Access Code Switch Setting

SW1 and SW2 sets the transmitter access code. The Access Code is set at the factory and should not be changed unless absolutely necessary.

Access Code		Transmitter		Receiver	
High	Low	Byte	Byte	SW1	SW2
High	Low	Byte	Byte	SW1	SW2

(See section 6-3.1 for more information on setting the access code)

6-2.2 Output Mode Selection

Switches.

SW4 sets the Transmitter Unit to various predefined output configurations and may be adapted to most common crane control applications

SW4-1 through SW4-4: Allows the selection of Auxiliary and Tandem hoists and trolleys to be setup according to the crane configuration..

SW4-5 through SW4-8 Allows the

selection of common crane controls.

(See the following sections for further information on the various modes currently available:)

Section 7

Appendix B

Appendix D

More configurations will be available in the future.

6-3. Receiver Unit Operating

Instructions.

The receiver unit has a number of selectable control switches that may be changed to alter the configuration of the receiver.

6-3.1 Master CPU Module

The Master CPU Module has several switches that may be changed to re-configure the receiver unit

1) SW7 and SW8 sets the receiver

access code

2) SW9 sets the number of modules

the Master CPU expects to see on

the I²C data buss.

3) SW10 sets the number of transmitters

that can be received in multibox operation

Setting Access Code (SW7,SW8).

The Access Code is set at the factory and should not be changed unless absolutely necessary, or when used with a designated spare Transmitter Unit.

If a spare Transmitter Unit is used, change the Receiver Unit Access Code to match the Access Code of the spare Transmitter Unit.

The following general guidelines are presented:

Both the Transmitter Unit and Receiver Master CPU Module in the Receiver Unit contain two 8 position DIP switches with stations labeled "1" through "8". These switch stations set the system Access Code. Figure 7-1 and Figure 7-2 shows the location of these DIP switches.

NOTE

Set switch stations using a ball-point pen or similar tool. Do not use a pencil.

The Access Code, as listed on the serial number label, is in standard decimal form. The Access Code, as used on the transmitter and receiver, is in binary code (ones and zeros or on and off). The label on the top of the Transmitter Unit is a direct (or one to one) representation of the Access Code switch position settings. Note the switch marked "A" on the label is SW2 in the transmitter or SW7 in the receiver. The switch marked "B" on the label is SW1 in the transmitter and SW8 in the receiver.

MultiBox Settings (SW9,SW10)

These switches configure the Receiver to Standard or Multibox Systems

SW9 is set at the factory and should not be changed unless the receiver unit is being upgraded to MultiBox and a Display Output Module is being added. If no Display Output Module is being added then the Switch settings should not be changed

(See Appendix H for more information on installing the MultiBox Display Module.)

SW10 is set at the factory and should not be changed unless the receiver unit is being upgraded to MultiBox. Then the receiver must be set to the maximum number of transmitters that the receiver is to service.

(See section 7-2.1 or Appendix H for the setting these switches)

6-3.2 Interface Control Module

The Interface Control Module has several switches that may be changed to re-configure the receiver unit

SW3-1 through SW3-3 sets the board address of the module This is factory selected and **should not be changed.**

SW2 configures selected outputs to operate in special predefined manner.

Selectable options are

1) SW2-1 Sets Auto Alarm to be Enabled or Disabled

When enabled an ON command transmitted from the transmitter to the receiver will turn Aux 4 ON for the duration of the ON transmission.

2) SW2-2 Sets EMS Alarm to be Enabled or Disabled

When enabled the pressing of the EMS button or when the Master CPU Module detects a system error the F8 (AUX#4) will automatically turn ON.

3) SW2-3 Temporarily disables contact monitoring of the MCR relay output in emergency situations.

4) SW2-6, SW2-7, SW2-8 Three additional functions (Aux1, Aux2 and Aux3) may be configured as latched outputs. These outputs may be toggled ON and OFF by pressing the respective

5) SW2-6 Enables or Disables the latching feature for AUX 1

6) SW2-7 Enables or Disables the latching feature for AUX 2

7) SW2-8 Enables or Disables the latching feature for AUX 3

(See section 7-2.2 for setting this switch)

8) JU2 Enables or Disables the K8 relay on output module A to make the Alarm Output available during an EMS shutdown condition.

6-3.3 Relay Output Module

The Relay Output Module has 8 electro-mechanical relays to switch external controls. Each relay is individually fused and noise suppressed with a MOV. Additional noise suppression is available through a field upgradable R-C network snubber module (E10106-0).

6-3.4 Power Input Assembly

Power is applied to the Receiver Unit by pushing the circuit breaker, mounted on the Power Input assembly, all the way in. Power is removed by pushing the red release lever mounted on the circuit breaker beneath the reset switch.

The Power Input Assembly controls and distributes the power required to operate the Receiver Unit. This unit may operate from 110 - 220 VAC (nominal) 50-60 Hz power, or as indicated on the label on the Power Input Module. For best results, it is recommended that the Receiver Unit operate from an isolated and conditioned 110 VAC line.

The supply for this assembly must be wired with a separate pair of leads going directly to the power transformer. These leads may or may not be isolated from the users control lines that operate the crane. If the Receiver Unit chassis is not grounded to the same structure to which the neutral line is grounded, a separate ground lead must also be installed. The Power Input Assembly is grounded to the Receiver Unit cabinet through the lower left mounting hole. It also contains a 2 Ampere circuit breaker (with a release for controlling the input power), a transient voltage suppressor (MOV), and connectors for the input and output power.

SECTION 7

SWITCH CONFIGURATION GUIDE

7-1 Transmitter Switch Configuration Selection.

The transmitter comes in the standard configuration. All special functions are disabled. To enable the alternate functions the following switch setting may be made. Refer to Figure 7-1 for Switch location.

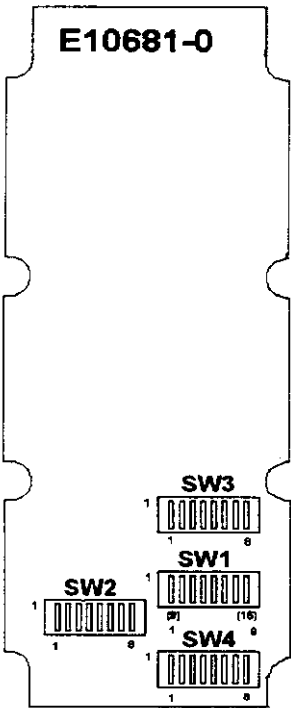


Figure 7-1. Location of Transmitter Unit Configuration Switches.

7-1.1 Access Code Switches

SW1,SW2 Sets the transmitter Access Code.

The Access Code is set at the factory and should not be changed unless absolutely necessary.

Note that SW2 and SW1 on the Transmitter CPU module correspond to SW7 and SW8

on the Receiver Master CPU Module respectively.

Access Code	Low Byte	High Byte
Transmitter	SW2	SW1
Receiver	SW7	SW8

7-1.2 Automatic Time-out

SW3 Selects or de-selects Automatic Time-out transmitter shutdown

SW3-8 set to OFF enables the Automatic Time-out feature
SW3-8 set to ON disables the Automatic Time-out feature

When Automatic Time-out is turned OFF then transmitter will not automatically shut OFF after 15 Min.

7-1.3 Mode Select/Configuration Switch

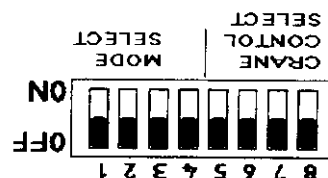
SW4 on the Transmitter CPU Module is divided into 2 banks.

Bank 1 SW4-1 through SW4-4: Controls the enabling and disabling of dual and tandem hoists and trolleys as well as the method by which dual hoists and trolleys are controlled or selected.

Bank 2 Selects the different type of common predefined crane control .

NOTE: A complete description of these modes are available in Appendix B and Appendix C

More configurations will be available in the future.



Bank 1

- SW4-1: Selects Mode 1 or Mode 2
- SW4-1 set to OFF turns Mode 1 ON
- SW4-1 set to ON turns Mode 2 ON

SW4-2: Selects or de-selects Second Trolley

- SW4-2 set to OFF Second Trolley is available.
- SW4-2 set to ON Second Trolley is not available.

SW4-3: Selects or de-selects Tandem control of Hoists and Trolleys

- SW4-3 set to OFF Tandem control of Hoists and Trolleys is available.
- SW4-3 set to ON Tandem control of Hoists and Trolleys is not available.

In this mode, all tandem outputs are disabled despite the position of the selector switch. The main hoist and trolley operate completely independent of the auxiliary hoist and trolley.

SW4-4: Mode 2 crane select inversion.

- SW4-4 set to OFF Crane select output operate in a standard mode.
- SW4-4 set to ON Crane select output operate is inverted from the standard mode.

Note This is presently available in the SLTX transmitters only

Bank 2

- SW4-4 through SW4-8 Selects the different type of common predefined crane control .

See Appendix B and Appendix C for a complete discussion of the modes and crane types selected by SW4.

7-2. Receiver Unit Switch

Configurations.

There are several controls and configuration switches located in the Receiver Unit. Configuration options for these switches are provided below:

7-2.1 Master CPU Module.

Figure 7-2 shows the location of all user selectable switches Master CPU Module.

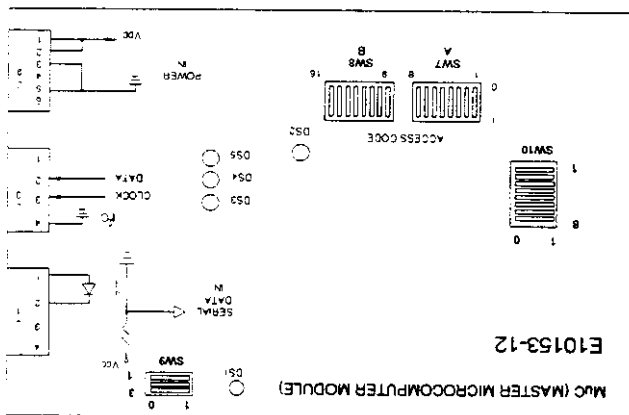


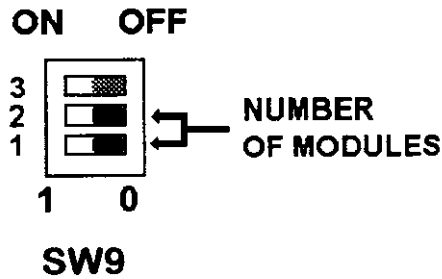
Figure 7-2. Location of Receiver Master CPU Configuration Switches.

SW7, SW8 Access Code Switches
The Access Code is set at the factory and should not be changed unless absolutely necessary

Note that SW7 and SW8 on the Receiver Master CPU Module correspond to SW2 and SW1 on the Transmitter CPU Module respectively. SW7 (SW2 on the Transmitter CPU Module), station 1 corresponds to the least significant bit. SW 8 (SW1 on the Transmitter CPU Module), station 8 corresponds to the most significant bit of the Access Code.

SW9 configures the number of module the Master CPU module expects to see on the I²C buss. Two configurations are possible.

- 1) Std system 16/24 outputs
- 2) Std system with multibox display module



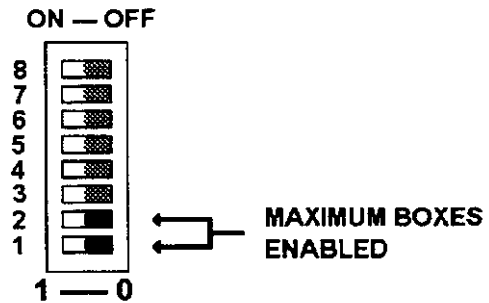
SWITCH SETTING CONFIGURATION

SW 9-1	SW9-2	
ON	OFF	std system (16/24)
ON	ON	std system *

** with MULTIBOX DISPLAY MODULE*

SETTING MAXIMUM NUMBER OF TRANSMITTERS

Switches 10-1/10-2 sets the maximum number of transmitters that can access the receiver. The switch settings are binary 00 to 11 for 1 to 4 transmitters.



SWITCH SETTING MAXIMUM BOXES ACCESS CODE

SW10-2 SW10-1

OFF	OFF	1	BASE ADDRESS
OFF	ON	2	BASE ADDRESS +1
ON	OFF	3	BASE ADDRESS +2
ON	ON	4	BASE ADDRESS +3

NOTE: *Selected transmitters must have consecutive addresses beginning from the base address*

NOTE: More information on Multibox is available in Appendix H

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7-2.2 Interface Control Module

Figure 7-3 shows the location of all user selectable switches for the Interface Control Module.

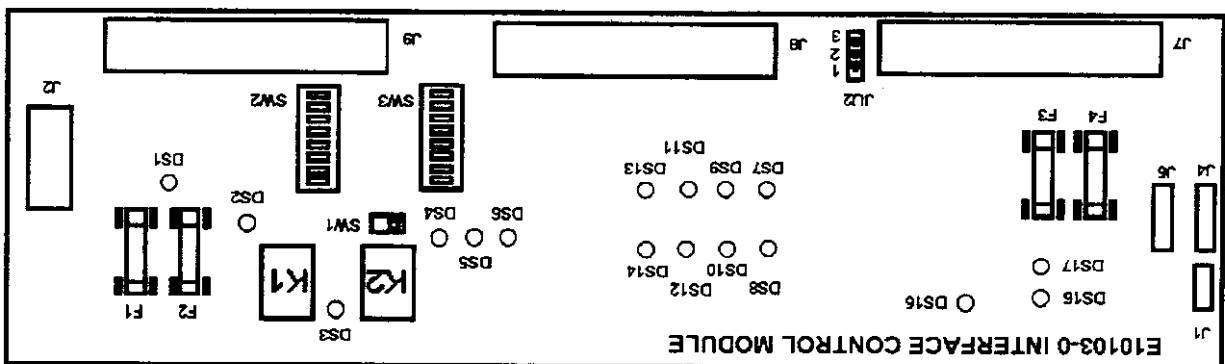


Figure 7-3. Location of Receiver Interface Control Module Configuration Switches

SW1 MCR. Removes power to the Master Control Relay.

Setting the switch to 0 opens the K1 relay and removes power to all output relay modules. This allows testing of the digital control section without activating any external controls.

SW2 System Function Select Switch

This switch sets optional alternate output control functions.

SW2-1 Auto Alarm Select (Aux 4, K8). Allows an automatic generation of an ALARM command for five seconds (approximate) when the receiver is initially started by the pressing of the ON/OFF push-button in the transmitter. When not set Alarm (Aux 4, K8) will respond to the momentary toggle command.

Set to 0 to disable auto ALARM.
Set to 1 to enable auto ALARM.

SW2-2 EMS Alarm Select (Aux 4, K8). Allows an automatic generation of an ALARM command for five seconds (approximate) when the transmitter EMS push-button switch is pressed or an internal EMS command is generated by the Master CPU Module.

Set to 0 to enable
Set to 1 to disable

SW2-4 Not used.

SW2-5 Not used.

SW2-6 Auxiliary 1 (K5), Latch Select. Allows Aux#1 to be toggled and latched ON and OFF or allows Aux#1 to operate as a momentary ON and OFF command.

Set to 1 for latched ON and OFF operation.
Set to 0 for momentary ON and OFF operation.

SW2-7 Auxiliary 2 (K6), Latch Select. Allows Aux#2 to be toggled and latched ON and OFF or allows Aux#2 to operate as a momentary ON and OFF command.

Set to 1 for latched ON and OFF operation.
Set to 0 for momentary ON and OFF operation.

SW2-8 Auxiliary 3 (K7), Latch Select. Allows Aux#3 to be toggled and latched ON and OFF or allows Aux#3 to operate as a momentary ON and OFF command.

Set to 1 for latched ON and OFF operation.

Set to 0 for momentary ON and OFF operation.

SW3 System Mode Address Select Switch

This switch sets the module address for the I²C buss. The normal address of the module is 0. **SW1,SW2,SW3 should be OFF.**

SW3-1 Module Address Select (Bit 0).

SW3-2 Module Address Select (Bit 1).

SW3-3 Module Address Select (Bit 2).

SW3-4 Not used.

SW3-5 Not used.

SW3-6 Not used.

SW3-7 Not used.

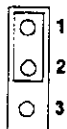
SW3-8 Not used.

JU2 - Alarm Function Select.

JU2 Enables or disables the alarm function during EMS mode.

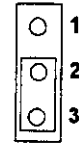
JU2 This controls relay K8. It allows the alarm to operate when an EMS condition is in effect. If this function is used as an alarm, it is preferable to allow this function to operate during an EMS shutdown. If the function is used as a control function, then it should be disabled during an EMS shutdown. This is the factory default position.

For this function to be enabled during an EMS shutdown, set JU2 shunt to position 1-2 (upper position on the board).



JU2

For this function to be disabled during an EMS shutdown, set JU2 shunt to position 2-3 (lower position on the board).



JU2

Note: Power to this function (J3-8), normally is wired to switched AC power for control applications. If this function is used as an alarm function, it should be wired directly to AC power.

7-2.3. Relay Output Module

The Relay Output Modules have no switch settings that need configuration. There are eight fuses that may need to be replaced from time to time.

Figure 7-4 shows the location of fuses

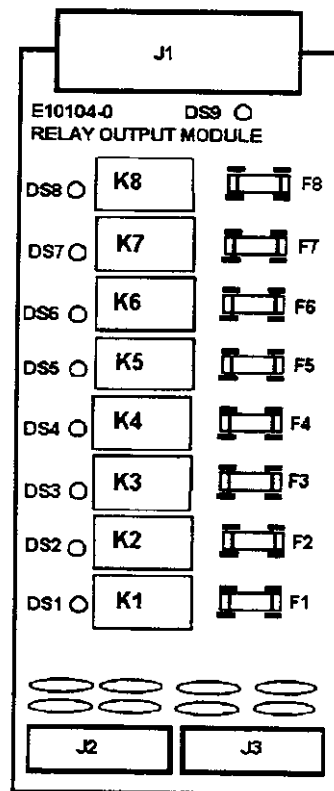


Figure 7-4 Location of Relay Output Module Fuses

7-2.4. Power Input Assembly
SW1 is a 2 amp circuit breaker and applies AC power to the main power supply.

7-2.5. Power Supply

The Power Supply has no switch settings that need configuration.

Section 8

Troubleshooting

8-1. Troubleshooting.

It is recommended only qualified technicians attempt to troubleshoot and repair the system. The system is diagnosed primarily using indicators on the Receiver Modules and the applicable documentation and drawings. Additional pieces of electronic test equipment may be required to fully diagnose certain malfunctions.

The procedural steps in diagnosing a problem should be:

- 1) Check diagnostic LED's
- 2) Check Configuration Switch Settings
- 3) Replace suspected Module

8-2. The Transmitter Unit

The transmitter has one diagnostic LED that serves a dual purpose of battery monitor and data transmission monitor.

Battery voltage is monitored by an LED mounted on the Transmitter Unit front panel.

If the transmitter is turned OFF or total battery voltage is less than 5.8 VDC, the indicator will not illuminate the LED.

The LED also provides data transmission status. When the transmitter circuitry is transmitting data, the LED flashes at a faster rate.

If the battery monitor LED does not turn ON when the ON/OFF pushbutton is pressed, check for bad or low batteries.

If the data monitor flashing rate does not occur, then the transmitter is defective and should be replaced or repaired.

See Appendix B and Appendix C for more information on the Pendant Transmitter.

See Appendix D, Appendix E and Appendix F for more information on the SLTX Transmitter

8-3. The Receiver Unit

The receiver Unit has a number of diagnostic LED's to help locate a malfunction should it occur. Repair is done on a module replacement basis.

8-3.1 UHF Converter/Receiver Module Diagnostic and Status Indicators.

This module has an indicator to aid in troubleshooting. Figure 8-1 provides the location of the indicator. Indicator number, color and indicator function are presented below.

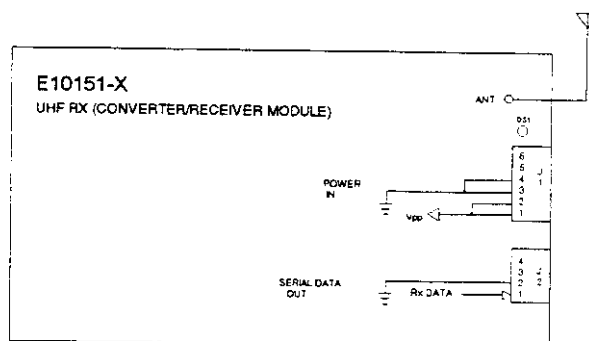


Figure 8-1. Location of UHF Converter /Receiver Module Indicators.

DS1 (Green) - Monitors +8 VDC regulated voltage (normally ON).

If the LED is not illuminated, the +8 VDC is not present. Check connectors, the +8 VDC regulator, or for shorts on the board.

Check power fuse and Power Monitor LED on the Interface Control Module.

8-3.2 Receiver Master CPU Module Diagnostic and Status Indicators.

This module has indicators to aid in troubleshooting. Figure 8-2 provides the location of the indicators. Indicator number, color and indicator's function is presented below.

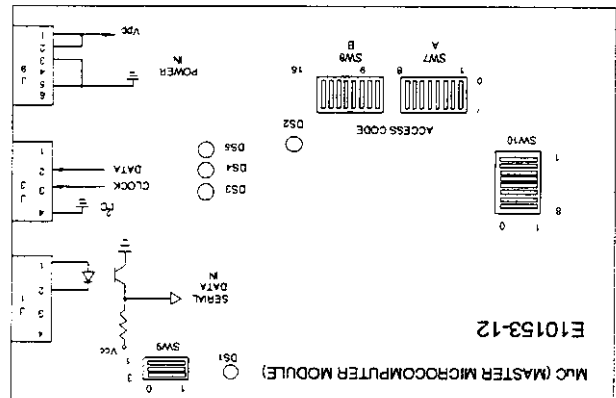


Figure 8-2. Location of Receiver Master CPU Module Indicators.

DS1 (Green) - Monitors +5 VDC regulated voltage (normally ON).

If the LED is not illuminated, the +5 VDC is not present. Check connectors, the +5 VDC regulator, or for shorts on the board.

Check power fuse and Power Monitor LED on the Interface Control Module.

DS2 (Red) - Monitors the watchdog timer (normally OFF).

The LED will illuminate momentarily when power is applied to or removed from the system. If the LED is flashing continuously, the computer is not working properly.

If LED is illuminated constantly, the +5 VDC is probably too low. This could be caused by shorts on the board or by a defective voltage regulator. If the LED flashes at a constant

rate the micro computer chip or EPROM may be defective.

DS3 (Red) - Monitors received data errors (normally OFF).

A flashing LED during data transmission may indicate interference of the received data. If LED is illuminated continuously when data is transmitted and the system will not respond, the Access Code of the Receiver and Transmitter Units may not match. If LED is illuminated when data is not transmitted, another Transmitter Unit may be present on the same frequency with a different Access Code. The presence of activity on this LED does not necessarily indicate a problem. It should be used with other indicators in analyzing system status.

DS4 (Yellow) - Monitors data synchronization (normally OFF when no formatted signal is present).

This LED will flash rapidly when data is transmitted. The LED can be used with DS3 to analyze incoming data. If DS3 is illuminated or flashing when DS4 also is flashing another Transmitter Unit on the same frequency may be present. This is normal. As more Transmitter Units operate on the same frequency, LED will flash brighter and faster often.

DS5 (Yellow) - Monitors I²C serial data line.

This LED monitors communications between the Master CPU Module and the Interface Control Module. Under normal conditions it will flash rapidly when the two modules are communicating properly. If LED is OFF the link between the two modules possibly is broken.

8-3.3. Receiver Interface Control Module Diagnostic and Status Indicators.

The Receiver Interface Control Module has indicators to aid in troubleshooting. Figure 8-3 provides the location of the indicators. Indicator number, color and indicator's function is presented below.

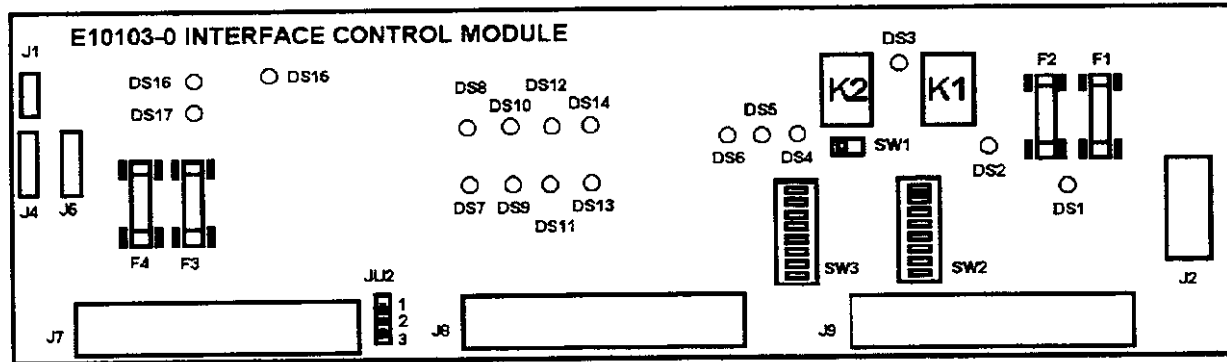


Figure 8-3. Receiver Interface Control Module Indicators

DS1 (Green) - Monitors the 12 DC power supply to control relay coils of the Relay Output Module via The Security Relay K1.

If 12 VDC relay coil power is present when LED is illuminated. LED is off if 12 VDC power is not present.

DS2 (Green) - Monitors +5 VDC regulated voltage (normally ON).

If the LED is not illuminated, the +5 VDC is not present. Check connectors, the +5 VDC regulator, or for shorts on the board.

Check power fuse and Power Monitor LED on the Interface Control Module

DS3 (Red) - Monitors closure of the MCR relay (K1).

LED will be illuminated when the MCR relay has been enabled by an ON command received from the Transmitter Unit. LED will extinguish, when an OFF command has been transmitted, an EMS condition is present, or SW1 is set to 0.

DS4 (Yellow) - Monitors closure of the Security Relay output (K2).

The Security Relay controls the 12 VDC power to the MCR relay (K2), and the power to the coils of the control relays (K1 through K8) on the Relay Output Modules. The LED will be illuminated when the Security Relay has been enabled by an ON command received from the Transmitter Unit. LED will extinguish when an OFF command is transmitted, or an EMS condition is present.

DS5 (Yellow) - Monitors the AC bias pump line for the Security Relay (K2).

LED will flash only when the Receiver Output Module has been enabled by an ON command.

The Security Relay is enabled by an AC signal generated by the slave microcomputer. The ac signal is capacitively isolated from the slave microcomputer to help prevent the Security Relay from being latched ON if the slave microcomputer fails. LED will not be illuminated when an OFF command has been sent or an EMS condition is present.

DS6 (Yellow) - Monitors AC bias pump line for the Master Control Relay (K1)
LED will flash only when the Receiver Interface Control Module has been enabled by an ON command.

The Master Control Relay (K1) is enabled by an AC signal generated by the slave microcomputer. The AC signal is capacitively isolated from the slave microcomputer to help prevent the MCR from being latched ON if the slave microcomputer fails. The LED will not be illuminated when an OFF command has been sent or is in an EMS mode.

DS7 (Yellow) - Monitors I²C serial data bus.
LED is off if I²C bus is not active.
LED ON (Flashing) shows normal I²C bus activity.

DS8 (Red) - Bad board address (normally OFF).
LED ON if the Master CPU Module has detected a bad address on the I²C bus.

DS9 (Red) - Monitors ON or EMS condition (normally OFF).
LED will flash when an ON command is being received from the transmitter. DS9 and DS13 will both illuminate continuously when an EMS state is in effect due to an incoming data error having occurred on the I²C bus.

DS11 (Red) Monitors OFF or EMS condition (normally OFF).
LED will flash when an OFF command is being received from the Transmitter Unit. DS11 and DS13 will both illuminate continuously when an EMS state is in effect.

DS12 (Red) - Monitors MCR contactor Error (normally OFF).
LED ON if the Interface Control Module detects a MCR contact monitoring error.

DS13 (Red) - Monitors EMS condition (normally OFF).
LED will flash when an EMS command is transmitted and illuminated continuously when the EMS condition is in effect. An EMS condition may be created when an EMS command is transmitted or when a failure mode is detected by the slave microcomputer. If both DS11 and DS13 are illuminated, a contact monitoring error has been detected. If both DS9 and DS13 are illuminated, the incoming data on the I²C bus has been corrupted.

DS8 and DS13 are illuminated continuously, if an incorrect board address is detected in the system.
DS14 (Yellow) - Monitors the AC activity for the Security Relay (K1).
DS15 (Red) - Monitors the watchdog timer (normally OFF).
The LED will illuminate momentarily when power is applied to or removed from the system. If the LED is flashing continuously, the computer is not working properly.

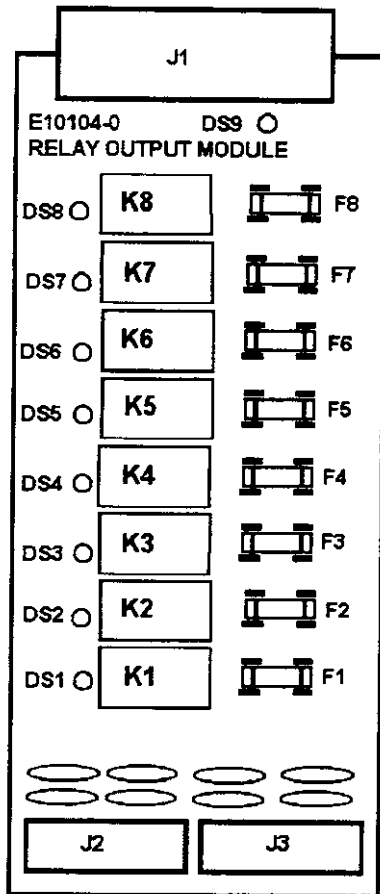
If LED is illuminated constantly, the +5 VDC is probably too low. This could be caused by shorts on the board or by a defective voltage regulator. If the LED flashes at a constant rate the micro computer chip or EPROM may be defective.

DS16 (Green) - Monitors the 12 VDC portion of the power supply that powers external modules.
If the LED is not illuminated, the +12 VDC is not present. Check connectors.

Check power fuse and Power Monitor LED on the Interface Control Module.

8-3.4. Receiver Relay Output Module Diagnostic and Status Indicators.

This module has indicators to aid in troubleshooting. Figure 8-4 provides the location of the indicators. Indicator number, color and indicator's function is presented below.



8-4. Location of Relay Output Module Indicators.

DS1 through DS8 (Red) - Monitors the state of control voltage to the coils K1 through K8 (normally OFF).

F1 through F8 provide a fused link to the output control lines. If the relay appears to be working but no output voltage is present at the output connector check the appropriate fuse.

The Receiver Relay Output Modules may be tested, using a Transmitter Unit without starting crane controls by setting SW1 on the Interface Control Module to 0 (OFF). This allows testing and analyze the system without causing movement of the crane. Setting SW1 to 0 (OFF) on the Interface Control Module, removes power to the Master Control Relay (K9) and the Master Power Relay mounted in the cabinet of the Receiver Unit. Setting SW1 to 1 (ON) returns the output module to normal operating mode.

8-3.5. Power Input Assembly

The Power Input Assembly controls and distributes the power required to operate the Receiver Unit. This unit may operate from 110 - 220 VAC (nominal) 50-60 Hz power, or as indicated on the label on the Power Input Module. For best results, it is recommended that the Receiver Unit operate from an isolated and conditioned 110 VAC line.

The supply for this assembly must be wired with a separate pair of leads going directly to the power transformer. These Leads may or may not be isolated from the users control lines that operate the crane. If the Receiver Unit chassis is not grounded to the same structure to which the neutral line is grounded, a separate ground lead must also be installed. The Power Input Assembly is grounded to the Receiver Unit cabinet through the lower left mounting hole. It also contains a 2 Ampere circuit breaker (with a release for controlling the input power), a transient voltage suppressor (MOV), and connectors for the input and output power.

Section 9

Theory of Operation

9-1 The Transmitter Unit.

A block diagram of the transmitter unit is presented in figure 9-1

The ON/OFF switch toggles the transmitter from the OFF state to the ON state or from the ON state to the OFF state. When the transmitter is initially turned ON, it automatically transmits to the receiver an ON command frame that last approximately five seconds before entering the quiescent ON state. When the transmitter is turned OFF, it automatically transmits an OFF command frame for approximately five seconds before turning the transmitter power OFF.

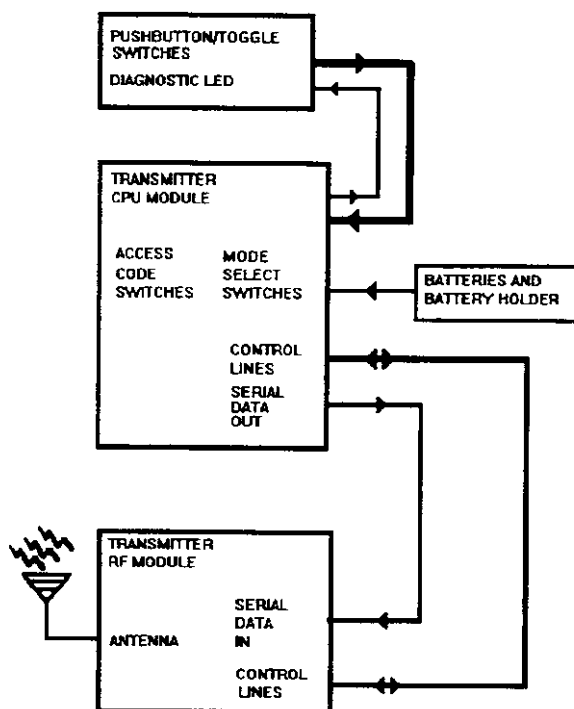


Figure 9-1. Transmitter Unit, Block Diagram

While in the quiescent ON state, the transmitter periodically scans the control switches looking for a closure. If no closure is detected, it continues scanning. If a switch closure is detected, the transmitter sends a specially coded data frame that tells the receiver which switch or combination of switches has

been closed. Besides command or control data, the transmitted frame will always include a unique 16 bit Access Code and an 8 bit CRC code for error detection. A serial data output from the microcomputer provides a serial digital signal that serves as modulation information.

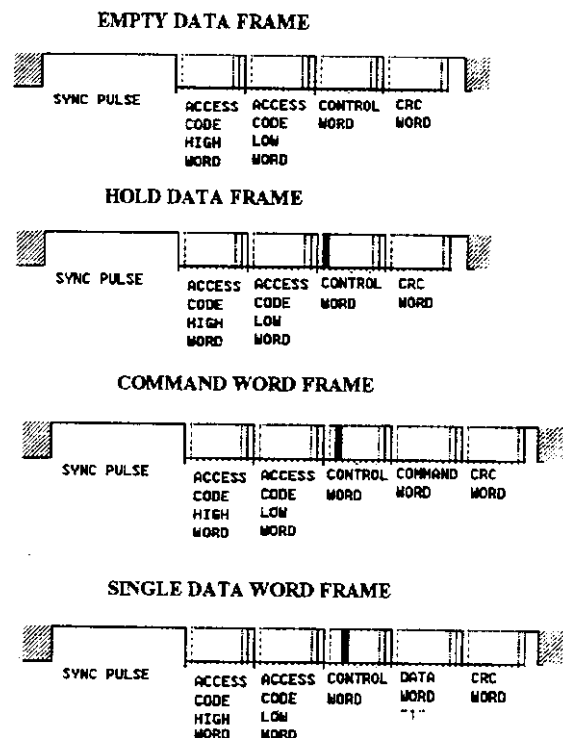


Figure 9-2. Data Frame, Sync Pulse, Access Code Words, and Data Words.

The serial data output feeds an oscillator/modulator that produces an FM FSK modulated signal in the 16.148 to 16.289 MHz frequency range. Frequency modulation is accomplished using a varactor diode in the oscillator tank circuit. The modulated signal is amplified and the frequency multiplied 27 times through three triplers to produce a signal in the 436.0 to 439.8 MHz range.

The Transmitter CPU Module is the controller, which reads the front panel switches, internal Access Code switches, and the configuration switches. This

signal is converted to 10.7 MHz, amplified, and then passed through a four-pole 10.7 MHz filter to another IF amplifier and quadrature detector. The detector output passes through signal processing circuits to produce a digital output, which duplicates the control signal used to modulate the transmitter.

9-2-2 Receiver Master CPU Module.

The primary task of the Master CPU Module is to receive the recovered data from the UHF Converter/Receiver Module. test, it for errors and send the decoded output information to the Interface Control Module. Tests on the data include proper frame format, parity, CRC 8 and Access Code. If any of these tests indicate that the received data has been corrupted, the frame will be discarded. To maintain continuity at the output, the last good frame of data is held and sent to the Interface Control Module for a fixed period of time if incorrect data has been received from the UHF Converter/Receiver Module for approximately 0.5 seconds, the output data sent to the Converter/Receiver module will be cleared.

The system Access Code and System Configuration switches for the receiver are located on this module. The Access Code on the Master CPU Module must match the Access Code of the companion Transmitter Unit to correctly receive data.

9-2-3 Receiver Interface Control Module.

The Interface Control Module has an on-board slave microcomputer, which receives command and control data from the Master CPU Module via the I²C serial data link.

The slave microcomputer receives data from the I²C bus, checks the Address Code, performs the checksum and error detection, and updates the current output and status of the module. When the board is enabled by a transmitted ON command and no EMS condition is in effect, the slave will output the most recent control data to the electro-mechanical output relays.

The Interface Control Module also holds fuses for short circuit protection to the UHF Converter/Receiver Module, the Master CPU Module, the

information, converted into a frame of serial data, is transmitted by the RF module at 9600 bits per second. In addition, it also provides a transmit enable signal that turns the transmitter RF module ON and OFF, providing asynchronous time multiple shared (TMS) operation.

A frame of serial data consists of a sync pulse, and a sequence of ON/OFF bits organized according to the standard data word format. Each data word has one start bit followed by eight data bits, one parity bit and a stop bit. Figure 3-2 further define the data frame, the sync pulse, the Access Code words, and data words.

9-2. Receiver Unit

A block diagram of the receiver unit is presented in figure 9-3. A description of these modules follows:

Located within the Receiver Unit are separate modules that accept the transmitted signal; detect and perform checks on the signal; and provide a contact closure corresponding to the command selected on the Transmitter Unit.

The Receiver Unit consists of the a

- 1) UHF Converter/Receiver Module,
- 2) Master CPU Module,
- 3) Interface Control Module
- 4) Two or three Relay Output Modules
- 5) Power Supply Assembly.

9-2.1 UHF Converter/Receiver Module.

This module is a dual conversion receiver operating in the 436.0 to 439.8 MHz band. The module is a wideband digital receiver working at 9600 baud and is specifically designed for TMS transmissions. The received signal is dual superheterodyne converted to the 10.7 MHz intermediate frequency range. It is then demodulated to recover the audio, and then signal conditioned to recover the digital data. The module has an on board regulator with an output of 8.0 VDC to all circuits.

Signals from the antenna go through a preslector and then to an RF amplifier. Output from the RF amplifier then feeds the first mixer, which produces an output signal between 40.3 and 41 MHz. This signal then goes through the first IF filter and amplifier to the second mixer. In this mixer, the

digital circuitry of the Interface Control Module and the Relay Output Modules.

Two Safety Relays are used to disable the outputs if the slave microcomputer detects a problem or fails. These are the Security Relay (K2) and the Main Control Relay (K1). The Main Control Relay is also called the MCR relay. Each relay is enabled by a separate AC signal generated by the slave microcomputer. The ac signal sources are capacitively isolated from the slave microcomputer to help prevent the MCR and Security Relays from being latched ON if the slave microcomputer fails. If the slave microcomputer fails to generate these signals, the security relay (K2) will open and remove power from the MCR relay (K1). This will remove the 12 VDC, switched by K2, from the coils of the EMR relay so they cannot turn ON.

The MR relay (K1) output drives the Master Power Relay. This drives the main line contactor that controls the three phase power to the crane. When the system first receives an ON command, the output of the MCR (K1) is first contact monitored. If there is a voltage, an EMS condition occurs and the system will not start. If there is no voltage, the K1 relay is energized, switching power to the Master Power Relay. This is located on the Receiver Enclosure.

9-2-4 Receiver Relay Output Modules.

The Receiver Relay Output Modules plugs into the Receiver Interface Control Module, and contains eighth (8) Electro-mechanical Relays per module. Each output is individually fused, and is suppressed with an MOV. An optional RC snubber network is also available. Each module can provide eight (8) outputs of ON/OFF control. The left most module may be configured as an Auto Alarm function automatically turns ON the Alarm (k8 relay) for approximately five seconds when the system is turned ON. Three (3) additional functions (Aux#1, Aux#2 and Aux#3) may be configured as latched outputs. These may be toggled ON and OFF by the pressing of their associated toggle switches on the transmitter.

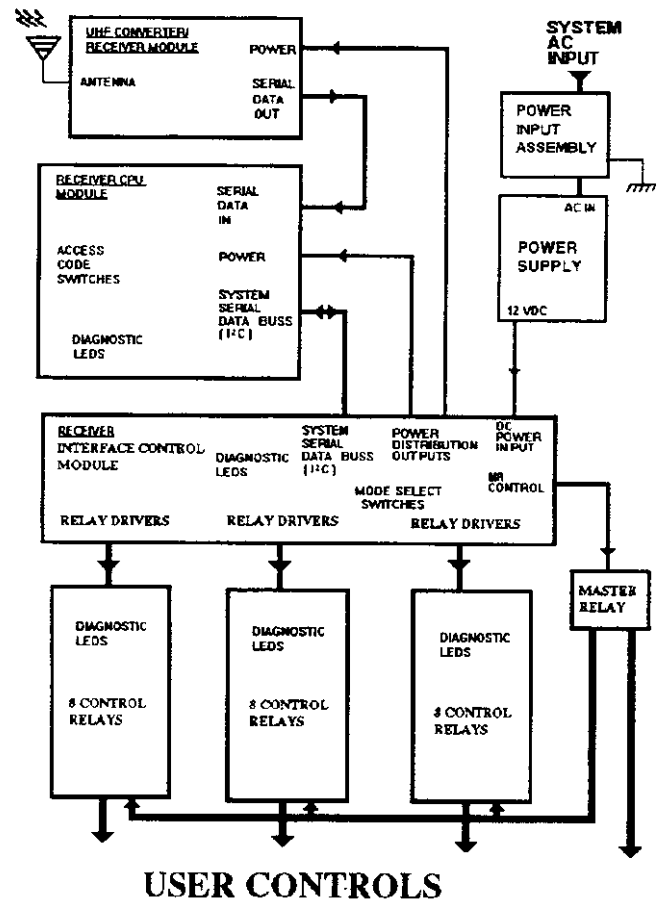


Figure 9-3. Receiver Unit, Block Diagram

9-3. Access Code.

The system Access Code consists of two bytes transmitted at the beginning of each frame. The Access Code identifies the transmitted signal to the receiver as valid. Any received signal not matching the receiver Access Code is considered invalid. Invalid signals rejected for lacking an Access Code include: random noise, adjacent channel transmissions, or a Transmitter Unit set to an Access Code that does not match the Receiver Unit Access Code.

9-4 Time Multiple Shared (TMS) System Software.

The system software is structured to minimize "on the air" transmission time of any transmitter. This allows for multiple transmitters to share a common frequency. The TMS system is designed so that a transmitter will send a signal for a predetermined ON

time, and will then turn OFF. The length of the transmitter ON time is called a data burst or packet. The packet length depends on the quantity of data to be sent, and the data rate (baud). Once the packet is sent, the transmitter will turn OFF. This allows for other transmitters to time share the same frequency when a transmitter has turned OFF. The OFF period and repetition rate of the ON period are determined by the TMS system software. This allows up to 4 TMS systems to share and have equal access to the same frequency. It also allows for reduced Transmitter Unit power consumption, and extended battery life.

9-5 Inter-Integrated Circuit Bus (I²C).

The Receiver Master CPU Module communicates with the Receiver Interface Control Module via an Inter-Integrated Circuit bus (I²C).

The I²C data format is presented in Figure 9-4.

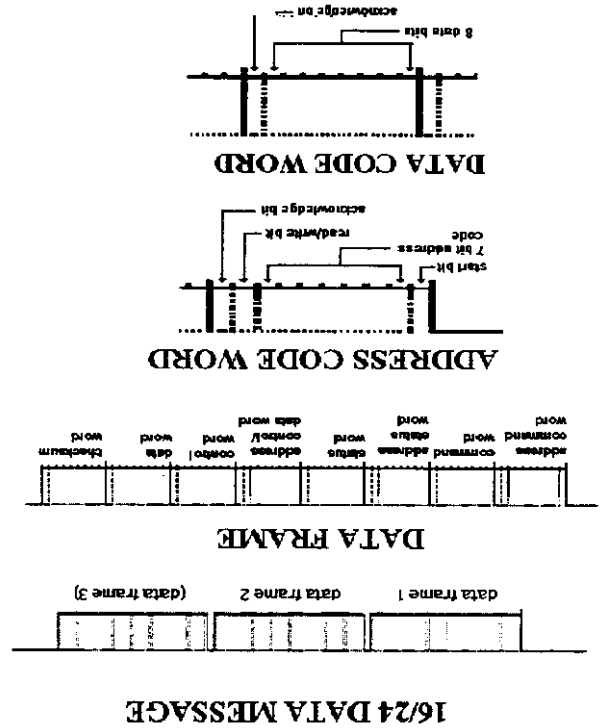


Figure 9-4. I²C Data Format.

The I²C bus is the two-line synchronous serial data system that allows two-way communication between the Master CPU Module and the Interface Control Module. The data format consists of 2 or 3 frames

of 8 words. There is one frame for each 8 bit output being sent to the Interface Control Module. Each frame, divided into 3 segments, begins with a 7 bit address and an 8th, read/write bit. The read/write bit decides whether the following word or words will be read from the receiver output/interface assemblies or written to them. Besides the eight data bits, there is a ninth acknowledge bit. When a sender (called a master) transmits an eight bit data word, it must receive an "acknowledge" bit (ACK) from the receiving (slave) unit. Each word must be "acknowledged" for successful data communication to occur.

The first segment of each frame begins with a command "address/write" byte and a command word. The command address decides the module that will receive the command word. The command word tells the addressed module what type of status information it should return to the Master CPU Module. The command segment, followed by a status segment, with a status address/read byte, tells the addressed module to return the status word. The status word reflects the state of the receiver output/interface assemblies After the status segment, a control/data segment is sent with an address/write byte followed by a control word and a data word. The data word contains the output commands. The control word contains the ON/OFF and EMS transmitted commands, also transmitted are the time-out shutdown flag, an EMS type shutdown flag, and a bad board address flag.

These three flags of the control word will cause a shutdown of the system. The time-out shutdown flag tells the output modules to turn off if no transmission has been received for 15 minutes. The EMS shutdown also tells the Interface Control Module to turn OFF and requires the transmitter to be turned OFF and ON for restarting. The bad board flag tells the Interface Control Module that the Master CPU Module has not seen the right board address configuration. It displays this by setting the bad board diagnostic and the EMS diagnostic LED. The last word is a check sum error detection word that is tested by the Interface Control Module.

9-6 Power Input Assembly.

The Power Input Assembly controls and distributes the power required to operate the Receiver Unit. This unit may operate from 110 - 220 VAC (nominal) 50-60 Hz power, or as indicated on the label on the Power Input Module. For best results, it is recommended that the Receiver Unit operate from an isolated and conditioned 110 VAC line.

The supply for this assembly must be wired with a separate pair of leads going directly to the power transformer. These Leads may or may not be isolated from the users control lines that operate the crane. If the Receiver Unit chassis is not grounded to the same structure to which the neutral line is grounded, a separate ground lead must also be installed. The Power Input Assembly is grounded to the Receiver Unit cabinet through the lower left mounting hole. It also contains a 2 Ampere circuit breaker (with a release for controlling the input power), a transient voltage suppresser (MOV), and connectors for the input and output power.

Section 10

Maintenance

10-1. Maintenance.

NOTE: *Do not attempt to desolder or solder any piece parts mounted on any module within the system. Return defective assemblies or parts ,which are removable without soldering, to Telemotive for replacement or repair.*

10-2. Interface Control Module Fuse Replacement.

The Interface Control Module also holds fuses for power to the UHF Converter/ Receiver Module, the Master CPU Module, the Interface Control Modules digital circuitry and the Relay Output Modules.

Fuse F1 is located on the Interface Control Module. Replace only with a 1 Ampere, 250 Volt slow blow type.

F2 through F4, are located on the Interface Control Module. Replace these fuses only with .3 Ampere, 250 Volt slow blow type.

10-3. Relay Output Module Fuse Replacement.

Fuses, F1 through F8, are located next to their corresponding output relays on the Relay Output Module. Replace these fuses only with 10 Ampere, 250 Volt slow blow type.

The Receiver Unit is protected by a 2 Ampere circuit breaker. If either the circuit breaker or a fuse is open, it is possible a malfunction exists either in the receiver unit or the material

handling equipment. If either protection device opens, it is recommended trouble-shooting procedures be performed to determine the cause of the open. Reset the circuit breaker by simply pushing the black reset button in.

10-4. Relay Output Module Replacement.

If a relays K1 through K8 is defective it may be replaced by removing the defective Relay Output Module and replacing it with a working module.

10-5. Master Power Relay Replacement.

The Master Power Relay may be removed from the Receiver Unit as required. Replace relay with a normally open DPST, 110 VAC, 25 A (Telemotive part number K2111-2).

10-6 Transmitter Battery Replacement.

Transmitter Unit is powered by a 7.5 VDC battery pack (Telemotive part number BT10KP-0). Alkaline type batteries are recommended, although rechargeable Ni-Cad batteries are available. Replace discharged batteries as follows: Open the battery compartment door by rotating the door latch clockwise or counter clockwise to "open" position. Remove the door.

Install new battery pack. Ensure battery pack is completely positioned in its holder, and that the latch is locked forward over the battery pack. Replace the door. While firmly holding the door closed, rotate the door latch

clockwise or counterclockwise to the "lock" position.

10-7. Transmitter Unit Disassembly and Re-assembly.
There are no serviceable parts in the transmitter.

10-8. Receiver Unit Disassembly and Reassembly.

Remove all connectors. If the UHF Converter/Receiver Module is being removed, remove the BNC connector from antenna bottom, then the four(4) nuts securing the module. If removing the Receiver CPU Module, or the power supply, remove the four (4) nuts securing the module. If removing the Receiver Output Module, release locking tab and pull the module straight out. If removing the Receiver Interface Module, tag or otherwise identify the leads to ease assembling. Then remove the two (2) screws securing card guides, and the six (6) screws securing the module. Assemble in reverse order of removal.

10-9. Receiver Unit Replacement Parts.

Part Number	Description
10K16/24RSPK-0	Spare parts kit, consisting of the following spare modules.
E10151-X	UHF Converter/Receiver Module (Specify channel #).
E10153-16	Receiver CPU Module
E10103-0	Receiver Interface Control Module
E10104-0	Receiver Relay Output Module
A5656-0	Power Supply - 25 W, 12 VDC
A10160-0	Power Input Assembly
F2708-0	Fuse - 10 A, 250 V, 5x20 mm SLO-BLO
F2708-1	Fuse - 1.0 A, 250 V, 5x20 mm SLO-BLO
F2708-3	Fuse - 0.3 A, 250 V, 5x20 mm SLO-BLO
K1301-0	Output Relays K1 through K10 -12 VDC coil. Normally open SPST 16 A, 250 VAC contact. Coil rating of 12 VDC.
K2111-2	Master Relay - Normally open DPST, 110 VAC, 25 A.
K1000-0	Relay - Normally open SPST 5 A, 250 VAC. Coil rating of 12 VDC.
E2028-2	Remote Antenna Kit.
TS1060-8	Terminal Strip, 8 circuits, Plug-In
W1098-2	Jumper, Insulated, 2 circuits.
W1098-4	Jumper, Insulated, 4 circuits.
E10106-0	RC Snubber Module
E10161-0	MultiBox Display Module
OPTIONAL	
E10670-1	Rechargable battery Charger
E2028-2	Remote External Antenna Kit

10-10. Pendant Transmitter Unit Replacement Parts.

Part Number	Description
MP10678-0	Shoulder Strap Assembly
A10670-0	Battery Holder Assembly with Bracket
A10669-0	Battery Door Assembly
S1026-0	Switch, Push-button, SP, Momentary, Blk.
S1026-2	Switch, Push-button, SP, Momentary, Red
S1039-3	Switch, Push-button, 3 speed, 5V, Opto-Elect.
S1040-0	Switch, Rotary, SP3T, 2A
S1041-0	Switch, Toggle, SPDT, Center Off
MP10666-0	Knob, 1/2" Dia., Blk.
E10666-X	Transmitter RF Module (Specify Channel #)
E10681-0	Transmitter CPU Module
BT10KP-0	Battery, Alkaline (Standard)
BT10KP-1	Battery, Ni-Cad (Optional)
E10671-0	Dual Ni-Cad Battery Charger (Optional)
E10668-3	Replacement Top Case Assembly
A10667-3	Replacement Bottom Case Assembly
MP10671-11	Boot, Pendant Switch, "Up"
MP10671-12	Boot, Pendant Switch, "Down"
MP10671-13	Boot, Pendant Switch, "Right"
MP10671-14	Boot, Pendant Switch, "Left"
MP10671-15	Boot, Pendant Switch, "Fwd"
MP10671-16	Boot, Pendant Switch, "Rev"
MP10671-17	Boot, Pendant Switch, "North"
MP10671-18	Boot, Pendant Switch, "South"
MP10671-19	Boot, Pendant Switch, "East"
MP10671-20	Boot, Pendant Switch, "West"

10-11. SLTX Transmitter Unit Replacement Parts.

Part Number	Description
A231-204	ASSY,KEYSWITCH & CABLE, TX
A232-X	ASSY TOGGLE SWITCH & CABLE, TX
A234-2	ASSY, LED W/CONNECTOR
A235-0	ASSY, ROTARY SWITCH & CABLE, TX
A10685-1	ASSY BATTERY CONTACT BOARD
A2260-0	ENDCAP ASSY, BATTERY SIDE
A2261-X	ENDCAP ASSY, ANTENNA SIDE
E10601-X	10KSLTX CPU MODULE
H633-0	BOOT, TOGGLE, RED
H634-0	BOOT, PUSHBUTTON, GRAY
H635-0	BOOT, PUSHBUTTON, RED
H638-0	BOOT, TOGGLE, GRAY
H2055-3	LENS, LED
MP135-1	KNOB/KEY ASSY, MOLDED
MP630-0	KNOB, CYLINDER 5/8 DIA.
MP632-0	KNOB, SQUARE 5/8 SQ.
MP681-0	KNOB, SPHERICAL 3/4 DIA.
MP2161-X	TOP PANEL EXTRUSION 10KSLTX
N10170-X	LABEL TX FUNCTIONS, WRITE-IN
N10171-X	LABEL TX FUNCTIONS
S763-101	MOTION SWITCH, 5 SPEED STEPPED
WA4645-0	RECEPTACLE, CODE PLUG
WA4647-X	CODE PLUG ENGRAVED WITH ACCESS CODE
BT10KP-0	BATTERY, ALKALINE (STANDARD)
BT10KP-1	BATTERY, Ni-Cad (OPTIONAL)

Appendix B

10K24 PENDENT TRANSMITTERS (MODE 1 CONFIGURATION)

SECTION 1.0 OVERVIEW

The 10KPLUS PENDENT TRANSMITTERS (*with extended crane control options*) is a new enhancement to the Telemotive 10KPLUS line of products. It adds to the lineup the abilities to select between a number of popular crane control configurations with the simple changing of a dip switch setting. This will in many cases eliminates the need for the addition of external hardware

Two versions of the 10KPLUS pendent transmitter are available.

**A 16/18 OUTPUT TRANSMITTER
(10K24OM03P4)**

**A 24 OUTPUT TRANSMITTER
(10K24OM03P5)**

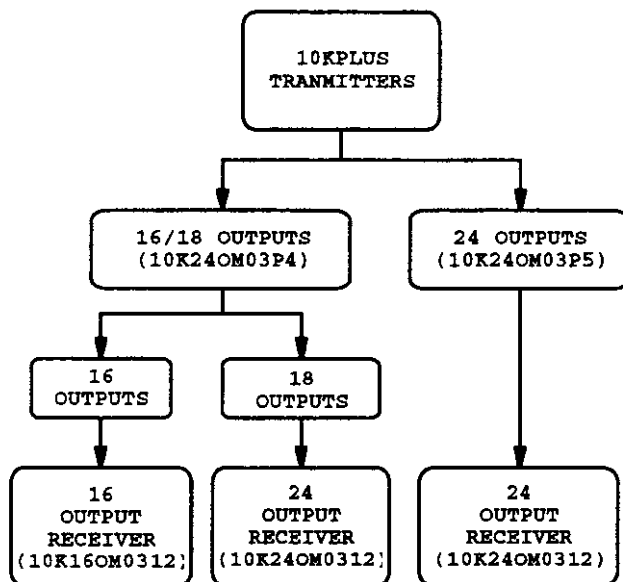


Chart 1

SECTION 1.1 THE 16/18 OUTPUT TRANSMITTER

The 10K16/18 three speed transmitter comes with the following switch hardware.

- 1) Three bi-directional 3-speed pushbutton switches
- 2) Three momentary, 3-position (center OFF) toggle switches.

Five/Six independent bi-directional functions are available for a total of 16/18 output controls.

The transmitter is able to control

THREE (3-SPEED)* MOTION CONTROLS
and
FOUR/SIX AUXILIARIES**

Available motion functions are

**Hoist
Trolley
Bridge**

**AUX 1
AUX 2
AUX 3
AUX 4**

AUX 5
AUX 6****

* NOTE

THIS IS FOR THE STANDARD CONFIGURATION ONLY, IN CERTAIN OF THE OPTIONAL CRANE CONTROL CONFIGURATIONS THE HOIST, TROLLEY AND BRIDGE MAY OPERATE AS 2-SPEED CONTROLS

**NOTE

NOTE TO HAVE SIX INDEPENDENT BI-DIRECTIONAL FUNCTIONS WITH 18 OUTPUTS (AUX5,AUX6) REQUIRES A 24 OUTPUT RECEIVER

SECTION 1.2 THE 24 OUTPUT TRANSMITTER

The 10KPLUS 24 three-speed transmitter comes with the following switch hardware.

- 1) Three bi-directional 3-speed pushbutton switches.
- 2) Two momentary, 3-position (center OFF) toggle switches.
- 3) One 3-position rotary switch.

Transmitter is able to control

THREE/FOUR/FIVE (3-SPEED)* MOTION CONTROLS

FOUR AUXILIARIES

Available motion functions are

- Main Hoist
- Aux Hoist
- Main Trolley
- Aux Trolley
- Bridge

4 AUXILIARIES

* NOTE

THIS IS FOR THE STANDARD CONFIGURATION ONLY, IN CERTAIN OPTIONAL CRANE CONTROL CONFIGURATIONS THE HOIST, TROLLEY AND BRIDGE MAY OPERATE AS 2-SPEED CONTROLS

The hoist/trolley pushbutton pairs may be selected to operate the Main Hoist /Main Trolley and/or the Aux Hoist/Aux Trolley by the use of the rotary selector switch. The three possible Hoist /Trolley selections are

- 1) H1 (Main Hoist/Main Trolley)
- 2) H2 (Aux Hoist/ Aux Trolley)
- 3) B (Tandem Main Hoist & Aux Hoist) / (Tandem Main Trolley & Aux Trolley)

For applications that do not have an Aux Trolley, Aux Trolley may be de-selected by a dip switch in the transmitter. For applications that do not need Tandem operation Tandem may be de-selected by a dip switch in the transmitter.

The transmitter comes from the factory configured with Aux Trolley and Tandem Trolley and Hoist enabled and the output configured as the Standard Output Configuration:
(See TABLE 1a or 2a for Standard Output Configuration)

If this configuration supports your crane controls no further configuration steps are necessary.

If this configuration does not support your crane controls go to TABLE 1 for a 16/18 output transmitter and TABLE 2 for the 24 output transmitter to determine which of the available configurations best supports your crane controls. Proceed to SECTION 2 to configure the transmitter. If none of the available configurations appear suitable, contact the factory for further support.

SECTION 2 CONFIGURING THE TRANSMITTER

DETERMINE THE DESIRED CONFIGURATION BEFORE BEGINNING THE TRANSMITTER SETUP.

- 1) Determine whether the transmitter is a 16/18 output model or a 24 output model.
- 2) For the 16/18 output model, if a crane control configuration other than the standard version is needed, chose which of the available crane control configurations is desired from TABLE 1.
- 3) For the 24 output model, first determine whether an aux trolley is available and if tandem operation is desired, then determine if a crane crane control configuration other than the standard crane control version is required then chose which of the available optional crane control configurations is desired from TABLE 2.

THEN

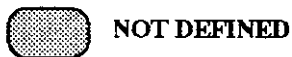
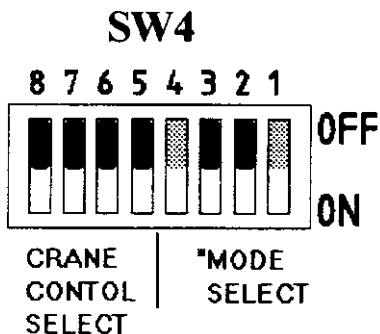
- 4) Remove the 8 screws holding the two halves of the transmitter case together.
- 5) Remove the bottom half of the case.
- 6) The main digital board is now accessible.

Three dip switches should be visible.

(SW1,SW2,SW4)

DO NOT CHANGE SW1 OR SW2. THEY CONTROL THE TRANSMITTER ACCESS CODE AND ARE SET TO MATCH THE RECEIVER AT THE FACTORY AND SHOULD NOT BE CHANGED.

6) Locate SW4. It closest to the top left edge of the main digital board.



NOT DEFINED

***NOTE: MODE SELECT SWITCH
DEFINED FROM 24 OUTPUT
TRANSMITTER ONLY**

SECTION 2.1 CONFIGURING THE 16/18 TRANSMITTER

- 2) Go to **TABLE 1**
- 3) Set crane control select switches

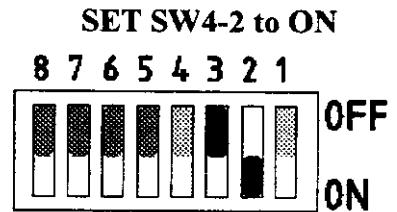
*SW4-5 to SW4-8 according to the
Configuration Type Switch Select
section of **TABLE 1***

- 4) Replace cover and screws

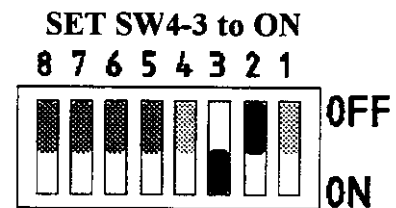
SECTION 2.2 CONFIGURING THE 24 OUTPUT TRANSMITTER

- 1) To deselect tandem or the second trolley make the following dip switch settings

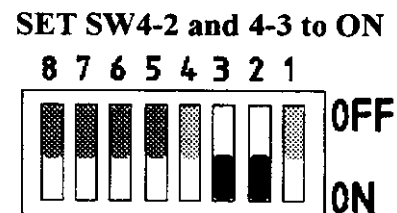
To de-select the second trolley



To de-select the tandem hoist



To de-select the tandem hoist and the second trolley



NOT DEFINED



CRANE
CONTROL
CONFIGURATION

- 2) Go to **TABLE 2**
- 3) Set crane control select switches

*SW4-5 to SW4-8 according to the
Configuration Type Switch Select
section of **TABLE 2***

- 4) Replace bottom cover and screws

0221

Appendix C

10K24 PENDENT TRANSMITTER (MODE 2 CONFIGURATION)

SECTION 1.0 OVERVIEW

The 10KPLUS line of crane controls has been extended to include the option (MODE 2) of having a set of decoded relay outputs to select

HOIST / TROLLEY
AUX HOIST /AUX TROLLEY.
TANDEM HOIST / AUX HOIST
TANDEM TROLLEY / AUX TROLLEY

When MODE 2 is selected, four relay outputs are used to select which of the external controls will be enabled when the corresponding transmitter functions are activated.

These are:

Hoist Select
Aux Hoist Select
Trolley Select
Aux Trolley Select

These outputs come from the third ("C") output module.

Bridge requires no select function.

A transmitter may be configured to operate in the standard (MODE 1) with Hoist , Trolley, Aux Hoist and Aux Trolley being driven by separate relay output banks or the decoded output (MODE 2) with hoist/trolley and aux hoist/aux trolley sharing a

common relay output bank and are activated externally by four select relay outputs.

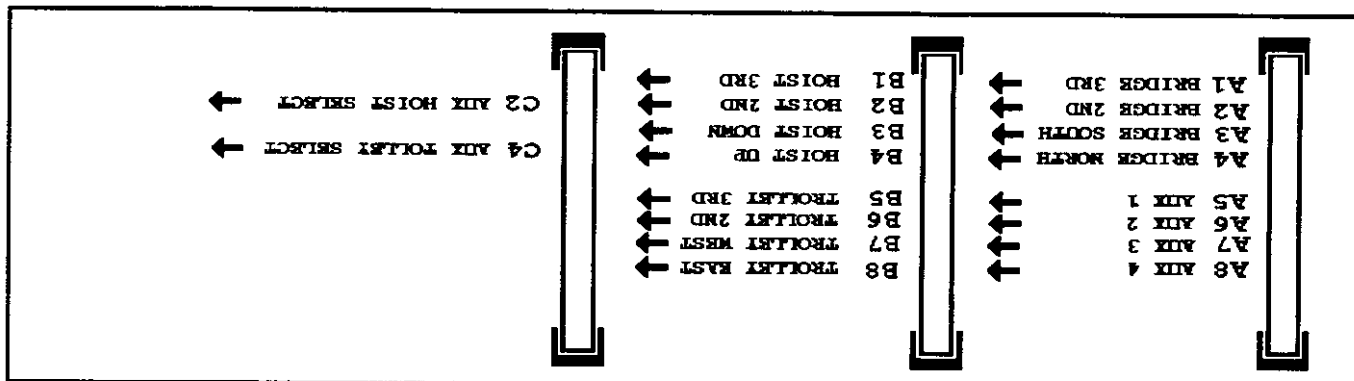
The choice of mode is made by the setting of a internal dip switch contact on the transmitter CPU module. (See Section 2)

In either mode the Rotary Select Switch on the transmitter front panel is used to determine whether the transmitter's hoist or trolley pushbuttons controls will be routed to the hoist/trolley or aux hoist/aux trolley outputs. .

The multi-crane control types described in appendix B are still available and may be selected as describe in the setup procedure.

In addition to the new mode feature, the time-out disable feature which previously required a special ROM is now dip switch selectable. (See Section 2.2)

NOTE: This requires the latest transmitter digital motherboards. Older transmitters may not have the necessary selection switch and will still require a special ROM

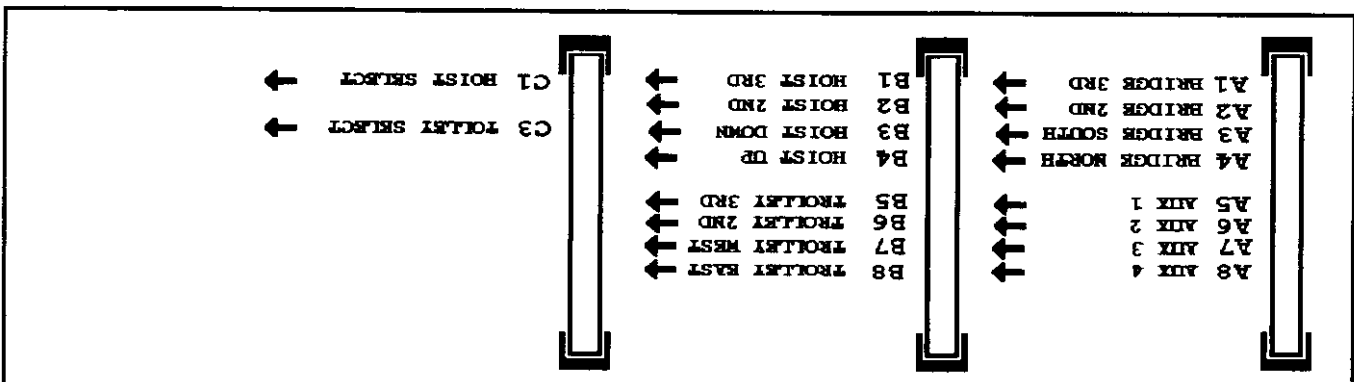


OUTPUT MODULE RELAY CLOSURES

SECTION 1.1.2 AUX TROLLEY AND/OR AUX HOIST OPERATION

When the rotary function selector switch is set to position H2, then Aux Hoist Select will be energize when the

HOIST UP BUTTON or HOIST DOWN BUTTON is pressed and Aux Trolley Select will energize when the TROLLEY EAST BUTTON or TROLLEY WEST BUTTON is pressed



OUTPUT MODULE RELAY CLOSURES

SECTION 1.1 FUNCTION SELECT OPERATION

The Rotary Select Switch allows the transmitter to control Hoist and Trolley or Aux Hoist and Aux Trolley or Tandem Hoists and Tandem Trolleys

SECTION 1.1.1 TROLLEY AND/OR HOIST OPERATION

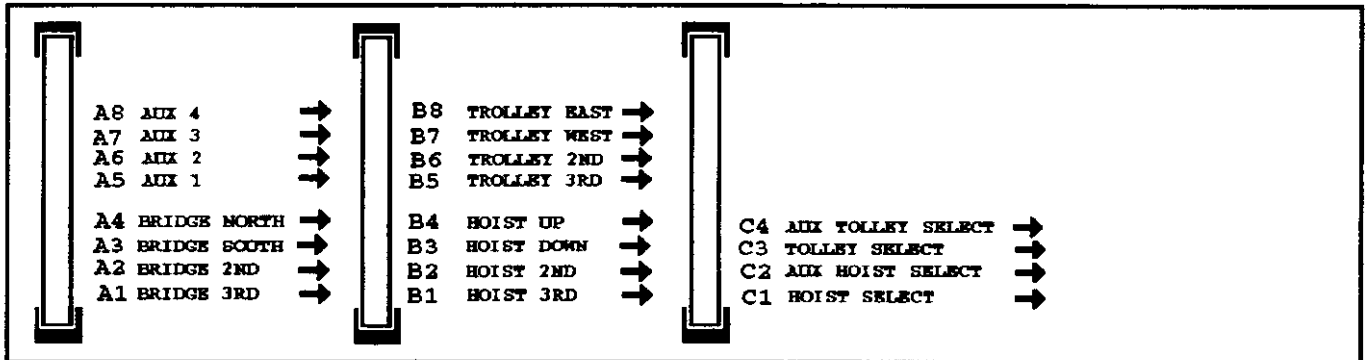
When the rotary function selector switch is set to position H1 then Hoist Select will energize when the HOIST UP BUTTON or HOIST DOWN BUTTON is pressed and Trolley Select will energize when the TROLLEY EAST BUTTON or TROLLEY WEST BUTTON is pressed

SECTION 1.1.3 TANDEM HOISTS AND/OR TROLLEY OPERATION

When the rotary function selector switch is set to position **B**, then both Hoist Select and Aux Hoist

Select will be energize when the HOIST UP BUTTON or HOIST DOWN BUTTON is pressed and both Trolley Select and Aux Trolley Select will energize when the TROLLEY EAST BUTTON or TROLLEY WEST BUTTON is pressed

OUTPUT MODULE RELAY CLOSURES



H1 H2 B



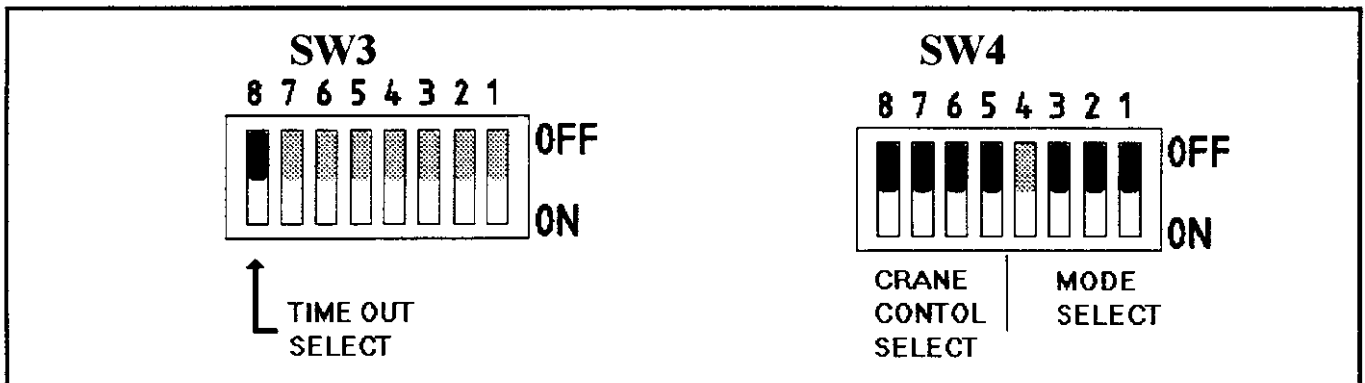
ROTARY
SELECTOR
SWITCH

SECTION 2.0 SWITCH SETTINGS

Two switches on the TRANSMITTER CPU MODULE are involved in setting up the transmitter in this appendix.

Switch 4-1 now switches the transmitter between conventional output configuration as describe in Appendix B and the new decoded output configuration.

Switch 4 contacts 2 to 8 provides the same function as in Appendix B.

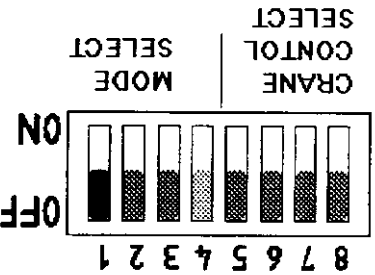


NOT DEFINED

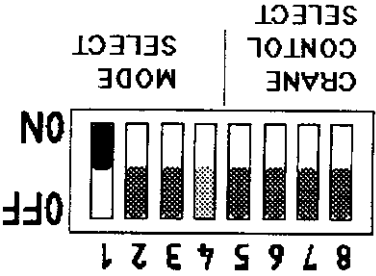
SECTION 2.1 SWITCH SW4 CONTROL

DESCRIPTION

When SW4-1 is set to OFF then the transmitters will output data in the (MODE 1) configuration.



When SW4-1 is set to ON then the transmitters will output data in the (MODE 2) decoded relay configuration.

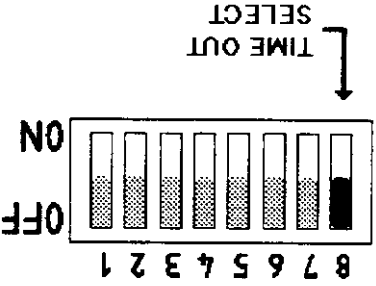


THE FUNCTION OF SW4-2 AND 4-8 REMAIN THE SAME IN EITHER MODE AND ARE DESCRIBED IN APPENDIX B SECTION 2.2

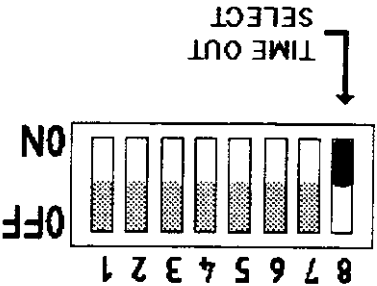
SECTION 2.2 SWITCH SW3 CONTROL

DESCRIPTION

When sw3-8 is set to OFF then the transmitter times-out in the normal manner



When sw3-8 is set to ON then the transmitter will NOT time-out.

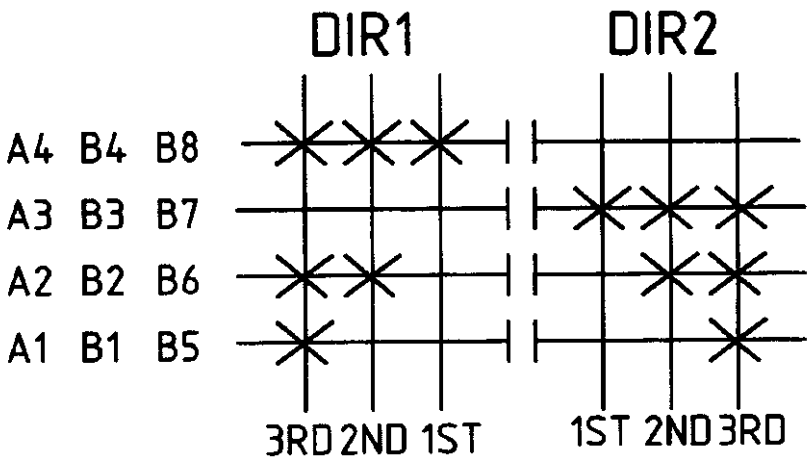


NOTE: This feature requires the latest transmitter digital motherboards. Older transmitters may not have the necessary selection switch and will still require a special ROM

TABLE 1(a)

Crane Control Type Selection: 10K16-TYPE 0

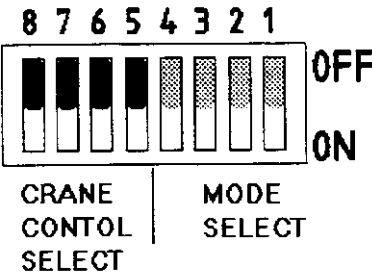
STANDARD CONFIGURATION: ALL MOTIONS
(hoist, trolley, bridge)



Configuration Type Switch Select:

Switch settings SW4-5 to SW4-8 are defined as follows

SWITCH SETTINGS: TYPE	SW4-8	SW4-7	SW4-6	SW4-5
0	OFF	OFF	OFF	OFF



 NOT DEFINED

TABLE 1(b)

Crane Control Type Selection: 10K16-TYPE I

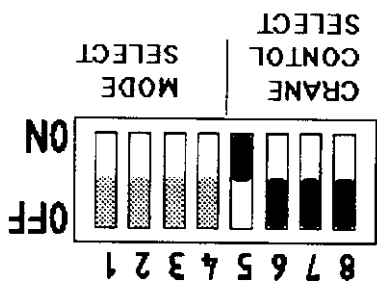
2 SPEED WITH DIRECTIONAL CONTROL: ALL MOTIONS

DIR1				DIR2			
3RD 2ND 1ST				3RD 2ND 3RD			
A1 B1 B5	*				*		
A2 B2 B6	*	*	*		*	*	*
A3 B3 B7	*	*	*		*	*	*
A4 B4 B8	*	*	*				

Configuration Type Switch Select:

Switch settings SW4-5 to SW4-8 are defined as follows

SWITCH SETTINGS: TYPE 1
 SW4-8 SW4-7 SW4-6 SW4-5
 OFF OFF OFF ON

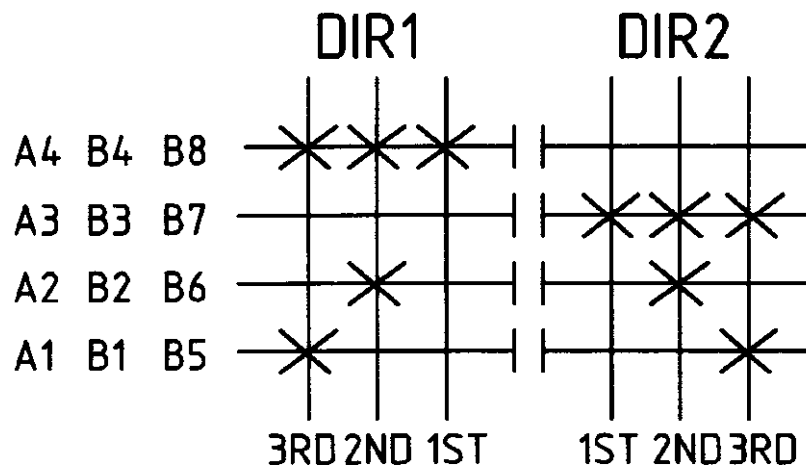


NOT DEFINED

TABLE 1(c)

Crane Control Type Selection: 10K16-TYPE 2

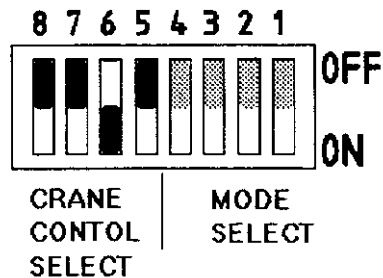
2 SPEED, 2 WINDINGS: ALL MOTIONS



Configuration Type Switch Select:

Switch settings **SW4-5** to **SW4-8** are defined as follows

SWITCH SETTINGS:	TYPE	SW4-8	SW4-7	SW4-6	SW4-5
	2	OFF	OFF	ON	OFF



NOT DEFINED

TABLE 1(d)

Crane Control Type Selection: 10K16-TYPE 3

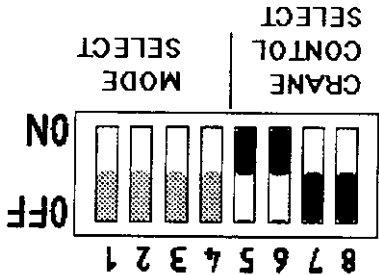
ACCO CONTROLS: ALL MOTIONS

DIR1		DIR2	
A4 B4 B8	*	*	*
A3 B3 B7	*	*	*
A2 B2 B6	*	*	*
A1 B1 B5	*	*	*

Configuration Type Switch Select:

Switch settings SW4-5 to SW4-8 are defined as follows

SWITCH SETTINGS: TYPE 3
 SW4-8 SW4-7 SW4-6 SW4-5
 OFF OFF OFF ON

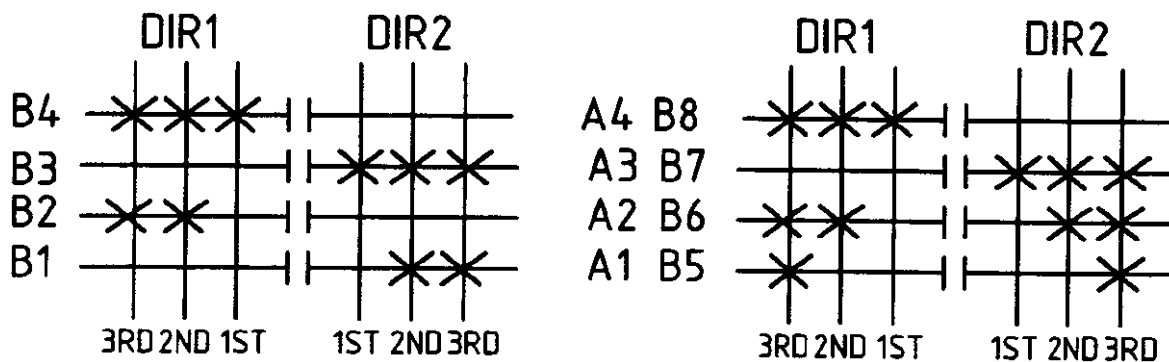


NOT DEFINED

TABLE 1(e)

Crane Control Type Selection: 10K16-TYPE 4

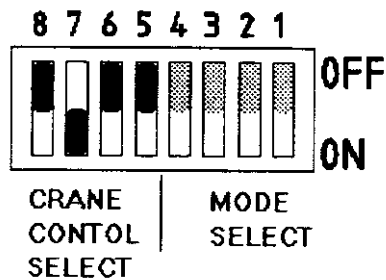
DEMEG: 2 SPEED 2 WINDINGS for HOIST: STD BRIDGE AND TROLLEY



Configuration Type Switch Select:

Switch settings SW4-5 to SW4-8 are defined as follows

SWITCH SETTINGS:	TYPE	SW4-8	SW4-7	SW4-6	SW4-5
4		OFF	ON	OFF	OFF



NOT DEFINED

TABLE 1(f)

Crane Control Type Selection: 10K16-TYPE 5

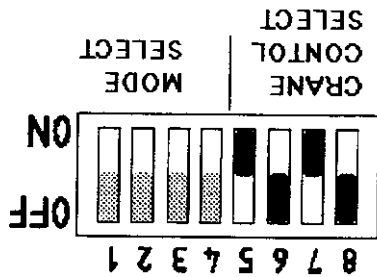
P&H HOIST: 2 SPEED, 2 WINDING for HOIST:
STD BRIDGE AND TROLLEY

DIR1				DIR2			
3RD 2ND 1ST	3RD 2ND 1ST	3RD 2ND 1ST	3RD 2ND 1ST	3RD 2ND 1ST	3RD 2ND 1ST	3RD 2ND 1ST	3RD 2ND 1ST
B1	*			*			*
B2	*	*		*	*		*
B3	*	*	*	*	*	*	*
B4	*	*	*	*	*	*	*
A1 B5	*			*			*
A2 B6	*	*		*	*		*
A3 B7	*	*	*	*	*	*	*
A4 B8	*	*	*	*	*	*	*

Configuration Type Switch Select:

Switch settings SW4-5 to SW4-8 are defined as follows

SWITCH SETTINGS: TYPE 5
SW4-8 SW4-7 SW4-6 SW4-5
OFF ON OFF ON

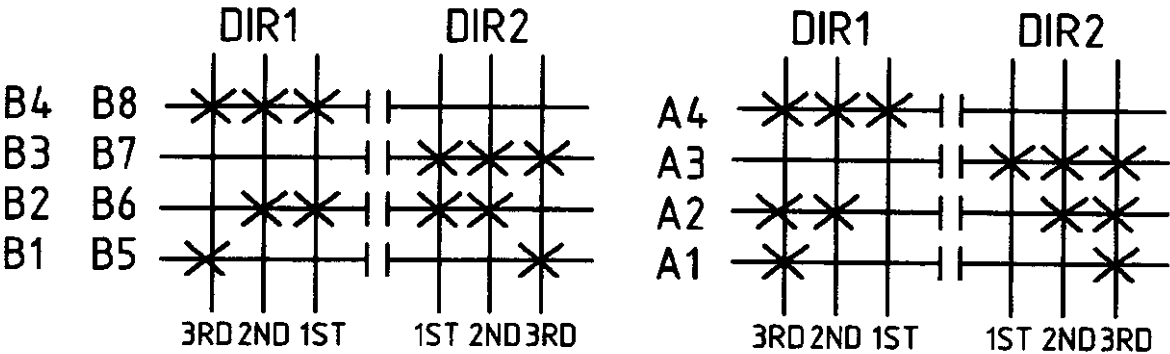


NOT DEFINED

TABLE 1(g)

Crane Control Type Selection: 10K16-TYPE 6

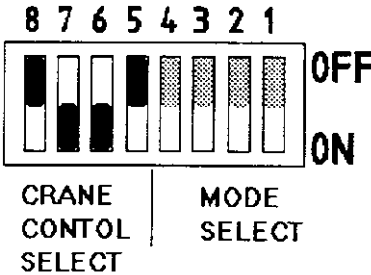
P&H HOIST: 2 SPEED 2 WINDING HOIST AND TROLLEY:
STD BRIDGE



Configuration Type Switch Select:

Switch settings **SW4-5** to **SW4-8** are defined as follows

SWITCH SETTINGS:	TYPE	SW4-8	SW4-7	SW4-6	SW4-5
	6	OFF	ON	ON	OFF

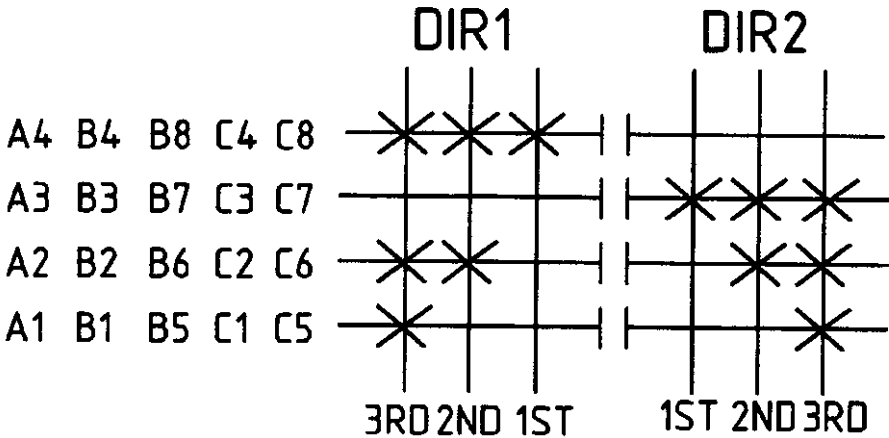


 NOT DEFINED

TABLE 2(a)

Crane Control Type Selection: 10K24-TYPE 0

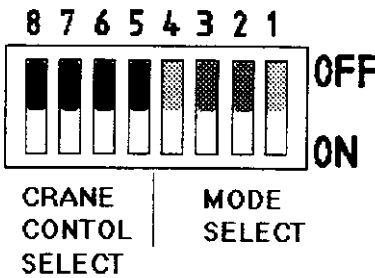
STANDARD CONFIGURATION: ALL MOTIONS
(hoist, trolley, bridge)



Configuration Type Switch Select:

Switch settings SW4-5 to SW4-8 are defined as follows

SWITCH SETTINGS:	TYPE	SW4-8	SW4-7	SW4-6	SW4-5
	0	OFF	OFF	OFF	OFF



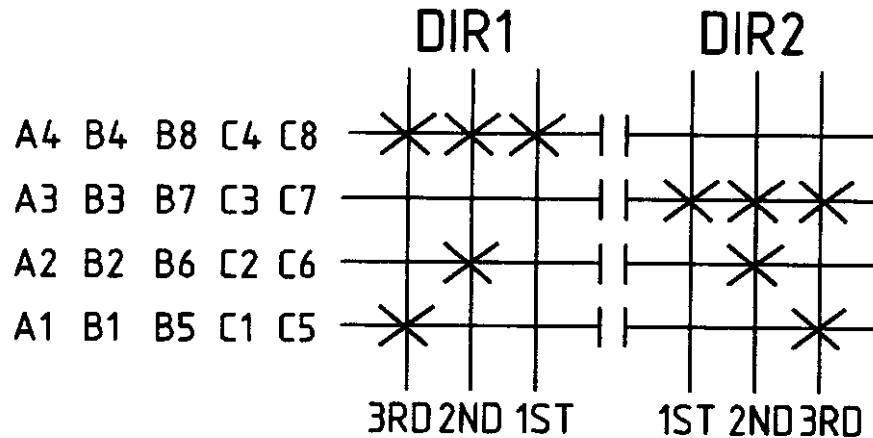
 NOT DEFINED  MODE SELECT

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TABLE 2(c)

Crane Control Type Selection: 10K24-TYPE 2

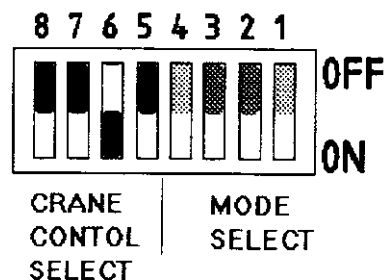
2 SPEED, 2 WINDINGS: ALL MOTIONS



Configuration Type Switch Select:

Switch settings **SW4-5** to **SW4-8** are defined as follows

SWITCH SETTINGS:	TYPE	SW4-8	SW4-7	SW4-6	SW4-5
	2	OFF	OFF	ON	OFF



NOT DEFINED



MODE SELECT

TABLE 2(d)

Crane Control Type Selection: 10K24-TYPE 3

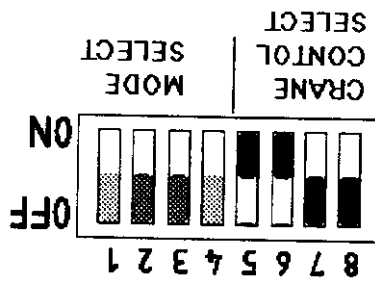
ACCO CONTROLS: ALL MOTIONS

		DIR1				DIR2			
		3RD 2ND 1ST				1ST 2ND 3RD			
A1	B1 B5 C1 C5							*	*
A2	B2 B6 C2 C6	*	*					*	*
A3	B3 B7 C3 C7					*	*	*	*
A4	B4 B8 C4 C8	*	*	*					

Configuration Type Switch Select:

Switch settings SW4-5 to SW4-8 are defined as follows

SWITCH SETTINGS: TYPE 3
 SW4-8 SW4-7 SW4-6 SW4-5
 OFF OFF OFF ON

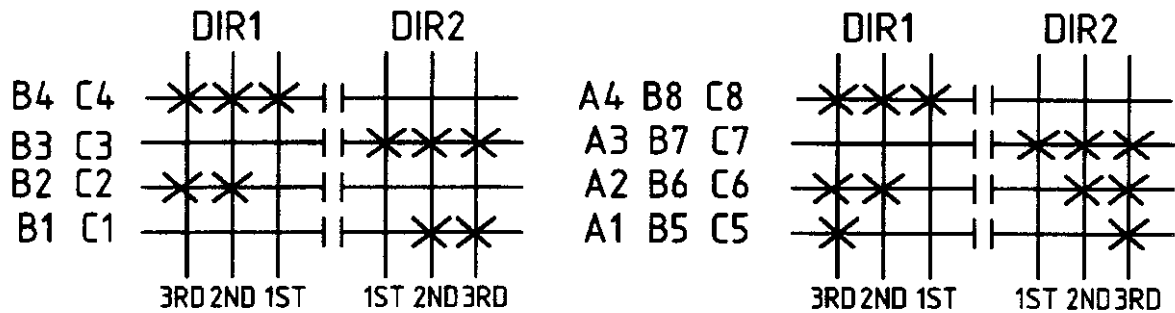


NOT DEFINED
 MODE SELECT

TABLE 2(e)

Crane Control Type Selection: 10K24-TYPE 4

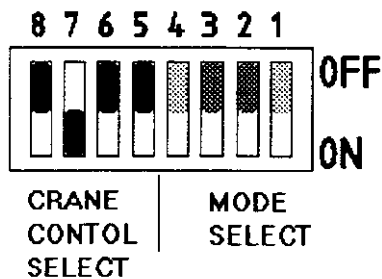
DEMEG: 2 SPEED 2 WINDINGS for HOIST: STD BRIDGE AND TROLLEY

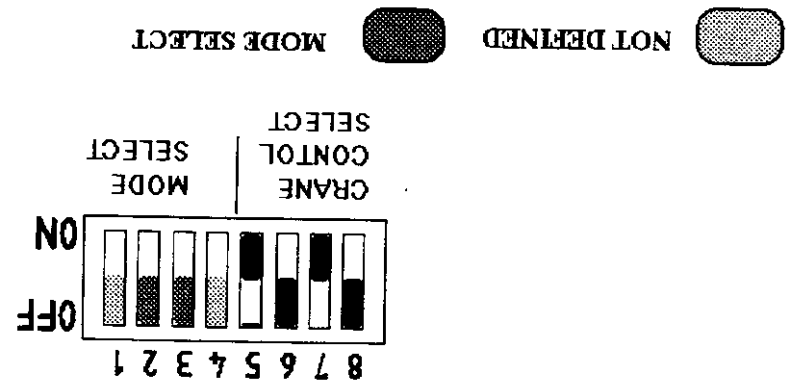


Configuration Type Switch Select:

Switch settings **SW4-5** to **SW4-8** are defined as follows

SWITCH SETTINGS:	TYPE	SW4-8	SW4-7	SW4-6	SW4-5
	4	OFF	ON	ON	OFF





Switch settings SW4-5 to SW4-8 are defined as follows

SWITCH SETTINGS: TYPE 5
 SW4-8 SW4-7 SW4-6 SW4-5
 OFF ON OFF ON

Configuration Type Switch Select:

B4 C4	*	*	*	*	*	*	A4 B8 C8
B3 C3	*	*	*	*	*	*	A3 B7 C7
B2 C2	*	*	*	*	*	*	A2 B6 C6
B1 C1	*	*	*	*	*	*	A1 B5 C5
	DIR1						DIR2
	3RD 2ND 1ST						3RD 2ND 1ST

P&H HOIST: 2 SPEED, 2 WINDING for HOIST:
STD BRIDGE AND TROLLEY

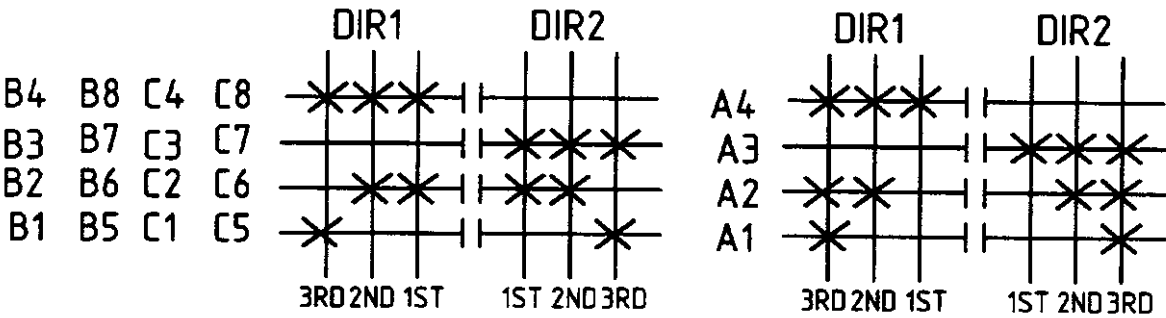
Crane Control Type Selection: 10K24-TYPE 5

TABLE 2(f)

TABLE 2(g)

Crane Control Type Selection: 10K24-TYPE 6

P&H HOIST: 2 SPEED 2 WINDING HOIST AND TROLLEY:
STD BRIDGE



Configuration Type Switch Select:

Switch settings **SW4-5** to **SW4-8** are defined as follows

SWITCH SETTINGS:	TYPE	SW4-8	SW4-7	SW4-6	SW4-5
6		OFF	ON	ON	OFF

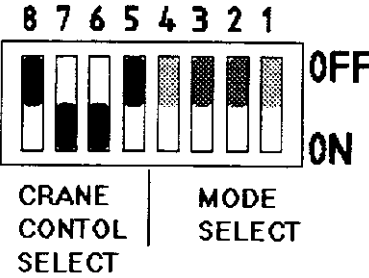


TABLE 2(h)

Crane Control Type Selection: 10K24-TYPE 7

P&H 2 SPEED 2 WINDING HOIST #1 & TROLLEYS
with CREEP SPEED HOIST #2
STD BRIDGE

B1 B5 C5	DIR1	DIR2	C1	A1
B2 B6 C6	DIR1	DIR2	C2	A2
B3 B7 C7	DIR1	DIR2	C3	A3
B4 B8 C8	DIR1	DIR2	C4	A4
	DIR1	DIR2	DIR1	DIR2
	1ST	2ND	1ST	2ND
	3RD	1ST	3RD	1ST

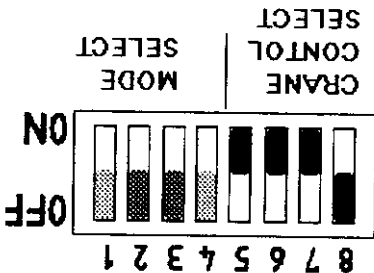
Configuration Type Switch Select:

Switch settings SW4-5 to SW4-8 are defined as follows

SWITCH SETTINGS: TYPE 7

SW4-8 SW4-7 SW4-6 SW4-5

OFF ON OFF ON



NOT DEFINED

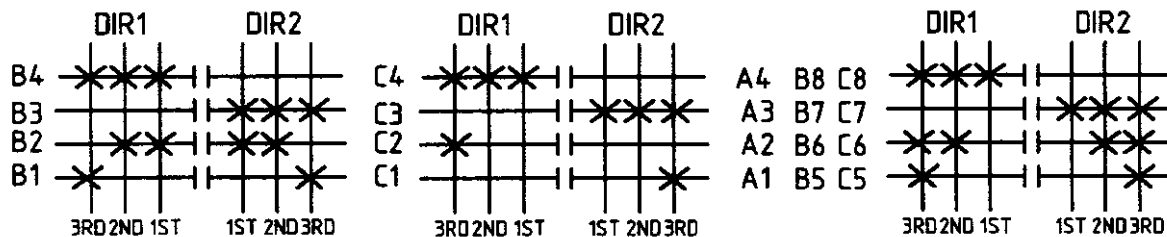
MODE SELECT

NOTE : TANDEM HOIST & TROLLEY IS NOT AVAILABLE IN THIS CONFIGURATION

TABLE 2(i)

Crane Control Type Selection: 10K24-TYPE 8

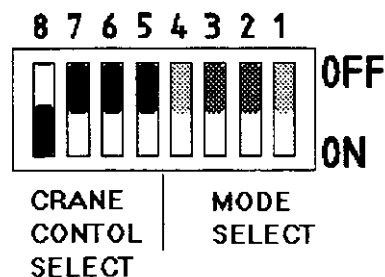
P&H: 2 SPEED 2 WINDING HOISTS,
with CREEP SPEED HOIST #2
with STD BRIDGE & TROLLEYS



Configuration Type Switch Select:

Switch settings **SW4-5** to **SW4-8** are defined as follows

SWITCH SETTINGS: TYPE	SW4-8	SW4-7	SW4-6	SW4-5
8	ON	OFF	OFF	OFF



 NOT DEFINED  MODE SELECT

NOTE : TANDEM HOIST & TROLLEY IS NOT AVAILABLE IN THIS CONFIGURATION

Appendix D

10K16 SLTX

3 MOTOR 3-SPEED TRANSMITTER

SECTION 1.0 OVERVIEW

The 10K family of transmitters has been expanded to include a new 3 motor 3-speed lever handled belly box transmitter. The new transmitter is functionally interchangeable with the 10K16 3-speed pendant transmitter. The three speed lever switches add a new level of controllability to the family of 10K transmitters

Figure 1 shows the top panel layout of the new transmitter. In addition to the standard key functions, a KEY SWITCH has been added to improve transmitter security. An ACCESS CODE PLUG is optionally available to externally set the lower 8 bits of the 16 bit access code..

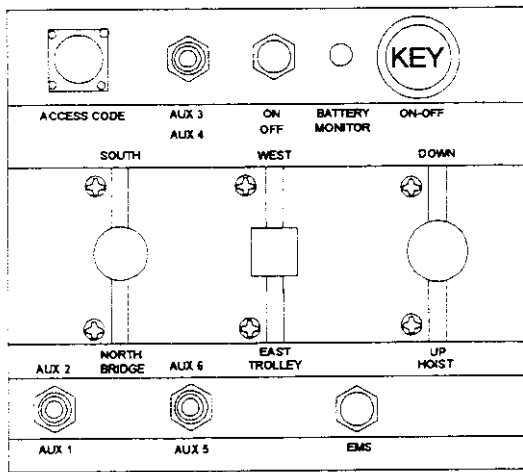


Figure 1

Options described in appendix B of this manual are still available in the SLTX transmitter.

NOTE: For Aux 5 & Aux 6 to be active a "C" output module must be added to the system and the system configured as a 10K24 receiver

New options have been added.

- 1) A key switch has been added for better transmitter security
 - 2) The time-out disable feature is dip switch selectable.
- (See section 2.0 for new dip switch settings.)

SECTION 1.1 OPERATING FEATURES

The SLTX operates very similarly to the standard pendant transmitter.

Turning the key switch ON will enable power to the transmitter but not start the receiver.

To enable the receiver and begin operation the ON/OFF button must be pressed.

Once enabled pressing the ON /OFF button will transmit an OFF command to the receiver and turn power OFF to the transmitter.

After the transmitter has turned OFF pressing the ON/OFF button again will return power to the transmitter and transmit an ON command to the receiver.

In standard configuration if the transmitter has been inactive for more the approximately 15 min. the transmitter will shut off power to itself to conserve battery life. The transmitter may be restored to power by the following procedures.

- 1) Turning to key switch off, waiting 30 sec. and then turning it on.
- 2) Pressing the ON/OFF button.
- 3) Pressing the EMS button.

Each of these actions will produce a different result.

Turning the key switch OFF and ON will restore power to the transmitter but not transmit an ON command.. To enable the receiver the ON/OFF button must be pressed.

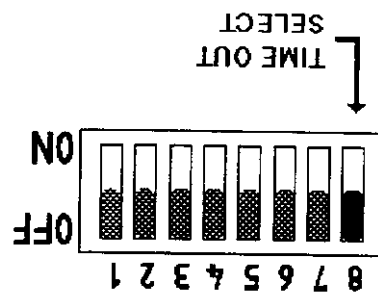
Pressing the ON/OFF button will restore power to the transmitter AND transmit a ON command to the receiver.
Pressing the EMS button will restore power to the transmitter and transmit an EMS command to the receiver.

- 3) Loosen the three captive screws with knurled head on the right side of the transmitter case.
- 4) Swing the right side out and note the position and orientation of the battery.
- 5) Remove the old battery and replace with a fresh battery.
- 6) Close the battery door and retighten the three captive screws.

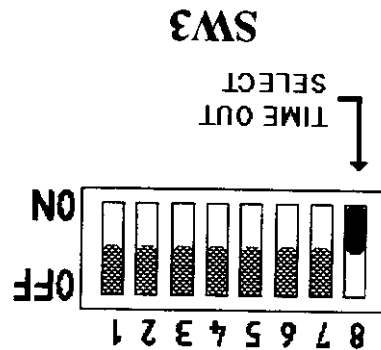
SECTION 2.0 SWITCH SETTINGS

The ACCESS CODE SWITCHES (SW1 & SW2) and CONFIGURATION SWITCH (SW4) are set as described in appendices B

The new selectable features controlling SW3 automatic time-out has been added using SW3



When sw3-8 is set to OFF then the transmitter times-out in the normal manner



When sw3-8 is set to ON then the transmitter will NOT time-out.

SECTION 3.1 Battery Replacement

To replace a battery perform the following procedure:

- 1) First turn the key switch OFF.
- 2) Place the transmitter on it's left side so that the right side is up. The right side is the battery door and is hinged.

Appendix E

10K24 SLTX

3/4/5 MOTOR 3-SPEED

TRANSMITTER

SECTION 1.0 OVERVIEW

The 10K family of transmitters has been expanded to include a new 3/4/5 motor 3-speed lever handled belly box transmitter. The new transmitter are functionally interchangeable with the 10K24 3-speed pendent transmitter. The three speed lever switches add a new level of controllability to the family of 10K transmitters

Figure 1 shows the top panel layout of the new transmitter. In addition to the standard key functions, a KEY SWITCH has been added to improve transmitter security. An ACCESS CODE PLUG is optionally available to externally set the lower 8 bits of the 16 bit access code..

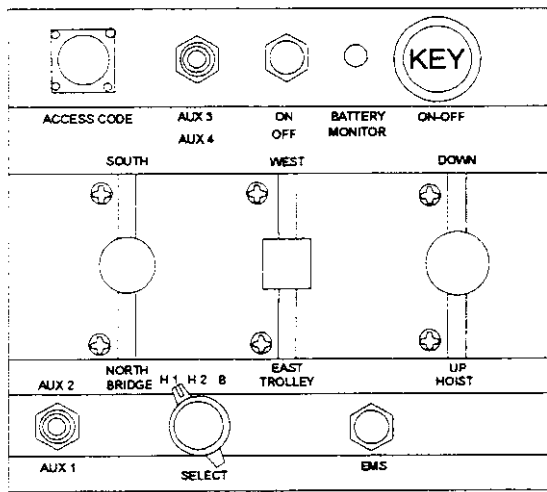


Figure 1

Options described in appendices B and D of this manual are still available in the SLTX transmitter.

New options have been added.

- 1) A key switch has been added for better transmitter security
- 2) The time-out disable feature is dip switch selectable.

3) For Mode 2 operation the auxiliary crane select outputs may be set to standard or inverted by dip switch.

(See section 2.0 for new dip switch settings.)

SECTION 1.1 OPERATING FEATURES

The SLTX operates very similarly to the standard pendent transmitter.

Turning the key switch ON will enable power to the transmitter but not start the receiver.

To enable the receiver and begin operation the ON/OFF button must be pressed.

Once enabled pressing the ON /OFF button will transmit an OFF command to the receiver and turn power OFF to the transmitter.

After the transmitter has turned OFF pressing the ON/OFF button again will return power to the transmitter and transmit an ON command to the receiver.

In standard configuration if the transmitter has been inactive for more the approximately 15 min. the transmitter will shut off power to itself to conserve battery life. The transmitter may be restored to power by the following procedures.

- 1) Turning to key switch off, waiting 30 sec. and then turning it on.
- 2) Pressing the ON/OFF button.
- 3) Pressing the EMS button.

Each of these actions will produce a different result.

Turning the key switch OFF and ON will restore power to the transmitter but not transmit an ON command.. To enable the receiver the ON/OFF button must be pressed.

Pressing the ON/OFF button will restore power to the transmitter AND transmit a ON command to the receiver.

Pressing the EMS button will restore power to the transmitter and transmit an EMS command to the receiver.

The enhanced Mode 2 operation is as follows

For the standard mode the system operates the same as described the appendix D

For the inverted mode the outputs are the inverse of the standard mode and used for deselecting a hoist or trolley

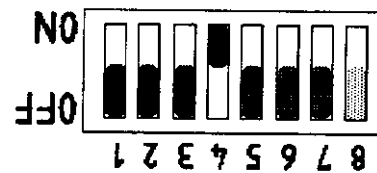
SECTION 2.0 SWITCH SETTINGS
The ACCESS CODE SWITCHES (SW1 & SW2) and CONFIGURATION SWITCH (SW4) are set as described is appendices B and D.

SECTION 2.1 MODE 2 ENHANCEMENT
The mode 2 modification adds an extra dip switch setting to SW4.



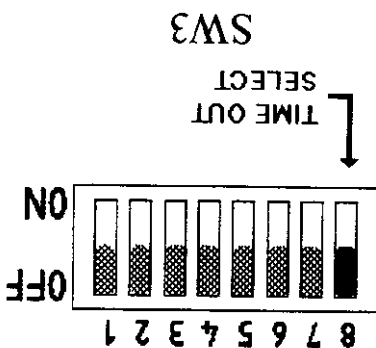
For standard aux crane select outputs SW4.4 should be OFF

SW4

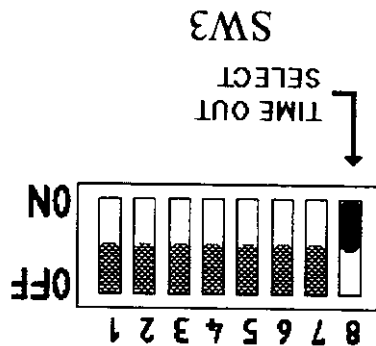


For inverted aux crane select outputs SW4.4 should be ON

SECTION 2.2 TIME-OUT SELECTION
The new selectable features controlling automatic time-out and shutdown have been added using SW3



When sw3-8 is set to OFF then the transmitter times-out in the normal manner



When sw3-8 is set to ON then the transmitter will NOT time-out

SECTION 3.1 Battery Replacement
To replace a battery perform the following procedure:

- 1) First turn the key switch OFF.
- 2) Place the transmitter on it's left side so that the right side is up. The right side is the battery door and is hinged.
- 3) Loosen the three captive screws with knurled head on the right side of the transmitter case.
- 4) Swing the right side out and note the position and orientation of the battery.
- 5) Remove the old battery and replace with a fresh battery.
- 6) Close the battery door and retighten the three captive screws.

Appendix F

10K24 SLTX

3/4/5 MOTOR 5-SPEED TRANSMITTER

SECTION 1.0 OVERVIEW

The 10K family of transmitters has been expanded to include a new 3/4/5 motor 5-speed lever handled belly box transmitter. The five speed lever switches add a new level of controllability to the family of 10K transmitters

Figure 1 shows the top panel layout of the new transmitter. In addition to the standard key functions, a KEY SWITCH has been added to improve transmitter security. An ACCESS CODE PLUG is optionally available to externally set the lower 8 bits of the 16 bit access code..

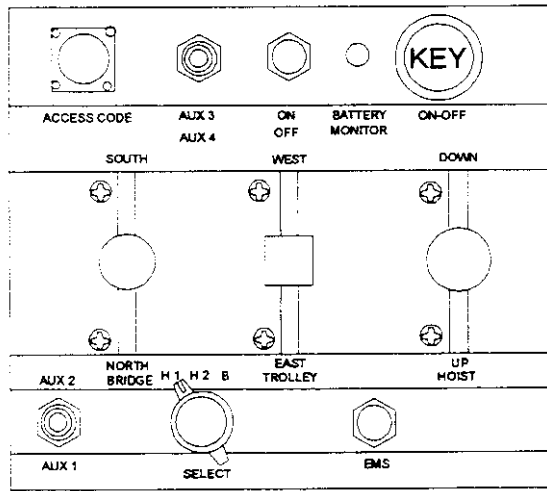


Figure 1

New options have been added.

- 1) 5-speed switches provide improved speed control.
- 2) A key switch has been added for better transmitter security
- 3) The time-out disable feature is dip switch selectable.
- 4) The auxiliary crane select outputs may be set to standard or inverted by dip switch.
(See section 2.0 for new dip switch settings.)

SECTION 1.1 OPERATING FEATURES

The SLTX operates very similarly to the standard pendant transmitter.

Turning the key switch ON will enable power to the transmitter but not start the receiver.

To enable the receiver and begin operation the ON/OFF button must be pressed.

Once enabled pressing the ON /OFF button will transmit an OFF command to the receiver and turn power OFF to the transmitter.

After the transmitter has turned OFF pressing the ON/OFF button again will return power to the transmitter and transmit an ON command to the receiver.

In standard configuration if the transmitter has been inactive for more than approximately 15 min. the transmitter will shut off power to itself to conserve battery life. The transmitter may be restored to power by the following procedures.

- 1) Turning to key switch off, waiting 30 sec. and then turning it on.
- 2) Pressing the ON/OFF button.
- 3) Pressing the EMS button.

Each of these actions will produce a different result.

Turning the key switch OFF and ON will restore power to the transmitter but not transmit an ON command. To enable the receiver the ON/OFF button must be pressed.

Pressing the ON/OFF button will restore power to the transmitter AND transmit a ON command to the receiver.

Pressing the EMS button will restore power to the transmitter and transmit an EMS command to the receiver.

For 4 and 5 motor operation the rotary select switch may be used to enable or disable Hoist/Aux Hoist and Trolley/Aux Trolley via crane select outputs C7&C8

For the standard mode.

When the rotary switch is in the H1, Output C8 will pull-in automatically whenever the Trolley or Hoist pushbuttons are pressed. The Output C8 may be used to externally enable Hoist 1 and/or Trolley 1 controls.

When the rotary switch is in the H2, Output C7 will pull-in automatically whenever the Trolley or Hoist pushbutton switches are pressed. The Output C7 may be used to externally enable Hoist 2 and/or Trolley 2 controls.

When the rotary switch is in the B, C8&C7 will pull-in automatically whenever the Trolley or Hoist pushbutton switches are pressed. This allows Tandem operation of two hoists or trolleys.

For the inverted mode the outputs are the inverse of the standard mode and used for deselecting a hoist or trolley

When the rotary switch is in the H1, C7 will pull-in automatically whenever the Trolley or Hoist pushbutton switches are pressed. The Output C7 may be used to externally disable Hoist 2 and/or Trolley 2 controls.

When the rotary switch is in the H2, C8 will pull-in automatically whenever the Trolley or Hoist pushbutton switches are pressed. The C8 may be used to externally disable Hoist 1 and/or Trolley 1 controls.

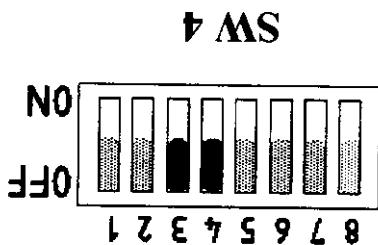
When the rotary switch is in the B, C7&C8 are open. Neither hoists or trolleys are disabled and tandem operation of two hoists or trolleys is available for cranes that require this type of output.

SECTION 2.0 SWITCH SETTINGS

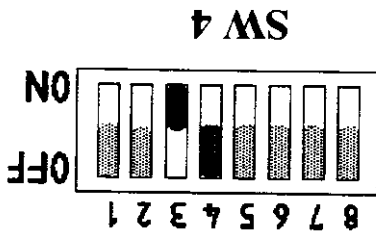
The ACCESS CODE SWITCHES (SW1 & SW2) ARE SET TO MATCH THE RECEIVER AND SHOULD NOT BE CHANGED

SECTION 2.1 TANDEM SELECT

The tandem feature may be enabled or disabled by the following switch settings



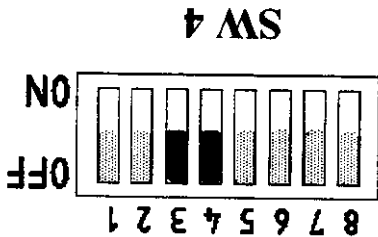
For Tandem operation of Hoist/Aux Hoist and Trolley/Aux Trolley SW4.3 should be OFF



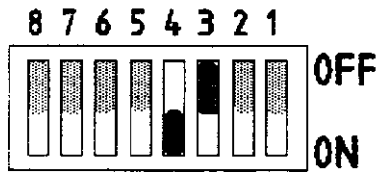
IF Tandem operation of Hoist/Aux Hoist and Trolley/Aux Trolley is not desired then SW4.3 should be ON

SECTION 2.2 AUX SELECT OUTPUTS

The aux select output may be set to standard or inverted by the following switch settings



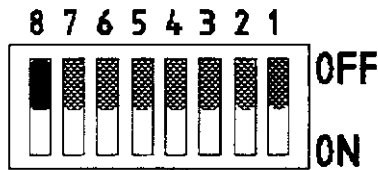
For standard aux crane select outputs SW4.4 should be OFF.

**SW 4**

For **inverted** aux crane select outputs SW4.4 should be ON

SECTION 2.3 TIME-OUT FEATURE

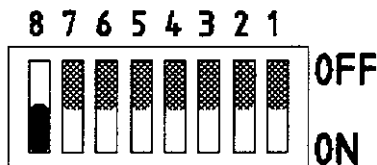
The new selectable features controlling automatic time-out has been added using SW3



↑
TIME OUT
SELECT

SW 3

When sw3-8 is set to OFF then the transmitter times-out in the normal manner



↑
TIME OUT
SELECT

SW 3

When sw3-8 is set to ON then the transmitter will NOT time-out.

When sw3-8 is set to OFF and SW3-7 is ON then the transmitter battery saver feature is disabled. The transmitter times-out in the normal manner but does not turn OFF

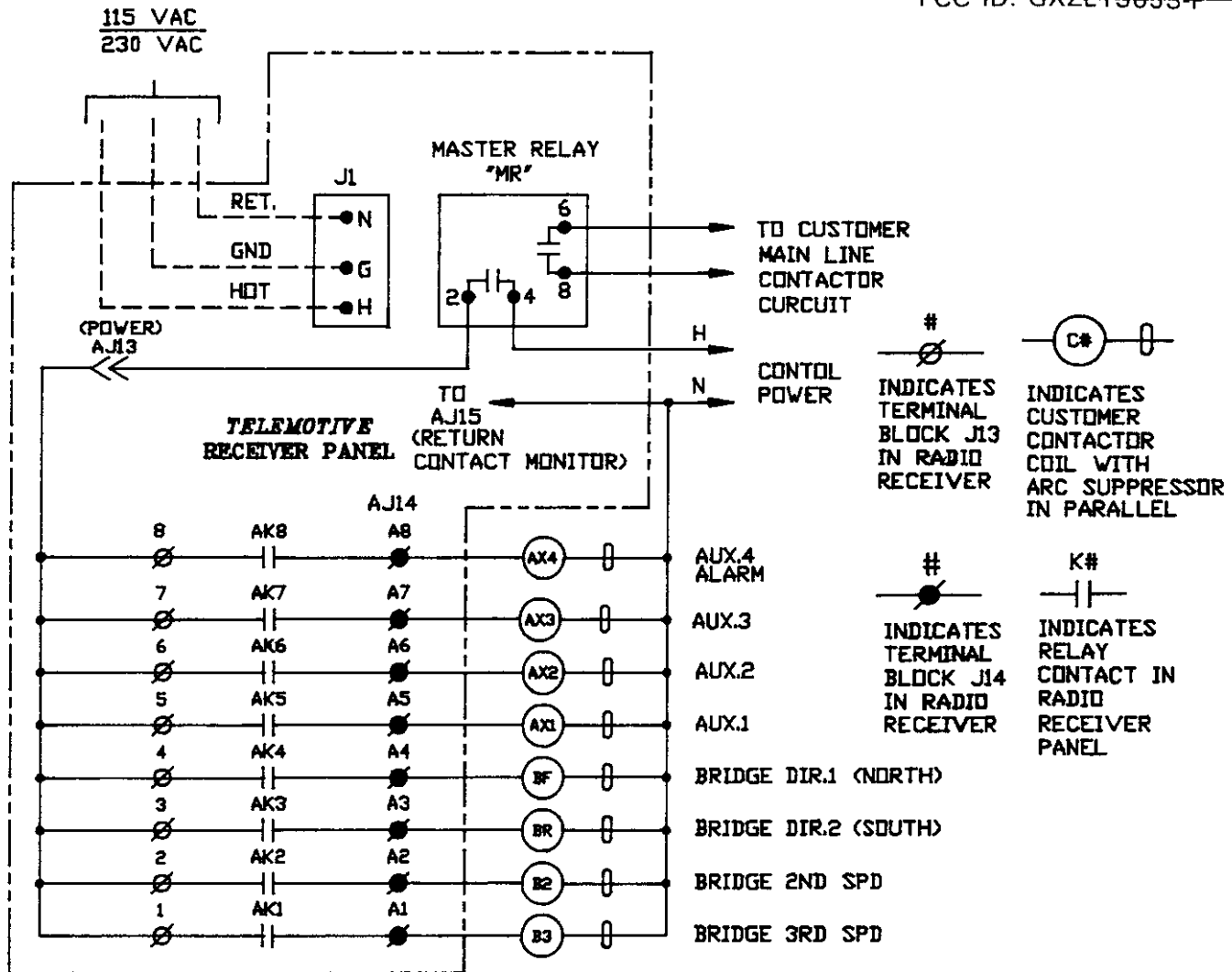
SECTION 3.1 Battery Replacement

To replace a battery perform the following procedure.

- 1) First turn the key switch OFF.
- 2) Place the transmitter on it's left side so that the right side is up. The right side is the battery door and is hinged.
- 3) Loosen the three captive screws with knurled heads on the right side of the transmitter case.
- 4) Swing the right side out and note the position and orientation of the battery.
- 5) Remove the old battery and replace with a fresh battery.
- 6) Close the battery door and retighten the three captive screws.

SECTION 4.0 Interface Diagrams

This section contains those diagrams required for reference purposes during troubleshooting and maintenance.



DIR 2					OFF	DIR 1					J14 OUTPUT TERMINAL
5	4	3	2	1		1	2	3	4	5	A4
						X	X	X	X	X	A3
X	X	X	X	X			X	X	X	X	A2
X	X	X						X	X	X	A1
X	X								X	X	B8
X										X	B7

BRIDGE

REFER TO
SH. 2 OF 3

telemotive

MAXTEC
INTERNATIONAL
CORPORATION

6470 W. Cortland St. Chicago, Illinois 60635 • 312-889-1448

FAX: 312-794-9740 TELE: 210017/DYNCO UR

SERIES 10K24 STANDARD FIVE SPEED INTERFACE
WITH SLTX LEVER SWITCH TRANSMITTER

USER

10K16/24

JOB

DRN

L.L.

CHKD

C.P.

APPV'D

SCALE

DATE

6/27/96

DRAWING No

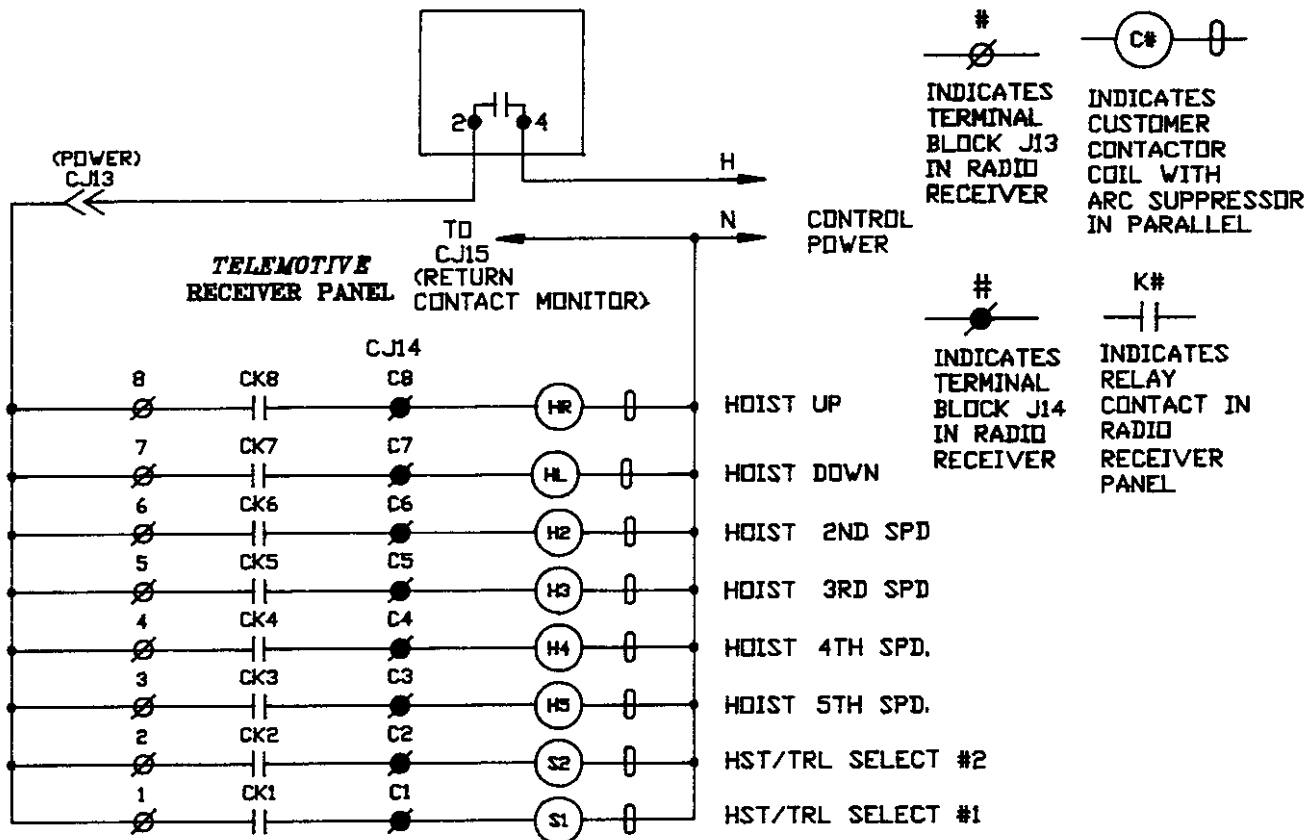
SHEET 1 OF 3

REF

NO.	DATE	REVISIONS	BY
2	2/20/97	REVISED PER M.B.	L.L.
1	12/09/96	REVISED CONTRACT ID	L.L.

n(4)

MASTER RELAY
'MR'



DIR 2					OFF	DIR 1					J14 OUTPUT TERMINAL
5	4	3	2	1		1	2	3	4	5	
						X	X	X	X	X	C8
X	X	X	X	X							C7
X	X	X	X				X	X	X	X	C6
X	X	X						X	X	X	C5
X	X								X	X	C4
X										X	C3

HOIST

				 MAXTEC INTERNATIONAL CORPORATION telemotive 6470 W. Cortland St. Chicago, Illinois 60635 • 312-889-1448 FAX: 312-794-9740 TELEX: 210017/DYNCO UR				
				SERIES 10K24 STANDARD FIVE SPEED INTERFACE WITH SLTX LEVER SWITCH TRANSMITTER				
				USER 10K 16/24				
2	2/20/97	REVISED PER M.B.	L.L.	JOB	DRN L.L.	CHKD	C.P.	APPV'D
1	12/09/96	REVISED CONTRACT ID	L.L.	SCALE	DATE 6/27/96	DRAWING No	SHEET 3 OF 3	
NOL	DATE	REVISIONS	BY	REF				

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Appendix G

10K16

7 MOTOR 3-SPEED TRANSMITTER

SECTION 1.0 OVERVIEW

The 10KPLUS/16 System has been expanded to provide seven (7) motor control using external select relays. Three (3) of the auxiliary functions of the 10K16 have been reconfigured to provide this extended type of control.

The standard pendant transmitter has been equipped with 3-two position rotary switches to act as motor select control inputs. Using these rotary switches the transmitter may control up to seven motors.

Fig #1 shows the front panel control on the new transmitter.

The auxiliary select functions are designed to pull in whenever a hoist or trolley pushbutton switch is pressed according to the following convention..

If a rotary switch is in the OFF position then the auxiliary function relay will not close when the hoist or trolley pushbutton switches are pressed.

If a rotary switch is in the ON position then the selected auxiliary function relay will close whenever the hoist or trolley pushbutton switches are pressed.

Note however that the motor control relay outputs will still close in the normal manner regardless of the auxiliary rotary select positions..

Thus the three auxiliary functions may be used to select

Hoist #1// Trolley #1
Hoist #2// Trolley #2
Hoist #3//Trolley #3

The Bridge pushbuttons are not affected by this arrangement and no auxiliary functions will pull in when the bridge pushbuttons are pressed.

In addition the time-out disable feature which previously required a special CPU/ROM is now dip switch selectable. (See Section 2.2)

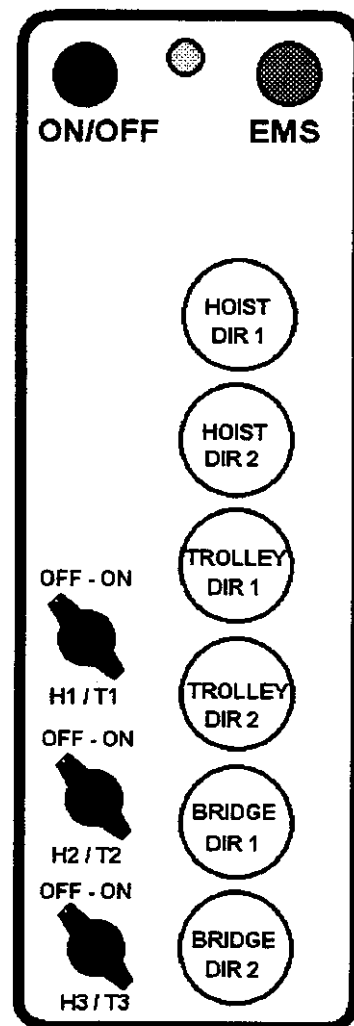


FIG 1

NOTE: The Latch function for Aux 2 & Aux 3 function for Aux 1 should be disabled as these functions will interfere with the operation of the motor select control function. These switches are located on the Output Interface Module.

SECTION 2.0 SWITCH SETTINGS

The follow switch settings will affect the operation of the seven motor system.

SECTION 2.1 OUTPUT INTERFACE

MODULE SWITCH SETTING

Dip Switch 1-4 & 1-5 should be set to OFF.

(See Section 7-3 of the 10KPLUS manual for a description of these functions)

Auto-Alarm is still available if switch 1-7

on the output interface module is set ON.

(See Section 7-3 of the 10KPLUS manual for a description of this function)

SECTION 2.2 TRANSMITTER SWITCH

SETTING.

SECTION 2.2.1 OUTPUT

CONFIGURATION

The transmitter comes configured as type 0 in TABLE 1(a) of Appendix B. This is the

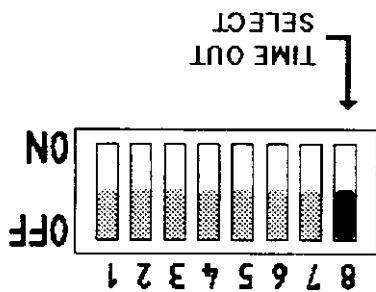
standard configuration.

All the output configurations described in

TABLE 1 are available and may be selected by

setting the switch SW4 as described in

TABLE 1.

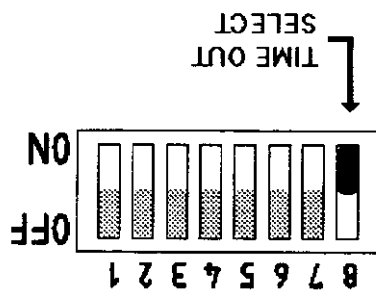


When sw3-8 is set to OFF then the transmitter times-out in the normal manner

SECTION 2.2.2 TIME-OUT

ENABLE/DISABLE

When sw3-8 is set to ON then the transmitter will NOT time-out.



Appendix H

MULTIBOX EXTENSION TO THE 10K16/24

SECTION 1.0 OVERVIEW

The 10K16/24R line of crane controls has been extended to include Multibox. With multibox up to 4 transmitters may access a single receiver. Only one transmitter may control a receiver at a given time. Access is on a first come first serve basis. Once a transmitter has gained control, no other transmitter may access the receiver until the controlling transmitter relinquishes control by transmitting a OFF command to the receiver or the receiver times out due to transmitter inactivity.

The first transmitter to send an ON command after the receiver has been released will then gain control of the receiver. The number of transmitters allowed to control a receiver (1-4) is dip switch selectable on the Receiver Master CPU Module.

To display the active box with externally mounted lights (i.e. the transmitter in control of the receiver), a special Output Module with 4 relay closures is also available. This module will provide relay closures to drive the external light display.

A new Receiver Master CPU Module and Software may be necessary to implement multibox. Additional dip switches SW10 have been added to the module to provide selectable option control for multibox as well as future enhancements.

SECTION 2.0 DISPLAY MODULE

The display module is intended to be mounted over the system power supply. For systems shipped with this option this is where it will be found. For those who wish to add this module to there system an upgrade kit is available.

To mount the module in a existing multibox system the following procedure should be followed.

SECTION 2.2.1 DISPLAY MODULE MOUNTING AND INSTALLATION

- 1) Turn system power OFF!
- 2) From the display kit locate the 4-2" stand-offs. In the 10K16/24R enclosure locate the 4 #6 ESNA nuts that hold the power supply to the enclosure. Remove the ESNA nuts and one at a time replace with the 2-3/8" stand-offs. Make sure the standard-offs are tightened firmly.
- 3) Place the display module onto the 4 stand-offs. Orient the module so the output connector TB1 is facing down.
- 4) Locate the #6 Keps nut from the kit and place on the upper right hand corner stand-off and tighten firmly. Fasten the remaining stand-offs using 3 of the 4-#6 ESNA nuts Tighten firmly
- 5) Locate the power cable from the kit and connect the read wire to the +12VDC output of the power supply.
Connect the black wire to the ground output of the power supply.
- 6) Connect the other end of the power cable to the power input of the display board (J3).
- 7) Locate the data cable from the kit.
Connect one end off the cable to the last output module's data connection (J9). Connect the other end of the data cable to the data input connector of the display board. (J1)
- 8) Reset SW9 on the Master CPU module to the new number of output modules in the system.

All transmitters access codes must be selected from a bank of 4 consecutive addresses. These addresses are assigned by the factory and should not be changed. The RECEIVER ACCESS CODE SWITCHES must be set to the lowest member of this group of access code addresses.

SECTION 2.2 DISPLAY MODULE OUTPUT CONNECTION TO EXTERNAL DISPLAY

The display module is designed to drive external incandescent lamps. Maximum current as 120VAC is 5 amp.

Relay Outputs 1 to 4 represent Box 1 to 4. Relay Inputs 5 to 8 may be made common with the provide 4 pin power shunt.

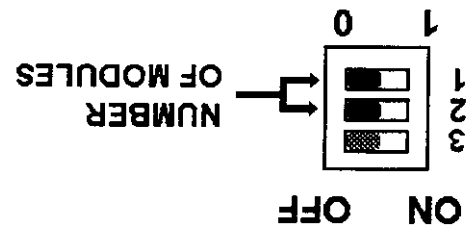
SECTION 3.0 SWITCH SETTINGS

Two switches on the MASTER CPU MODULE are involved in setting up the receiver for multibox.

Switch SW9 is used to set the number of output modules the receiver expects to see in the system. Switch SW10 is used to set multibox settings and various system options. Switch SW11 is presently not used.

SECTION 3.1 SWITCH SW9 CONTROL DESCRIPTION

Normally this switch is set at the factory and should not be changed in the field. The only exception would be to retrofit of an additional output module to the system, such as conversion from a 16 / 24 output or the addition of a box display module.



SW9
SWITCH SETTING
NUMBER OF OUTPUTS
ON OFF
ON OFF
Std system 16 / 24
Std system 16 / 24+*

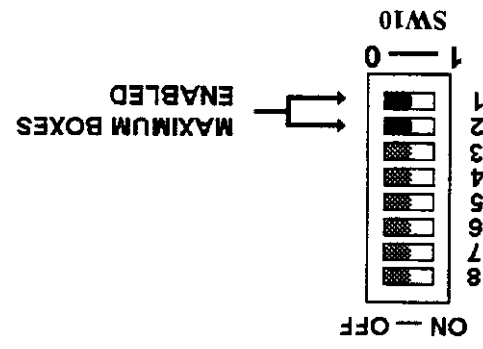
* DISPLAY MODULE WITH 4 OUTPUT RELAYS

SECTION 3.2 SWITCH SW10 and SW11 CONTROL DESCRIPTION

Switches SW10 and SW11 are used to set system options. Unused switch contacts are reserve for future use.

SECTION 3.2.1 MAXIMUM NUMBER OF TRANSMITTERS

Switches 10-1/10-2 set the maximum number of transmitters that can access the receiver. The switch settings is binary 00 to 11 for 1 to 4 transmitters.

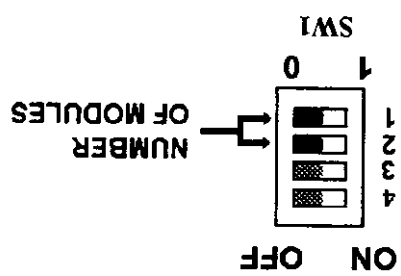


SWITCH	SETTING	MAX. ACCESS
1	OFF OFF	BASE ADDRESS
2	OFF ON	BASE ADDRESS +1
3	ON OFF	BASE ADDRESS +2
4	ON ON	BASE ADDRESS +3

NOTE: Selected transmitters must have consecutive addresses beginning from the base address

SECTION 4.0 DISPLAY MODULE SW1 SWITCH SETTINGS

SW1 on the Display Module sets the address of the module. It should be set to the next available module address



SW1
SWITCH SETTING
1-1 /// 1-2
ON ON
ON ON