

EXHIBIT D  
INSTRUCTION MANUAL

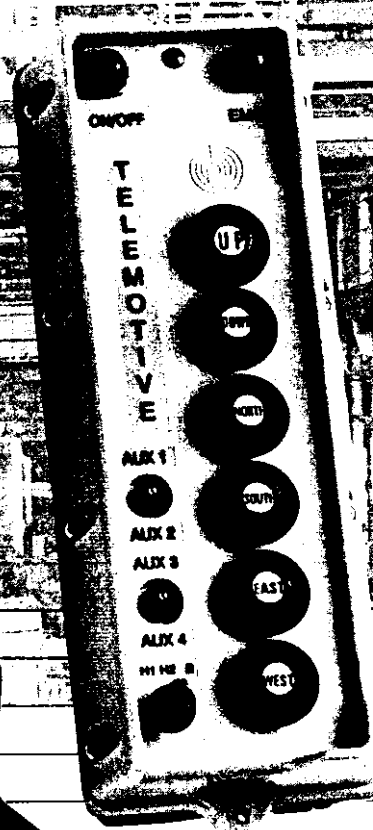
**A. USER'S MANUAL**

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

Section 1 contains statements that warn users against unapproved modifications.



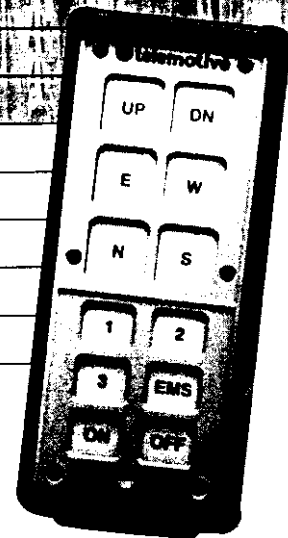
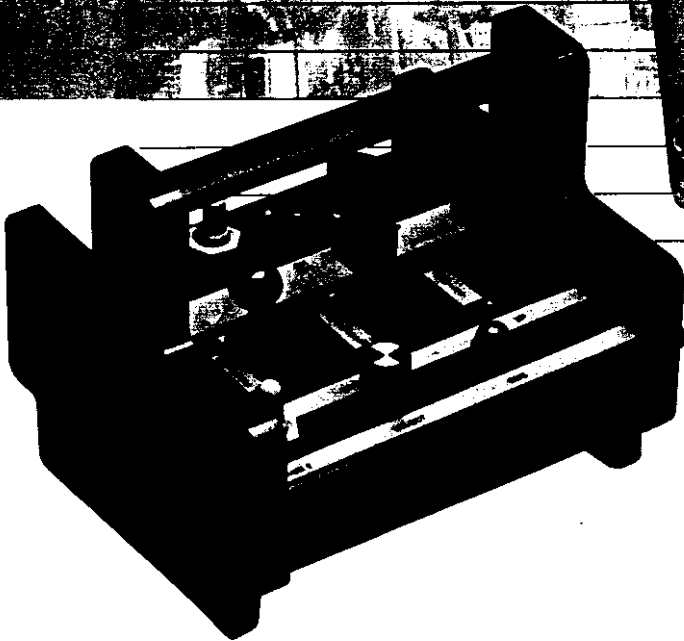
# TELEMOTIVE SERIES 10K12



RADIO

CONTROL

SYSTEM



**telemotive**<sup>®</sup>

Industrial Controls

TELE  
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TC10K12R-0

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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 Order Entry Department.

Telephone: (773) 889-9035  
TELEX: 210017/DYNCO UR  
FAX: (773) 794-9470

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Telemotive Industrial Controls Division  
6470 W. Cortland Street  
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## 1-2. FCC Information

### **NOTE:**

Any modifications or changes not expressly approved by **Maxtec International Corp.** could void the user's authority to operate this device.

## Section 2 - Radio Controlled Crane Safety

### 2-1. 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 in conjunction 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.

### 2-2. 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. Extreme caution must be exercised by the crane operator at all times. Workers must constantly be alert to avoid accidents. The following rules have been included to indicate 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, special care must be taken to secure the transmitter. Refer to paragraph titled "Boarding The Crane" for specific safety rules.

### 2-3. 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 or hearing or by any person who may be suffering from a disorder or illness or is taking any medication that may cause loss of crane control.

### 2-4. Training Checklist For Crane Operators.

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

- Knowledge of hazards peculiar 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 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 box when not in use.
- Transferring radio control box 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.

### 2-5. Operating Area.

Aisles between equipment, stock, etc., should be free of obstructions so the crane operator can move freely. These aisles should be a minimum of 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.

### 2-6. 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 and the transmitter unit should always be placed there when not in use. This precaution will prevent unauthorized people from operating the crane.

**SECTION 2 PAGE 3****2-7. 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 in excess of the equipment rated capacity.

The bridge and trolley should be centered 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 make certain the load is under control. Tag lines should be used for handling unusual lengths or bulky loads. Remove slack from chains or slings gradually. Make certain all personnel are clear before making a lift.

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.

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 permit anyone to ride on the load or hook except when authorized by the supervisor.

When another crane on the same runway is stationary with a load hanging, the crane operator should maintain a safe distance between the stationary crane and the one under their control.

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 which 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.

## 2-8. 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 boarding the crane, one person should be made responsible for ensuring all personnel are off the crane before the system is returned to operation.

## 2-9. 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 prior to starting repairs. Notification should include the nature of the repair, safeguards provided, and movement limitations while repairs are in progress.

When practical, radio controlled cranes which 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 indicated by red lights placed so that they are clearly visible to other crane operators traveling on the same runway. When it is not possible to use bumpers, red lights must be placed so they are clearly visible to other crane operators traveling on the same runway to indicate the restricted travel zone. All crane operators on the same runway must be informed of the repair effort and thoroughly instructed to what their operations are limited to and informed they will be notified when repairs are completed.

If any hazard involving the repairmen exists when there is a runway adjacent 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 prior to entering the restricted area and should proceed 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, open and lock out the main switch, and 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 the use of 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 prior to 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.

## 2-10. 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 operators 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.

### 2-11. 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. The following is a list of what should be included in the report:

Condition of hoisting cable and hook block (broken strands, clipped sheave wheels, etc.).

Condition of brakes (hoist, trolley, and bridge).

Alignment of bridge (screeching or squealing wheels indicate 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 which cause faulty operation such as uncommanded stopping or starting of any crane motion, warning devices, lights, or auxiliary functions).

Condition of gears (grinding or squealing may indicate 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).

## Section 3 - General System Information and Theory Of Operation

### 3-1. General System Information.

The Series 10K12 Radio Control System (system) provides remote control of overhead cranes using radio signals. The system consists of a hand held portable battery operated transmitter unit and a fixed station receiver unit. The system is capable of controlling up to 12 separate outputs.

Each system has its own access code which permits a receiver unit to respond only to a transmitter unit with the same access code. Up to four transmitters may be used with the same frequency. Each transmitter operating on the same frequency may be operated in close proximity (not less than six feet) to each other.

The transmitter and receiver units use computer controlled circuitry.

The system operates on one of twenty available UHF frequencies from 436.0 MHz to 439.8 MHz.

### 3-2. Transmitter Unit.

The transmitter unit is light weight, portable, and hand held. Located within the transmitter unit case is the battery compartment, membrane pushbutton switches, a transmitter RF Module and a Micro Computer Control Module. Four configurations (modes) of the membrane pushbutton switches are available. Twelve independent outputs may be selected by the user to run at one or two speeds plus AUX. In addition, there is an Emergency Stop (EMS) key on all transmitter configurations. This key is used to immediately disable all relay outputs, putting the receiver system into a standby state. The receiving system will have to be restarted after the EMS command is transmitted.

The transmitter unit is frequency modulated, low power and is certified under part 15 of FCC rules and regulations. A license is not required for the transmitter or operator. The transmitter unit uses crystal controlled oscillators to set the operating frequency.

The transmitter unit antenna is internal and integral.

A power down feature turns the transmitter unit OFF if no keys are pressed for an extended (approximately 15 minutes) period of time. The transmitter unit must again be turned ON. A

configuration of the transmitter unit is available without automatic time-out.

Battery voltage and data transmission status is provided by an LED mounted on the front panel.

### 3-3. Receiver Unit.

The fixed station receiver unit is housed in an all metal enclosure. Located within the receiver unit are three separate modules which 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.

A power down feature turns the receiver unit OFF if no commands are received for an extended (approximately 15 minutes) period of time. A configuration of the receiver unit is available without automatic time out.

### 3-4. System Specifications.

Channel Designations:

AK1-439.8 MHz	AK6-438.8 MHz
AK2-439.6 MHz	AK7-438.6 MHz
AK3-439.4 MHz	AK8-438.4 MHz
AK4-439.2 MHz	AK9-438.2 MHz
AK5-439.0 MHz	AK10-438.0 MHz

AK11-437.8 MHz	AK16-436.8 MHz
AK12-437.6 MHz	AK17-436.6 MHz
AK13-437.4 MHz	AK18-436.4 MHz
AK14-437.2 MHz	AK19-436.2 MHz
AK15-437.0 MHz	AK20-436.0 MHz

Operating Frequency Tolerance - 0.001%.

Twenty available channels, expandable to fifty.

Channel Spacing - 200 kHz

Modulation - Wideband FM (WBFM)

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

Humidity - up to 95% (non-condensing)

Typical Operating Range - 200 feet

Up to four transmitter units may operate on the same frequency while in close proximity (not less than six feet) to each other.

### 3-5. Membrane Transmitter Unit Specifications:

Battery Life - 120 Hours (approximate)

Battery - Five 1.5 vdc AA disposable alkaline batteries

Source Voltage - 7.5 vdc @50mA

Weight - 1 pound

Dimensions - 2"H X 2.75"W X 6"L

Complies with FCC Part 15 requirements

### 3-6. Receiver Unit Specifications:

Line Requirements - 120/240 vac

Antenna - 1/4 wave stainless-steel whip; mounted and connected to receiver unit using BNC connector.

Sensitivity - Less than 1.0 microvolt (12 dB SINAD)

Dynamic Range - 80 decibels

Data Rate - 9600 baud

Response Time - 60 milliseconds (typical)

Weight - 12 pounds (approximate)

Dimensions - 12"H X 10"W X 4.5"D

### 3-7. Theory of Operation.

The system consists of a transmitter unit and receiver unit. The transmitter circuitry and CPU unit are described below. A block diagram of the transmitter unit is presented in figure 3-1. A block diagram of the receiver unit is presented in figure 3-2.

### 3-8. Transmitter Circuit Description.

The ON switch sends a signal to the microcomputer to transmit the ON command. In the active mode, the microcomputer executes all of its normal operating functions. Additionally, gating controlled by the microcomputer supplies power to the transmitter RF section. At this time, the microcomputer sends a start command sequence, begins scanning the membrane switches and accepts switch closures as they occur.

When a transmitter unit key is pressed, the micro computer identifies the switch closure and activates a predetermined bit location in one of two 8 bit command words. A serial data output from the micro computer provides a serial digital signal which serves as modulation information.

The serial data output is fed to an oscillator/modulator which produces an FM FSK modulated signal in the 16.148 MHz 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 is then frequency multiplied 27 times through three triplers to produce a signal in the 436.0 MHz to 439.8 MHz range.

### 3-9. Transmitter Unit CPU Module.

The transmitter unit CPU module is a micro computer controlled circuit board which reads the keyboard, access code switches and the configuration switches. This information is then converted into a frame of serial data that will be transmitted by the RF module at 9600 bits per second. In addition it also provides control signals that turn the RF module ON and OFF for asynchronous time multiplex shared (TMS) operation.

A frame of serial data consists of a sequence of ON/OFF bits preceded by a sync pulse, then organized according to the standard data word format with one start bit followed by 8 data bits, 1 parity bit and a stop bit.

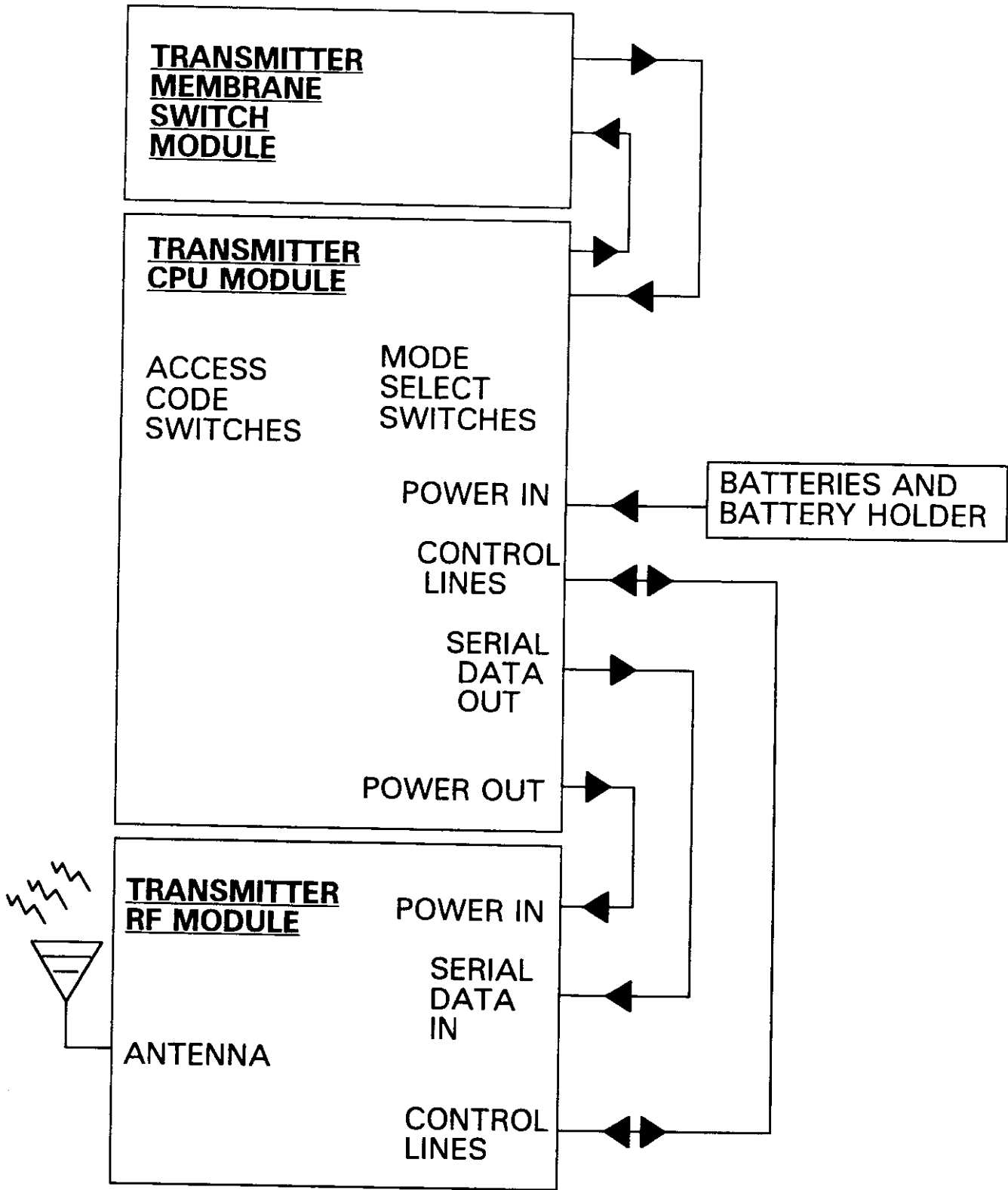


Figure 3-1. Transmitter Unit, Block Diagram



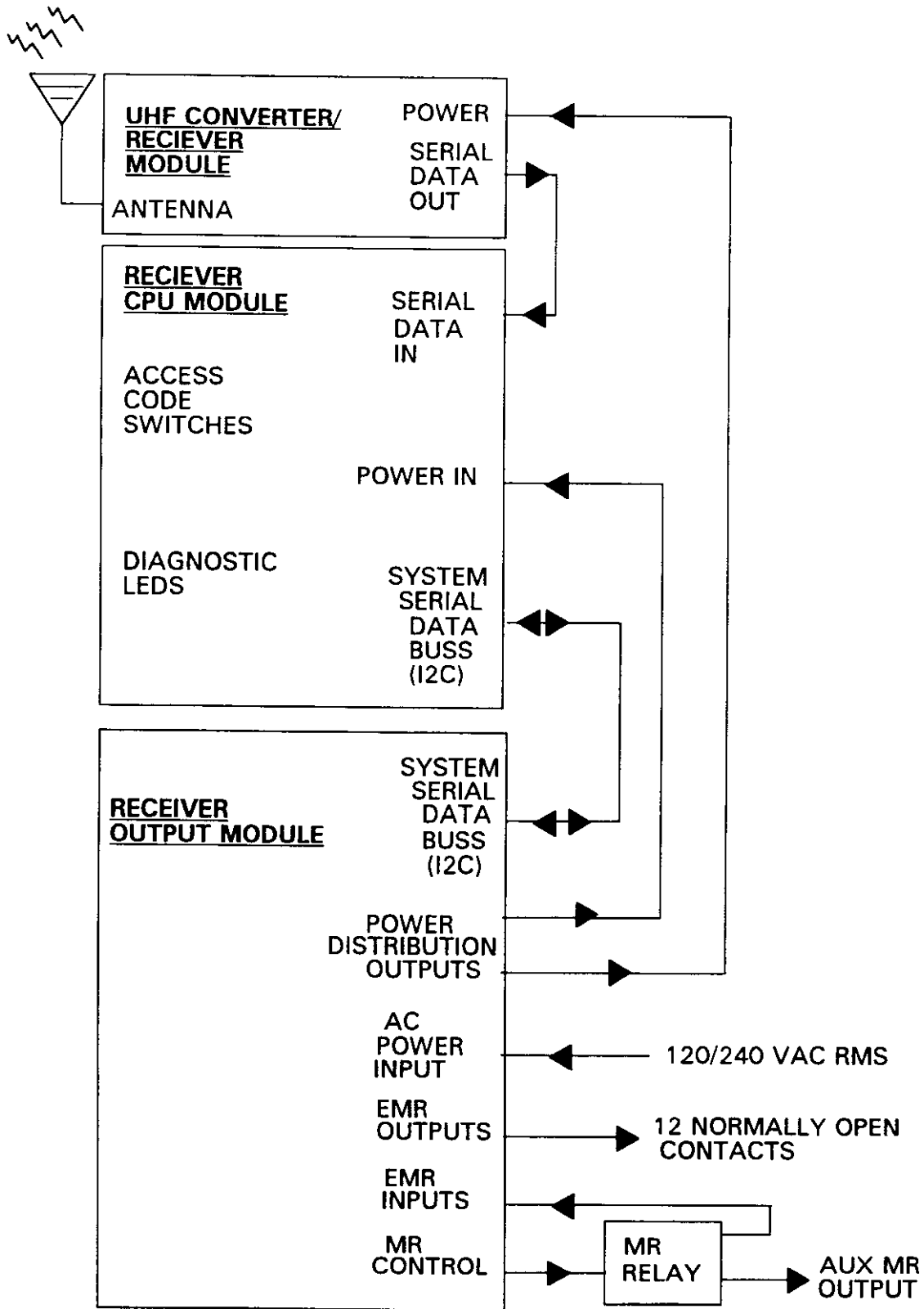


Figure 3-2. Receiver Unit, Block Diagram

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### 3-10. Receiver Unit.

The receiver unit consists of an RF receiver module, master microcomputer receiver control module and an output control module. A block diagram of the receiver unit is presented in figure 3-2. A description of these modules follows:

### 3-11. UHF Receiver Module.

The receiver module is a dual conversion receiver operating in the 436.0 MHz to 439.8 MHz band. The receiver module is a wide band digital receiver working at 9600 baud and is specifically designed for TMS transmissions. The receiver has an on board regulator with an output of 8 volts to all circuits.

### 3-12. Master Microcomputer Receiver Control Module.

The primary task of the CPU module is to receive the recovered data from the receiver module, and test it for errors before sending decoded output information to the output 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 output module for a fixed period of time. If no good data has been received from the UHF receiver module for approximately .5 second, the output data sent to the output relay module will be cleared.

The system access code switches for the receiver are located on this module. They must match the access code of the transmitter to correctly receive data.

This module communicates with the output control module via an Inter-Integrated circuit bus ( $I^2C$ ). The  $I^2C$  is a two line synchronous serial data system which allows two way communication between the master micro computer module and the output module. Data format consists of 5 eight bit words. The first word sent is the board/device address and read/write control. The first seven bits of this word are address bits which must match to allow the data to be accepted by the output module (like the access code in the RF link). The last bit of the first word determines the direction of subsequent data flow between modules. The next word is a control word followed by two words of data. These two words contain the control/command information. The last word is a check sum error detection word which will be tested by the output module.

In addition to 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 if successful data communication is to be accomplished.

### 3-13. Output Module.

The output module has an on board slave micro computer that receives command and control data from the CPU Module via the  $I^2C$  serial data link and checks the address code, performs the checksum error detection and if the board has been enabled by a transmitted ON command and no EMS condition is in effect will output the control data to the EMR outputs.

Two security relays are used to disable the outputs if the slave micro computer detects a problem or fails. These are the Security Relay (K13) and the Master Control Relay (K14). Each relay is enabled by a separate ac signal generated by the slave microcomputer. The ac signal sources are capacitively isolated from the slave computer to help prevent the MR and Security Relay from being latched ON if the slave micro computer fails. If the slave microcomputer fails to generate these signals, the security relay (K13) will open and remove power from the MR relay K14. This will remove 12 vdc from the coils of the EMR relays so they cannot turn ON.

Each output is individually fused, and suppressed with an MOV.

The module can provide 12 outputs of ON/OFF control. The module can be configured to provide and Auto Alarm function that will automatically turn ON the Alarm (function #1) for approximately 5 seconds when the system is turned ON. Two additional functions (#2 and #3) may be configured as latched outputs which may be toggled ON and OFF by the pressing of their associated keys on the transmitter.

### 3-14. RF Receiver Description.

The received signal is dual superheterodyne converted to the 10.7 MHz intermediate frequency range. The IF signal is then detected and fed to digital signal processing circuits.

### 3-15. Receiver Unit Signal Path.

The signal from the antenna goes through a preselector and then to an RF amplifier. Output from the RF amplifier then feeds the first mixer, which

**SECTION 3 PAGE 11**

produces an output signal between 40.3 Mhz and 41 Mhz. This signal then goes through the first IF filter and amplifier to the second mixer. In this mixer the signal is mixed down 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 is then passed through signal processing circuits to produce a digital output, which duplicates the signal used to modulate the transmitter.

**3-16. 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 which does not match 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 doesn't match the receiver unit access code.

**3-17. Time Multiplex 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 then will turn OFF. The length of transmitter ON time is referred to as data burst or packet. The packet length is a function of 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 transmitters to share and have equal access to the same frequency, and also allows for reduced battery consumption and extended battery life.

## **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.

### **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.

The receiver unit should not be subjected to moisture.

### **4-2. Receiver Unit Mounting Location Considerations.**

The receiver unit requires a mounting area or approximately 12" wide by 17" long. A depth of at least 16" must be provided to allow the cabinet door to open.

Ensure 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 warpage 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 receiver unit to a surface where high vibration or shock is present. If this can not 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.

### **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 path should be provided between the receiver unit and the area where the transmitter unit is normally used.

The antenna must be 6 feet (1.9 m) minimum from equipment power lines.

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

### **4-4. Line Input Considerations.**

### **WARNING**

SWITCH SW4 MUST BE SET TO THE CORRECT VOLTAGE, FAILURE TO DO SO MAY DAMAGE THE SYSTEM.

SET TO 115 FOR INPUT VOLTAGE OF 120 VAC; SET TO 230 FOR INPUT VOLTAGE OF 240 VAC.

The receiver unit has direct connect provisions for operation from 110 or 220 vac (nominal), 50-60 Hz power.

For applications where line voltage deviation exceeds 20% of nominal values or if 440 v power is used, a step up or step down transformer must be used.

### **NOTE**

The receiver unit should not be connected to lines containing excessive power up transients or continuous commutator noise. A line conditioner may be necessary in some installations.

**SECTION 4 PAGE 13****4-5. Receiver/Equipment Interface Considerations.**

All output relay contacts are rated at 10 amp 250 vac, however the system rating for the contacts is 5A. Connection to equipment or contactors with higher voltage or current requirements will require intermediate relays.

All relay outputs are normally open, momentary contact. Since a relay closure is only active while the transmitter unit key is pressed and held, devices such as lights or lifting magnet must use a mechanical auxiliary latching relay. Two functions may be set for electronic latch which should NOT be used with lifting magnets or other similar applications. Refer to Section 5, DIP Switch SW 3 for instructions.

**NOTE**

Contact Telemotive for information on interfacing systems with high impedance inputs.

**4-6. Receiver Unit Cabinet Mounting.**

Prepare a template or scribe marks directly on surface to which it will be mounted. Drill four 9/32" holes.

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

Flat washers should be used in front of nuts when receiver unit is mounted to a non structural surface.

Mount receiver unit cabinet securely to mounting surface.

## Section 5 - Operating Instructions

### 5-1. Output Module Switches.

A brief description of the output module switches is provided below. The location and information on configuring all switches on the output module is presented in Section 7.

SW 1 - Master Relay. Removes power from the master relay (K14). This allows the digital control section of the system to be tested without activating any external controls.

DIP Switch 2 Also see Section 7-3

SW 2-1 Not Used

SW 2-2 Not Used

SW 2-3 Auto Alarm Select. Allows function 1 to generate a 5 second (approximate) ALARM command when the transmitter unit ON switch is pressed.

DIP Switch 3

SW 3-1 Function 2 Latch Select. Allows function 2 to be toggled and latched ON or OFF or allows function 2 to operate as a momentary ON and OFF command.

SW 3-2 Function 3 Latch Select. Allows function 3 to be toggled and latched ON or OFF or to operate as a standard momentary ON and OFF command.

SW 4 - 115/230. Switches transformer input primary power windings. This switch must be set to the correct input power voltage.

SW 5 - POWER. Controls AC power to the receiver unit.

### 5-2. Output Module Indicators.

To facilitate system monitoring and diagnostics, LEDs are provided to help determine the status and condition of module operation. The location, description and function of the LEDs is provided in Section 6.

### 5-3. Master Micro Computer Control Module Indicators.

To facilitate system monitoring and diagnostics,

LEDs are provided to help determine the status and condition of module operation. The location, description and function of the LEDs is provided in Section 6.

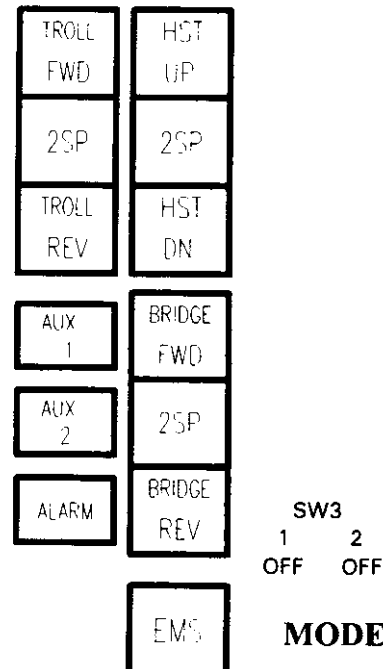
### 5-4. Function Pushbuttons.

Four configurations of the keyboard are available. Functions are configured to have various lock-outs between motion directions. This prevents two opposing motions from being active at the same time. Figure 5-1 shows the functions of each configuration as well as the switch settings required.

**Emergency Stop (EMS) Key.** On all configurations of the keypad, there is a key marked EMS. When pressed, all equipment movement immediately stops. After the EMS pushbutton is pressed, only the ALARM function can be transmitted if JU 15 is set accordingly. Reset the system for normal operation by turning the transmitter OFF then ON using the key switch.

A description of the functional operation of the various modes is provided below.

#### Two Speed 3 Motion With 3 Auxiliary Switches (Mode 0).



The 2-speed 3 motion transmitter is similar to the single speed 4 motion transmitter (modes 1 or 2) except the keyboard is arranged to provide integral access to the second speed.

**SECTION 5 PAGE 15**

Motion functions are:

HST UP/2SP/HST DOWN - Selects hoist movement in the up or down direction.

BRIDGE FWD/2SP/BRIDGE REV - Selects bridge in the forward or reverse direction.

TROLL FWD/2SP/TROLL REV - Selects trolley in the forward or reverse direction.

To operate the second speed, the directional must first be pressed. The finger or thumb may then slide up or down or rocked to engage the second speed. The first direction is maintained while the second speed key is held.

There are three auxiliary functions:

- AUX 1 (K3)
- AUX 2 (K2)
- ALARM (K1)

The AUX 1 and AUX 2 keys may be configured using switches SW 3-1 and 3-2 on the output control module. Depending on the switch setting, the AUX functions may be set for latched or momentary ON and OFF operation. Refer to Section 7 for switch settings.

ALARM pushbutton, if needed will activate the warning device.

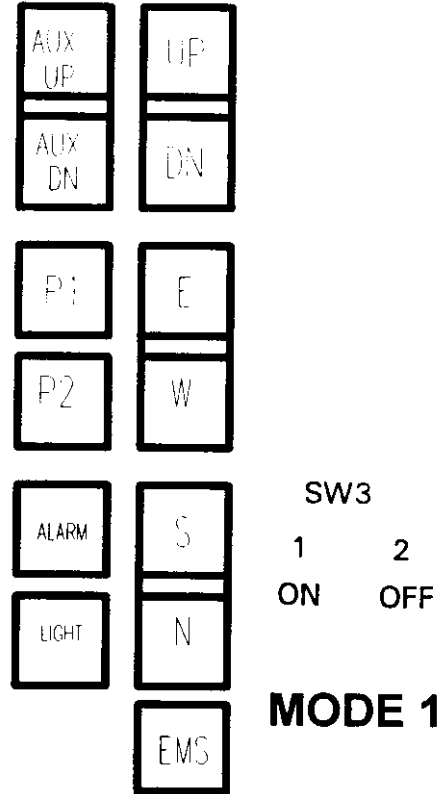
**WARNING**

**SOME WARNING DEVICES MAY PULL EXCESS CURRENT. BE SURE TO CHECK REQUIREMENTS BEFORE WIRING IN DEVICE**

**NOTE**

The ALARM command has a special jumper provision located on the output module to allow the ALARM command to be enabled or disabled during an EMS shutdown.

Single Speed 4 Motion With 4 Auxiliary functions (Mode 1)



The motion functions are:

UP/DN - Selects hoist movement in the UP or DOWN direction.

E/W - Selects east or west direction of the bridge or trolley. Bridge or trolley is selected depending on whether the bridge or trolley moves in east - west direction.

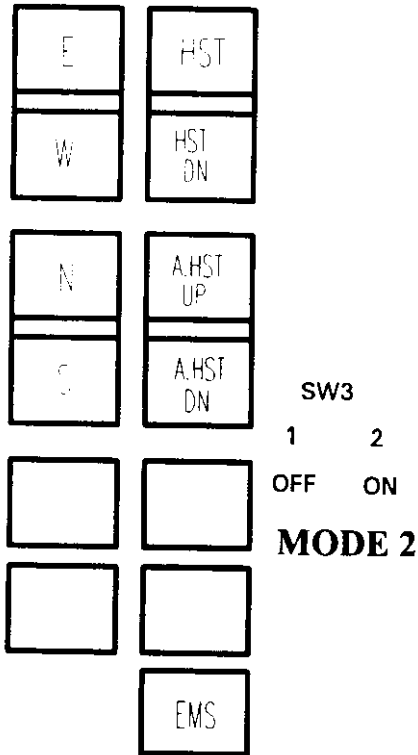
S/N - Selects south or north direction of the bridge or trolley. Bridge or trolley is selected depending on whether the bridge or trolley moves in north - south direction.

AUX UP/AUX DN - Selects an auxiliary hoist movement in the up or down direction.

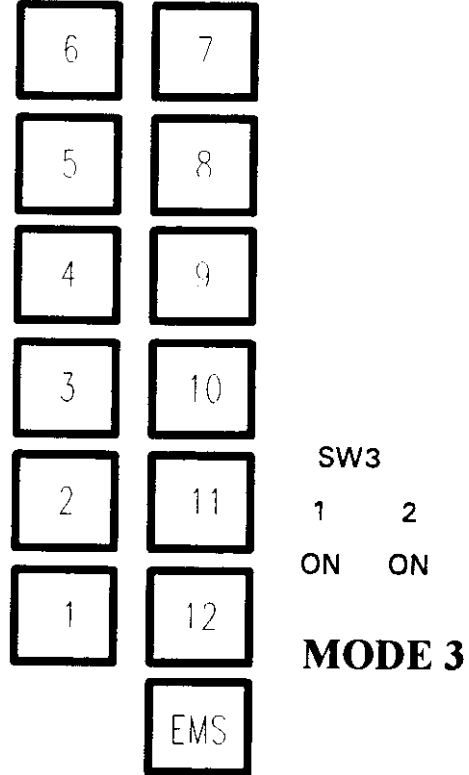
There are four auxiliary functions:

- P1
- P2
- ALARM
- LIGHT

Single Speed 4 Motion With 4 Auxiliary Functions (Mode 2).



Blank Keypad (Mode 3).



E - Selects EAST direction of bridge or trolley. Bridge or trolley is selected depending on whether the bridge or the trolley moves in an east-west direction.

W - Selects WEST direction of bridge or trolley. Bridge or trolley is selected depending on whether the bridge or the trolley moves in an east-west direction.

N - Selects NORTH direction of bridge or trolley. Bridge or trolley is selected depending on whether the bridge or the trolley moves in a north-south direction.

S - Selects SOUTH direction of bridge or trolley. Bridge or trolley is selected depending on whether the bridge or the trolley moves in a north-south direction.

HST UP - Selects main hoist up.

HST DOWN - Selects main hoist down.

AUX HST UP - Selects auxiliary hoist up.

AUX HST DOWN - Selects auxiliary hoist down.

In addition there are four blank keys on the keypad which may be used to provide selected motions or single functions for a specific application.

This configuration allows for 12 independent ON/OFF functions. Each key function may be set for a single motion. 2 keys may be set to latch ON and OFF for a particular application. Refer to Section 7 for information.

**5-5. Transmitter Unit Indicator.**

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

**5-6. Transmitter Unit Operating Instructions.**

ON/OFF key switch. Turn transmitter ON by pressing the key attached to the wrist strap into the ON hole. Turn transmitter OFF by pressing the key into the OFF hole. DO NOT USE A SHARP OBJECT IN PLACE OF THE KEY. Always remove key from hole after turning transmitter ON or OFF.



**SECTION 5 PAGE 17**

Function pushbuttons. To activate transmitter functions press and hold pushbutton which corresponds to the desired motion. To activate the 2SP function associated with the TROLL, HST and BRIDGE movements, press the motion control switch desired and slide finger or thumb to 2SP. Initial speed resumes when thumb or finger slides back to initial motion control. Motion is discontinued when thumb or finger is removed from either switch.

**5-7. Receiver Unit Operating Instructions.**

Power. Power is applied to the receiver unit by moving power switch SW5 to 1.

**5-8. Setting Access Code.**

The access code is set at the factory and should not be changed unless absolutely necessary. It is recommended that the system access code not be changed except when used with a designated spare transmitter unit. If a spare transmitter unit is used, the receiver unit access code is changed to match the access code of the transmitter unit.

Also, note that SW 7 and SW 8 on the micro computer control module correspond to SW 1 and SW 2 on the transmitter control module. SW 7 (SW 1 on the transmit control module), station 1 corresponds to the least significant bit, and SW 8 (SW 2 on the transmit control module), station 8 corresponds to the most significant bit of the access code.

The following general guidelines are presented:

Both the transmitter unit and master micro computer 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 5-2 shows the location of the DIP switches.

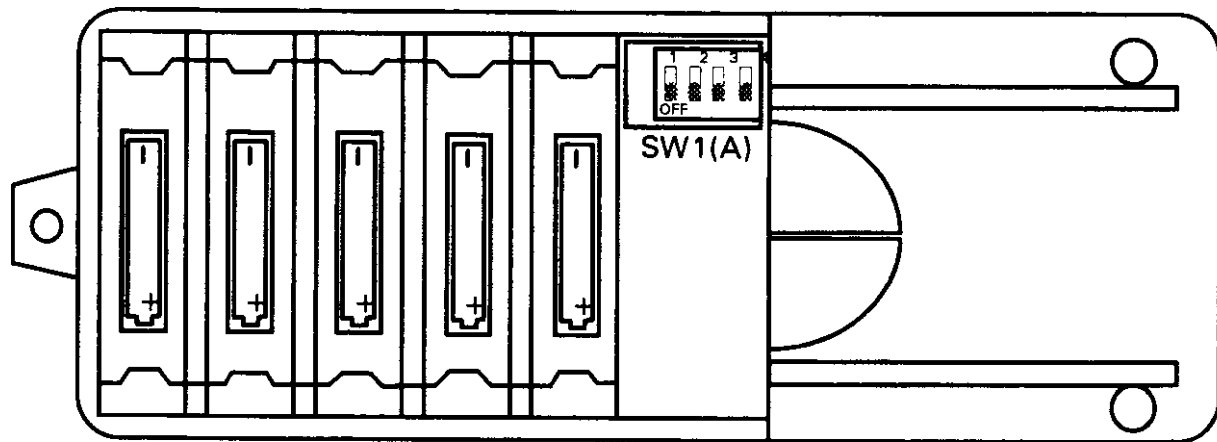
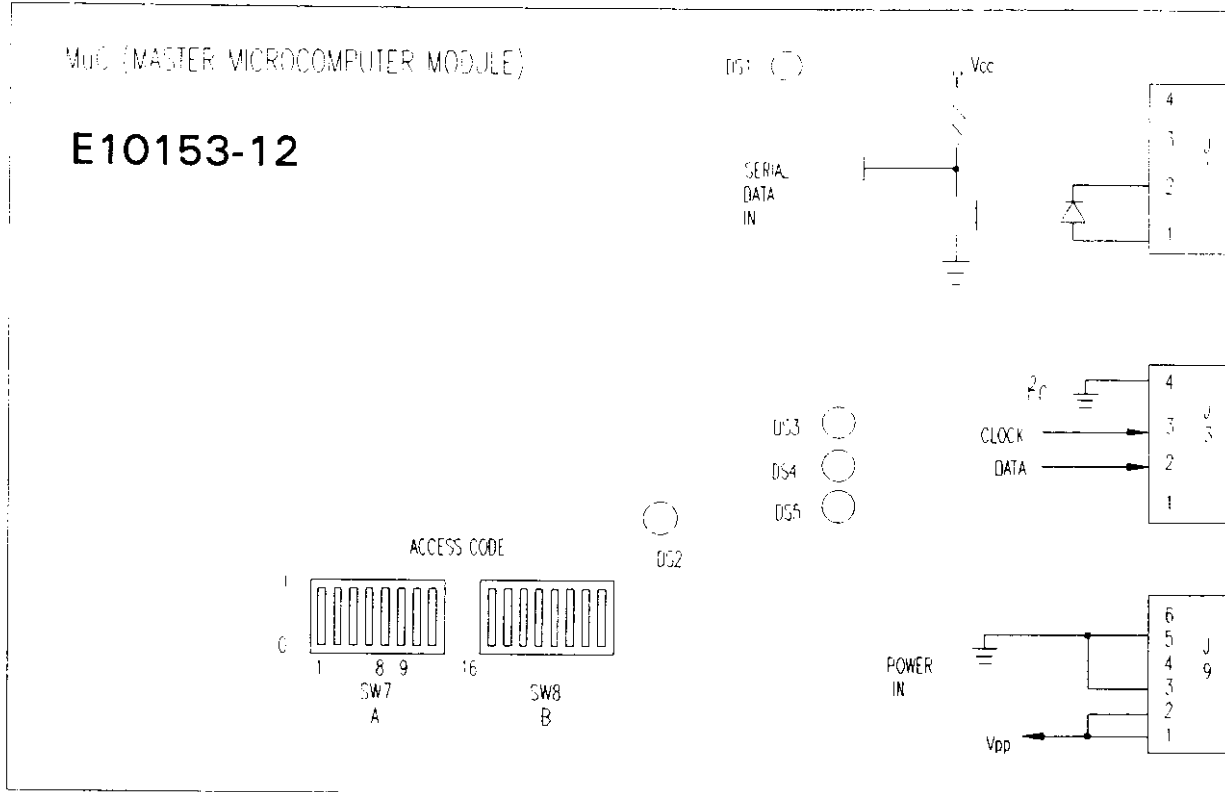
Open cover and turn power OFF before setting access code switches. After setting access code turn power ON before closing cover.

**NOTE**

Set switch stations using a ballpoint 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 is a direct (or one to one) representation of the access code switch position settings. Note the switch marked "A" on the label is SW 1 in the transmitter or SW 7 in the receiver, and the switch marked "B" on the label is SW 2 in the transmitter and SW 8 in the receiver.

When setting the access code in the receiver, use figure 5-2 to position the individual switches either ON or OFF.



**TRANSMITTER UNIT**

Figure 5-2. Location of Access Code DIP Switches on Transmitter and Master Micro Computer Modules

## Section 6 - Troubleshooting

### 6-1. UHF Receiver Module Diagnostic and Status Indicators.

The UHF Receiver module has an indicator to aid in troubleshooting. Figure 6-1 provides the location of the indicator. Indicator number, color and indicator function is presented below.

**DS 1 (Green)** - Monitors +8 vdc regulated voltage (normally ON).

If the LED is not illuminated, +8 vdc is not present. Check connectors, +8 vdc regulator, or for a short on the board.

### 6-2. Master $\mu$ C Module Diagnostic and Status Indicators.

The master micro computer module has indicators to aid in troubleshooting. Figure 6-2 provides the location of the indicators. Indicator number, color and indicators function is presented below.

**DS 1 (Green)** - Monitors +5 vdc regulated voltage (normally ON).

If the LED is not illuminated, +5 vdc is not present. Check connectors, +5 vdc regulator, or for a short on the board.

**DS 2 (Red)** - Monitors 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, +5 vdc is probably too low. This could be caused by a short 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.

**DS 3 (Red)** - Monitors received data errors (normally OFF).

A flashing LED during data transmission may indicate data is being interfered with. If LED is illuminated continuously when data is transmitted and the system will not respond, the access codes 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.

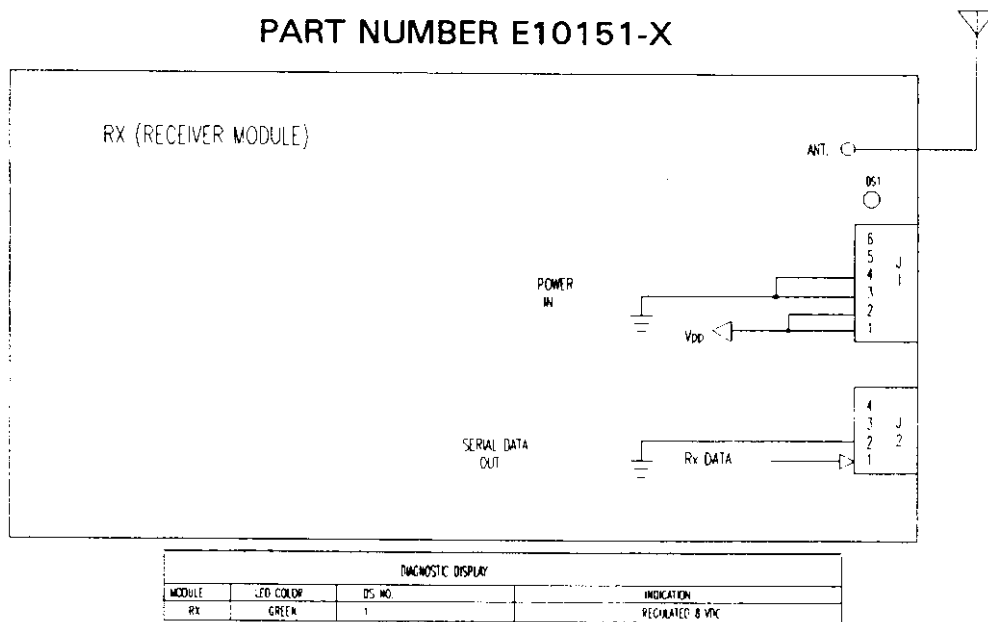


Figure 6-1. Location of Receiver Module Indicators.

D(14)

PART NUMBER E10153-12

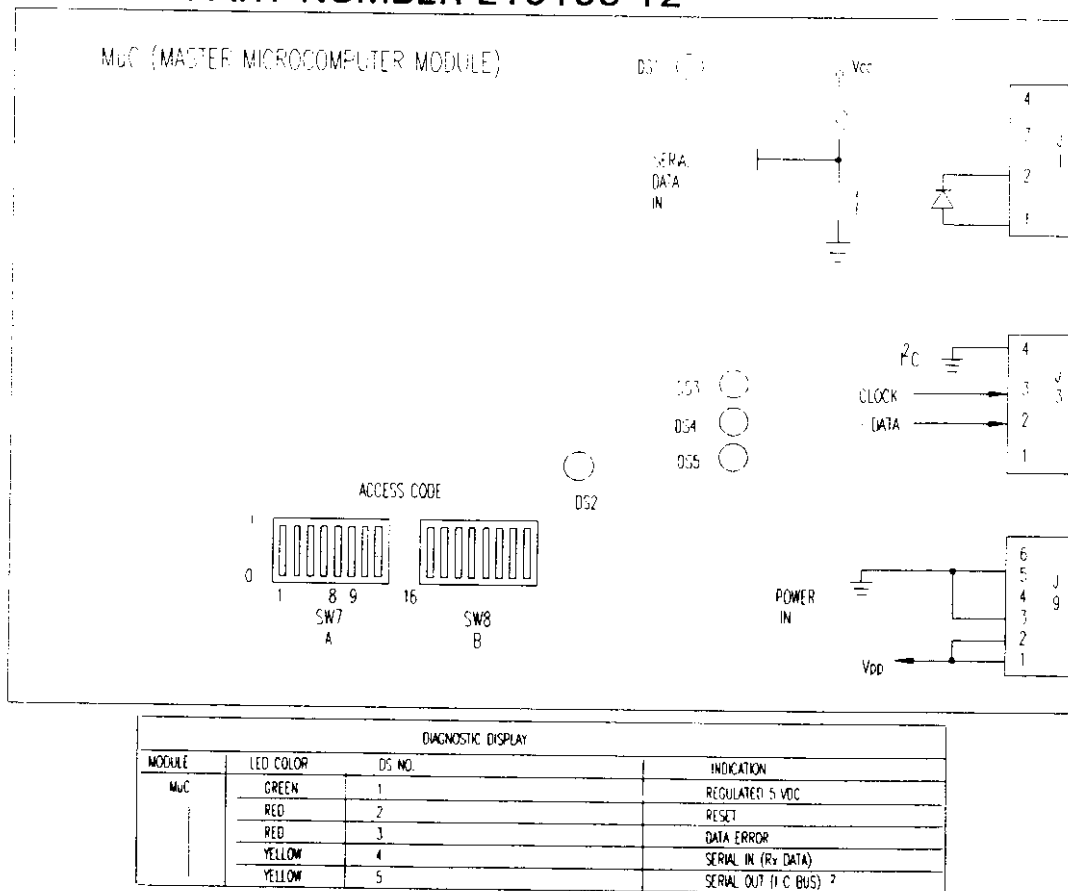


Figure 6-2. Location of Master Micro Computer Module Indicators.

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

LED will flash rapidly when data is transmitted. The LED can be used in conjunction with DS 3 to analyze incoming data. If DS 3 is illuminated or flashing when DS 4 also is flashing another transmitter unit on the same frequency may be present. This is normal. As more transmitter units are operated on the same frequency, LED will flash brighter and more often.

**DS 5 (Yellow)** - Monitors I<sup>2</sup>C serial data line.

LED monitors communications between the CPU module and the output 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.

**6-3. Output Module Diagnostic and Status Indicators.**

The output module has indicators to aid in troubleshooting. Figure 6-3 provides the location of the indicators. Indicator number, color and indicators function is presented

below.

**DS 1 through DS 12 (Red)** - Monitors EMR driver circuits for relays K1 through K12 (normally OFF).

LEDs will be illuminated when a control function is called.

**DS 13 (Yellow)** - Monitors driver signal to the security relay. The LED should be illuminated when the system has been enabled with an ON command.

The LED should not be illuminated when an OFF or EMS command is present or has been transmitted.

**DS 15 (Red/Green)** - Monitors master control relay output (normally OFF).

LED will illuminate when the MCR has been enabled

## SECTION 6 PAGE 21

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 MCR switch is set to 0.

DS 27 (Yellow) - Monitors ac bias pump line for the master control relay enable line. LED will flash only when the output module has been enabled by an ON command.

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

DS 28 (Yellow) - Monitors the ac bias pump line for the security relay. LED will flash only when the output module has been enabled by an ON command.

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

DS 29 (Red) - Monitors watchdog timer (normally OFF).

LED will flash momentarily when power is applied to or removed from the system. If LED is flashing, the computer is not working properly. If the LED is illuminated continuously the +5 vdc may be too low.

DS 30 (Red) - Monitors ON or EMS condition (normally OFF).

LED will flash when an ON command is transmitted. LED may be lighted continuously when an EMS state is in effect indicating an incoming data error has occurred.

DS 31 (Red) - Monitors OFF or EMS condition (normally OFF).

LED will flash when an OFF command is transmitted and will remain illuminated when an EMS state is in effect. When LED is illuminated a contact monitoring error is indicated.

DS 32 (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 micro computer. If both DS 32 and DS 31 are illuminated a contact monitoring error has been detected. If both DS 32 and DS 30 are illuminated the incoming data on the I<sup>2</sup>C bus has been corrupted.

DS 34 (Green) - Monitors +5 vdc regulated power (ON whenever +5 volts is present).

If LED is not illuminated check power connections, power switch, and transformer connection.

DS39 (Green) - Monitors unregulated power (ON whenever unregulated DC power is present). If either LED is not illuminated check position of power switch and transformer connections.

DS 36 (Green) - Monitors +12 vdc regulated power (ON whenever +12 volts is present).

If LED is not illuminated check power connections, position of power switch, and transformer connections.

DS 14 (Yellow) - Monitors switched +12 vdc to EMR relay coils. LED should be illuminated when the system has been enabled by an ON command.

LED should not be illuminated when an OFF or EMS condition is present or an EMS command has been transmitted.

DS 38 (Green) - Monitors input power (ON when ac power is present).

If LED is not illuminated check power connections.

#### 6-4. Output Module Testing.

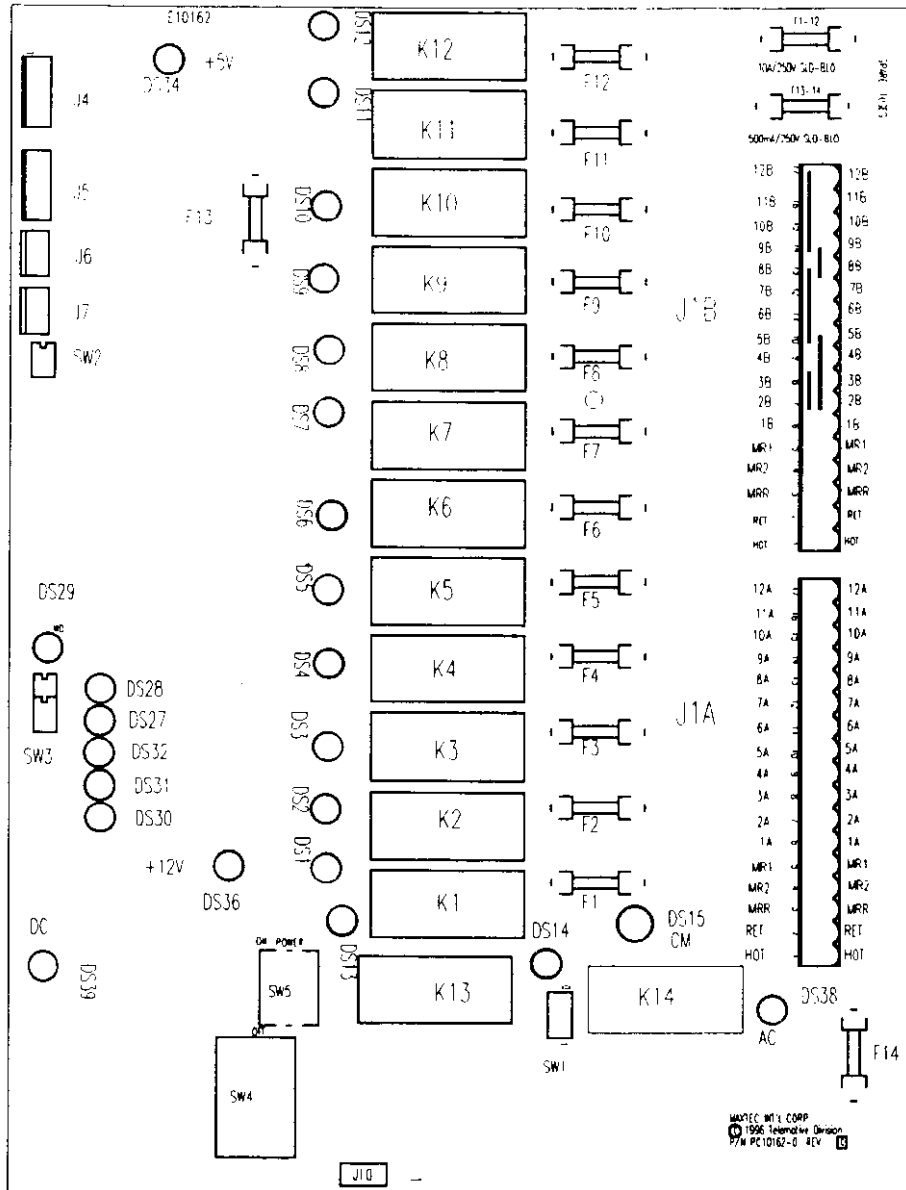
The output module may be tested with a transmitter without activating crane controls by setting SW 1 to 0. This allows the system to be tested and analyzed without causing movement of the crane by removing power to the master control relay (K14) and master power relay (K15).

#### 6-5. Troubleshooting.

The troubleshooting chart is intended to be general in nature. It is recommended only qualified technicians attempt to troubleshoot and repair the system. The system is diagnosed primarily using indicators on the output module and the applicable documentation on the drawings. Additional pieces of electronic test equipment may be required to fully diagnose certain malfunctions.

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PART NUMBER E10162-0



DIAGNOSTIC DISPLAY			
OUTPUT MODULE	RED	1-12	RELAY DRIVE (K1 K12)
	YELLOW	13	SECURITY RELAY DRIVE
	YELLOW	14	SWITCHED 12 VDC
	RED/GREEN	15	MCR OUTPUT
	YELLOW	27	MCR AC BIAS
	YELLOW	28	SECURITY RELAY AC BIAS
	RED	29	WD RESET
	RED	30	DATA ERROR
	RED	31	CONTACTOR ERROR
	RED	32	EMS MODE
	GREEN	34	REGULATED 6 VDC
	GREEN	35	REGULATED 12 VDC
	GREEN	38	AC IN
	GREEN	39	UNREGULATED 12 VDC

Figure 6-3. Output Module Indicators.

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**WARNING**

THROUGHOUT THE TROUBLESHOOTING PROCEDURE, TESTING IS PERFORMED ON THE RECEIVER UNIT WITH POWER APPLIED. USE CAUTION WHEN PERFORMING TROUBLESHOOTING WITHIN THE RECEIVER UNIT.

Troubleshooting Table (Sheet 1 of 7)

Malfunction	Probable Cause	Corrective Action
<p>All indicators in receiver not illuminated, except for DS38, indicating that AC power is present.</p>	<p>Power switch SW5.</p> <p>Line fuse.</p> <p>Incorrect line voltage.</p>	<p>Ensure power switch is placed to ON.</p> <p>Check line fuse. Replace open fuse with fuse of same rating (0.5 amp, slow blow)</p> <p>Check line voltage. Voltage must be between 95 - 130 vac for 115 volt operation or 190 -260 vac for 230 volt operation.</p> <p>If line voltage is correct, but receiver unit still does not operate, contact Telemotive.</p>
<p>Power indicators are illuminated, but relays K13 and K14 or K15 are not energizing. Indicator DS4 on receive control module is flashing (receiving data) when ON command is transmitted and indicator DS5 is flashing continuously.</p>	<p>Master control relay switch SW1.</p> <p>Relay circuit (K13, K14 on, K15 off). Indicators DS13 and DS14 are illuminated.</p>	<p>Ensure master control relay switch SW1 is set to 1 and indicator DS32 is not illuminated.</p> <p>If relay K15 is powered from the receiver unit, ensure the return line is connected to neutral side of the receiver power supply at J1. If relay K15 is powered from the user equipment ensure the respective ground is connected to the user AC power neutral. Also, check that line voltage to relay K15 is sufficient.</p>

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Troubleshooting Table (Sheet 2 of 7)

Malfunction	Probable Cause	Corrective Action
<p>Power indicators are illuminated, but relays K13 and K14 or K15 are not energizing. Indicator DS4 on receive control module is flashing (receiving data) when ON command is transmitted and indicator DS5 is flashing continuously.</p>	<p>System Latched In EMS Mode (indicator DS32 is illuminated, indicators DS13 and DS14 are extinguished).</p> <p>Incorrect access code (indicator DS3 on receive control module illuminated or flashing).</p>	<p>Ensure system is not latched in EMS mode by checking indicator DS32 on output module. If the EMS key was pressed, the system must be cleared before any outputs can be activated. An EMS mode may also be activated by an output function being activated at the same time an ON command is transmitted. To clear EMS, turn transmitter OFF then ON. If system still does not start and the transmitter indicator continues flashing rapidly after 3 seconds a transmitter key is stuck in the ON position causing an EMS condition.</p> <p>Ensure access code of receiver matches transmitter.</p>



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Troubleshooting Table (Sheet 3 of 7)

Malfunction	Probable Cause	Corrective Action
<p>Power indicators illuminated but relays K13 and K14 or K15 are not energizing. Indicator DS4 on receive control module not flashing or flashing intermittently when ON command is transmitted. Indicator DS5 is flashing continuously.</p>	<p>Defective relay K13 or K14</p>	<p>Remove relay K14 and place in socket of relay K13. Place relay K13 in socket of relay K14. If the relay which was originally K13 does not energize, replace the relay.</p>
	<p>Transmitter batteries.</p>	<p>Ensure transmitter battery condition is good.</p>
	<p>Incorrect transmitter is being used.</p>	<p>Ensure correct transmitter is in use.</p>
	<p>Transmitter and receiver units using different frequencies.</p>	<p>Ensure transmitter and receiver units are using the same frequency.</p>
	<p>Radio frequency jamming or multipath interference.</p>	<p>Move transmitter unit close to receiver unit. If transmission is possible one of the following conditions may exist:</p> <p>Jamming from a source at the same frequency as the transmitter.</p> <p>The transmission path is not compatible with the environment. A line of sight transmission path offers best system performance.</p>
<p>Antenna cabling and connectors.</p>	<p>Check antenna, coaxial cable and connectors for damage such as pinching,</p>	

SECTION 6 PAGE 26

Troubleshooting Table (Sheet 4 of 7)

Malfunction	Probable Cause	Corrective Action
<p>Power indicators illuminated but relays K13 and K14 or K15 are not energizing. Indicator DS4 on receive control module not flashing or flashing intermittently when ON command is transmitted. Indicator DS5 is flashing continuously.</p>	<p>Indicator DS5 on receive control module not flashing continuously.</p> <p>Defective transmitter unit.</p>	<p>Communications between receive control module (J3) and output module (J7 or J6) on I<sup>2</sup>C bus interrupted. Check integrity of connectors and wiring.</p> <p>To determine whether the transmitter unit or receiver unit is defective, use a spare transmitter unit. Ensure access code of the receiver unit matches the access code of the spare transmitter. Refer to setting access code paragraph in Section 5. If a spare transmitter unit is not available or problem is not corrected, contact Telemotive.</p>
<p>Output module indicators illuminate when the appropriate transmitter unit key is pressed, but material handling equipment does not respond with any motion.</p>	<p>Control panel relay circuit.</p> <p>Output fuses.</p>	<p>Check for main control voltage at the material handling equipment master relay. Ensure the relay is closing when voltage is applied.</p> <p>Check output fuses (F1 through F12). Replace any open fuse with fuse of same rating (10 amp slow blow). If fuse should blow again,</p>

SECTION 6 PAGE 27

Troubleshooting Table (Sheet 5 of 7)

Malfunction	Probable Cause	Corrective Action
<p>Output module indicators illuminate when the appropriate transmitter unit key is pressed, but material handling equipment does not respond with any motion.</p>	<p>Shorted or open output control line.</p>	<p>Activate each of the motion commands on the transmitter unit one at a time while verifying the associated output indicator is illuminated. If each output indicator turns ON and OFF with the corresponding output command, connect one lead of a voltmeter to the ground or neutral line of the user equipment . Set voltmeter to read 120/240 vac. Connect other lead to the output on the terminal block A side that corresponds to the malfunctioning control line and press the corresponding key on the transmitter unit. If full voltage is present, the fault is in the material handling equipment or the wiring leading to the equipment. In addition, check for an open circuit.</p>

SECTION 6 PAGE 28

Troubleshooting Table (Sheet 6 of 7)

Malfunction	Probable Cause	Corrective Action
<p>Output module indicators illuminate when the appropriate transmitter unit key is pressed, but material handling equipment does not respond with any motion.</p>		<p>Check output lines from the receiver unit to the user control panel for damage such as pinching, corrosion, stretching, loose connections or broken wires.</p>
<p>Dropouts (Random loss of radio control).</p>	<p>Radio frequency jamming or multipath interference.</p>	<p>If intermittent operation occurs and indicator DS3 on the Receive Control Module starts flashing irregularly, use a spare transmitter with matching frequency and access code to ensure the transmitter unit is not defective. If a spare transmitter unit is not available or the problem still exists, one of the following conditions may exist:</p> <p>Defective transmitter.</p> <p>Jamming from a source at the same frequency as the transmitter.</p> <p>The transmission path is not compatible with the environment. A line of sight transmission path offers best system performance</p>

SECTION 6 PAGE 29

Troubleshooting Table (Sheet 7 of 7)

Malfunction	Probable Cause	Corrective Action
<p>System latches into EMS mode automatically.</p>	<p>Line Noise</p>	<p>Using an oscilloscope, check the power input line for excessive noise. Excessive switching transients as well as continuous "hash" (such as commutator noise) on the power input or control line output will cause system to enter EMS mode and shut down. The line should be screened for transients by manually activating loads which could cause such conditions, particularly inductive loads. The receiver should be powered from direct lines and not routed via reactive or noisy loads.</p>

## Section 7 - Maintenance

### 7-1. Output Control Module Switches.

There are several control and DIP switches located on the output control module. Figure 7-1 shows the location of all switches. Configuration options for these switches is provided below.

### 7-2. Control Switches Configurations.

SW 5 POWER. Controls AC power to the receiver unit.

Set to 1 (ON) to apply power to the receiver unit.  
Set to 0 (OFF) to remove power from the receiver unit.

SW 4 120/240. Switches input transformer primary winding to match input voltage.

### **WARNING**

Switch must be set to the correct voltage. FAILURE TO DO SO MAY DAMAGE THE SYSTEM.

Set to 115 for input voltage of 120 vac.

Set to 230 for input voltage of 240 vac.

SW 1 MR Enable. Removes power to the master control relay. Setting the switch to 0 allows the digital control section of the system to be tested without activating any external controls.

### 7-3. DIP Switch Configurations.

Configuring switches SW 2 and SW 3.

Switches SW 2 and SW 3 on the output module can be configured to disable contact monitoring, to provide an auto alarm (function 1) when the ON key is pressed, or to configure two additional functions (functions 2 or 3) as latched outputs. These outputs may be toggled ON and OFF by pressing the appropriate transmitter unit keys.

#### DIP Switch SW 2.

SW 2-1 Not Used.

SW 2-2 Not Used.

SW 2-3 Auto Alarm Select.

Allows function 1 to generate a 5 second (approximate) ALARM command when power is applied to the system.

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

#### DIP Switch SW 3.

SW 3-1 Function 2 Latch Select.

Allows function 2 to be toggled and latched ON and OFF or allows function 2 to operate as a momentary ON and OFF command.

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

SW 3-2 Function 3 Latch Select.

Allows function 3 to be toggled and latched ON and OFF or allows function 3 to operate as a momentary ON and OFF command.

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

### 7-4. Configuring Jumpers on Output Module.

There are several jumpers located on the output module. Figure 7-1 shows the location of all jumpers. Configuration options for these jumpers is provided below.

JU 15 - Alarm Function Select.

Controls whether the alarm (function 1) command will be disabled by EMS or allows the alarm to operate when an EMS condition is in effect. If function 1 is used as an alarm it is preferable to allow this function to operate during EMS shutdown. If function 1 is used as a control function then it should be disabled during EMS shutdown.

For function 1 to be disabled by an EMS shutdown, set JU-15 shunt to position 1-2.

For function 1 to remain enabled during EMS shutdown, set JU-15 shunt to position 2-3.

## SECTION 7 PAGE 31

**Note**

Power to function 1 normally is wired directly to ac power. If function 1 is used as a control function it should be wired to switched ac power.

**WARNING**

REMOVE POWER FROM SYSTEM BEFORE ATTEMPTING TO REWIRE TERMINAL BLOCK

**7-5. Maintenance.****NOTE**

Do not attempt to desolder or solder any piece parts mounted on any module within the system. Defective assemblies or parts which are removable without soldering should be returned to Telemotive for replacement or repair.

**7-6. Receiver Fuses Replacement.**

Fuses F1 - F12 are located next to their corresponding output relays. Replace these fuses only with 10A, 250 volt slow blow type.

The receiver unit is protected by fuses F13 and F14. If either fuse is open, it is possible a malfunction exists either in the receiver unit or the material handling equipment. If either fuse opens it is recommended troubleshooting procedures be performed to determine the cause of the open fuse. Replace fuses F13 and F14 with .5A, 250 volt slow blow type.

**7-7. Output Relay Replacement.**

Relays K1 through K14 may be removed from the output module as required. Relays should be replaced with normally open SPST 10 amp, 250 vac with a coil rating of 12 vdc (Telemotive part number K2110-0).

**7-8. Master Relay Replacement.**

Relay K15 may be removed from the receiver unit as required. Replace relay with a normally open SPST, 110 vac, 30 amp (Telemotive part number K2111-0).

**7-9. Transmitter Battery Replacement.**

Transmitters are powered by five 1.5 volt AA size dry cell batteries. Alkaline type batteries are recommended. Replace discharged batteries as follows:

Open battery compartment door by rotating door latch clockwise or counter clockwise to "open" position. Remove door.

Install five new batteries noting correct polarity. Ensure all batteries are completely positioned in their holders.

Replace door. While firmly holding door closed, rotate the door latch clockwise or counterclockwise to the "lock" position.

**7-10. Transmitter Unit Disassembly and Reassembly.**

There are no serviceable parts in the transmitter. Disassembly instructions are provided for replacement of the keyboard inserts.

Remove six phillips screws.

Carefully remove bezel. Place ON and OFF plugs on bezel facing down.

To reassemble, place ON and OFF plugs in their holes on the bezel. While holding the bezel and bottom portion of the case together tightly, replace six phillips head screws.

**7-11. Receiver Unit Disassembly and Reassembly.**

Remove all connectors. If the receiver module is being removed, remove BNC connector from antenna bottom. If removing the output module, tag or otherwise identify leads to facilitate reassembly. If removing receiver or master micro computer module, remove 4 nuts securing module. If removing output module, remove 6 nuts securing module. Assemble in reverse order of removal.

7-12. Receiver Unit Spare Parts.

Part Number Description

- 10K12RSPK Consisting of Receiver Module, Micro Computer Module, and Output Module
- E10151-X UHF Converter/receiver Module
- E10153-12 Receiver CPU Module
- E10162-0 Receiver Output Module
- K2111-0 Master Relay, K15 - Normally open SPST, 110 vac, 30 amp.
- K2110-0 Output Relays K1 through K14 - Normally open SPST 10 amp, 250 vac. Coil rating of 12VDC.
- Remote Antenna Kit - Contact Telemotive for information.

7-13. Membrane Transmitter Unit Spare Parts.

Part Number Description

- A9654-0 Strap Assembly
- E9654-0 Battery Holder Assembly
- A10662-1 Transmitter Case Assembly
- A10663-1 Bezel Assembly (Single Speed Transmitter)
- A10663-2 Bezel Assembly (Two Speed Transmitter)
- A10664-1 Battery Door Assembly
- S313-1 Membrane Switch (Single Speed Transmitter)
- S314-1 Membrane Switch (Two Speed Transmitter)
- MP9653-1 Grey Plastic Key
- A9657-1 Insert Package (Single Speed Transmitter)
- A9659-1 Insert Package (Two Speed Transmitter)
- MP9656-0 Vinyl Pouch
- A9665-0 Rubber Boot Assembly

SWITCHES			DEFAULT FACTORY SETTING
MODULE	SWITCH	FUNCTION	
OUTPUT MODULE	SW1	MR ENABLE	1
	SW2-1	NOT USED	X
	SW2-2	NOT USED	X
	SW2-3	AUTO ALARM(F1)	0
	SW3-1	LATCH/TOGGLE(F2)	0
	SW3-2	LATCH/TOGGLE(F3)	0
	SW4	120/240 SELECT	120
	SW5	POWER ON/OFF	OFF

JUMPERS			DEFAULT FACTORY SETTING
JUMPER POSITION	OPERATING MODE		
JU15	A	STD FUNCTION	✓
JU15	B	ALARM/W/EMS	
JU16	A	STD FUNCTION	FOIL
JU16	B	K11/W/EMS	
JU17	A	STD FUNCTION	FOIL
JU17	B	K12/W/EMS	

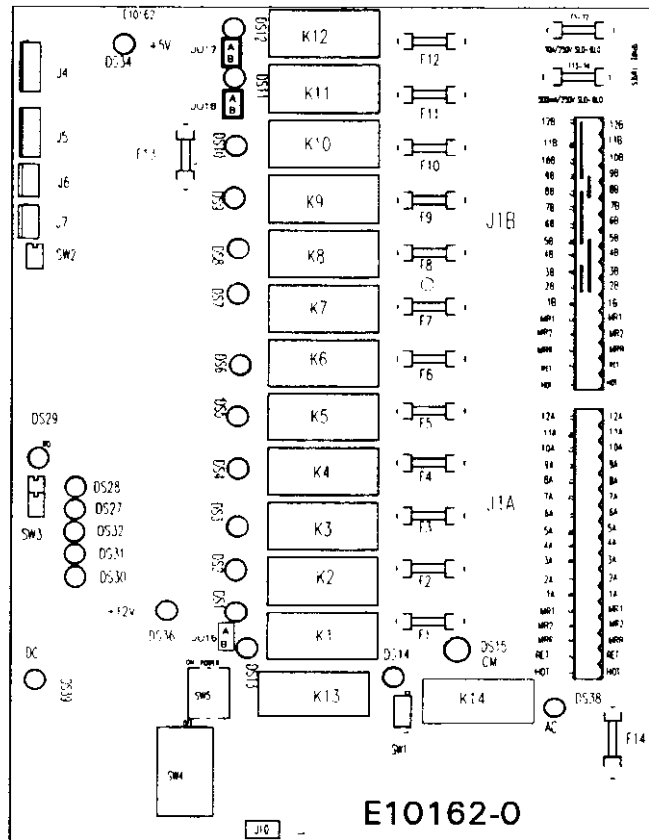
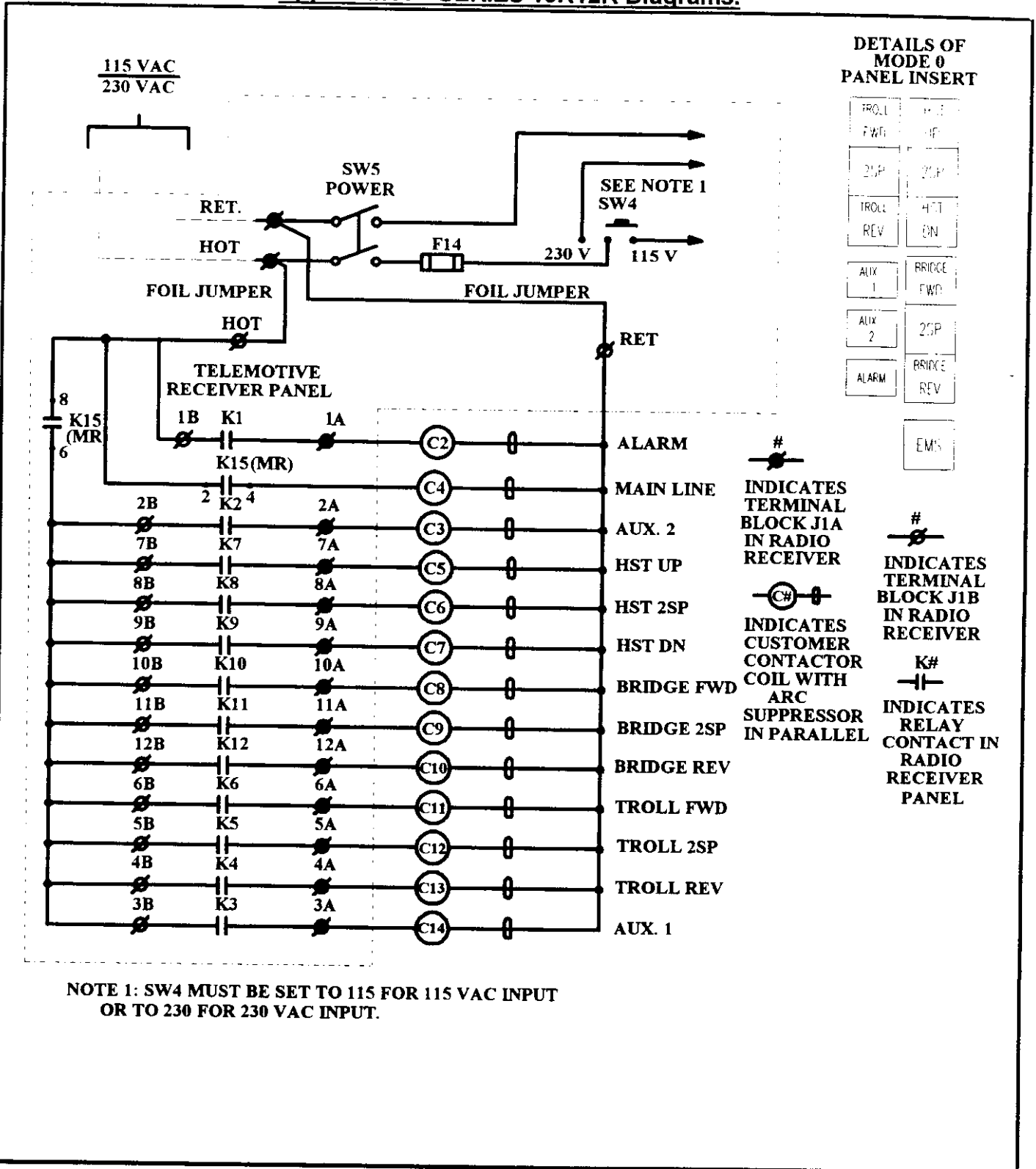


FIGURE 7-1. LOCATION OF SWITCHES AND JUMPERS



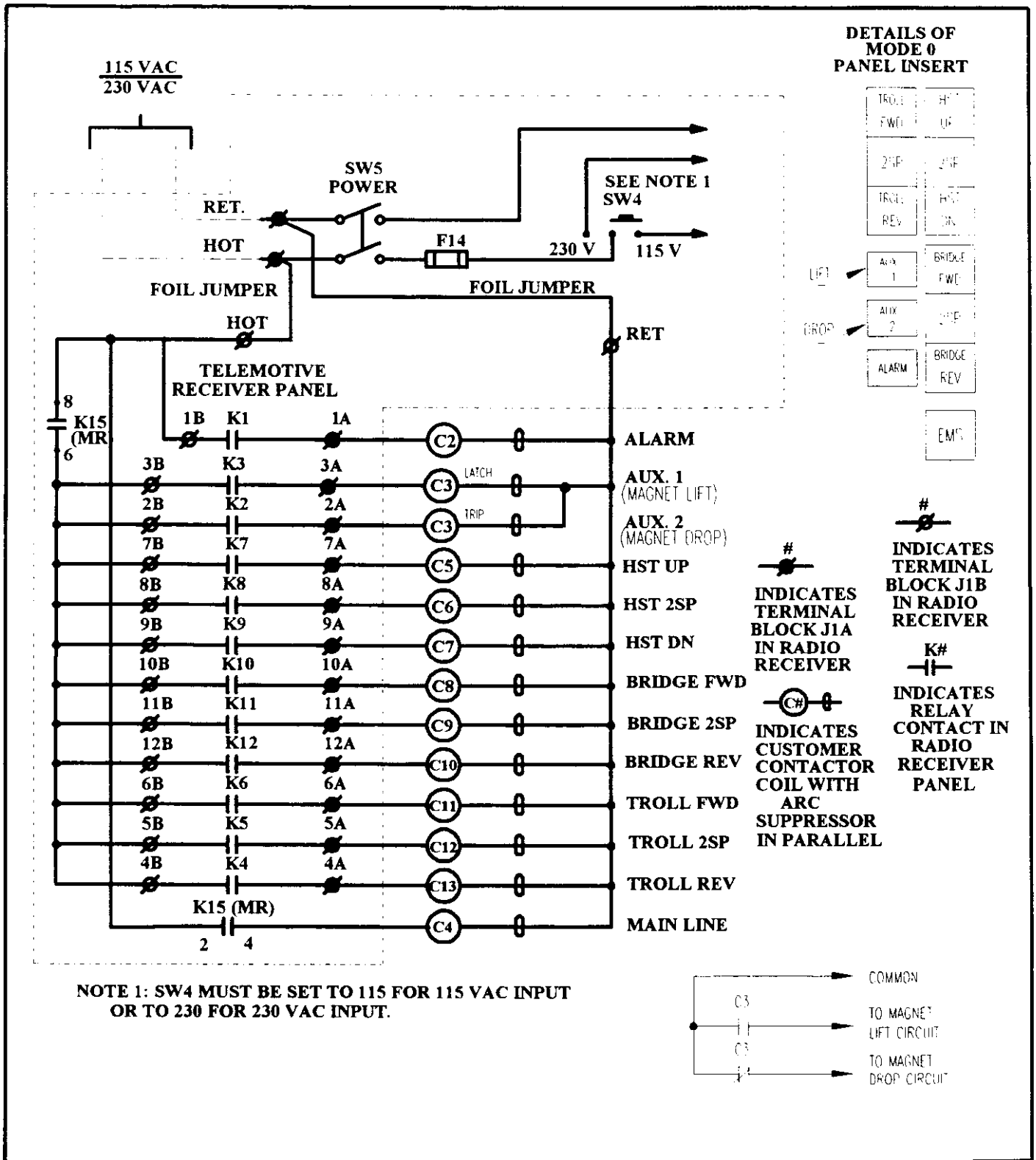
Appendix A - SERIES 10K12R Diagrams.



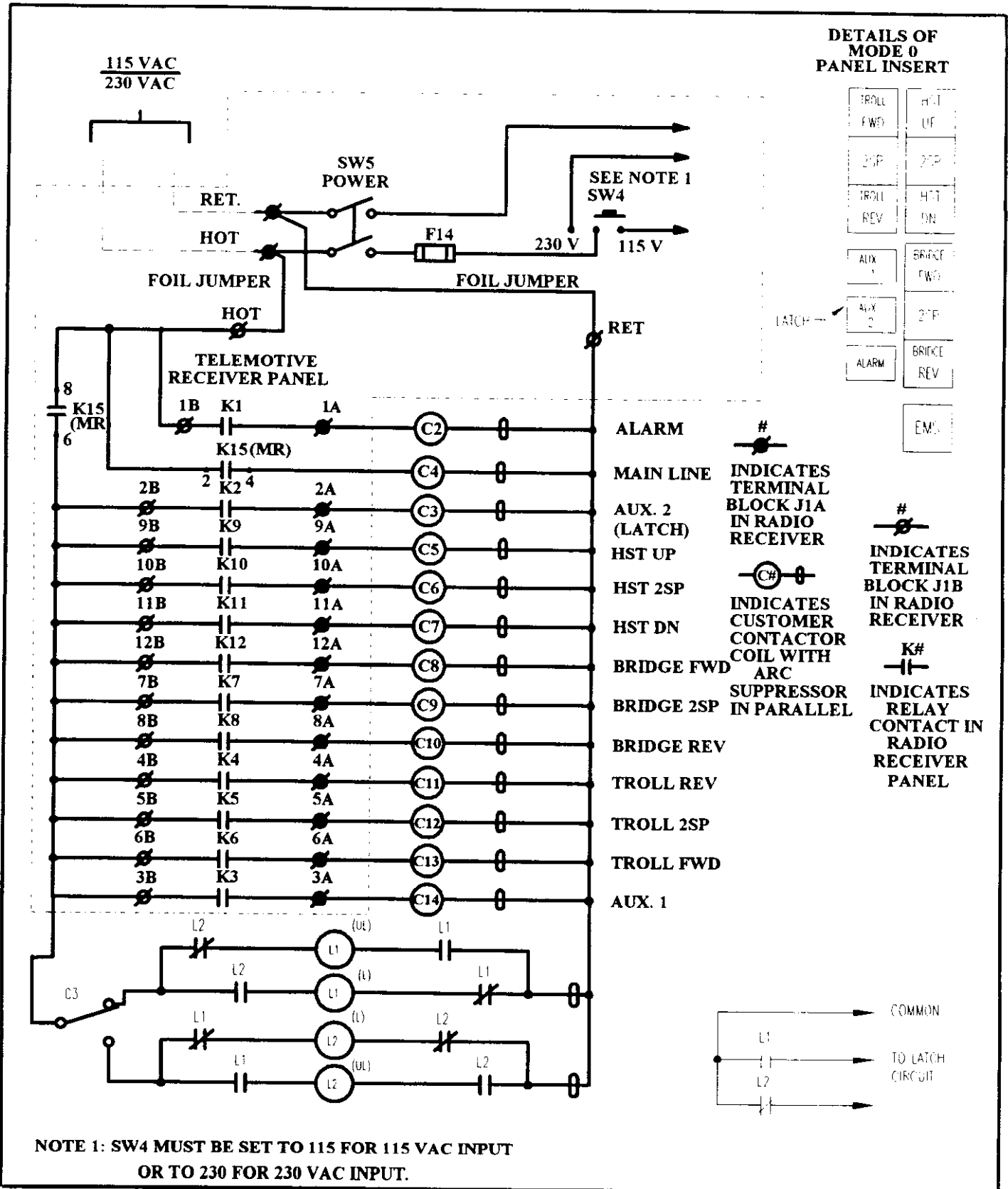
NOTE 1: SW4 MUST BE SET TO 115 FOR 115 VAC INPUT OR TO 230 FOR 230 VAC INPUT.

STANDARD TWO SPEED INTERFACE

D(21)

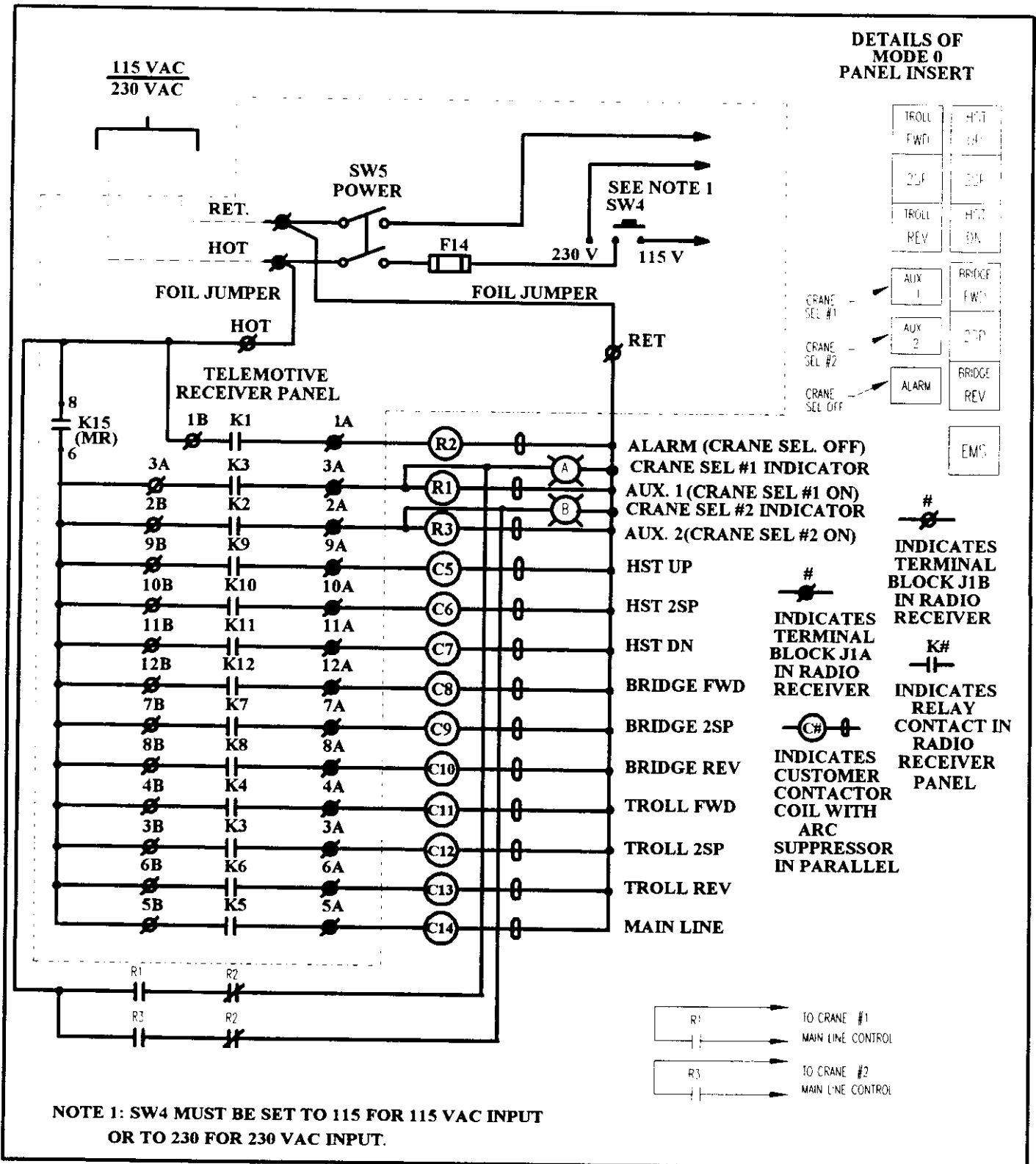


STANDARD TWO SPEED INTERFACE WITH MAGNET LIFT/DROP



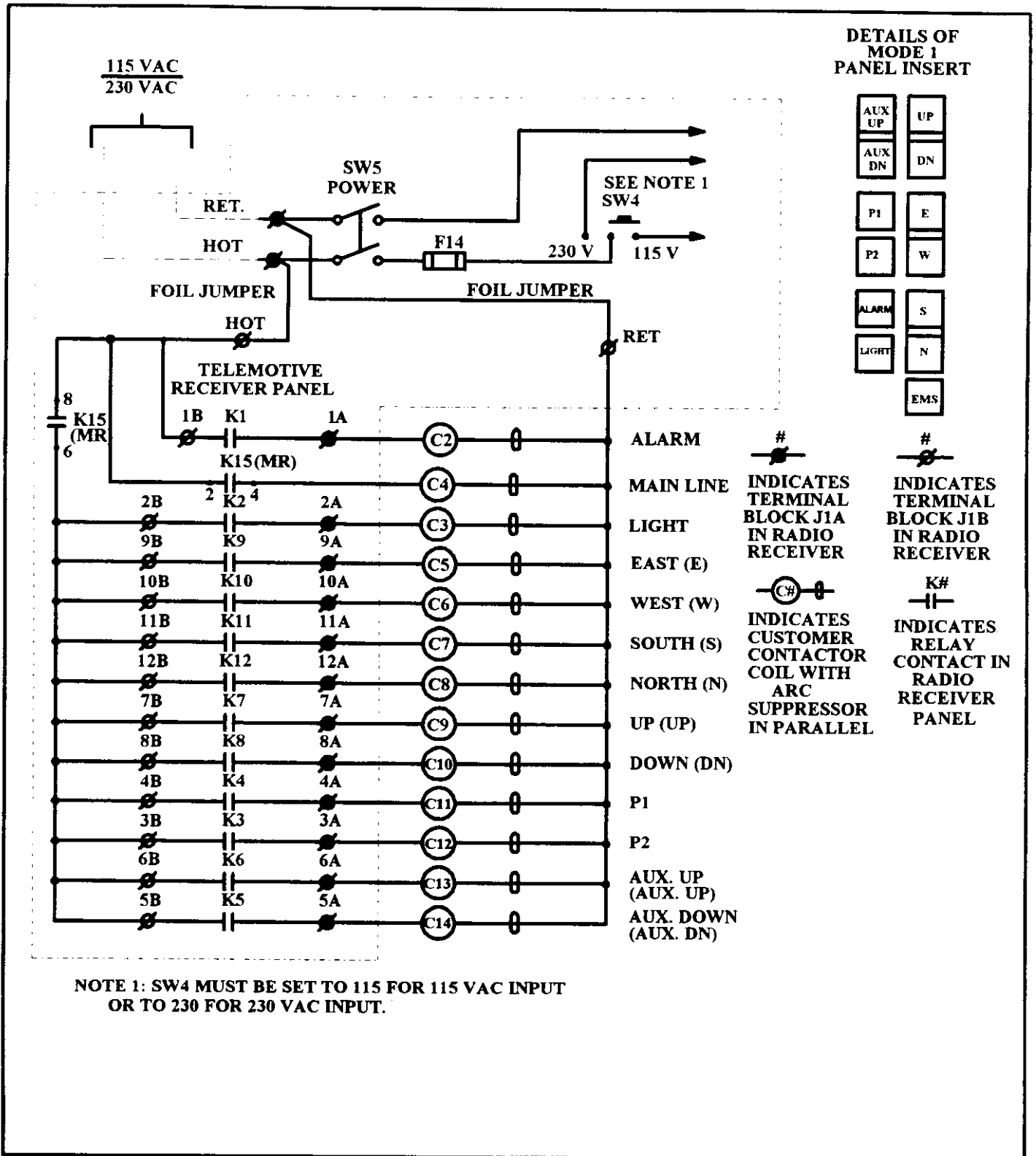
STANDARD TWO SPEED INTERFACE W/FULL LATCH (USES 1 CHANNEL)

D(22)



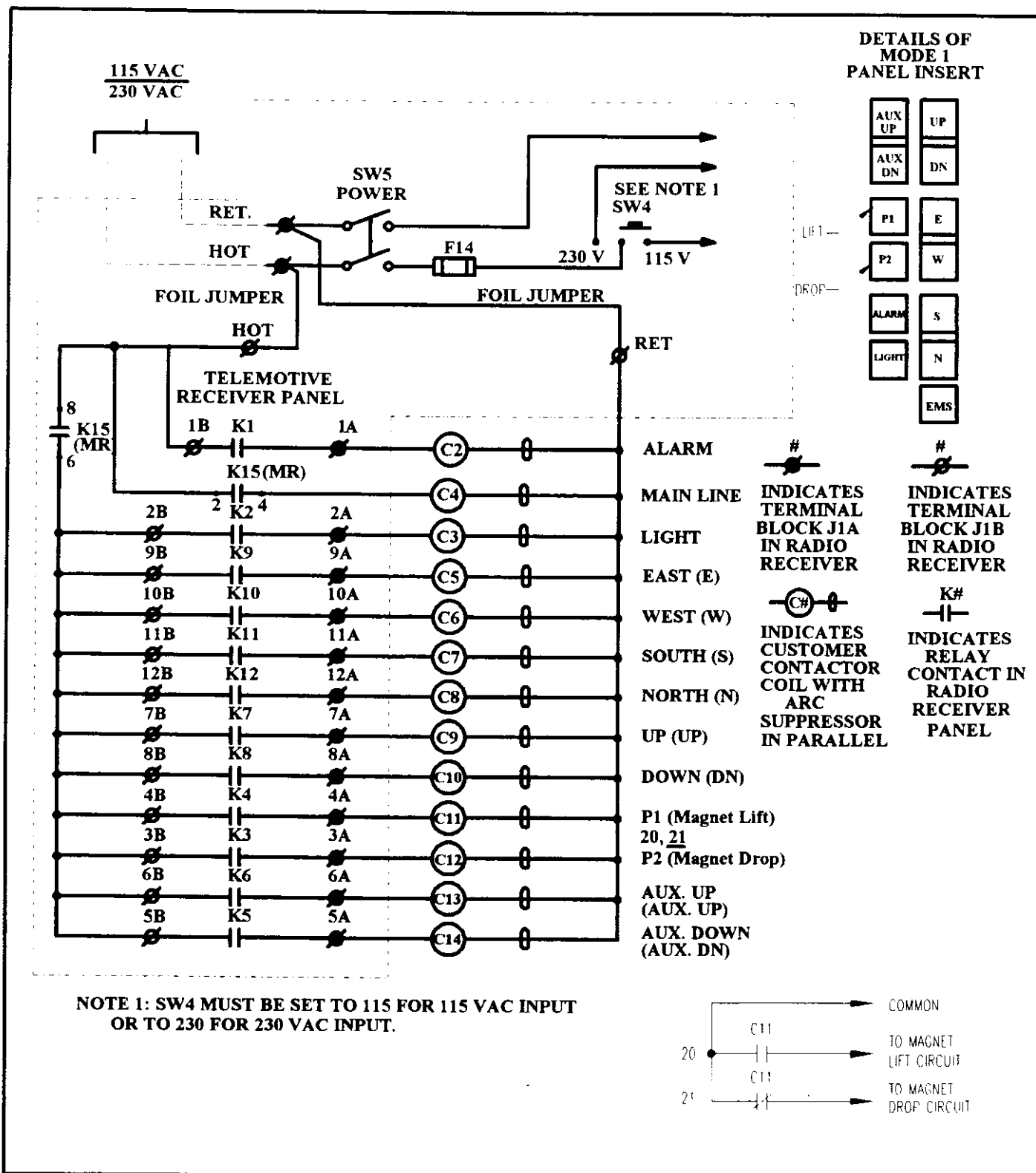
STANDARD TWO SPEED INTERFACE WITH CRANE SELECT

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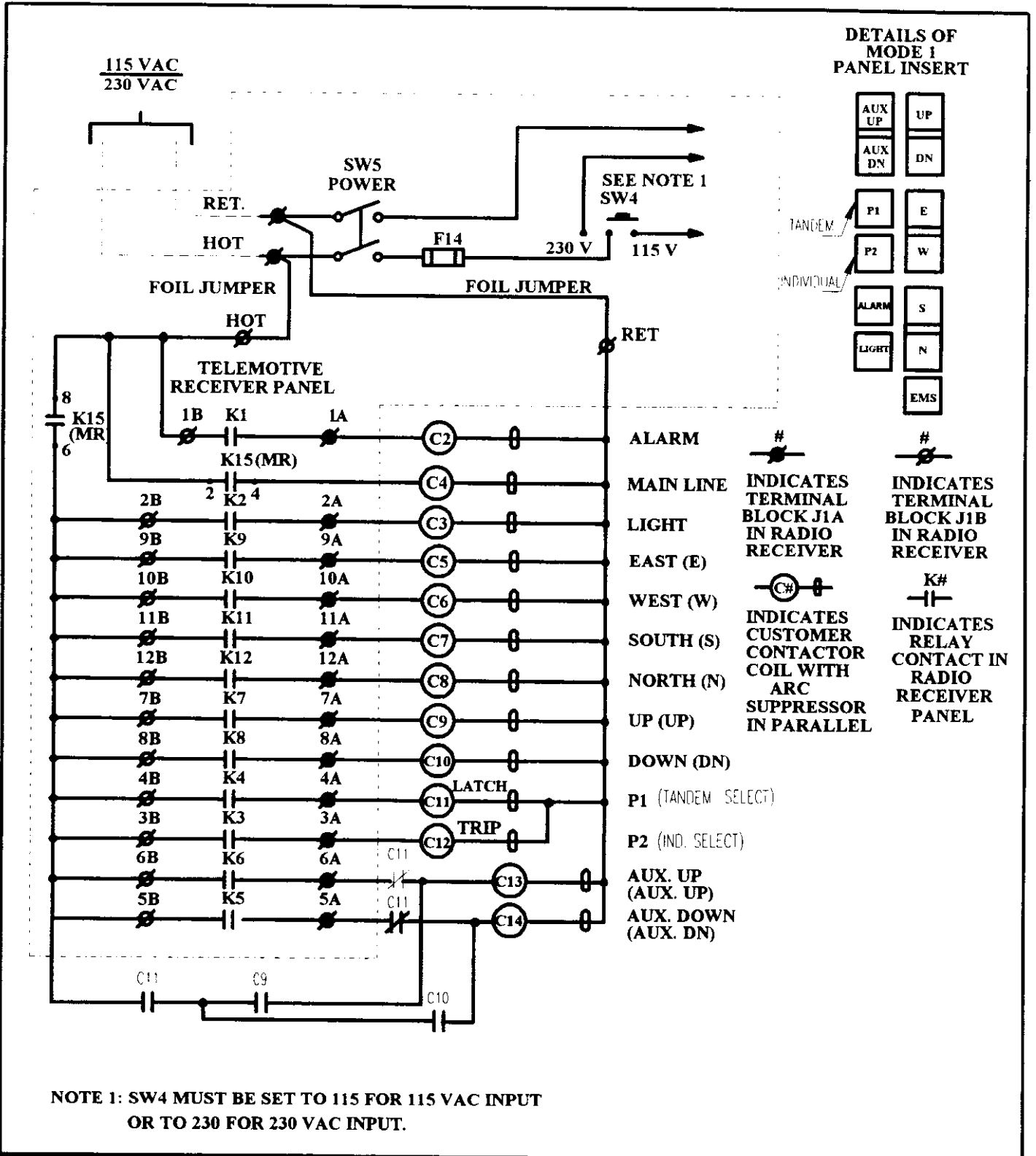


STANDARD SINGLE SPEED INTERFACE

D(23)

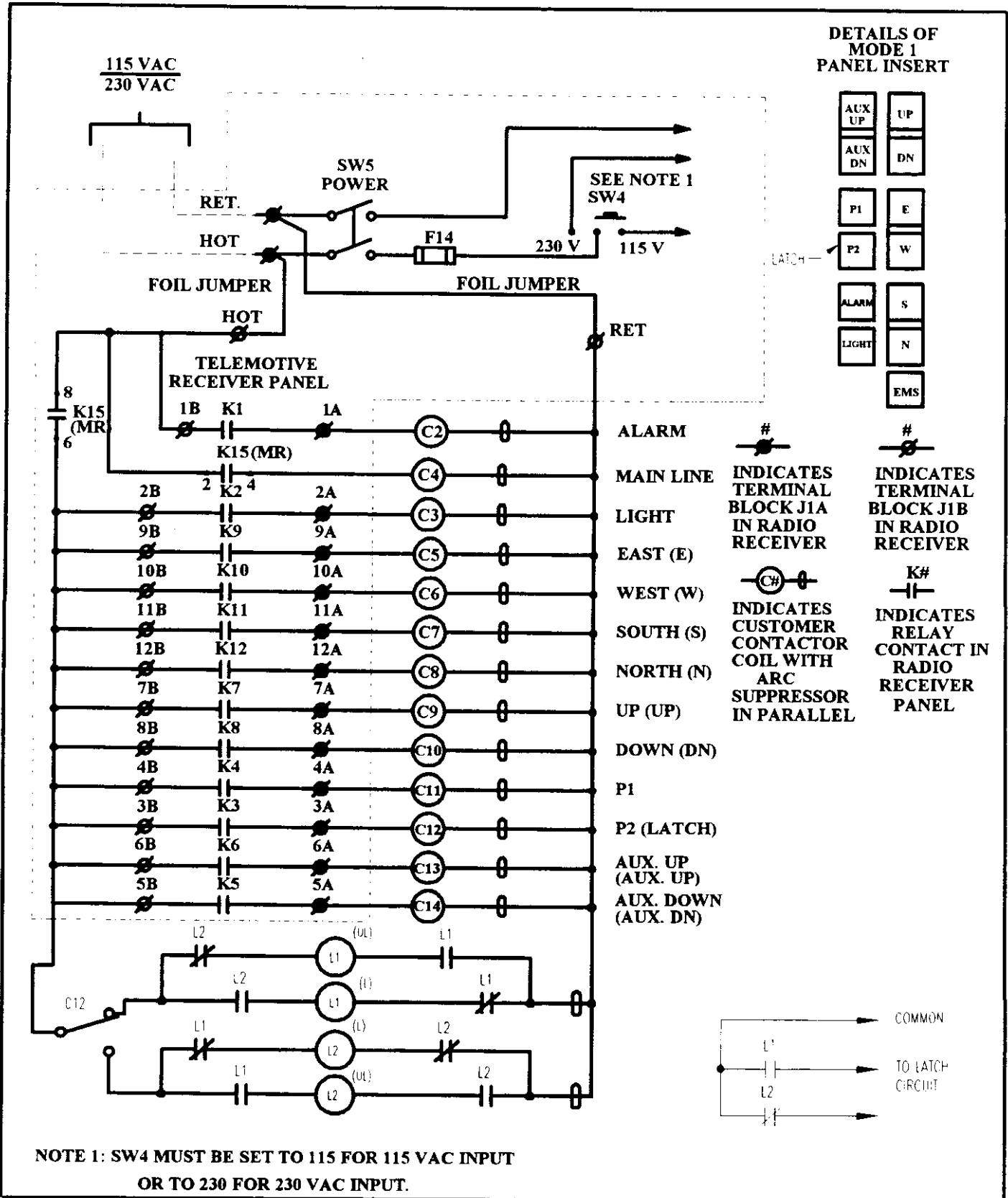


STANDARD SINGLE SPEED INTERFACE WITH MAGNET LIFT/DROP



STANDARD SINGLE SPEED INTERFACE WITH TANDEM

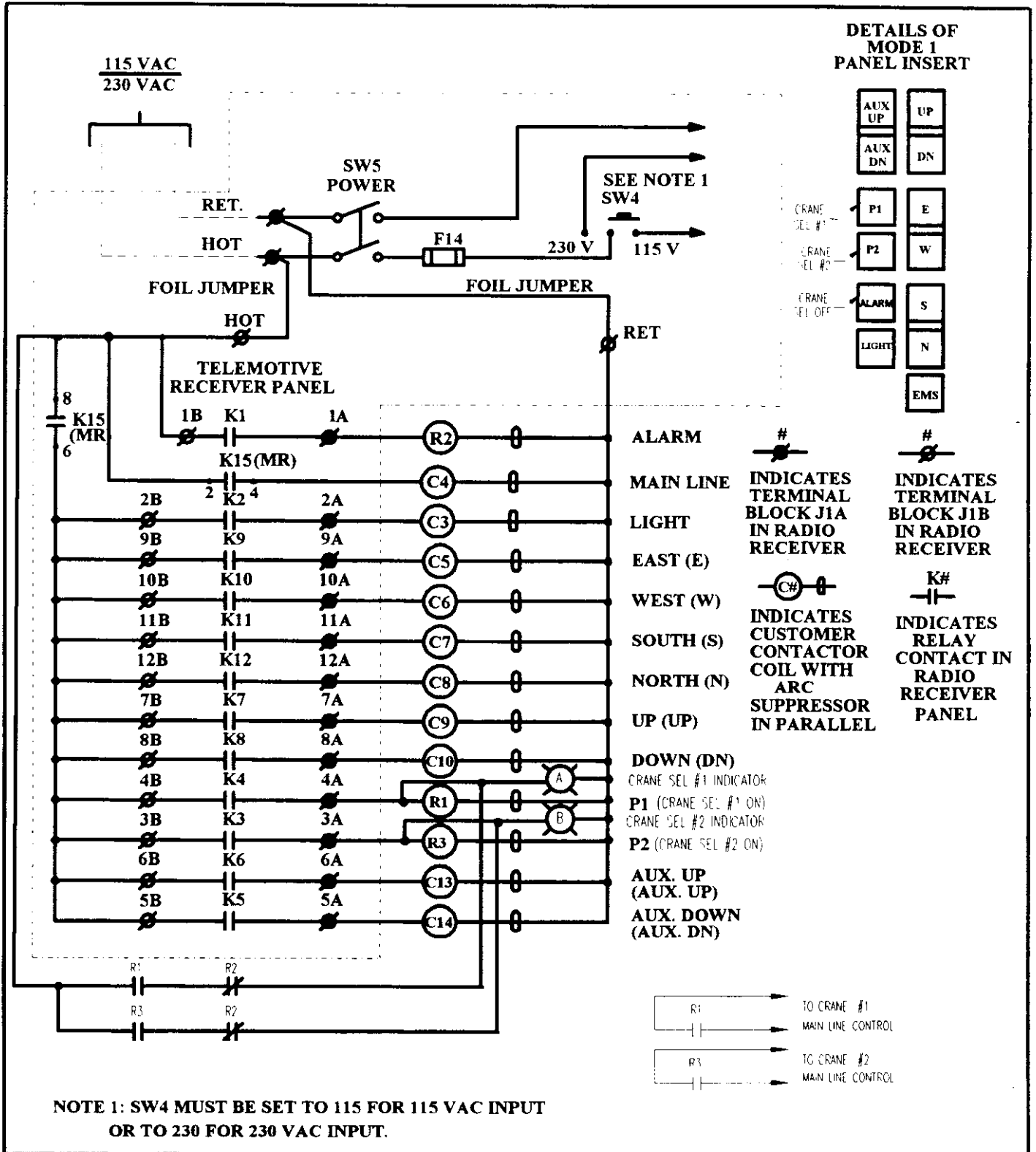
D(24)



STANDARD SINGLE SPEED INTERFACE W/FULL LATCH (USES 1 CHANNEL)

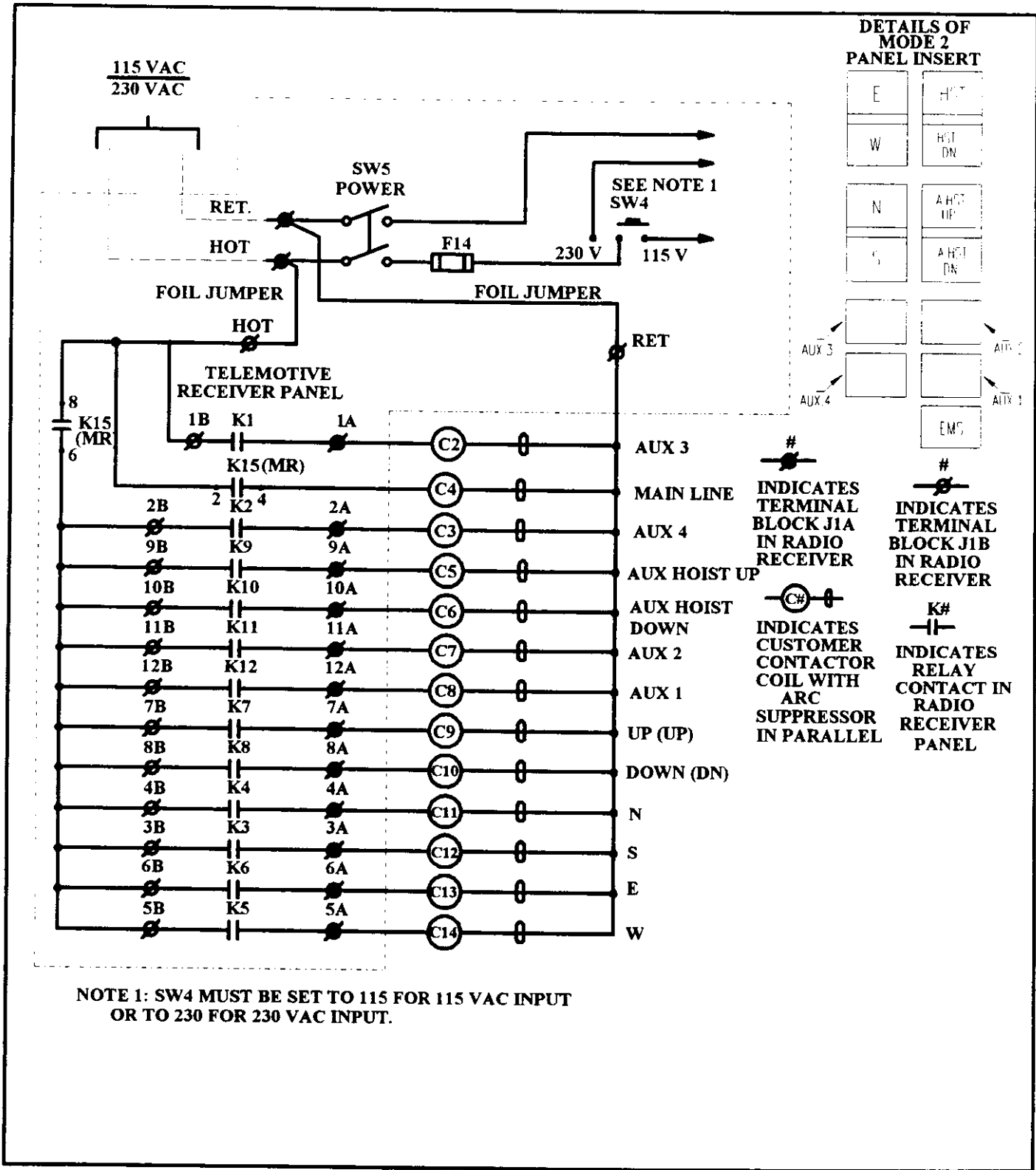


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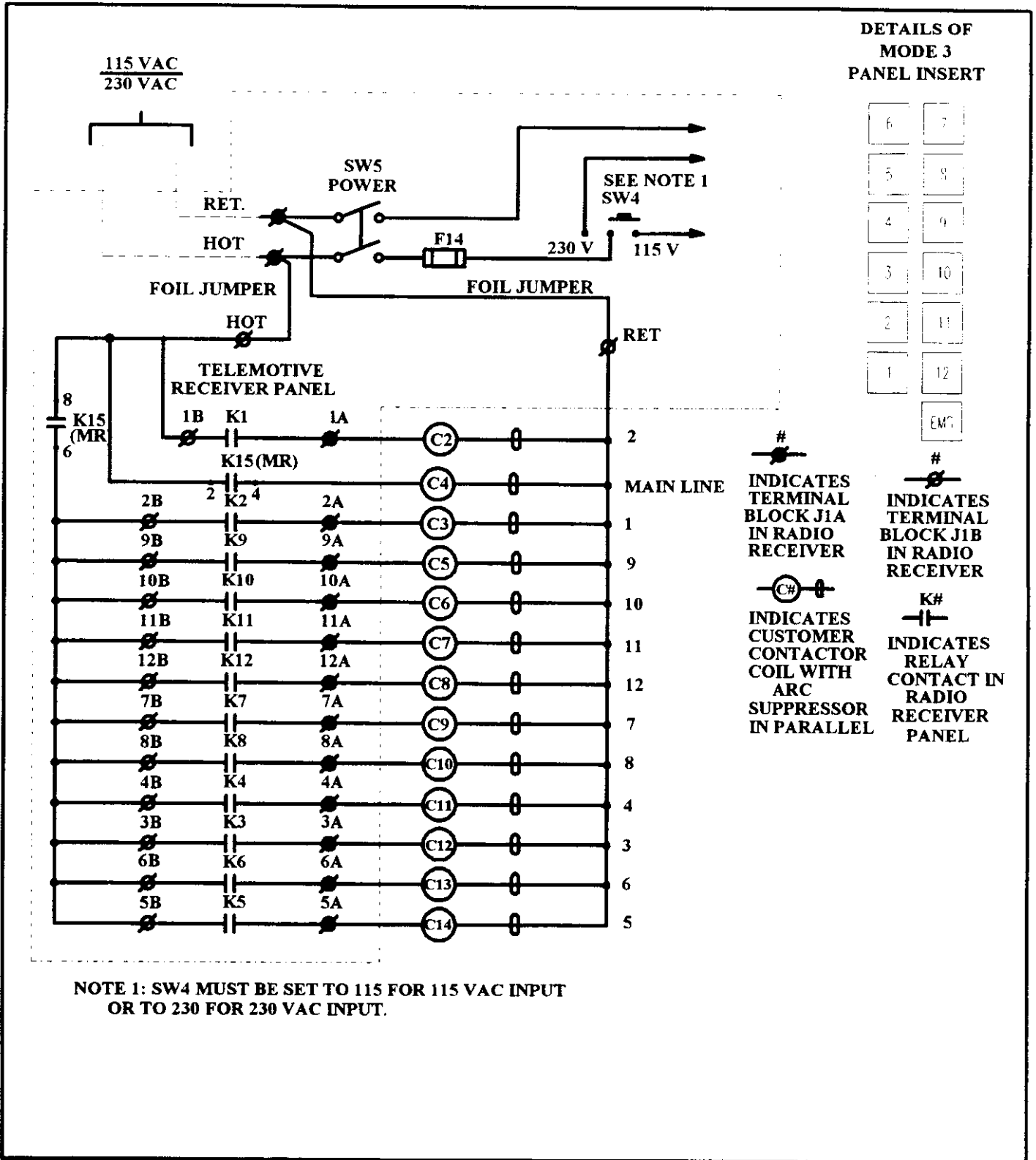
STANDARD SINGLE SPEED INTERFACE WITH CRANE SELECT

D(25)



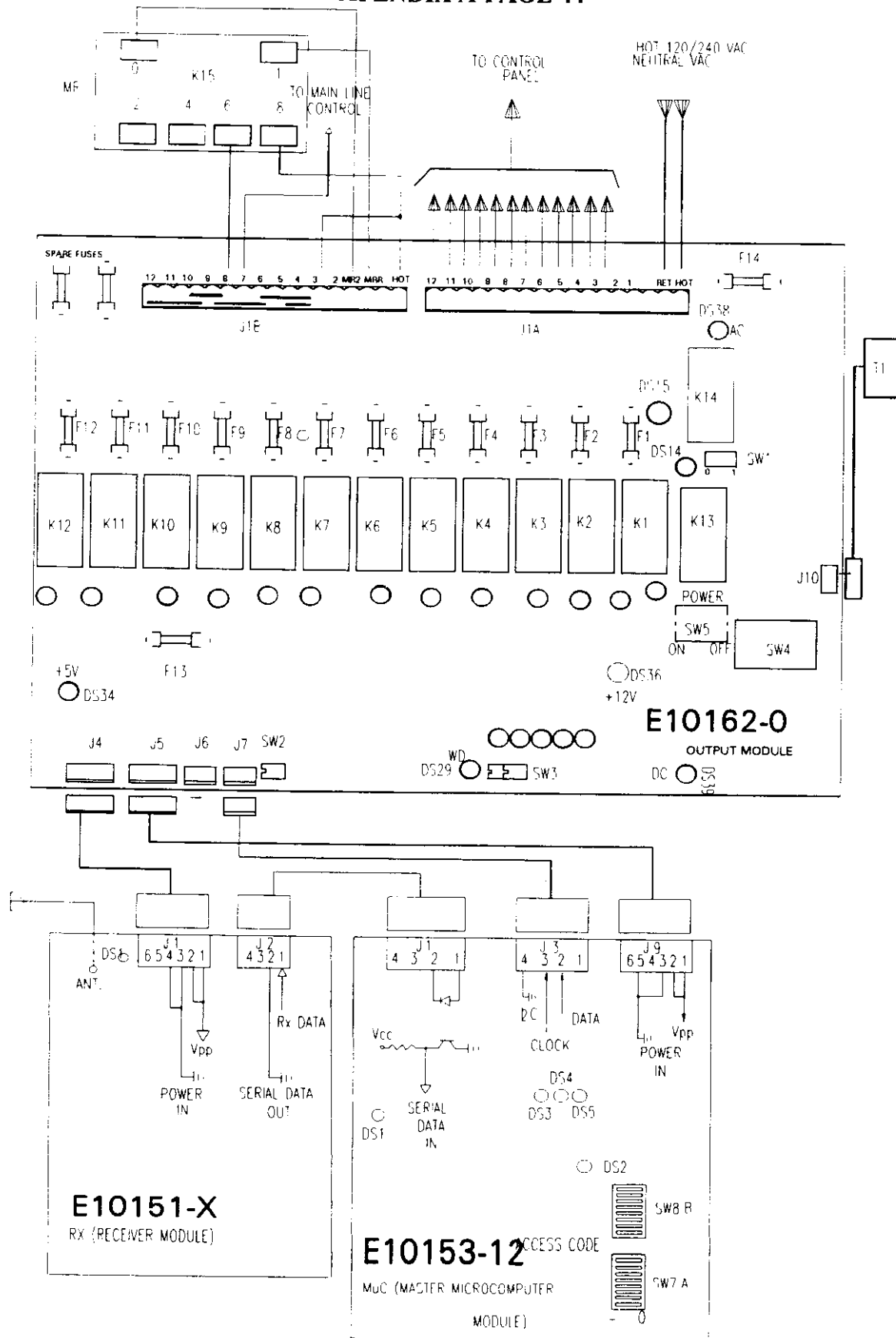
STANDARD SINGLE SPEED INTERFACE WITH FOUR AUX.

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STANDARD SINGLE SPEED INTERFACE NUMERIC PANEL

APPENDIX A PAGE 44



INTERCONNECT DRAWING

# Appendix B

## 10K12 PENDENT TRANSMITTERS (10K12OM01P3)

### SECTION 1.0 OVERVIEW

The 10K12 PENDENT TRANSMITTER is a new enhancement to the Telemotive 10K12 line of products. It adds to the lineup an industrial pendent style transmitter for increased durability in the Industrial Environment.

A major improvement in control capabilities has been achieved with the addition of two-speed switches for motion control. These switches provide a tactile de-tent not available with a membrane keyboard.

Two versions of the 10K12 PENDENT TRANSMITTER are available.

- A SINGLE-SPEED TRANSMITTER (10K12OM01P3)
- A TWO-SPEED TRANSMITTER (10K12OM02P3)

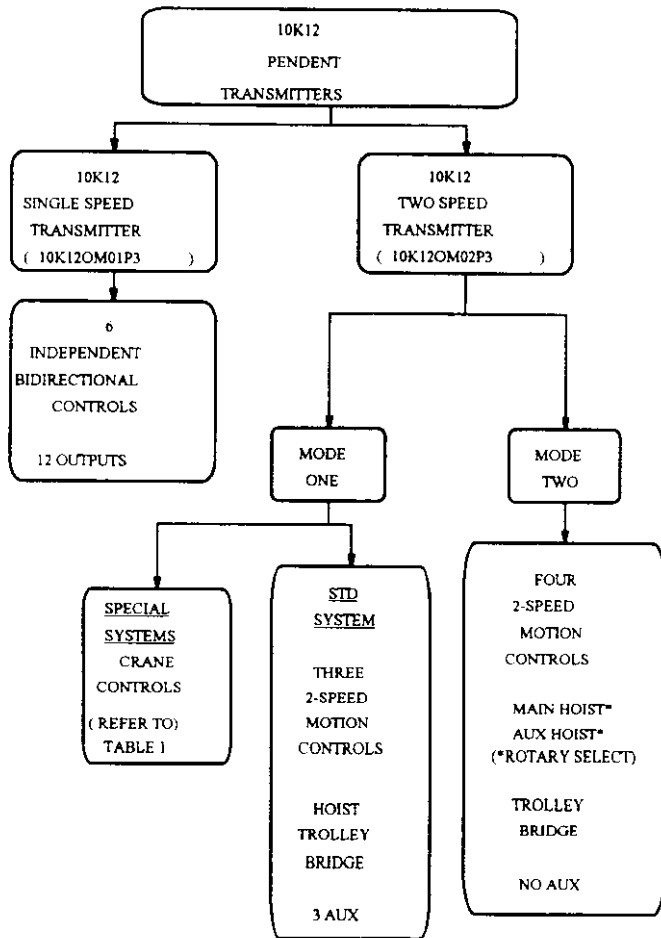


Chart 1

## (10K12OM02P3)

These new transmitters are compatible with the existing 10K12 Systems.

An additional feature for two speed systems only is the ability to select between several popular crane control configuration without the need of addition external hardware.

### SECTION 1.1 THE SINGLE SPEED TRANSMITTER

The 10K12 single speed transmitter comes with the following switch hardware.

- 1) Three 2-speed pushbutton switches (software configured to operate as single speed switches)
- 2) Three momentary, 3-position ( center OFF ) toggle switches.

Six independent bi-directional functions are available for a total of 12 output controls.

No special crane control configurations are available for the single speed pendent transmitter. The transmitter is ready to use.

### SECTION 1.2 THE TWO-SPEED TRANSMITTER

The 10K12 two-speed transmitter comes with the following switch hardware.

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

The 10K12 two-speed transmitter may be configured to operate in two distinct modes, selectable by an internal dip switch.

**SECTION 1.2.1 TRANSMITTER MODE ONE DESCRIPTION**

Configured in this mode the transmitter is able to control

**THREE 2-SPEED MOTION CONTROLS**  
and  
**0-3 AUXILIARIES**

Available motion functions are

- Hoist**
- Trolley**
- Bridge**
- AUX 1\***
- AUX 2\***
- AUX 3\***

\*The number of auxiliaries available will depend on the crane control configuration selected. **TABLE 1** give all of the available special configurations. In the future more may be added.

**SECTION 1.2.2 TRANSMITTER MODE TWO DESCRIPTION**

Configured in this mode the transmitter is able to control

**FOUR 2-SPEED MOTION CONTROLS**  
and  
**NO AUXILIARIES**

Available motion functions are

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

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

- 1) **H1** (Hoist)
- 2) **H2** (Aux Hoist)
- 3) **B** (Tandem Hoist & Aux Hoist)

For applications that do not want Tandem Hoists, Tandem may be de-selected by a dip switch in the transmitter.

*The transmitter comes from the factory configured as a MODE 1 system with std outputs configuration:*

**THREE MOTION CONTROLS**  
and  
**3 AUXILIARIES**

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

If this configuration does not support you crane controls go to **TABLE 1** to determine which of the available con-figurations best supports your crane controls. Then 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**

To configure the transmitter the following steps should be followed.

**DETERMINE THE DESIRED CONFIGURATION BEFORE BEGINNING THE TRANSMITTER SETUP.**

- 1) Determine whether Mode 1 or Mode 2 is to be implemented.
- 2) If a crane crane control configuration other then the standard version is needed, then chose **Mode 1** and determine which of the available crane control configurations is desired from **TABLE 1**.

- 3) If an aux hoist is needed then chose **Mode 2** and determine if tandem is desired..

**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.

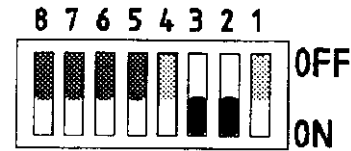
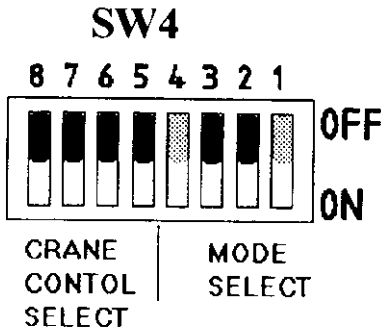
**(SW1,SW2,SW4)**

**NOTE**

**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.**

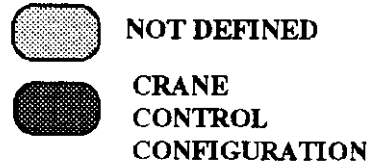
**APPENDIX B PAGE 47**

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



This is all that is required to setup **MODE 2**

3) Replace bottom cover and screws



**SECTION 2.1 CONFIGURING THE TRANSMITTER FOR MODE 1**

1) In **Mode 1** leave mode select switches

*SW4-1 to SW4-4 OFF*

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*

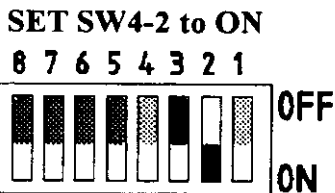
4) Replace cover and screws

**SECTION 2.2 CONFIGURING THE TRANSMITTER FOR MODE 2**

1) In **MODE 2** only SW4-2 and SW4-3 are active. leave

crane control select switch SW4-5 to SW4-8 OFF.

To set **MODE 2**:



this enables **MODE 2** with Tandem Select enabled.

2) If Tandem Select is to be disable then

**SET SW4-3 to ON**

**SECTION 3.0 OPERATING THE TRANSMITTER**

This following section describe the operation of the pushbutton and toggle controls on the transmitters and explains the diagnostic display.

With reference to **fig 1** (Single Speed Transmitter) or **fig 2** (The Two Speed Transmitter ), determine which transmitter is used in your system

**SECTION 3.1 ON/OFF CONTROL BUTTON**

The ON/OFF push-button is in the upper left hand corner of the transmitter.

The ON/OFF button toggles the transmitter ON or OFF.

If the transmitter is initially OFF, then pressing the ON/OFF button will turn the transmitter ON.

If the transmitter is ON then pressing the ON/OFF button will turn the transmitter OFF.

When the transmitter is turned ON or OFF the transmitter will transmit an ON or OFF command frame to the receiver for approximately 5 sec.

**SECTION 3.2 EMS CONTROL BUTTON**

An EMS push-button is at the top right hand corner of the transmitter. The EMS (EMERGENCY STOP) used to shutdown the system quickly. When the EMS button is pressed it will transmit an EMS command to the receiver. The receiver will shutdown and an EMS diagnostic LED on the RECEIVER OUTPUT MODULE will turn ON indicating receiver is in a EMS SHUTDOWN MODE.

When the transmitter EMS button has been pressed all function keys on the transmitter are disabled except the

ALARM

The receiver may be configured to output an ALARM command or to disable the ALARM command output during an EMS SHUTDOWN.

**IN CONFIGURATIONS WHERE OUTPUT 1 (ALARM) IS BEING USED AS A CONTROL FUNCTION OTHER THEN ALARM, THE RECEIVER SHOULD BE CONFIGURED TO DISABLE OUTPUT 1 DURING AN EMS SHUTDOWN CONDITION.**

To reset the transmitter and re-enable all the function switches the transmitter must be turn off and then on again.

If a control switch is detected to be stuck ON when the transmitter is turned ON the transmitter will transmit an EMS command and enter the EMS mode.

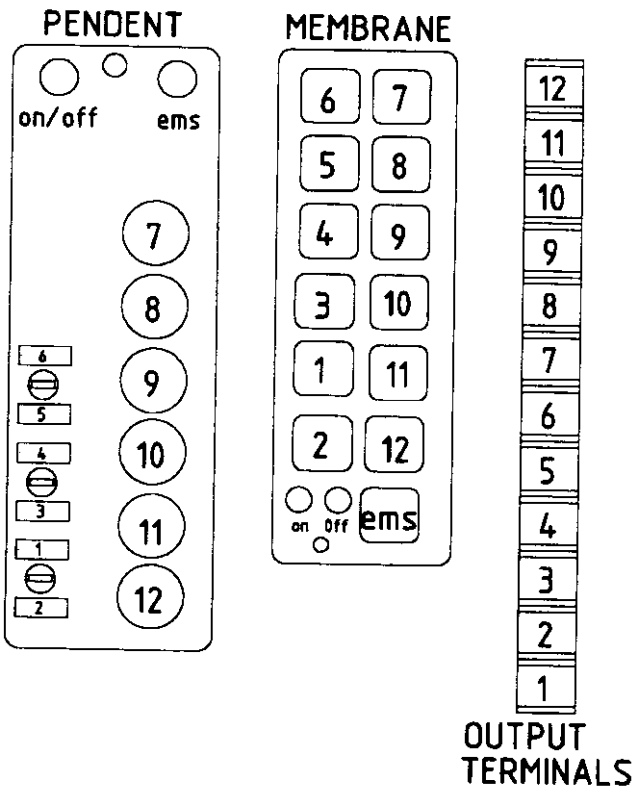


fig 1

Trolley(directional) 9-10  
 Bridge (directional) 11-12

When pressing a pushbutton switch two de-tents will be felt because two speed switches are used in both the single speed and two speed transmitters. In the single speed trans-mitter the software treats both positions as the same speed.

**SECTION 3.3.2 SINGLE SPEED TX TOGGLE SWITCHES**

With reference to Fig 1 each toggle switch is correlated to a pair of outputs. These are

- AUX1/AUX2 6/5
- AUX3/AUX4 4/3
- AUX5/AUX6 1/2

**NOTE: AUX5 IS ALSO DESIGNATED AS THE ALARM FUNCTION**

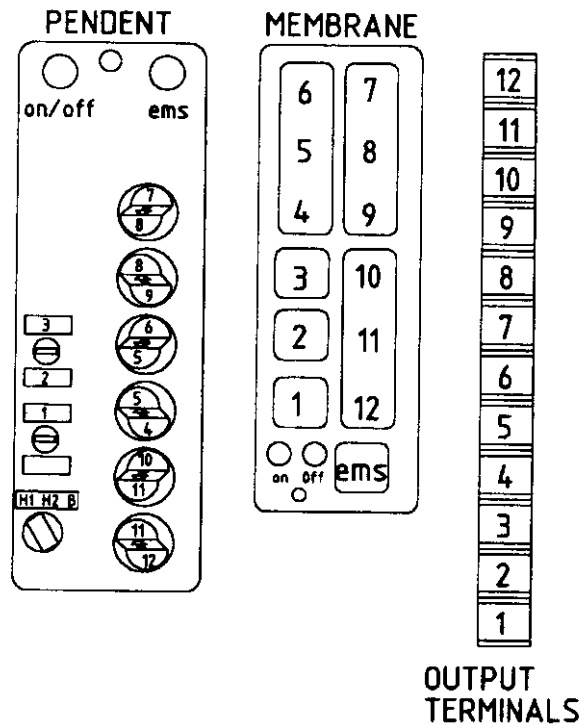


fig 2

**SECTION 3.3.1 SINGLE SPEED TX PUSHBUTTON SWITCHES**

With reference to Fig 1, each pushbutton is correlated to an output in the receiver. Each pushbutton pair is internally locked-out so that two incompatible commands can not be called simultaneously.

Commands that can not be called simultaneously are

Hoist (directional) 7-8

**SECTION 3.4.1 TWO SPEED TX PUSHBUTTON SWITCHES**

With reference to Fig 2, for the standard configuration each pushbutton pair is correlated to three output in the receiver. For special configurations this is not necessarily the case. Consult Table 1 for the correct outputs. Only second speed and auxiliaries are affected by this. In all cases the directionals remain the same. Each pushbutton



**APPENDIX B PAGE 49**

pair is internally locked-out so that two incompatible commands can not be called simultaneously.

Commands that can not be called simultaneously are

- Hoist(directionals)      7-9
- Trolley(directionals)    4-6
- Bridge(directionals)    10-12

and the AUX HOIST simultaneously.

This is referred to as Tandem Operation.

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

Each switch has a de-tent for first and second speed.

In MODE 2 no auxiliary functions are available.

**SECTION 3.4.2 TWO SPEED TX TOGGLE SWITCHES**

**NOTE: In MODE 1 the toggle switches are functional and the rotary switch is not functional**

With reference to Fig 2. (For a MODE 1 transmitter) each toggle switch is correlated to a pair of outputs. These are

- AUX1/AUX2      3/2
- AUX3/AUX4      1/not functional

AUX1,AUX2 and AUX3 are available in the standard configuration. For special configurations this is not necessarily the case. Consult Table 1 for the available outputs.

**NOTE: AUX3 IS ALSO DESIGNATED AS THE ALARM FUNCTION BUT IS ONLY AVAILABLE IN THE STANDARD CONFIGURATION.**

**SECTION 3.4.3 TWO SPEED TX ROTARY SELECTOR SWITCH**

**NOTE: In MODE 2 the Rotary Selector Switch is functional and the aux switches are not functional**

In Mode 2 the 3 auxiliary outputs have been redefined as the AUX HOIST. The HOIST pushbutton pair can control each hoist separately or simultaneously by the use of the selector switch.

If the rotary selector switch is in the **H1** position then the hoist pushbutton pair controls the MAIN HOIST.

If the rotary selector switch is in the **H2** position then the hoist pushbutton pair controls the AUX HOIST.

If the rotary selector switch is in the **B** position then the hoist pushbutton pair controls both the MAIN HOIST

**SECTION 3.5 THE DIAGNOSTIC DISPLAY**

A diagnostic led at the top center of the transmitter dis-plays the state of the transmitter.

When transmitter is OFF the LED will be OFF. If the battery is near the end of its useful life the LED will not turn ON when the transmitter is enabled. The transmitter will continue to operate in this condition for a while, possibly with reduced range., but the battery should be replaced as soon as possible.

When the transmitter is ON the LED will flash ON/OFF at a steady rate. When the transmitter is transmitting a ON/OFF/EMS command or a CONTROL FUNCTION to the receiver the flash rate will increase.

If the LED will not turn ON when the battery is known to be good or the LED will not switch to the fast rate when a key is pressed the transmitter is defective and should be replaced.

**SECTION 4.0 MAINTENANCE**

The transmitter is very rugged and should not require any significant maintenance other than an occasional inspection for case integrity and periodic replacement of the battery.

**SECTION 4.1 TX UNIT BATTERY REPLACEMENT.**

The transmitter units are powered by a 7.5 VDC battery pack.

**Telemotive part number  
BT10KP-0**

Alkaline type batteries are recommended, but recharge-able NiCad batteries are available.

Replace discharged batteries as follows:

- 1) Open the battery compartment door by rotating the door latch clockwise or counter clockwise to the "open" position. Remove the door.
- 2) Remove the old battery pack. Note orientation.

DL29)

## APPENDIX B PAGE 50

3)Place new battery in the same orientation.

Ensure battery pack is completely positioned in its holder, and that the battery latch is locked forward over the battery pack.

4)Replace battery door, and rotate the door latch to the closed position.

### SECTION 4.2 PUSHBUTTON INSERT REPLACEMENT

The pendent transmitter comes assembled with a complement of standard inserts. In addition a package of insert decals containing additional nomenclature is supplied with the transmitter.(**telemotive part number N10671-0**)

If the standard nomenclature is not suitable for your application the insert nomenclature may changed with

one of the supplied labels.

To remove an insert

1) Press inwardly around and behind the plasticinsert. Lift back the retaining rubber bezel around the insert to cause it to pop out.

2) Peel off the old decal on the underside of the clear plastic insert and replace with the new decal.

3) Re-insert the plastic insert into the rubber boot making sure the rubber retaining bezel of the boot has reformed around the insert.

## SECTION 5.1 TRANSMITTER UNIT SPARE PARTS 10K12OM01P3, 10K12OM02P3

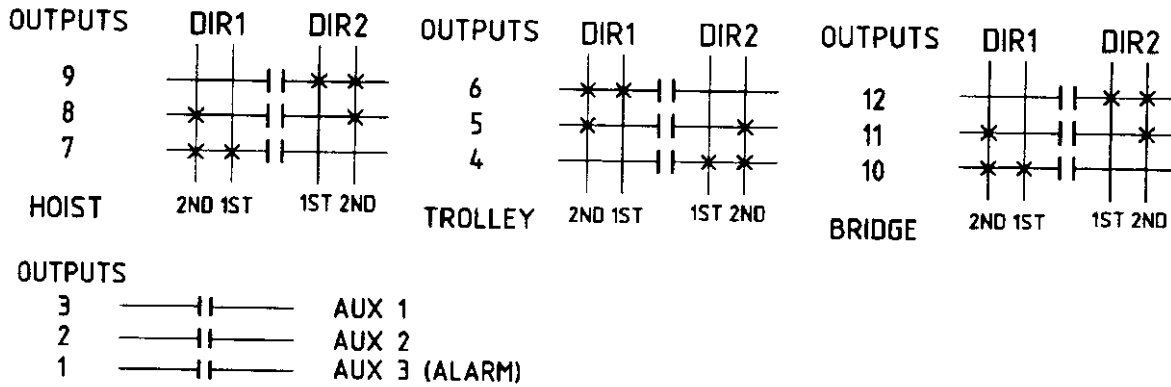
<u>PART NUMBER</u>	<u>DESCRIPTION</u>
A10667-3	REPLACEMENT BOTTOM CASE ASSEMBLY
A10669-0	BATTERY DOOR ASSEMBLY
BT10KP-0	BATTERY, ALKALINE (STANDARD)
BT10KP-1	BATTERY, NiCad (OPTIONAL)
E10668-2	REPLACEMENT TOP CASE ASSEMBLY
E10671-0	DUAL NiCad BATTERY CHARGER (OPTIONAL)
MP10666-0	KNOB, 1/2" DIA, BLK
MP10670-0	BATTERY HOLDER ASSEMBLY
MP10671-1	BOOT, PENDENT SWITCH, "UP"
MP10671-2	BOOT, PENDENT SWITCH, "DOWN"
MP10671-7	BOOT, PENDENT SWITCH, "NORTH"
MP10671-8	BOOT, PENDENT SWITCH, "SOUTH"
MP10671-9	BOOT, PENDENT SWITCH, "EAST"
MP10671-10	BOOT, PENDENT SWITCH, "WEST"
MP10678-0	SHOULDER STRAP ASSEMBLY
N10671-0	LABELS, SWITCH BOOT PKG.
S1026-0	SWITCH, PUSHBUTTON SP, MOM. BLK
S1026-2	SWITCH, PUSHBUTTON SP, MOM. RED
S1039-2	SWITCH, PUSHBUTTON 2SPD, 5V OPTO-ELEC
S1040-0	SWITCH, ROTARY SP3T .2A
S1041-0	SWITCH, TOGGLE SPDT CENTER OFF

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TABLE 1(a)

Crane Control Type Selection: 10K12-2spd TYPE 0

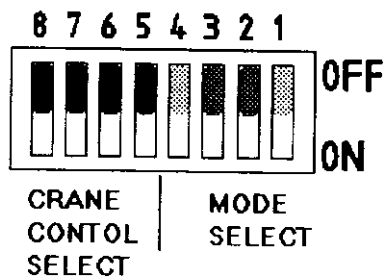
*STANDARD CONFIGURATION: ALL MOTIONS  
(single hoist, trolley, bridge; std config. 3 auxiliaries)*



*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

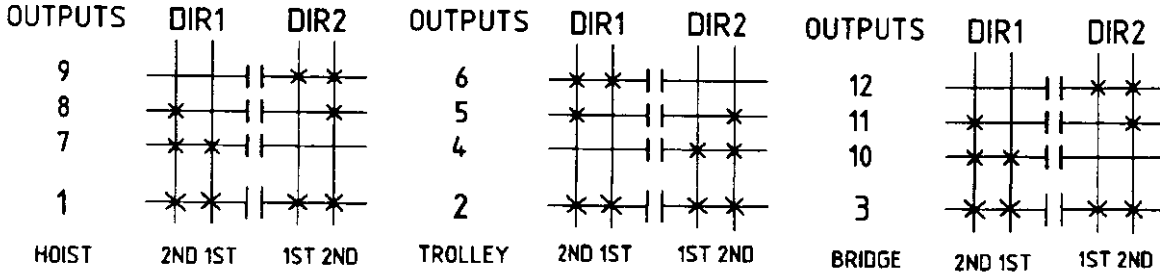


MODE SELECT

TABLE 1(b)

Crane Control Type Selection: 10K12-2spd TYPE 1

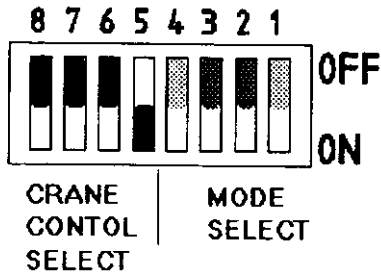
*2 SPEED WITH DIRECTIONAL CONTROL: ALL MOTIONS*



*Configuration Type Switch Select:*

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

<b>SWITCH SETTINGS:</b>	<b>TYPE</b>	<b>SW4-8</b>	<b>SW4-7</b>	<b>SW4-6</b>	<b>SW4-5</b>
	<u>1</u>	OFF	OFF	OFF	ON



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TABLE 1(c)

Crane Control Type Selection: 10K12-2spd TYPE 2

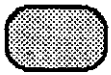
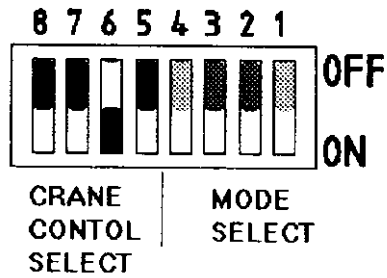
*2 SPEED, 2 WINDINGS: ALL MOTIONS*

OUTPUTS	DIR1	DIR2	OUTPUTS	DIR1	DIR2	OUTPUTS	DIR1	DIR2
9			6			12		
8			5			11		
7			4			10		
1			2			3		

*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
<u>2</u>	OFF	OFF	ON	OFF



NOT DEFINED

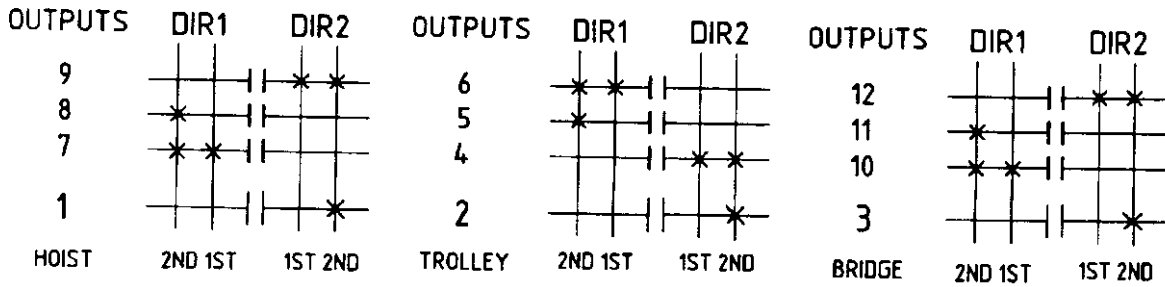


MODE SELECT

**TABLE 1(d)**

Crane Control Type Selection: 10K12-2spd *TYPE 3*

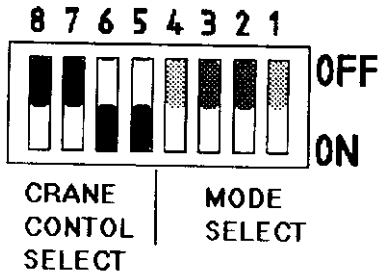
*ACCO. CONTROLS: ALL MOTIONS*



*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**  
    3      OFF      OFF      ON      ON

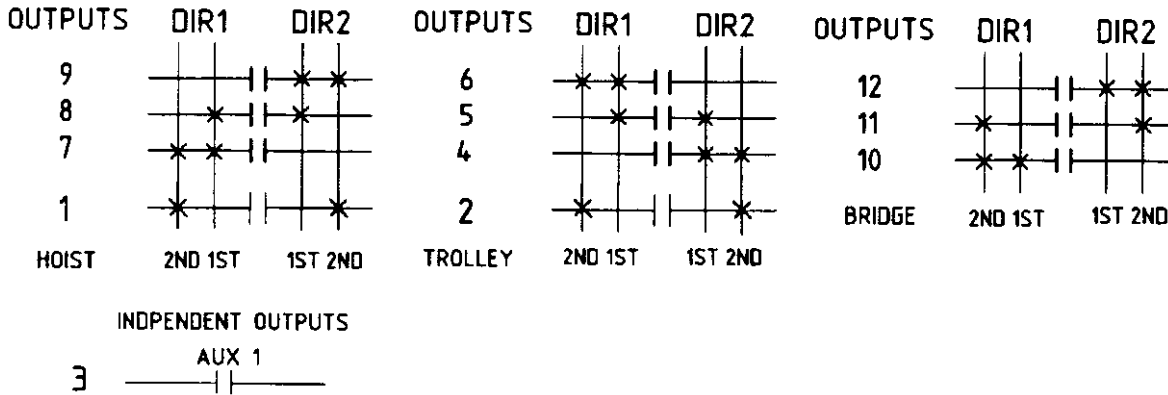


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TABLE 1(e)

Crane Control Type Selection: 10K12-2spd TYPE 4

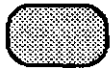
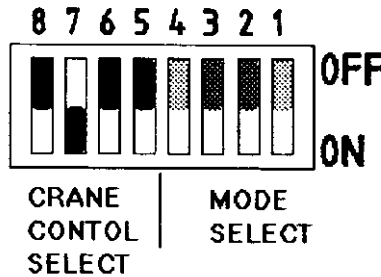
*P&H HOIST: 2 SPEED 2 WINDING HOIST AND TROLLEY:  
STD BRIDGE*



*Configuration Type Switch Select:*

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

<b>SWITCH SETTINGS:</b>	<b>TYPE</b>	<b>SW4-8</b>	<b>SW4-7</b>	<b>SW4-6</b>	<b>SW4-5</b>
	<u>4</u>	OFF	ON	OFF	OFF



NOT DEFINED

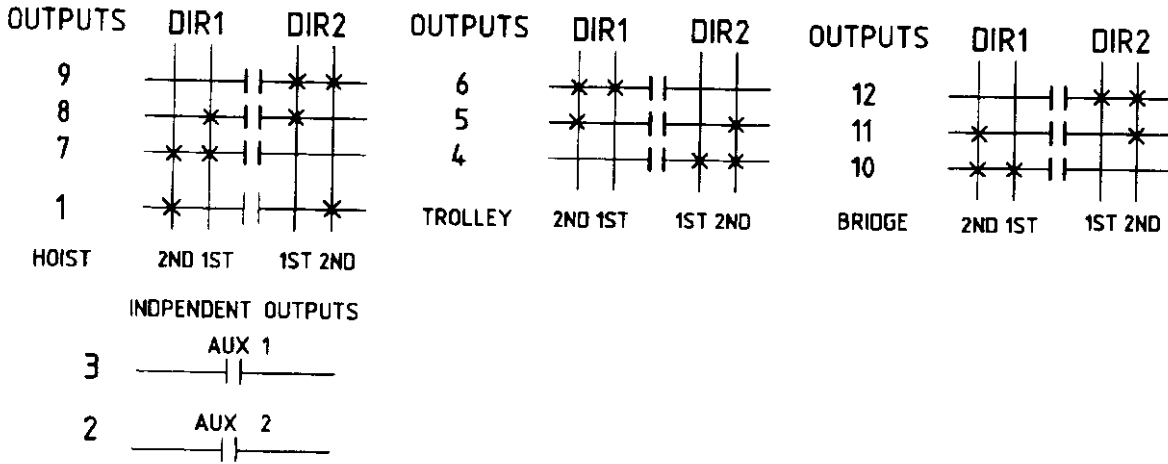


MODE SELECT

**TABLE 1(f)**

Crane Control Type Selection: 10K12-2spd *TYPE 5*

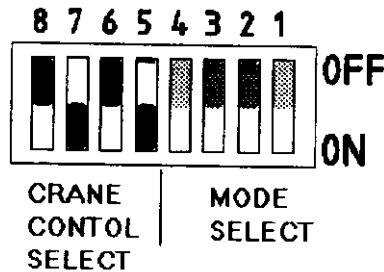
*P&H HOIST: 2 SPEED, 2 WINDING for HOIST:  
STD BRIDGE AND TROLLEY*



*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
<u>5</u>		OFF	ON	OFF	ON



NOT DEFINED



MODE SELECT



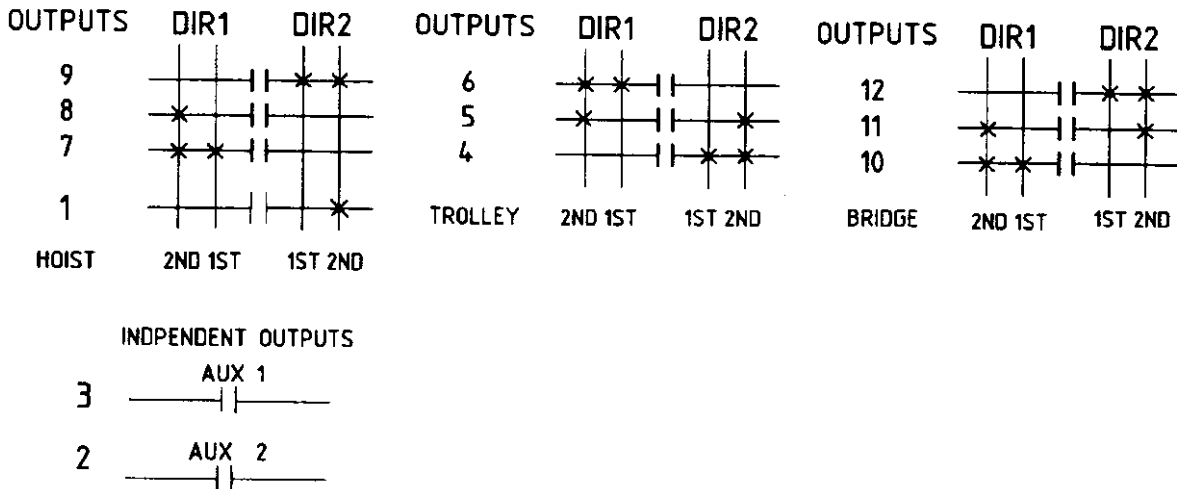
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TABLE 1(g)

Crane Control Type Selection: 10K12-2spd TYPE 6

*DEMAG: 2 SPEED 2 WINDINGS for HOIST:*

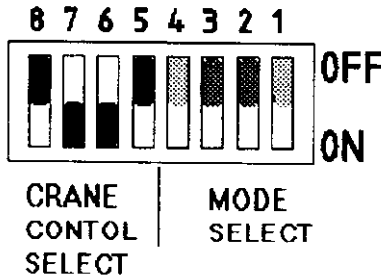
*STD BRIDGE AND TROLLEY*



*Configuration Type Switch Select:*

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

<b>SWITCH SETTINGS:</b>	<b>TYPE</b>	<b>SW4-8</b>	<b>SW4-7</b>	<b>SW4-6</b>	<b>SW4-5</b>
	<u>6</u>	OFF	ON	ON	OFF



## Appendix C

### Extended Crane Control Options for 10K12 Membrane Transmitter

The 10K12 Membrane transmitter is now available with extended crane control configurations similar to those provided by the 10K12 Pendant Transmitters. The new options are arranged into two new replacement CPU/PROMs for the transmitter microcomputer module. The first of these CPU/PROM #2 has four dip switch selectable configurations and the second CPU/PROM #3 has two dip switch selectable configurations.

Table 2 shows the available configurations and the CPU/PROM number designated to provide them.

The standard 2 speed transmitter comes with CPU/PROM #1 installed and has no extended crane control configurations. Its output configuration is shown in **TABLE 2a: TYPE 0.**

**For extended crane control configurations**

CPU/PROM#2 has four selections. See **TABLE 2b:TYPE 1** thru **TABLE2e:TYPE 4.**

CPU/PROM#3 has two selections. See **TABLE 2f:TYPE 5** thru **TABLE 2g:TYPE 6.**

If a configuration listed in tables 2b thru 2g is preferred over the standard configuration, contact the factory for a CPU/PROM replacement.

<b><u>TELEMOTIVE PART NUMBER</u></b>		
	<u>system roms with time-out</u>	<u>system roms without time-out</u>
CPU/PROM #1	<b>FW2785-0</b>	<b>FW2785-0N</b>
CPU/PROM #2	<b>FW2785-1T</b>	<b>FW2785-1N</b>
CPU/PROM #3	<b>FW2785-2T</b>	<b>FW2785-2N</b>

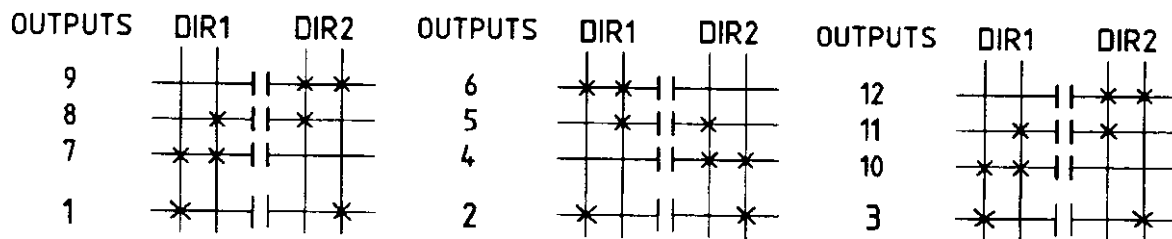




**TABLE 2(c)**

**Crane Control Type Selection: 10K12-2spd *TYPE 2***

*2 SPEED, 2 WINDINGS: ALL MOTIONS*

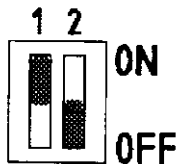


*Configuration Type Switch Select:*

Switch settings **SW3-1** to **SW3-2** are defined as follows

**SWITCH SETTINGS: TYPE**  
2

**SW3-1 SW3-2**  
ON OFF



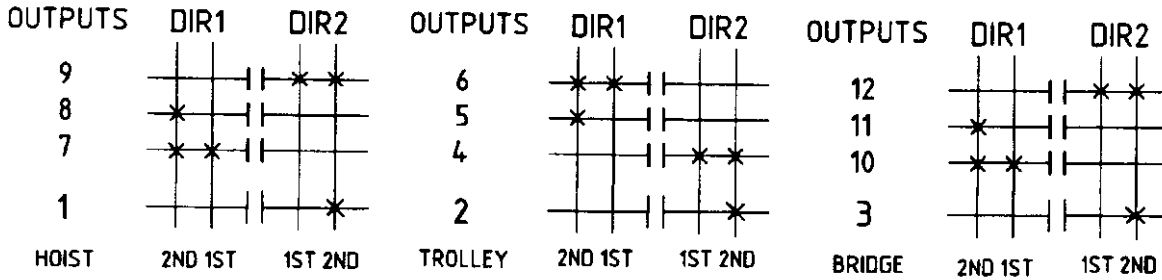
CPU/ROM #2

( *FW-2785-1T / FW2785-1N* )

**TABLE 2(d)**

Crane Control Type Selection: 10K12-2spd TYPE 3

*ACCO CONTROLS: ALL MOTIONS*

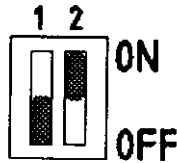


*Configuration Type Switch Select:*

Switch settings **SW3-1** to **SW3-2** are defined as follows

**SWITCH SETTINGS: TYPE**  
3

**SW3-1 SW3-2**  
OFF ON



CPU/ROM #2

(FW-2785-1T / FW2785-1N)





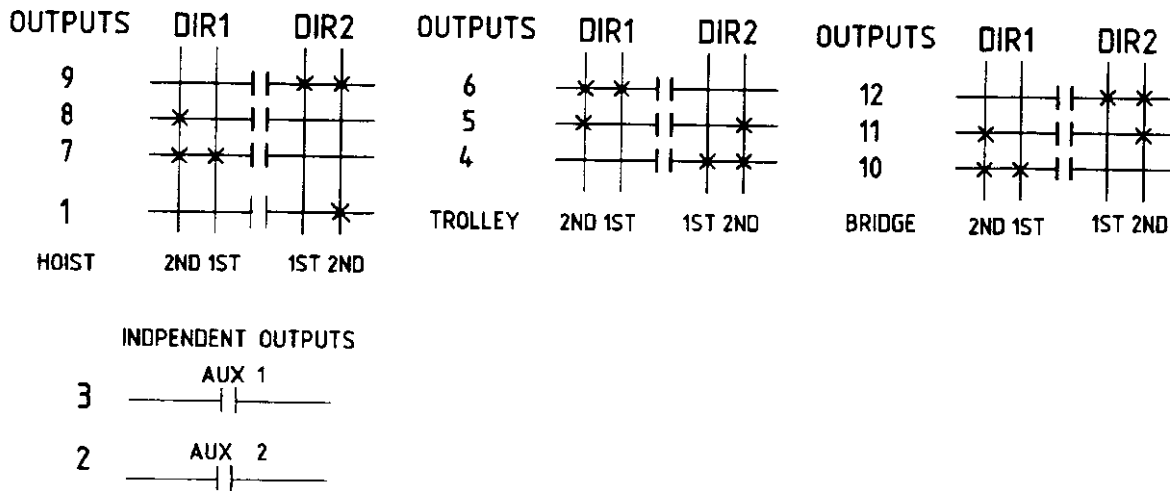


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TABLE 2(g)

Crane Control Type Selection: 10K12-2spd TYPE 6

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

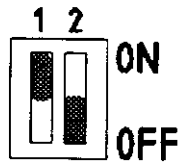


*Configuration Type Switch Select:*

Switch settings **SW3-1** to **SW3-2** are defined as follows

**SWITCH SETTINGS: TYPE**  
6

**SW3-1 SW3-2**  
ON OFF



CPU/ROM #3

(FW2785-2T / FW2785-2N)

## Appendix D

### MULTIBOX EXTENSION TO THE 10K12

#### SECTION 1.0 OVERVIEW

The 10K12 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.

**A new Receiver Master CPU Module and Software is necessary to implement multibox.**

Additional dip switches have been added to the module to provide selectable option control for multibox as well as future enhancements.

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 change. The RECEIVER ACCESS CODE SWITCHES must be set to the lowest member of this group of access code addresses.

**NOTE:** When the receiver has reset itself due to automatic time-out the first transmitter with a valid access code will gain control of the transmitter.

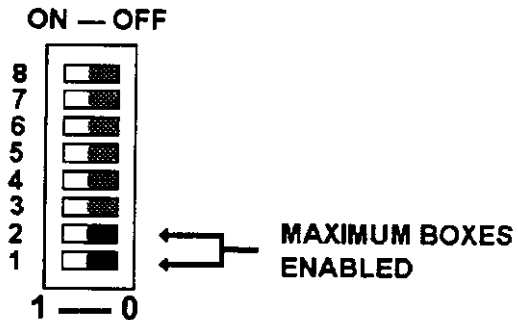
SWITCH SETTING	MAX BOXES
ACCESS CODE	
10-2///10-1	
OFF OFF	
1	
BASE ADDRESS	
OFF ON	
2	
BASE ADDRESS +1	
ON OFF	
3	
BASE ADDRESS +2	

#### SECTION 2 SWITCH SETTINGS

Two switches on the Master Cpu Module. are involved in setting up the receiver for multibox.

Switch SW10 is used to set multibox settings and various system options

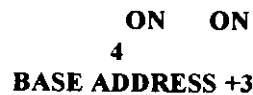
#### SECTION 2.1 SWITCH SW10 CONTROL DESCRIPTION



**SW10**

#### SECTION 2.1.2 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.



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

# Appendix E

## 10K12 2-SPEED PENDENT TRANSMITTER MODE 3

### SECTION 1.0 OVERVIEW

The 10K12 2-SPEED PENDENT TRANSMITTER has been enhanced to allow the control of up to 5 motors using the rotary selector switch. This new mode (3) reconfigures two of the 10K12 auxiliary outputs ( Aux 1 & Aux 2) to be external motor select functions.

In this mode (3) the Auxiliary toggle switch Aux1&Aux2 is disabled. The output of Aux1 and Aux2 are now controlled by the rotary switch.

### INPUT/OUTPUT CONFIGURATION

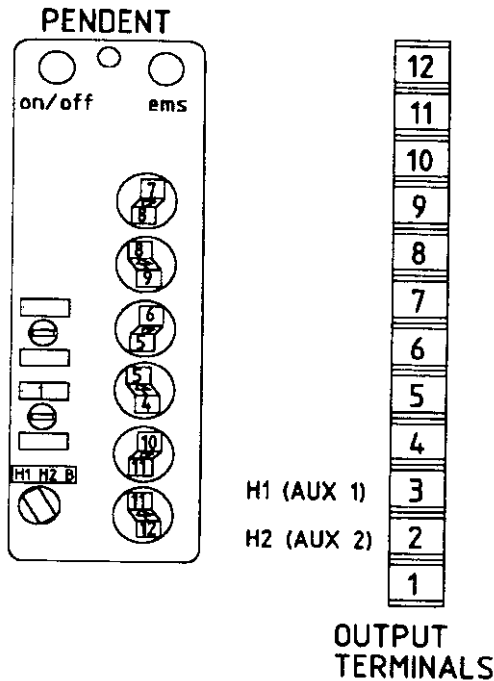


FIG 1

When the rotary switch is in the H1, Output 3 (Aux 1) will pull-in automatically whenever the Trolley or Hoist pushbutton switches are pressed. The Output 3 (Aux 1) may be used to externally enable Hoist 1 and/or Trolley 1 controls.

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

When the rotary switch is in the B, Output 2 & Output 3 ( Aux1&Aux 2) will pull-in automatically whenever the Trolley or Hoist pushbutton switches are pressed. This allows Tandem operation of two hoists or trolleys.

Aux 3 is still available and may be used as an Alarm or Control Function .

Mode 1 & Mode 2 are still available and may be set according to Appendix B

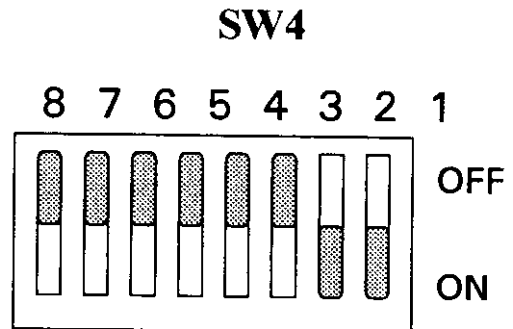
This new transmitter configuration is compatible with the existing 10K12 Systems.

Mode 3 requires dip SW4-1&SW4-2 to be set ON to become enabled. (See Section 2.1 for the setting of these switches)

### SECTION 2.1 CONFIGURING THE TRANSMITTER FOR MODE 3

In Mode 3 only SW4-1 & SW4-2 are active.

1) To set mode 3 set switches SW4-1 & SW4-2 to ON



## Appendix F

### 10K12 7 MOTOR 2-SPEED TRANSMITTER

#### SECTION 1.0 OVERVIEW

The 10K12 System has been expanded to provide seven (7) motor control using external select relays. The 3 auxiliary functions of the 10k12 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.

If the rotary switches are in the OFF position the aux function relays will not close when the hoist or trolley pushbutton switches are pressed.

Note however that the motor control relay outputs will still close in the normal manner.

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

Thus the aux 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 aux functions will pull in when the bridge push buttons 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)

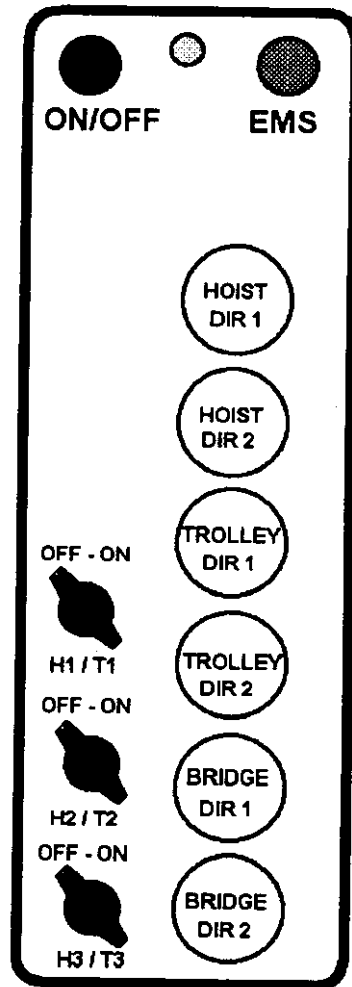


FIG 1

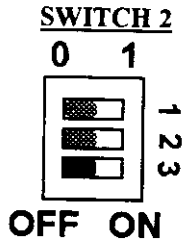
**NOTE: The Latch function for Aux 2 & Aux 3 and Auto-Alarm function for Aux 1 should be disabled as these functions will interfere with the operation of the motor select control function. These switches are located on the Output Module.**

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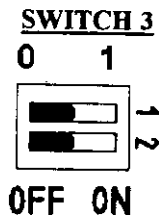
**SECTION 2.0 SWITCH SETTING**

**SECTION 2.1 OUTPUT MODULE**

Dip Switch 2-3 should be set to the OFF position.



Dip Switches 3-1 & 3-2 should be set to the OFF position.

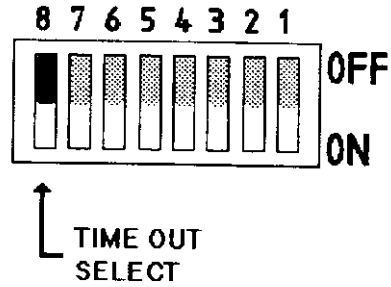


(See Section 5.1 and Section 5.4 of the manual for a description of these functions.)

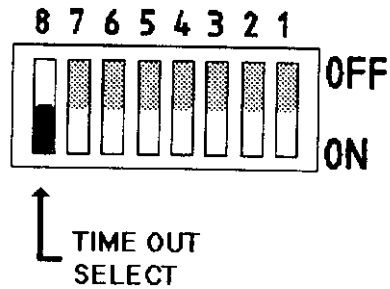
(Also see Section 7-4 for the configuring of Jumper 15)

**SECTION 2.2 TRANSMITTER MODULE**

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.



## Appendix G

### 10K12 2-BOX MONORAIL

#### SECTION 1.0 OVERVIEW

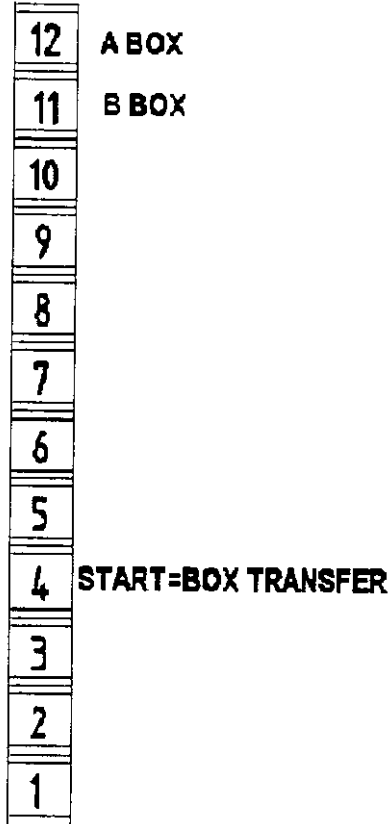
The 10K12 system has been expanded to include 2-box control of monorail cranes.

The 2-box monorail differs from the standard multibox by requiring the transmission of a control function to initiate the transfer of control from one transmitter to the other transmitter, commonly referred to as the A or B box. Unlike the standard multibox systems, simply turning off a transmitter will not initiate the transfer. Once the transfer has been made the relinquishing transmitter can no longer gain control of the receiver until the other now controlling transmitter initiates a transfer back. The only time this is not true is when the receiver has just been powered up. At this time the receiver does not know which transmitter requires control and will latch on to the first transmitter to transmit an On command. After this initial setup transfer can only be made with a deliberately transmitted command.

During the transfer the receiver is disabled. Therefore once the transfer has been made the new controlling transmitter must re-enable the receiver by pressing the ON button.

The transfer box control function is available as an output. The output of the transfer command will remain ON as an output until the key is released. The releasing of the key initiates the transfer to the other transmitter box.

Outputs 11 and 12 have been reconfigured to provide information as to which box (A or B) has current control and may be used to drive an external display to indicate which box has control.



**OUTPUT  
TERMINALS**

# Appendix H

## 10K12 SLTX 3/4/5 MOTOR 2-SPEED TRANSMITTER

### SECTION 1.0 OVERVIEW

The 10K12 family of transmitters has been expanded to include a new 3/4/5 motor 2-speed lever handled belly box transmitter. The new transmitter are functionally interchangeable with the 10K12 2-speed pendant transmitter. The two 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..

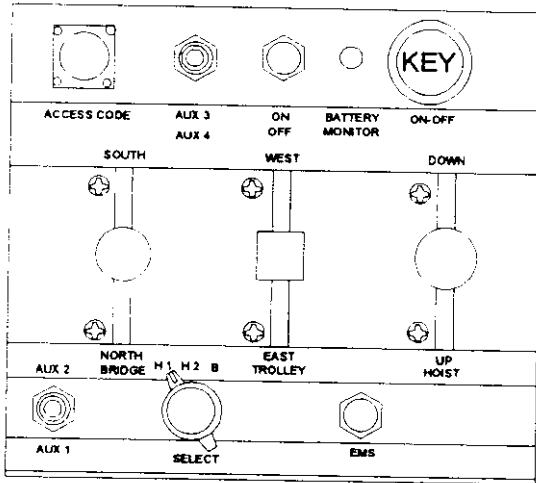


Figure 1

Options described in appendices B and E 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 3 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 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 transmitter 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.

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

If the automatic time-out feature is not desired it may be disabled by setting switch 3-8 to the ON position. ( See section 2.0 ) With the time-out feature disabled the transmitter will remain enabled until manually turned off.

The enhanced Mode 3 operation is as follows:

### For the standard mode.

When the rotary switch is in **H1**, Output 3 (Aux 1) will pull-in automatically whenever the Trolley or Hoist pushbutton switches are pressed. The Output 3 (Aux 1) may be used to externally enable Hoist 1 and/or Trolley 1 controls.

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

When the rotary switch is in **B**, Output 2 & Output 3 ( Aux1&Aux 2) will pull-in automatically whenever the Trolley or Hoist pushbutton switches are pressed. This allows Tandem operation of two hoists or trolleys.

This is the same as described the appendix E

**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 **H1**, Output 2 (Aux 2) will pull-in automatically whenever the Trolley or Hoist pushbutton switches are pressed. The Output 2 (Aux 2) may be used to externally disable Hoist 2 and/or Trolley 2 controls.

When the rotary switch is in **H2**, Output 3 (Aux 1) will pull-in automatically whenever the Trolley or Hoist pushbutton

switches are pressed. The Output 3 (Aux 1) may be used to externally disable Hoist 1 and/or Trolley 1 controls.

When the rotary switch is in **B**, Output 2 & Output 3 ( Aux1&Aux 2) are open. Neither hoists or trolleys are disabled and tandem operation of two hoists or trolleys is available for cranes that require his type of output .

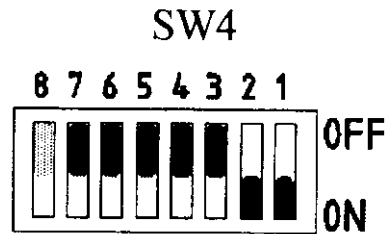
## SECTION 2.0 SWITCH SETTINGS

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

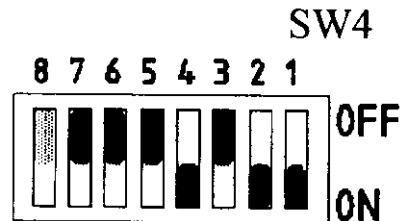
## SECTION 2.1 MODE 3 ENHANCEMENT

The mode 3 modification adds an extra dip switch setting to SW4.

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



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



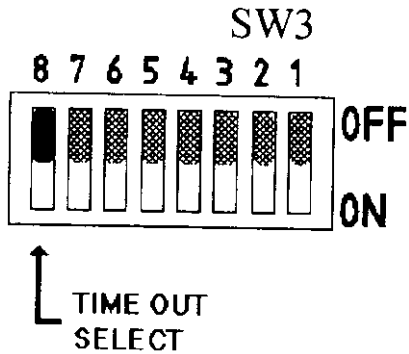


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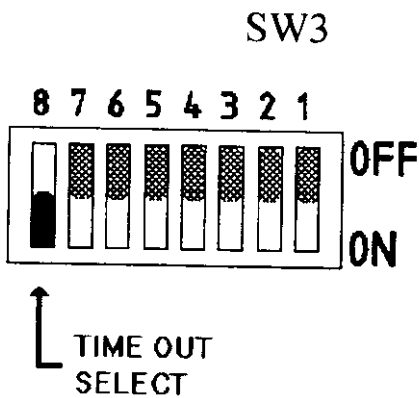
**SECTION 2.2 TIME-OUT SETTINGS**

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

When time-out is disabled the transmitter remains active and must be manually shutdown.



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 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.

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### SECTION 4.1 Small Lever Transmitter Unit Spare 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, GREY
H635-0	BOOT, PUSHBUTTON, RED
H638-0	BOOT, TOGGLE, GREY
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