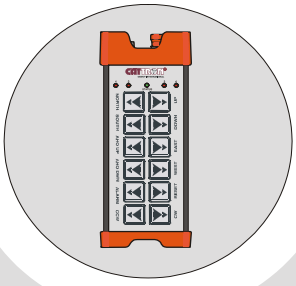
Unity Remote Control System




MKU System Manual



GROUP INTERNATIONAL

Part # 68C-MKU, Edition 01/2007, Version 1.0

IMPORTANT NOTICES

US and Canadian non-licensed 900 MHz Operator Control Units (OCUs) have been factory (software) pre-programmed to transmit data to the Machine Control Unit (MCU) until the OCU's power is switched 'OFF'. This pre-programming cannot be changed by yourselves.

The 'TransKey' that accompanies your OCU and MCU has been pre-programmed with certain system operating parameters before leaving our factory. Such 'TransKey' parameters will include a specific address and operating frequency; however, CATTRON® strongly advises you to check that our pre-configured address and frequency is not duplicated in other remote control equipment located at, or around, your operating facility.

Unless customer technicians have received formal maintenance training from CATTRON®, our maintenance philosophy is that inoperative OCUs and MCUs be returned as complete units to our workshops for repair. This is because systems are customized at our factory for a particular application, thus it is highly unlikely that two systems (or the components therein) will be the same.

Before returning a Unity product to CATTRON® for repair, the original 'TransKey' supplied with the unit should be removed and retained for use with your spare unit.

Information to the User regarding FCC Compliance:

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

This class A digital apparatus complies with Industry-Canada ICES-003 standards.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

This manual has been prepared by Stuart C. Banks MSTC (USA), MISTC (UK)
CATTRON® Group International Technical Writer/illustrator.

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1. SAFETY INSTRUCTIONS

1.1 WARNINGS and CAUTIONS

WARNING and CAUTION statements have been strategically placed throughout all text prior to operating or maintenance procedures, practices or conditions considered essential to the protection of personnel (WARNING), or equipment and property (CAUTION). A WARNING and CAUTION will apply each time the related step is repeated. Before starting any task, the WARNINGS or CAUTIONS included in the text for the task shall be reviewed and understood. All WARNINGS and CAUTIONS appearing in this manual are included below.

⚠	**WARNING:** **ALL EQUIPMENT MUST HAVE A MAINLINE (ML) CONTACTOR INSTALLED AND ALL TRACKED EQUIPMENT (I.E. CRANES) HAVE A BRAKE INSTALLED.** **THE REMOTE CONTROL OPERATE (OPR) RELAYS MUST BE CONNECTED TO THE MAINLINE SO THAT STOP COMMANDS WILL DE-ENERGIZE THE MAINLINE CONTACTOR AND SET THE EQUIPMENT BRAKE.** **FAILURE TO COMPLY WITH THE ABOVE WARNINGS MAY RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL AND DAMAGE TO EQUIPMENT**.

⚠	**WARNING:** **MORE THAN ONE REMOTE CONTROL SYSTEM MAY BE USED AT, AROUND, OR NEARBY YOUR OPERATING FACILITY. THEREFORE, BEFORE INSERTING A 'TRANSKEY' INTO AN OCU, YOU MUST INSURE THE CORRECT CODED 'TRANSKEY' IS SELECTED FOR THE DESIRED EQUIPMENT TO BE OPERATED.** **IF THE WRONG 'TRANSKEY' IS INSERTED INTO AN OCU, OTHER REMOTE CONTROLLED EQUIPMENT LOCATED AT, AROUND, OR NEARBY YOUR FACILITY MAY BECOME OPERATIONAL.** **FAILURE TO COMPLY WITH THE ABOVE WARNINGS MAY RESULT IN UNINTENED OPERATION OF REMOTE CONTROLLED EQUIPMENT WHICH IN TURN COULD RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL AND DAMAGE TO EQUIPMENT.**

⚠	**WARNING:** **BEFORE ATTEMPTING TO USE THE REMOTE CONTROL SYSTEM, VERIFY THE TARGET CRANE OR MACHINE YOU WISH TO OPERATE IS UNDER THE DIRECT COMMAND OF YOUR OCU. THIS IS ACCOMPLISHED BY OPERATING A NON-MOTION OCU FUNCTION SUCH AS A HORN OR LAMP AND OBSERVING THAT THE RESPECTIVE FUNCTION ON THE TARGETED CRANE OR MACHINE RESPONDS.** **FAILURE TO IMPLEMENT THE ABOVE MAY RESULT IN PERSONAL INJURY OR DEATH TO PERSONNEL AND DAMAGE TO EQUIPMENT.**

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WARNING:

UNLESS SPECIFIED, MKU PORTABLE REMOTE CONTROL SYSTEMS ARE NOT DESIGNED TO INTERFACE DIRECTLY TO SAFETY CRITICAL BI-STABLE MAINTAINED FUNCTIONS, (i.e., magnet circuits, vacuum circuits, grab, pump motors, fire supression, etc.).

A PROPER INTERFACE TO SAFETY CRITICAL BI-STABLE MAINTAINED FUNCTIONS SHALL BE INSTALLED, IDEALLY USING A CATTRON® RELAY INTERFACE UNIT, PART # RI004NE.

ALTERNATIVELY, EXAMPLE CIRCUIT DIAGRAMS ARE PROVIDED IN APPENDIX 'B' OF THIS MANUAL TO ENABLE YOU TO PROPERLY INTERFACE YOUR REMOTE CONTROL SYSTEM WITH SAFETY CRITICAL BI-STABLE MAINTAINED FUNCTIONS BEFORE OPERATIONAL USE.

SHOULD CATTRON® MKU SYSTEMS BE INADVERTENTLY CONFIGURED TO INTERFACE DIRECTLY WITH SAFETY CRITICAL BI-STABLE MAINTAINED FUNCTIONS AT YOUR OPERATING FACILITY, DAMAGE TO EQUIPMENT, SERIOUS INJURY, OR DEATH TO PERSONNEL MAY RESULT.

IT MUST BE FULLY UNDERSTOOD THAT CATTRON® WILL NOT BE HELD LIABLE FOR PERSONAL INJURY, DEATH, EQUIPMENT OR PROPERTY DAMAGE WHICH MAY ARISE FROM IMPROPER CONFIGURATION OF YOUR PORTABLE REMOTE CONTROL SYSTEM.

CAUTIONS:

CATTRON® MKU Battery Conditioners and External Charging Units are designed for use with CATTRON® Ni-Cad Battery Packs only.

Battery Packs must be removed or disconnected from Battery Conditioners/ External Charging Units within 48-hours of achieving the fully charged state.

Failure to comply with these Cautions may result in equipment and/or battery damage and will void our warranty.

CAUTION:

CATTRON® MKU Battery Adapters are designed for use with non re-chargeable 'AAA' size Alkaline Batteries only. Carbon/Zinc, Lithium, or Ni-Cad Batteries are not to be used with this adapter. Damage to batteries will occur if this adapter is used for battery charging.

1.2 GENERAL

The following are general safety precautions that are not related to any specific procedure and therefore do not appear elsewhere in this manual. These are general safety precautions and instructions that people must understand and apply during many phases of operation and maintenance to ensure personal safety and health and the protection of your company property.

KEEP AWAY FROM LIVE CIRCUITS. Maintenance personnel must observe all safety requirements at all times. Do not replace components or make adjustments inside the equipment with the electrical supply turned on. Under certain conditions, danger may exist even when the power control is in the off position due to charges retained by capacitors. To avoid injuries, always remove power, discharge and ground a circuit before touching it. Adhere to all lock out/tag requirements.

INTERNAL SERVICE AND/OR ADJUSTMENTS. Whenever possible, do not attempt internal service or adjustment of equipment unless another person capable of rendering aid and resuscitation is present.

FINGER RINGS/JEWELRY. Finger rings have caused many serious injuries. Remove rings, watches and other metallic objects that may cause shock or burn hazards.

SOLDERING/DE-SOLDERING. Avoid breathing fumes generated by soldering/de-soldering. Perform all operations in a ventilated area. Eye protection is required.

CLEANING SOLVENTS. Some cleaners and solvents have adverse effects on skin, eyes, respiratory tract and internal organs. These adverse effects range from discomfort to serious injury and death, depending on the material and degree of exposure. Observe manufacturers' warning labels and contact your immediate supervisor if in any doubt.

Remember…. the person now reading these instructions is primarily responsible for his or her own health and safety.

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2. PRODUCT DATA & SPECIFICATIONS

CATTRON® Unity Portable Remote Control (PRC) systems offer the safety and dependability required for industrial control applications with reversing motor control such as overhead cranes, conveyors, etc. Each system includes an Operator Control Unit (radio transmitter) and a Machine Control Unit (radio receiver) which are based on the CATTRON® 'Unity' electronics platform. **Unity PRC systems are custom engineered at our factory for your controlled machine and are designed to go straight on the job with no FCC or Industry Canada license required**.

The Unity PRC system described in this manual incorporates high-performance microprocessors with a minimum number of components in their design. An RF receiver, decoder and relay interface contained in the Machine Control Unit is under the direct control of a lightweight, hand-held Metal Keypad Operator Control Unit. Different system configurations are available so that we can recommend the best one for your application.

2.1 SYSTEM FEATURES

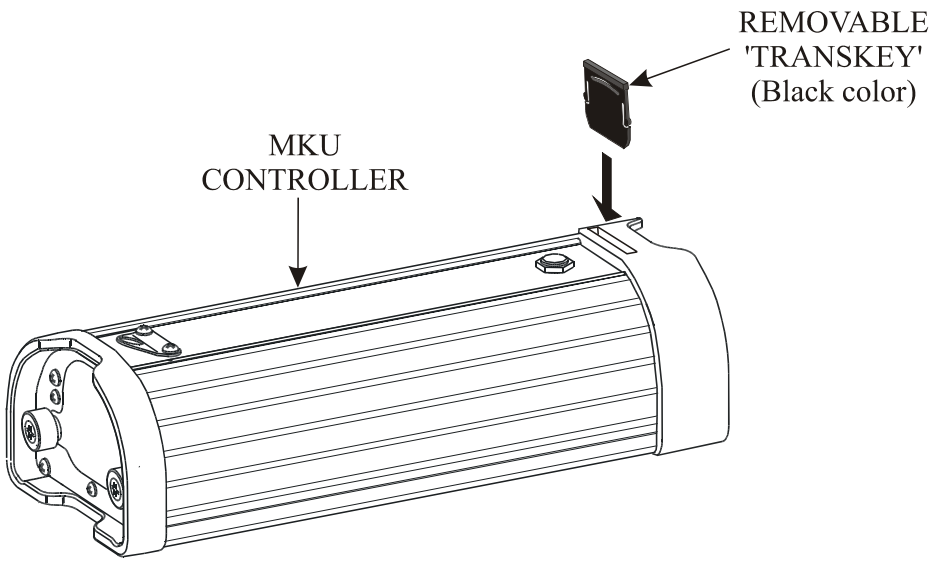
- Sturdy, lightweight transmitters with integrated fall protection
- Synthesized two, three, four, or five motor control, plus mainline ON/OFF
- Ergonomic design
- High availability and operating safety through use of quality components
- High message security, >16 million addresses
- Average response time of less than 70 mS
- 5 Multi-function LEDs for status and error indication, acoustic low voltage alarm
- Power-on self diagnostics
- Increased safety through Multiple transmission coverage, Hamming distance d ≥ 6, dual-processor system with Master/slave-technology
- Dual Stop circuit
- Pre-programmed system frequency, address, and operating parameters of radio control transmitters and receivers using 'TransKeys'
- Proven CATTRON® reliability

2.2 OPERATOR CONTROL UNIT (OCU)

The CATTRON® MK Unity Series OCU is a lightweight palm sized, extremely rugged customizable radio control transmitter for use with any CATTRON® Unity based PRC System.

Referring to Figure 1 overleaf, operational security is advanced to its maximum by the use of a removable 'TransKey' which, when installed to the OCU, defines and enables the appropriate operating parameters. A non-removable 'TransKey' option is available for situations where interchangeability of OCU s is not required.

Figure 1. OCU Removable 'TransKey'



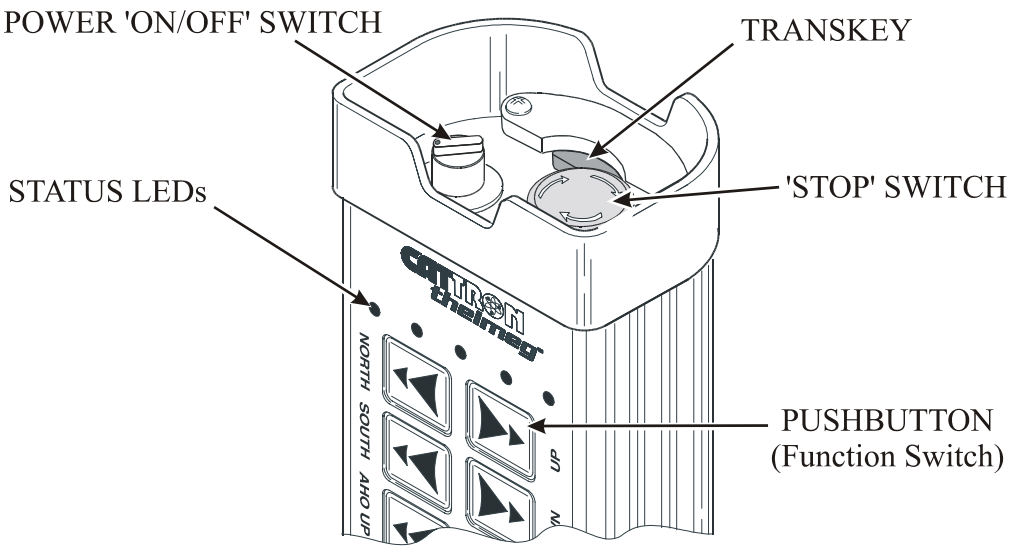
NOTE: OCU and MCU TransKeys must not be swapped. The OCU (transmitter) TransKey is black. The MCU (receiver) TransKey is yellow. Swapping TransKeys will result in OCU/MCU fault indications and the system will not go into operation.

Referring to Figure 2 opposite, the keypad unit and electronics are contained in an extreme duty, water and dust resistant, aluminum housing which has armorized rubber end-caps for switch protection and high impact resistance. Consequently, the OCU is able to withstand levels of impact previously unattainable by any other portable remote controllers, without the need for carrying cases or protective rubber housings.

The OCU housing is ergonomically designed with curved bottom and rubber side grips to allow comfortable handling. The 'TransKey' locates into a slot within the confines of the armorized rubber ‘bumper’ that surrounds the top end-cap. Separate ON/OFF and STOP switches are also located next to the 'TransKey'.

A completely sealed elastomer keypad on the OCU front face contains large pushbuttons that are coated with clear epoxy for additional durability. A label that clearly indicates the specific function for that particular key identifies each pushbutton. When pressed, each pushbutton actuates a function switch inside the OCU and may be of single-step or two-step operation. Also, when pressed, each pushbutton has a distinct limit of travel, thus providing an enhanced tactile feel that is noticed by the operator.

Figure 2. MKU OCU



MKU dual pressure keypad OCUs offer 6, 12, or 16 operator commanded functions (simultaneous, any combination). In addition, these OCUs can provide 2-speed operation and variable frequency drive (VFD) operation. All CATTRON® MKU OCUs normally send ON/OFF commands that activate programmed functions at the target CATTRON® Machine Control Unit.

MKU OCUs are equipped with an internal antenna and the typical operating (transmitter) range is in excess of 300 feet (92+ meters) line of sight. It should be understood that operating range varies with environmental conditions. Should the OCU go out of operating range, all motions on the crane or controlled machine will cease.

MKU OCUs have been approved to comply with both FCC Part 15 and Industry Canada RSS-210 applications standards.

No United States of America FCC, or Industry Canada license is required for operation of FCC Part 15 or RSS-210 MKU OCUs. Non-licensed OCUs transmit the very secure CATTRON® Series digital message, using frequency modulation (FM) radio. These radio transmitters are approved for use in the 902 to 928 MHz frequency band.

All MKU series controllers are powered by disposable 3-volt alkaline or re-chargeable Ni-Cad battery packs. In normal operation, a multicolor ‘STATUS’ LED flashes green with each function command message and a beep is sounded when a key is pressed. When the battery voltage becomes low, the multicolor ‘STATUS’ LED flashes red and a beep sounds every ten seconds to alert the operator that the battery pack needs to be replaced or re-charged. The multicolor Status LED will also illuminate in a series of red blinking sequences to indicate a specific transmitter fault.

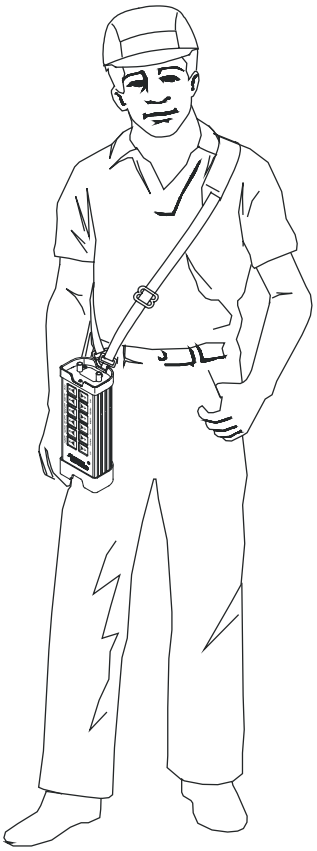
Four Multicolor Function Output LEDs above the top row of function keys indicate when a controller motion command has been activated at the target machine. These LEDs may also be used to identify a frequency channel number when the Channel Programming Option (see Appendix 'A') has been incorporated with the controller.

Battery packs are easily and quickly replaced without the need for tools by turning two knurled thumbscrews and removing the battery cover-plate located within the confines of the armorized rubber bottom end-cap. The battery pack makes positive contact without snaps or plugs and has no wires to break; simply drop it in, and replace the battery cover-plate.

A battery charger, battery conditioner, 'AAA' size battery adapter, and an external battery charging unit are available on request – refer to accessories/consumable items in Section 6 of this manual for details and part numbers.

A belt loop strap is provided with all CATTRON® MKU series OCUs. This is quickly and simply installed to a 'D'-ring located on the curved underside of the controller. Referring to Figure 3 below, an optional shoulder-carrying strap is available on request.

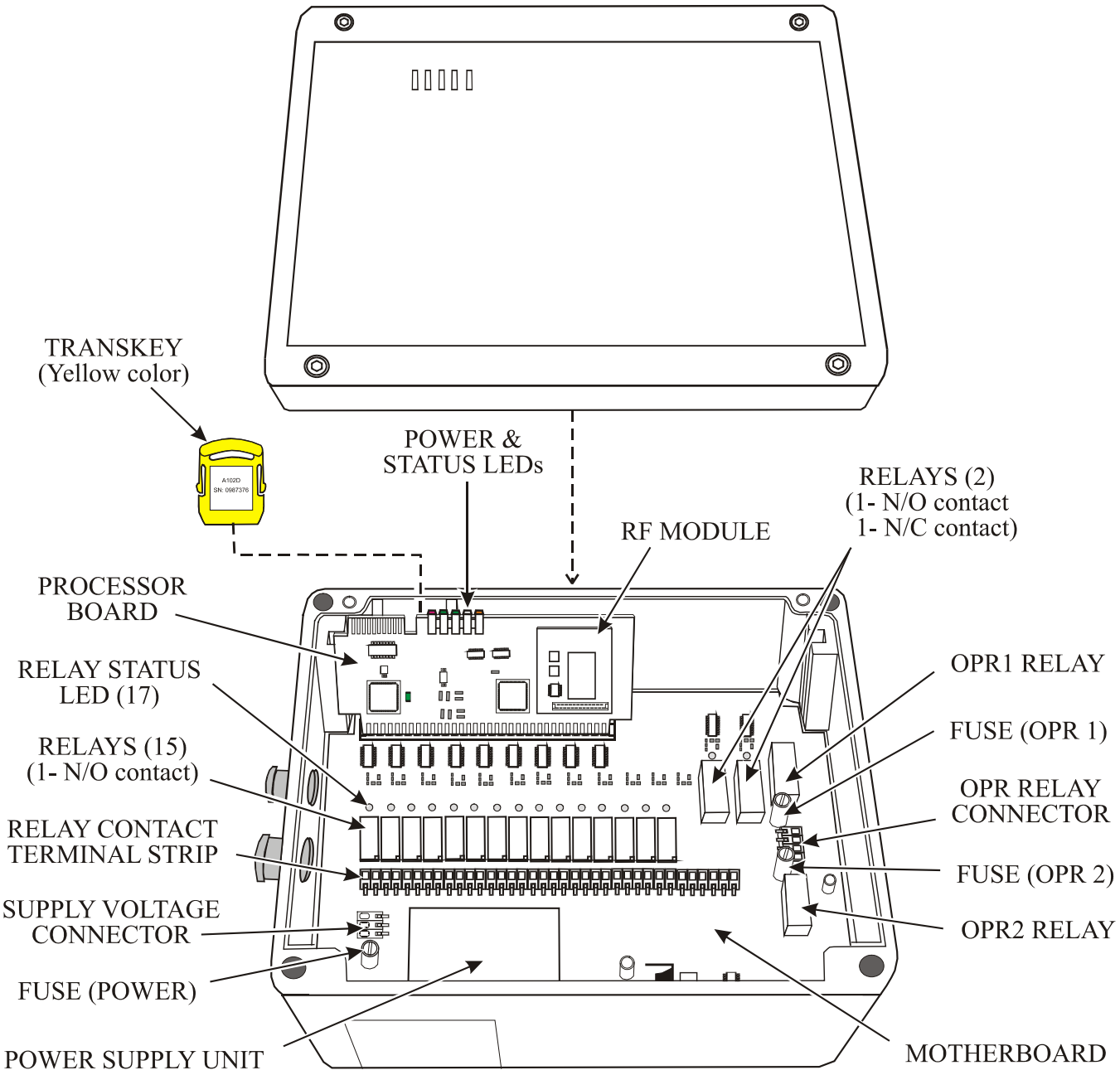
Figure 3. Optional Shoulder-Carrying Strap



2.3 MACHINE CONTROL UNIT (MCU)

Referring to Figure 4 below, the MCU's receiving and decoding hardware, along with the relay interface, is housed within an IP 65 water resistant enclosure.

Figure 4. Typical MCU Component Layout



The output interface to the controlled machine is handled by relays rated for heavy duty resistive and inductive industrial loads (up to 7 A / 250 VAC). Each relay has a 'Status' LED that illuminates when the relay is energized.

Individual relay outputs are routed to the controlled equipment via a terminal strip. When a fault condition is detected, the Operate (OPR) relay and all outputs are disabled.

Just like the OCU, MCUs use a removable 'TransKey' to define and enable the appropriate operating parameters.

NOTE: OCU and MCU TransKeys must not be swapped. The OCU (transmitter) TransKey is black. The MCU (receiver) TransKey is yellow. Swapping TransKeys will result in OCU/MCU fault indications and the system will not go into operation.

Referring to Figure 5 below and Table 1 opposite, the MCU has five externally visible LED indicators on the front cover that display the current system status to the operator.

Figure 5. MCU System Status LEDs

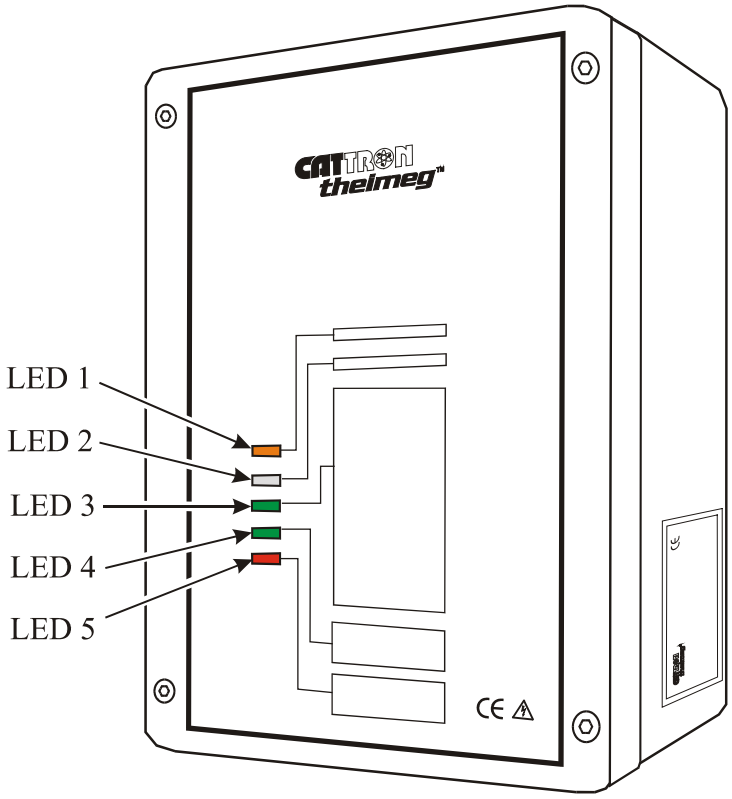


Table 1. MCU SystemStatus LEDs

LED	DESCRIPTION
1. Power On	Illuminates orange when the MCU has voltage
2. Scan Mode Not used when system is configured for fixed frequency	Flashes red/orange in Scan Mode
3. RF Reception	Illuminates green when valid data from the OCU is received and both OPR relays are energized Illuminates orange if valid data from the OCU is received and the OPR relays are de-energized Illuminates red if data from another OCU (with invalid address) is received
4. Command	Illuminates green when commands are received from the OCU (normal condition)
5. Fault indication	Blinks red when the MCU detects a fault

2.4 MKU SYSTEM SPECIFICATIONS

OCU:

Case Material:	Extreme duty, dust and water resistant, aluminum housing.
Approximate weight:	1.4 lbs. / 634 grams (including battery pack).
Dimensions:	8.0" x 3.0" x 2.0" (203 x 76 x 51 mm).
Environmental:	-4° F to +140° F (-20° C to +60° C), RH 0 to 95% Non-condensing.
Maximum Functions:	Dual-pressure MKU models: 6, 12, 16 (simultaneous, any combination) operator commands.
Switch options:	4, 8, or 12 dual pressure pushbuttons.
Switch type:	Sealed silicon elastomer keypad, dust, water, oil, acid resistant elastomer pad with 'tactile feel', clear epoxy coated pushbuttons.

Battery type: 3-volt Alkaline Battery Pack (standard).

2.4-volt re-chargeable Ni-Cad Battery Pack (optional).

3-volt Alkaline Battery Adapter for use with quantity 2 'AAA' size Alkaline batteries only (optional).

Battery life:

Battery Type	Constant Transmission
Alkaline Battery Pack, Part # 60C-0060A. 2500 mAh	73 hours
Ni-Cad Battery Pack, Part # 60C-0060N. 1100 mAh	32 hours
Qty. 2 AAA Alkaline Batteries in Adapter, Part # 60C-0062. 1100 mAh	33 hours

Power-up options: Using either the top end-cap switches *or* the bottom row of keypad switches. The actual 'ON'/'OFF'/'STOP' switch option is factory pre-configured to suit the customer requirement.

Transmit indicator: Status LED flashes green with every transmission.

Low battery indication: Status LED flashes red for low battery.

Fault Indication: Status LED sequentially blinks red to identify a specific fault.

Battery charging/conditioning: A 'Standard' rate (10 hour) Battery Charger and External Battery Charging Unit is available for Ni-Cad Battery Packs only. An additional Battery Conditioner is also available which operates from mains voltages between 100 to 240 VAC @ 50/60 kHz.

Audio speaker: For Power-up self test indication, function pushbutton 'click' and low battery indication.

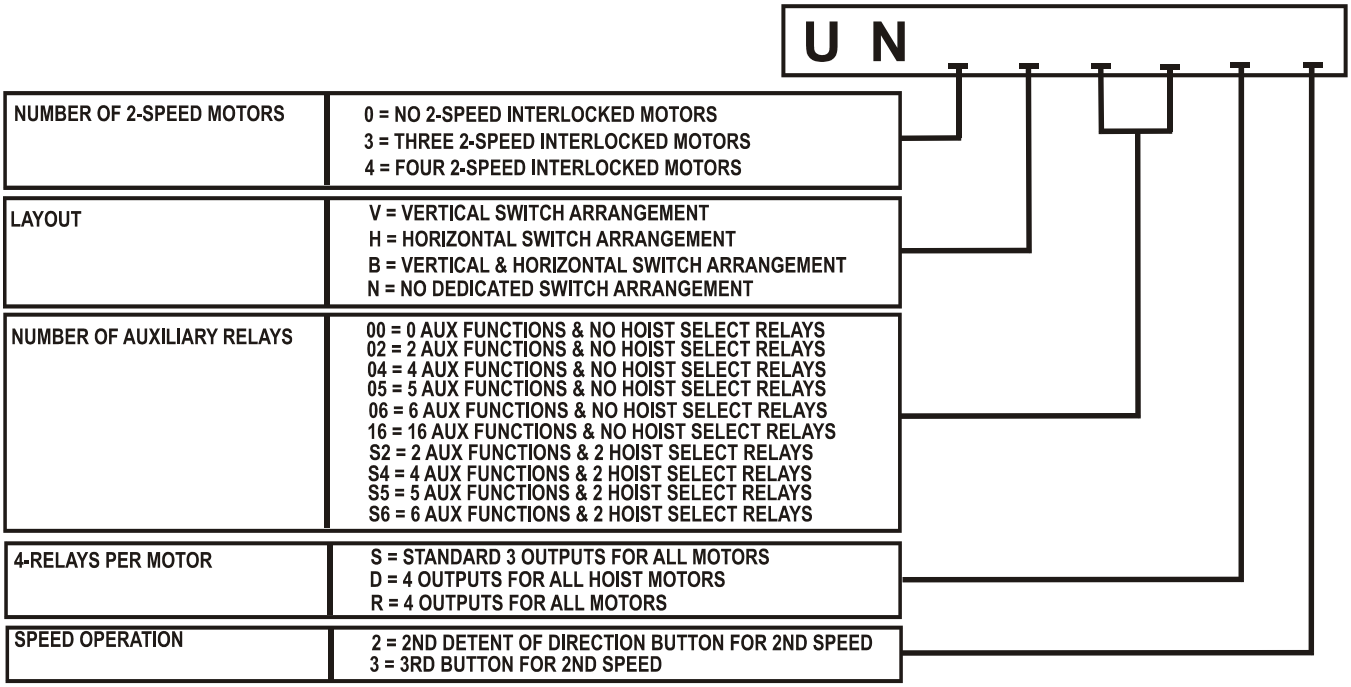
Transmitter frequency range: 902 to 928 MHz

Approvals: U.S. FCC and Industry Canada non-licensed operation.

MCU:

Receiver series:	CT24
Frequency range:	902 to 928 MHz
Transmission speed:	4.8 to 20 kBit/s
Receiver sensitivity:	-107 dBm
Antenna:	Internal
Typical response time:	70 ms
System addresses:	24 Bit, > 16 million addresses
Voltage supply:	85 – 265 V AC 50 - 60 Hz (Standard), 20 – 60 V AC (optional), 18 – 72 V DC (optional), 9 – 36 V DC (optional)
Outputs	17 output relays up to 7 A / 250 VAC 9 output relays (optional),
Stop command:	2 monitored safety relays (additional to output relays)
Connector:	2 cable glands
Display:	5 Multi-LEDs for status and fault display
Weight:	Approx. 2.4 lbs. / 1050 g
Dimensions:	9-relay unit: 6.0" x 6.7" x 4.1" (150 x 170 x 105 mm) [L x W x D] 17-relay unit: 9.25" x 6.7" x 4.1" (235 x 170 x 105 mm) [L x W x D]
Case Material:	Styrene butadiene, standard colors: matt silver-grey
Environmental:	-4°F to +140° F (-20º C to +60° C), RH 0 to 95% non-condensing.
IP protection class:	IP 65

2.5 MKU MODEL CONFIGURATIONS



2.6 MKU to MKEZ/MKCS Cross Reference Chart

	EZ4	EZ8	EZ12	EZ12+2	EZ16-4	EZ16-5	EZ6DP	EZ12DP	EZ16DP	EZ8OSP1	EZ12DPOSP1		CS4	CS8	CS12	CS12+2	CS16-4	CS6DP	CS12DP	CS16DP	CS16DP-5S	CS16DPH	CS16DPVH		NEW MODEL
UN0N16S2	X	X	X							X															
UN4VS2S3				X	X											X	X								
UN5V02S3						X																			
UN4V04S2							X	X	X				X	X	X			X	X	X					
UN4H00R2											X														
UN3VS6S2																					X				
UN4H04S2																						X			
UN4B04S2																							X		
UN3HS6S2																									X
UN4V02D2																									X
UN3VS5D2																									X
UN4H02D2																									X
UN3H05D2																									X

3 SAFETY CONSIDERATIONS

CATTRON® believes that to safely operate any remotely controlled equipment, the overall system needs to be configured so that movement or operation of the equipment will take place only when the device is commanded to move or operate. For example; overhead cranes must be equipped with a braking system which can only be released when an electrical signal is sent to the motor. Removal of electrical power or loss of the radio transmitted signal results in application of the brakes. One way to accomplish this is with a CATTRON® Electro-Hydraulic brake package. Contact the factory for details – refer to the rear cover of this manual for telephone numbers and e-mail addresses.

In keeping with this philosophy - **NO COMMAND, NO MOVEMENT** - CATTRON® has designed your radio remote control system with the following safety and security features.

3.1 STANDARD SAFETY & SECURITY FEATURES

'TransKey':

Operational security is advanced to its maximum by the use of pre-programmed TransKeys which, when installed to the OCU and MCU, define and enable the operating parameters.

NOTE: OCU and MCU TransKeys must not be swapped. The OCU (transmitter) TransKey is black. The MCU (receiver) TransKey is yellow. Swapping TransKeys will result in OCU/MCU fault indications and the system will not go into operation.

ON/OFF power switch:

The OCU is provided with a rotary power ON/OFF switch that must be set to 'ON' in order to send commands to the MCU. If the power switch is set to 'OFF', the MCU will remove all commands from the controlled machinery, stopping all movement.

Red System STOP Switch:

Operating the red STOP switch while the OCU is operational will stop commands to all outputs including the mainline control relay (OPR).

Operate relay (OPR):

The operate (OPR) output relay(s) shall be wired to control a user-provided electro-magnetic power contactor. The electro-magnetic contactor opens and closes the main electrical supply circuit(s) to the controlled device.

Data Error Checking:

All communications from the OCU to the MCU contain error-checking information (16-bit CRC Checksum). The entire data command packet must pass error detection tests before being processed.

Redundant Self-Checking Dual Processor Architecture:

Both the OCU and the MCU incorporate one Master processor and one Slave (checker) processor. On the OCU, these dual processors monitor the output commands from the pushbuttons. On the MCU, these dual processors monitor the input commands to the relay coils.

3.2 PERMANENT OCU 'TRANSKEY'

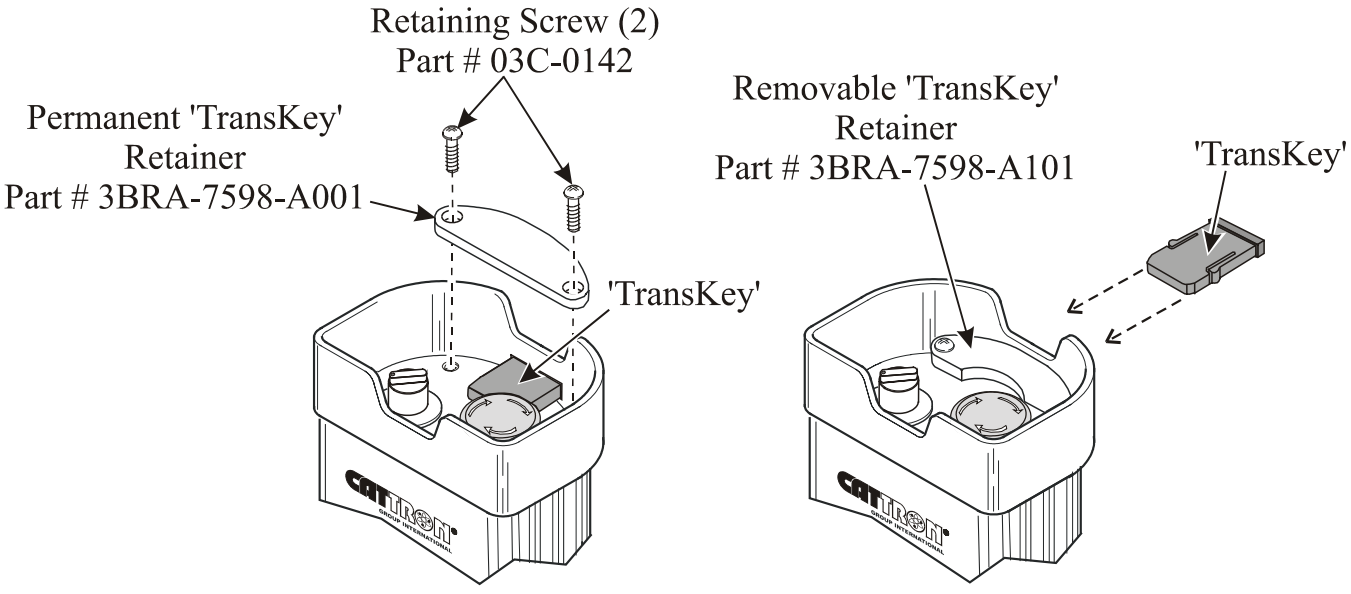
When the 'TransKey' is removed, the OCU is ***totally*** disabled. Thus, the ability to remove the TransKey from the OCU is an important safety feature that prevents unauthorized operation of the controller and its target machinery.

A **Permanent 'TransKey' Retainer** ia also supplied with your OCU. Installing this item as shown in Figure 6 below will securely retain the TransKey within the OCU's top end cap.

CATTRON® strongly emphasizes that installing the Permanent 'TransKey' Retainer is entirely at the operator's discretion. An operator should be aware that securely retaining the 'TransKey' within the OCU's top end cap will not prevent unauthorized operation of the controller or its target machinery.

THEREFORE, WHEN NOT IN AUTHORIZED USE, CATTRON® RECOMMEND THAT A OCU HAVING A PERMANENTLY RETAINED 'TransKey' BE HELD IN A SUITABLE CABINET UNDER LOCK AND KEY.

Figure 6. Permanent and Removable 'TransKey' Retainers



4 INSTALLATION

4.1 CHOOSING A MOUNTING LOCATION

There are a few items to consider when selecting a location to install the MCU enclosure.

First, the MCU enclosure must be installed in a location that allows easy access for maintenance and service. Adequate clearance must be allowed to remove the cover for access. The location must also provide adequate RF reception range and a clear 'line of sight' to the transmitter.

Select a location to minimize any possible interference from RF sources such as motors. Ideally, the MCU enclosure should be installed as close as practical to the controlled machine's electrical cabinet with a minimum of 48 inches clearance from obstructions in front of and on either side of the enclosure. If this clearance is not possible, the installation must be tested to ensure that interference does not impact the system's performance. Contact the CATTRON® service department for more information or for help in resolving any problems – refer to the rear cover of this manual for telephone numbers and e-mail addresses.

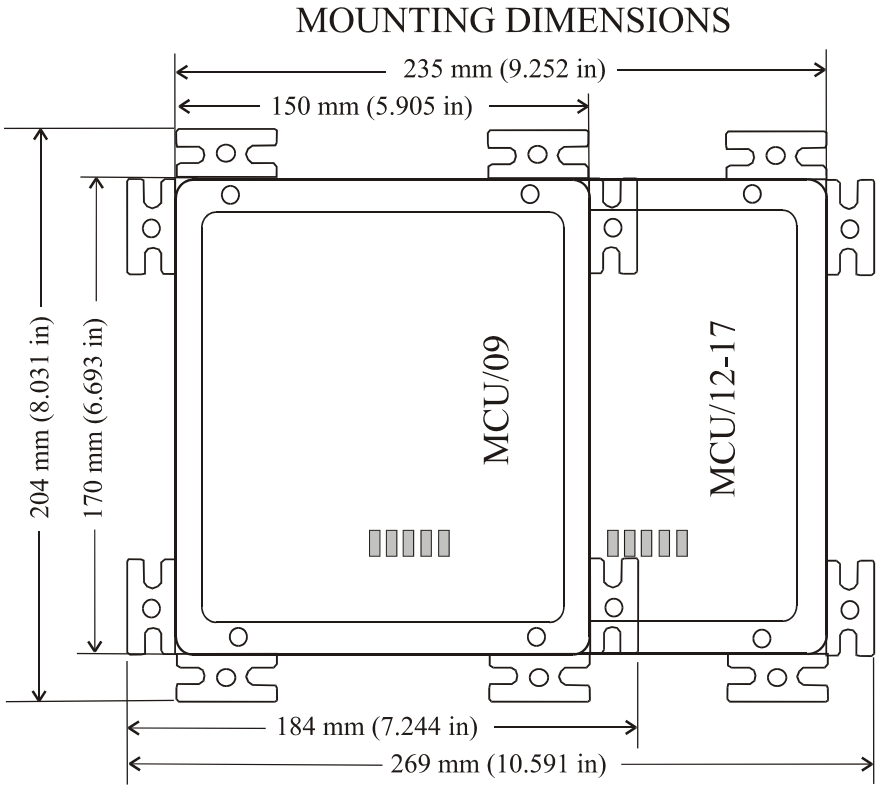
All wiring entering the enclosure must be terminated inside the enclosure. **Do not install any pass-through wiring**.

To prevent interference on signal lines, do not install high and low voltage cables in the same conduit. The standard MCU is shipped with an internal antenna. However, if an optional external antenna is required, keep the antenna wire separate from all other wiring, both inside and outside the MCU enclosure.

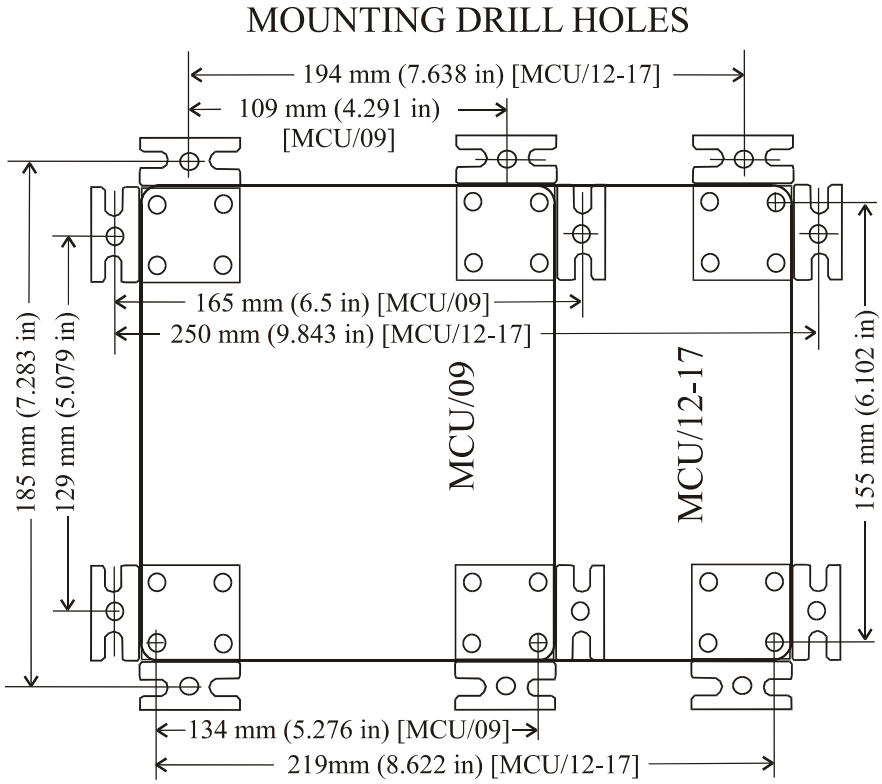
Figure 7 overleaf shows the mounting footprint drawings for both types of IP 67 MCU enclosures.

Note that optional shock mounting brackets are available. Contact the factory for this option - refer to the rear cover of this manual for telephone numbers and e-mail addresses.

Figure 7. MCU enclosure mounting footprint drawings



Mounting Drill Holes for MCU/12-17:
Affix installation bracket with self-shaping plastic screws
155mm x 219mm M4/M5 without mounting bracket, fastened through the case
or 129mm x 250mm M6 Mounting bracket top and bottom of case
or 185mm x 194mm M6 Mounting bracket left and right of case



Mounting Drill Holes for MCU/09:
Affix installation bracket with self-shaping plastic screws
155mm x 134mm M4/M5 without mounting bracket, fastened through the case
or 129mm x 109mm M6 Mounting bracket top and bottom of case
or 185mm x 165mm M6 Mounting bracket left and right of case

4.2 WIRING CONNECTIONS

Figures 8 and 9 below show the respective terminal strip connections within the 9 MCU and 12-17 MCU enclosures. The actual wiring configuration depends on; (1) the type of MCU Enclosure, and (2) the work/configuration sheet supplied with your system.

Figure 8. 9 MCU enclosure wiring connections

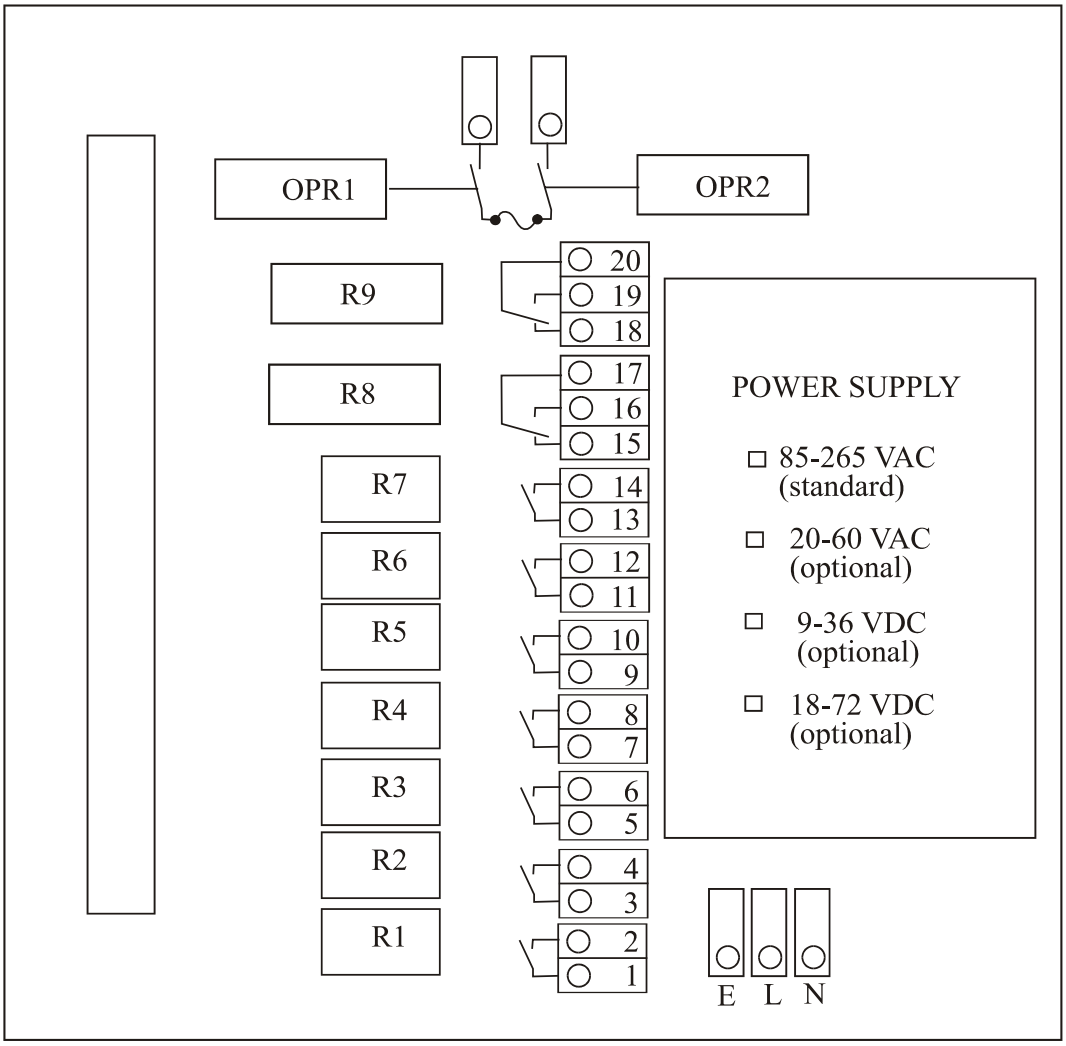
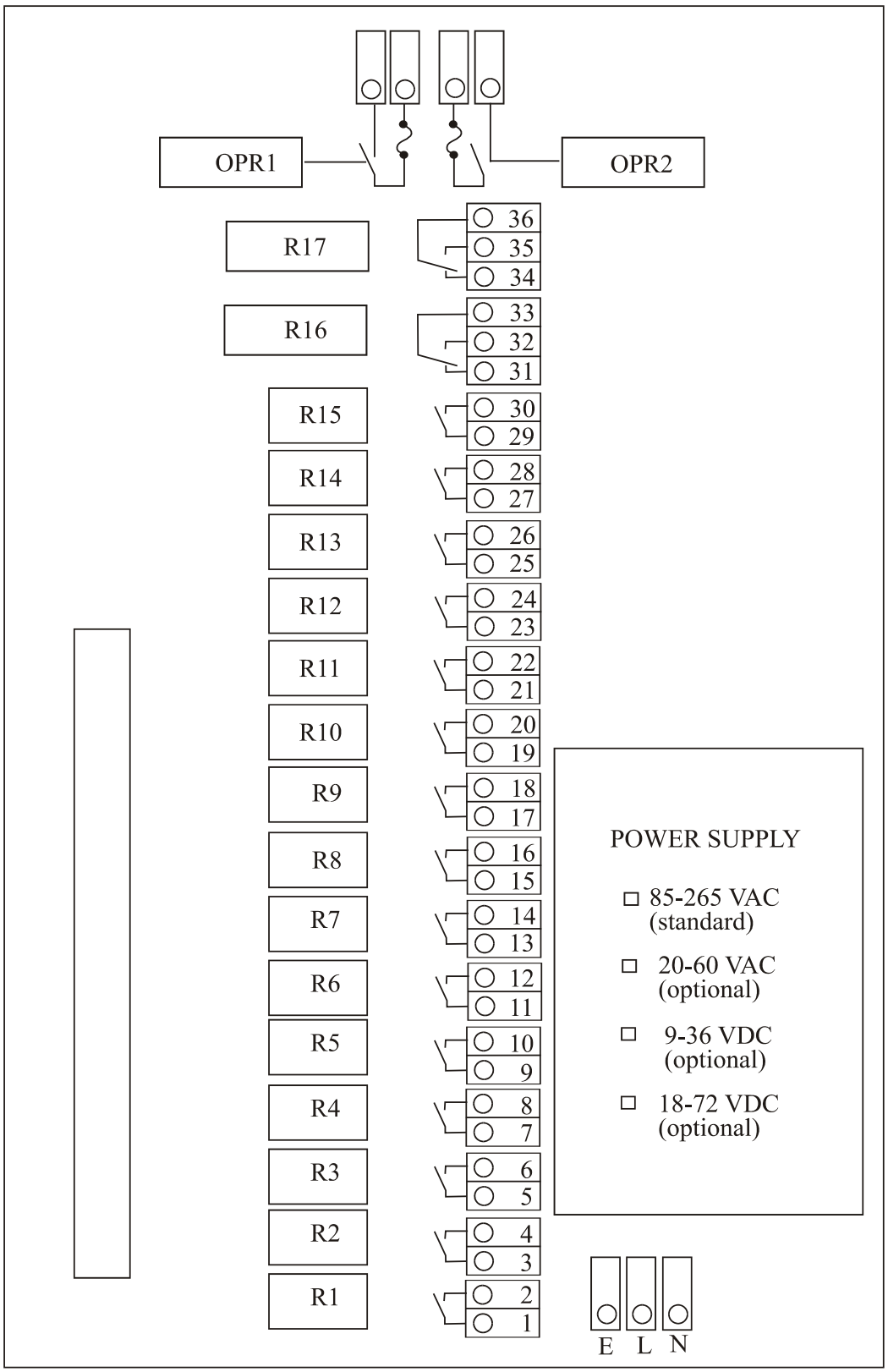


Figure 9. 12-17 MCU enclosure wiring connections



5 INTERFACE CONNECTIONS

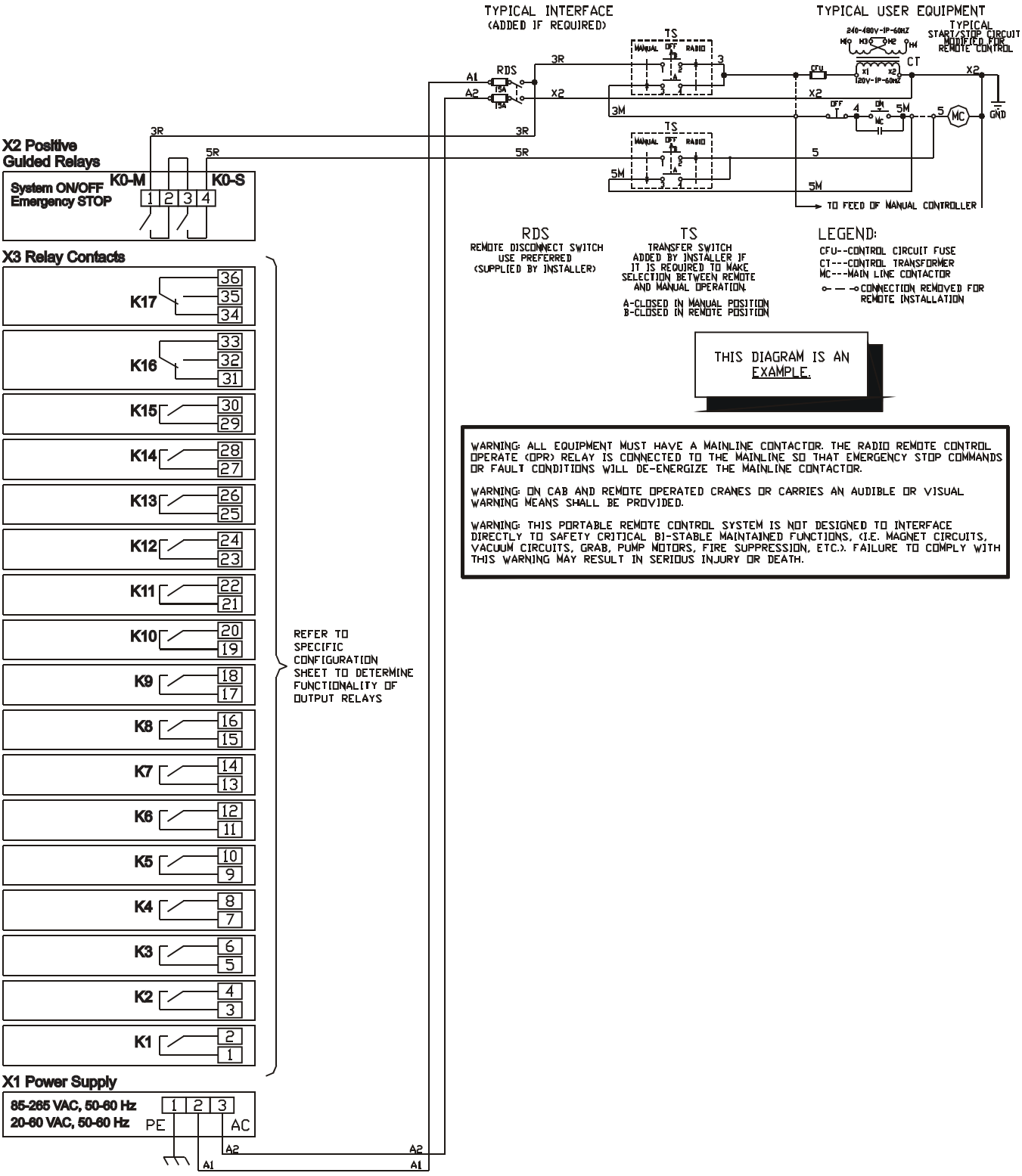
Before installing the remote control system, you are advised to prepare an electrical wiring diagram that defines all electrical interface connections between the system and the equipment being controlled. Before installing the remote control system, we advise you to first read the following topics of discussion (Paragraphs 5.1 thru 5.6). At the same time, you should locate and refer to the example mainline drawing provided in Figure 10 overleaf.

5.1 SAFETY INTERFACE UNIT

⚠	**<u>WARNING</u>:** **UNLESS SPECIFIED, MKU PORTABLE REMOTE CONTROL SYSTEMS ARE NOT DESIGNED TO INTERFACE DIRECTLY TO SAFETY CRITICAL BI-STABLE MAINTAINED FUNCTIONS, (i.e., magnet circuits, vacuum circuits, grab, pump motors, fire supression, etc.).** **A PROPER INTERFACE TO SAFETY CRITICAL BI-STABLE MAINTAINED FUNCTIONS SHALL BE INSTALLED, IDEALLY USING A CATTRON® RELAY INTERFACE UNIT, PART # RI004NE.** **ALTERNATIVELY, EXAMPLE CIRCUIT DIAGRAMS ARE PROVIDED IN APPENDIX 'B' OF THIS MANUAL TO ENABLE YOU TO PROPERLY INTERFACE YOUR REMOTE CONTROL SYSTEM WITH SAFETY CRITICAL BI-STABLE MAINTAINED FUNCTIONS BEFORE OPERATIONAL USE.** **SHOULD CATTRON® MKU SYSTEMS BE INADVERTENTLY CONFIGURED TO INTERFACE DIRECTLY WITH SAFETY CRITICAL BI-STABLE MAINTAINED FUNCTIONS AT YOUR OPERATING FACILITY, DAMAGE TO EQUIPMENT, SERIOUS INJURY, OR DEATH TO PERSONNEL MAY RESULT.** **IT MUST BE FULLY UNDERSTOOD THAT CATTRON® WILL NOT BE HELD LIABLE FOR PERSONAL INJURY, DEATH, EQUIPMENT OR PROPERTY DAMAGE WHICH MAY ARISE FROM IMPROPER CONFIGURATION OF YOUR PORTABLE REMOTE CONTROL SYSTEM.**

When safety critical bi-stable maintained functions (i.e., electro-magnet circuits, vacuum circuits, grab, pump motors, fire suppression etc) are part of your controlled equipment, a proper interface must be installed between the remote control system and all such functions <u>before</u> operational use. We strongly recommend you use a CATTRON® Relay Interface Unit, Part # RI004NE. In addition, example circuit diagrams are provided in **APPENDIX 'B'** at the end of this manual. These circuit diagrams illustrate how to properly interface your remote control system with safety critical bi-stable maintained functions.

Figure 10. Example mainline drawing



5.2 THE CONTROLLED MACHINE

The machine you are interfacing to may consist of single or multiple contactor panels, single or multiple manual controls, and single or multiple control transformers etc. Notice that there is no common connection between relay output contacts, allowing control of different power sources and combinations of AC and DC power. Application of the normally open relay contacts is similar to wiring that is required for any control switch, such as a pendant. Standard wiring practices should be observed. These can be found in the National Electrical Code and in local codes that may apply for your area.

5.3 CONTROL TRANSFORMER

The power required to operate a standard remote control system is 85–265 V AC, 50/60 Hertz, @ less than 1 Amp. The remote control system can be connected to an existing control transformer if the transformer's size permits, otherwise, a control transformer must be supplied to provide the appropriate power for the remote control system.

Using a separate control transformer helps by reducing chances of a power slump if other electrical components connected to it fail. It can also be sized to allow installation of a utility outlet near the MCU for connection of a light or test equipment.

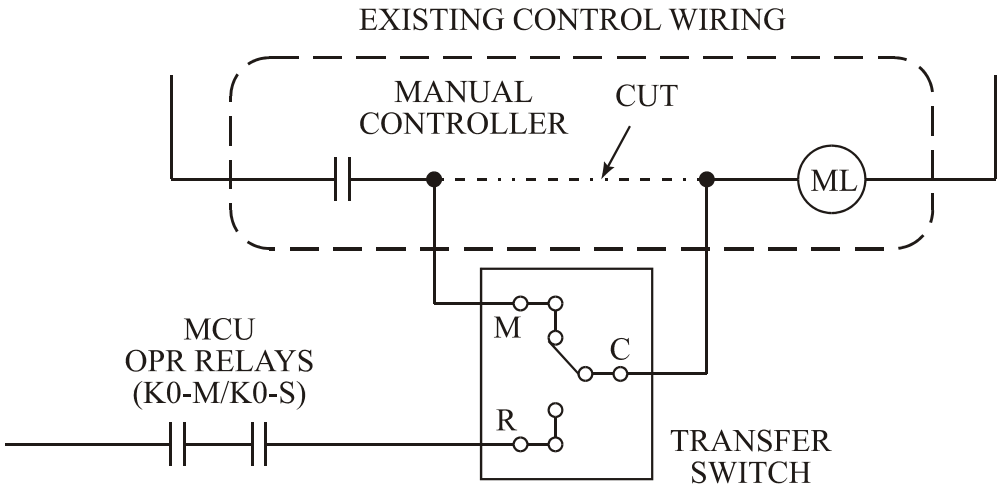
5.4 TRANSFER SWITCH

A CATTRON® Transfer Switch, Part # CPA-0166 provides an easy way to switch the controlled equipment from manual to remote control. If the equipment is to be operated in the **radio only** mode and there are **no manual controls**, the Transfer Switch (TS) can be omitted. Otherwise, installation of a transfer switch is desirable to allow selection between radio or manual operation.

Installing the transfer switch may require changes to the controlled equipment wiring. Prior to changing any existing wiring, create a wiring diagram of the planned changes. Use existing empty terminals on terminal boards as tie points.

When the transfer switch is in the 'REMOTE' position, the manual controls should be disconnected and vice versa. All power should be transferred to the radio control relays. When the transfer switch is placed in the 'MANUAL' position, manual control of the equipment should be restored. The equipment may now be controlled as it was prior to installation of the radio controls. Figure 11 overleaf shows a typical transfer switch wiring setup. The transfer switch also contains an 'OFF' position. In this position all circuits are disconnected from both remote and manual controls.

Figure 11. ***Typical transfer switch wiring***



When switching the transfer switch between remote and manual control, observe the following precautions:

- Do not transfer control of a crane with a load lifted. Always set down all loads prior to changing the position of the transfer switch.
- If the crane is equipped with a magnet, it shall be set in the drop position prior to changing the position of the transfer switch.
- Set (push down) the red STOP switch on the MKU controller to 'STOP'.
- Set the ON/OFF switch on the MKU controller to 'OFF'.

5.5 RELAY OUTPUTS

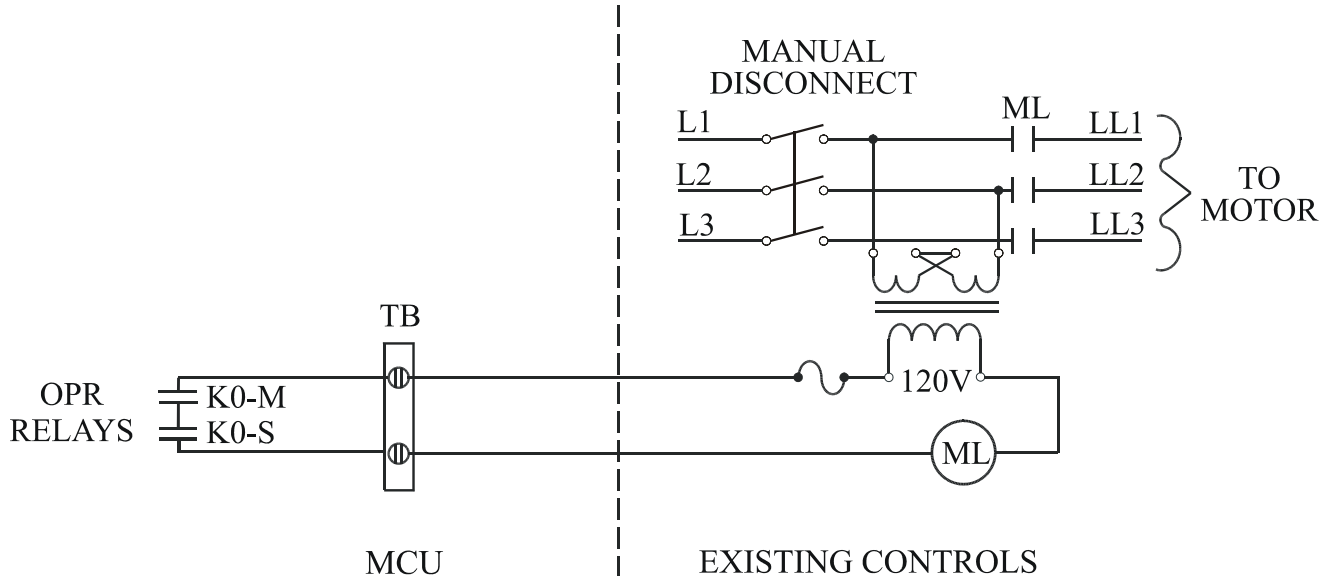
Each output relay has at least one Normally Open (NO) contact which is available for wiring at the relay board's Terminal Block (TB). These contacts are rated for up to 7.0 Amps @ 120 – 250 VAC or 30 VDC.

Each relay on the relay output boards is completely independent of all other relays. There are no common connections between any output contacts. This allows the connection of different power sources, AC and DC, to each of the separate relays.

5.6 MAINLINE CIRCUIT

Referring to Figure 12 below, the Operate (OPR) relay K0-M AND K0-S outputs are special. They should always be connected to the mainline (ML) contactor. If a fault were to occur, the 'OPR' relays, which control the mainline contactor, would safely bring the equipment to a stop. This makes the use of a mainline contactor **mandatory** for safe operation of this equipment.

Figure 12. OPR contact wiring



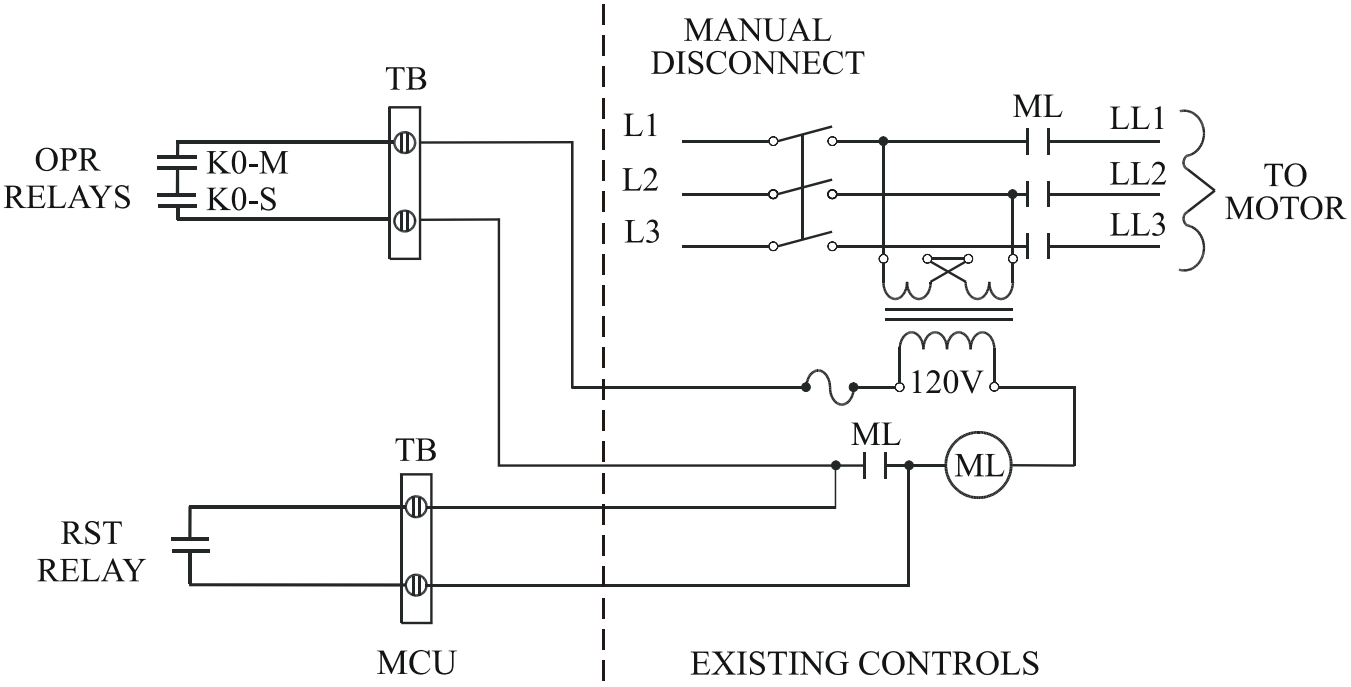
⚠	**<u>WARNING</u>:** **ALL EQUIPMENT MUST HAVE A MAINLINE (ML) CONTACTOR INSTALLED AND ALL TRACKED EQUIPMENT (I.E. CRANES) HAVE A BRAKE INSTALLED.** **THE REMOTE CONTROL OPERATE (OPR) RELAYS MUST BE CONNECTED TO THE MAINLINE SO THAT STOP COMMANDS WILL DE-ENERGIZE THE MAINLINE CONTACTOR AND SET THE EQUIPMENT BRAKE.** **FAILURE TO COMPLY WITH THE ABOVE WARNINGS MAY RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL AND DAMAGE TO EQUIPMENT**.

The Operate (OPR) relays are energized for the first time when the MCU has power applied, the controller is switched on, and a matching address code is sent from the controller via an RF signal to the MCU. The OPR relays are wired to the mainline (ML) contactor. Once the mainline is energized, a continuously repeated valid signal must be received for function outputs to engage. If this signal is interrupted for any reason, all function outputs will switch off.

In Figure 12 above, the OPR relay contacts are wired directly to the mainline (ML) contactor. Switching the remote controller to 'ON' energizes the mainline contactor.

Referring to Figure 13 below, an auxiliary function may be used as a Reset (RST) output that will only be effective when the Operate (OPR) relays have been closed.

Figure 13. OPR contact and RST wiring



Momentary closure of the Reset (RST) relay picks up the mainline (ML) contactor, which is maintained under control of the OPR relays. Thus, power is supplied to the controlled device. If OPR opens, the mainline contactor releases, removing power from the controlled device and stopping all motion.

Figure 13 above shows the Operate (OPR) relay and optional Reset (RST) relay wired to control a mainline contactor. This configuration requires the operator to activate the reset function on the controller after he or she has turned the unit on. Once reset, the ML contactor stays energized until OPR de-energizes.

6 OPERATING INSTRUCTIONS

NOTE: During normal operation, all interfaces with the system are through the OCU. MCUs require no operator action as these units have been designed to operate completely unattended.

6.1 CHANGING 'TRANSKEYS'

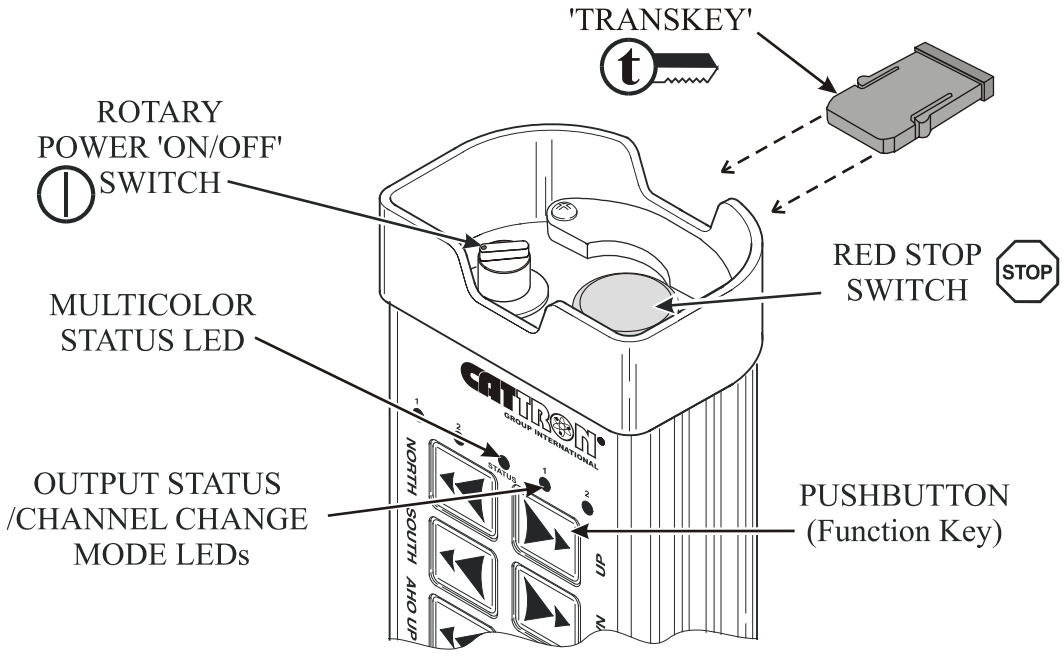
Due to the flexible '**TransKey**' concept, it is not uncommon for one OCU controller to be used to control multiple cranes or machines. Each crane or machine will be provided with a unique '**TransKey**' that must be inserted into the remote controller before carrying out remote control operations. ***Always set the OCU's power ON/OFF switch to 'OFF' before removing or inserting a TransKey***.

6.2 CONTROLS AND INDICATORS

The OCU is a lightweight hand-held unit with up to twelve pushbuttons (function keys) on a single keypad, plus a rotary ON/OFF switch and a push/pull STOP switch. The coded **'TransKey'** sets the operating parameters for your control system and has been pre-configured at our factory. Each OCU is custom engineered to duplicate all the manual control functions normally found on the machine and may contain basic control functions as well as some auxiliary functions, depending on system application. The OCU may be hand carried, held by a belt loop strap or an optional shoulder carrying strap. The OCU is powered by a disposable (Alkaline), or rechargeable (Ni-Cad), battery pack.

Referring to Figure 14 below, the majority of MKU OCUs have the following Controls and Indicators:

Figure 14. Operator controls and indicators



With the correct color coded 'TransKey' inserted into the OCU, setting both the STOP and ON/OFF switches to their respective 'RUN' and 'ON' positions will apply power to the OCU.

NOTE: Some MKU controllers use the bottom row of keypad switches to switch the unit 'ON' and 'OFF'.

Immediately after power has been applied to the transmitter, if a good battery is installed, the multicolor STATUS LED should momentarily illuminate red, followed by orange, then 'flash' green. Two short beeps will also be heard. In addition, any time a pushbutton (function key) is pressed, a beep will be heard and the multicolor STATUS LED will 'flash' green during each radio transmission.

When the battery energy starts to go low, the multicolor STATUS LED will 'flash' red and a beep will be heard once every ten seconds to alert the operator to change or re-charge the battery pack.

When the ON/OFF switch is set to the 'OFF' position, power is removed from the OCU causing all control functions to cease. Setting (pushing down) the red STOP switch to 'STOP' before setting the ON/OFF switch to 'OFF' immediately sends a stop command to the MCU. Immediately after the stop command has been sent, the radio transmitter within the OCU switches OFF.

Referring to Figure 14 above, all active Function Key (pushbutton) commands are identified using labels placed next to each pushbutton. When a pushbutton is depressed, the OCU transmits the corresponding command (as labeled). All pushbutton operations are momentary and must be maintained by the operator. Releasing the pushbutton will send an 'OFF' command that de-energizes the corresponding output function. A 'beep' will be heard each time a button is pressed or released.

6.3 OCU OPERATION

Dual Pressure (DP) function key pushbuttons are pre-assigned through **'TransKey'** programming for two-step operation. In other words, **a second output is tied to the second level of button depression**.

Typically, Dual Pressure OCUs send one of two output commands to the MCU from a single button. DP buttons are paired to opposite directions of the same output, (i.e., forward and reverse). These two buttons will control direction and speed relays. The first level of depression on each button will command the desired direction and first step of movement (two directions = two relays). The third relay is operated by either button's second level of depression to the second speed output of the controlled machine. This could be a single relay, or two separate relays assigned for the second speed step, or for the Variable Frequency Drive (VFD), accelerate output (for the button in use).

If the DP button is depressed to its first level, first speed is achieved and maintained as long as the button remains at that level of depression. If the button is depressed to its second level, second speed is achieved. If the operator releases pressure and allows the button to return to the first level, first speed is again achieved. Moving directly from 'OFF' to the second level of depression can command second speed if sufficient pressure is applied. For example, one of two DP buttons labeled 'FORWARD' and 'REVERSE' is used at the first pressure level to command the direction and first speed of the equipment. The second pressure level of the button in use will command a second speed.

⚠	**WARNING:** **ALL EQUIPMENT MUST HAVE A MAINLINE (ML) CONTACTOR INSTALLED AND ALL TRACKED EQUIPMENT (I.E. CRANES) HAVE A BRAKE INSTALLED.** **THE REMOTE CONTROL OPERATE (OPR) RELAYS MUST BE CONNECTED TO THE MAINLINE SO THAT STOP COMMANDS WILL DE-ENERGIZE THE MAINLINE CONTACTOR AND SET THE EQUIPMENT BRAKE.** **FAILURE TO COMPLY WITH THE ABOVE WARNINGS MAY RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL AND DAMAGE TO EQUIPMENT**.

⚠	**WARNING:** **MORE THAN ONE REMOTE CONTROL SYSTEM MAY BE USED AT, AROUND, OR NEARBY YOUR OPERATING FACILITY. THEREFORE, BEFORE INSERTING A 'TRANSKEY' INTO AN OCU, YOU MUST INSURE THE CORRECT CODED 'TRANSKEY' IS SELECTED FOR THE DESIRED EQUIPMENT TO BE OPERATED.** **IF THE WRONG 'TRANSKEY' IS INSERTED INTO AN OCU, OTHER REMOTE CONTROLLED EQUIPMENT LOCATED AT, AROUND, OR NEARBY YOUR FACILITY MAY BECOME OPERATIONAL.** **FAILURE TO COMPLY WITH THE ABOVE WARNINGS MAY RESULT IN UNINTENED OPERATION OF REMOTE CONTROLLED EQUIPMENT WHICH IN TURN COULD RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL AND DAMAGE TO EQUIPMENT.**