

Operator Manual

BMS 2 System

GA 610



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YOUR #1 PARTNER IN RADIO REMOTE CONTROLS

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INTRODUCTION

INTRODUCTION

Thank you for purchasing the Hetronic radio remote control system. Hetronic radio remote controls are the highest caliber in remote control value, performance and safety.

Hetronic radio remote controls use the latest frequency synthesizer technology to eliminate the problems typically associated with radio remote control systems.

THE MANUAL

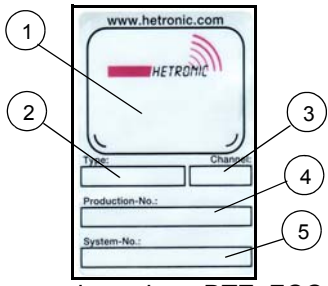
Before operation of unit, carefully and completely read your manuals. The contents will provide you with an understanding of safety instructions and controls during normal operation and maintenance.

The BMS-2 System is used with several different transmitter types. For this reason, the photos or illustrations of transmitters in this manual may not show the transmitter purchased with this system. Please refer to the technical documentation for your specific transmitter for control panel layout and operational instructions.

PRODUCTION AND SYSTEM NUMBERS

When contacting your dealer or Hetronic about service, repair or replacement parts, know the Production and System numbers of the transmitter and receiver.

The numbers are located on the label that is affixed to the unit itself.



1. Specific approvals such as BTZ, FCC, CE, etc. and the RF Unit.

2. The type of transmitter or receiver.

3. Frequency channel.

4. **Production Number** - The first digit indicates the manufacturing facility (1=H-Germany, 2=H-Malta, 3=H-US, 4=H-Italy). The next four digits are the production month and year. The last 6 digits are the system address.

5. **System Number** - The Hetronic Part Number of the transmitter or receiver.

Record the Production and System numbers here:

Transmitter Type

Transmitter Production Number

Receiver Production Number

System Number

UNAUTHORIZED REPLACEMENT PARTS

Use only Hetronic replacement parts. The replacement of any part with anything other than a Hetronic authorized replacement part may adversely affect the performance, durability, and safety of this system and may void the warranty. Hetronic disclaims liability for any claims or damages, whether warranty, property damage, personal injury or death arising out of the use of unauthorized replacement parts.

BEFORE ATTEMPTING TO OPERATE THIS SYSTEM:

1. Make sure all installation has been properly completed.
2. ALWAYS be sure the crane/machine and radio remote control Emergency-Stop functions work properly before beginning any crane/machine operation.
3. Understand all Safety Precautions provided in the manuals.
4. Review control functions and operation of the machine and this radio remote control system.
5. Surge suppressors (RC type only) must be used when the receiver is controlling magnetic contactors.
6. When not in use, turn the transmitter off and store in a safe place to prevent unauthorized use.
7. If the crane/machine does not respond properly, stop operation immediately. Turn off the transmitter and report the condition to the appropriate technician or supervisor.
8. Turn off the transmitter and remove the battery before any maintenance work is done.

IMPORTANT: AVOID SYSTEM DAMAGE - ALWAYS disconnect receiver power supply and control wiring before welding on any part of the crane/machine.

9. Turn off the transmitter when changing the battery or taking a break.

10. Always have batteries in the battery charger to ensure the availability of fully charged batteries.
11. Installation, setup and service must be performed by authorized personnel only.
12. Use only Hetronic spare parts.

THEORY OF OPERATION

The BMS-2 is the Hetronic designation for a receiver with specific functions and capabilities. The system transmitter generates the electronic signal that communicates with the receiver. Several different Hetronic transmitter types can be used with this system.

- GR
- GL
- GL-3
- Nova-S
- Nova-M
- Nova-L
- Nova-XL

Hetronic radio remote control systems operate in the 400-470 MHZ range (70 cm band). The transmitter and receiver are set with identical address codes and frequency channels. This allows operation of multiple systems within the same area without signal interference.

Some of the key features of the BMS-2 System are:

- Double Monitored E-Stop
- Optional Feedback Function
- CAN or RS232 Interface
- Setup/Adjustment Software
- Quick-Set Function
- Receiver Status Display

E-Stop Function

The most important feature of the radio remote control system is the E-Stop. The transmitter sends the E-stop status signal along with the specified crane/machine function. This method confirms that ongoing operations are safe. If the E-stop pushbutton is pressed, the relay module in the receiver causes all crane/machine motions to stop. The receiver goes into Safe mode.

The BMS-2 receiver display will show "0 0 2" indicating an active E-Stop condition.

To restart the system, disengage the E-stop button.

The E-Stop responds faster than any other function. When E-Stop is engaged, the system ignores any other signal that is transmitted. E-Stop must be disengaged before the system will respond to any other signal.

The E-Stop is self-monitoring and redundant in the transmitter and receiver. The system performs a self-test to ensure the E-Stop circuit is working properly. If an error is detected, the system automatically goes into Safe mode.

The BMS-2 receiver display will show "0 0 1" indicating an E-Stop condition in the receiver.

When the transmitter is turned on, it performs a self-test to be sure that communications are within designated parameters. If an error is detected, the transmitter will not transmit any signals.

The BMS-2 receiver display will show "0 0 4" indicating a passive E-Stop condition in the transmitter.

Receiver Safe Mode

The following conditions cause the receiver to go into its Safe mode:

- Radio signal interference
- Transmitter out of operating range
- E-Stop button is activated
- E-Stop circuit failure
- Low battery sends E-stop after time out

When the transmitter is turned off, the Time Out process begins. The Time Out period is set to 450 msec at the factory. If the receiver does not establish contact with the transmitter within that time period, it goes into the Safe Mode. In Safe Mode, the receiver shuts off power to the output modules and activates the E-stop function.

The BMS-2 receiver display will show "0 0 1" indicating an E-Stop condition in the receiver.

NOTE: For descriptions of other display codes, see the Operation Section of this manual, the Diagnostic Display Codes table on page 15, or the technical documentation supplied with your radio remote control system.

SAFETY

SAFETY ALERTS



Look for this symbol to point out important safety precautions. They mean:

Attention!

Personal Safety Is Involved!

Become Alert!

Obey The Message!

The safety alert symbol is used in decals on the unit and with proper operation procedures in this manual. Understand the safety message. It contains important information about personal safety on or near the unit.



DANGER: IMMINENTLY HAZARDOUS SITUATION! If not avoided, WILL RESULT in death or serious injury.



WARNING: POTENTIALLY HAZARDOUS SITUATION! If not avoided, COULD RESULT in death or serious injury.



CAUTION: POTENTIALLY HAZARDOUS SITUATION! If not avoided, MAY RESULT in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTATIONS

NOTE: General reference information for proper operation and maintenance practices.

IMPORTANT: Specific procedures or information required to prevent damage to unit or attachment.

PRACTICES AND LAWS

Practice usual and customary safe working precautions, for the benefit of yourself and others. Understand and follow all safety messages. Be alert to unsafe conditions and the possibility of minor, moderate, or serious injury or death. Learn applicable rules and laws in your area.

REQUIRED OPERATOR TRAINING

Original purchaser of this unit was instructed by the seller on safe and proper operation. If unit is to be used by someone other than original purchaser; loaned, rented or sold, ALWAYS provide this manual and any needed safety training before operation.

ALWAYS review the operators manual of any machine to be controlled by radio remote control.

POSSIBLE SOURCES OF DANGER

This system makes remote control via radio signals possible. However, the transmission of control commands can take place around obstacles and out of the operator's direct sight. To prevent accidental start-up and possible injury or damage:

1. Always engage the E-stop button and switch "OFF" the transmitter when it is not in use. Remove the key if the unit is placed any distance away from the operator.
2. Disconnect the power supply from the receiver before any assembly, maintenance or repair work is done.

IMPORTANT: AVOID SYSTEM DAMAGE - ALWAYS disconnect receiver power supply and control wiring before welding on any part of the crane/machine

3. Never remove or alter any of the safety features of this system.
4. ALWAYS be sure the crane/machine and radio remote control Emergency-Stop functions work properly before beginning any crane/machine operation.

OPERATION AND WORK AREA SAFETY

The work area must be free from obstacles, debris or other tripping hazards. Avoid uneven work areas and any rough terrain. Always be sure of your footing.

Be aware of overhead obstacles that may interfere with machine operation.

If a belt or strap is provided with your transmitter, use it at all times.

PROTECTIVE FEATURES

This radio remote control system is equipped with electronic and mechanical safety features. Processing of control signals transmitted from other transmitters is not possible, since transmission coding is unique to each system.

These safety features help protect the operator, as well as others within the work area. The machine functions can be stopped by pushing the emergency stop button on the transmitter control panel (EMERGENCY STOP).

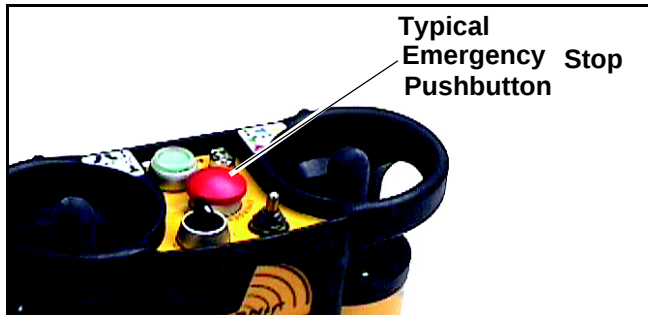
NOTE: The e-stop command is transmitted within approximately 0.5 seconds (450 ms) after the switch is turned to the "OFF" position.



WARNING: Accidental start-up can cause serious injury or death. NEVER remove or modify any safety feature.

TO STOP IN AN EMERGENCY

1. Press the red "EMERGENCY STOP" pushbutton.
2. Turn the key to "OFF".
3. Wait for all moving machine parts to stop.
4. Refer to machine's operator manual for further instructions.



MAINTENANCE

Always shut off power to the machine and the radio remote control system transmitter and receiver before any assembly, maintenance or repair.

IMPORTANT: AVOID SYSTEM DAMAGE - ALWAYS disconnect receiver power supply and control wiring before welding on any part of the crane/machine.

INSTALLATION



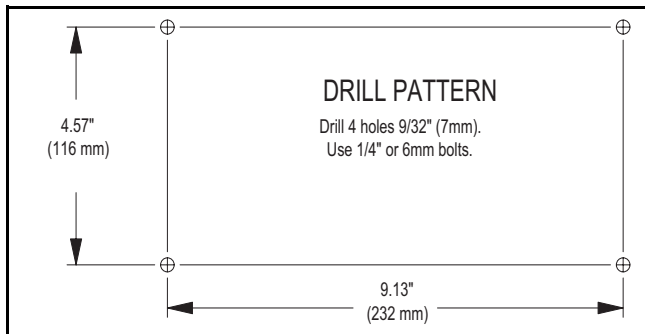
WARNING: FAILURE TO FOLLOW INSTRUCTIONS could result in personal injury and/or damage to equipment. Read and understand the safety instructions in all manuals provided.

MOUNT THE RECEIVER

Install Receiver and Output Wiring

Select a position for the receiver so that the display is easily visible, accessible and that provides protection from violent impact from debris or thrown materials. The receiver housing is rated IP65 and is protected against penetration of dust and moisture. Therefore, weather and elements should not be the primary concern when installing the receiver.

Four mounting holes are required when installing the receiver unit. The drill pattern and recommended hardware are shown in the following illustration.

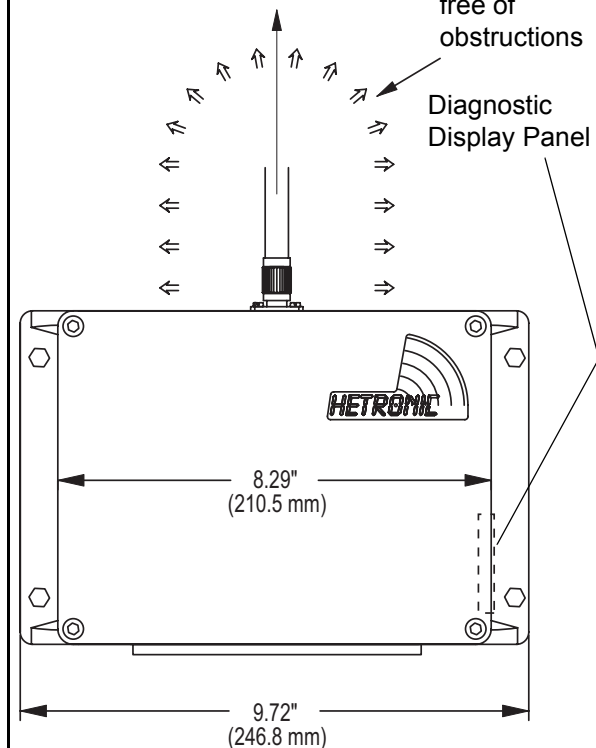


If the receiver includes an attached antenna, mount the receiver so that the antenna points straight up. The area around the antenna should be free of obstructions, especially metal.

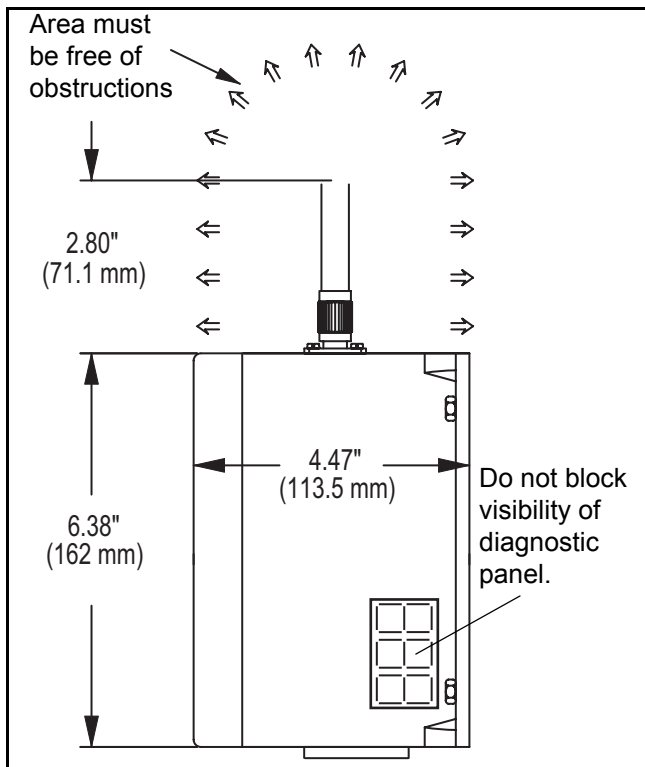
Antenna must be vertical (pointing up).

Area must be free of obstructions

Diagnostic Display Panel



Be sure that the Diagnostic Display panel is clearly visible.



The receiver wiring is critical for proper system operation. Make all connections with good quality contacts or solder joints to ensure proper electrical contact.

Supply voltage and ground wiring are crucial and must be connected to reliable connecting circuitry. Do not use a chassis ground for this equipment. The ground wire must be connected directly to the vehicle battery negative post.

IMPORTANT: Power supply wiring must be at least AWG 12 to prevent power drop.

The output control signals to the proportional control valves should be routed separately from any wiring that could produce transient voltage interference. Interference or "induced voltage spikes" could cause erratic performance of the proportional controls.

Mount the Actuators (Optional)

Mount and attach the actuators to the hydraulic valves or to the mechanical linkage with the brackets supplied.

Attach Wiring Harness (Optional)

Plug the wiring harness into the receiver and into the corresponding actuators.

Connect Electrical Wiring

Connect all remaining wires (power supply, engine start-stop, etc.) according to the wiring diagram of the crane/machine and the radio remote control.

SYSTEM SET-UP

QUICK-SET SYSTEM

The Quick-Set System provides easier installation, adjustment and service of the radio remote control system. Quick-Set allows adjustment of all proportional function speeds (valve travel) from the transmitter. A red Program Key is provided to control the programming mode. When adjustments are complete, remove the Program Key and store it in a secure location. Function speeds can be readjusted at any time.

The system includes a base board, or mother board, which includes all of the common function circuitry found in most Hetronic receivers. These functions include power regulation, decoding the received signal, 16 digital output functions, and the Quick-Set function. The receiver also contains diagnostic Error Codes that are visible on the outside of the housing to help quickly diagnose problems.

FUNCTION SPEED ADJUSTMENT

This procedure requires that the receiver is connected to the machine with power applied, all necessary wiring is complete and a fully charged battery is in the transmitter.

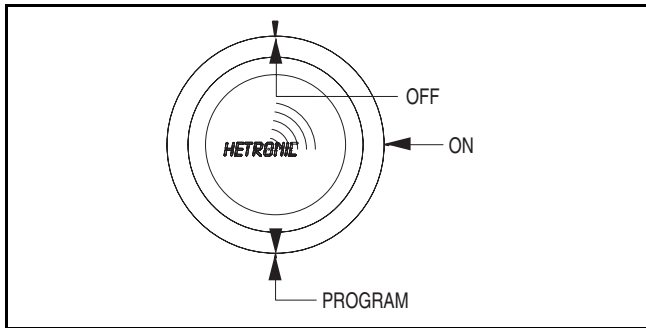
IMPORTANT: The crane must be located in an open area so that sudden or unexpected crane movements will not damage buildings or property. All power lines must be out of reach of the boom. Set the outriggers in the "out and down" position as recommended by the crane manufacturer and be sure the crane is stable. For specific instructions, refer to the crane manufacturer's operator manual. Allow the truck engine to run at "Idle".



CAUTION: AVOID INJURY AND PROPERTY DAMAGE - The crane may respond differently with radio remote controls than with manual controls. During the adjustment procedure, use extreme caution with joystick/lever movements. Avoid sudden movements and observe crane motions carefully. The operator must be standing on dry, level, stable ground that is free of oil and debris.

1. Use the crane's manual controls to raise the boom from its rest. Extend the boom to a safe starting point.
2. The transmitter must be attached to the operator with the belt adjusted to a firm fit.
3. Turn the receiver power "ON".

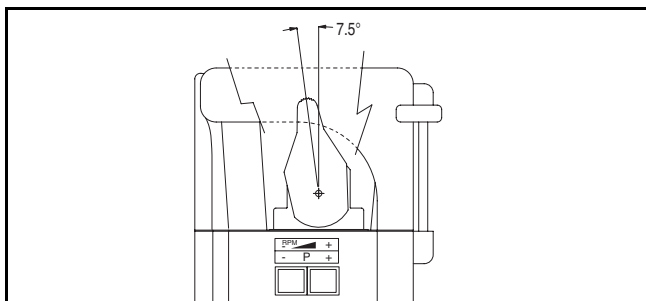
4. Remove the black key from the transmitter keyswitch.
5. Insert the red programming key into the keyswitch.
6. Turn the transmitter "ON".



7. Wait approximately 3 seconds until the second buzzing sound has finished.
8. Twist the key one quarter turn further to the program position. (This is only possible with the red programming key.) Press the "Start/horn" button for at least one second.



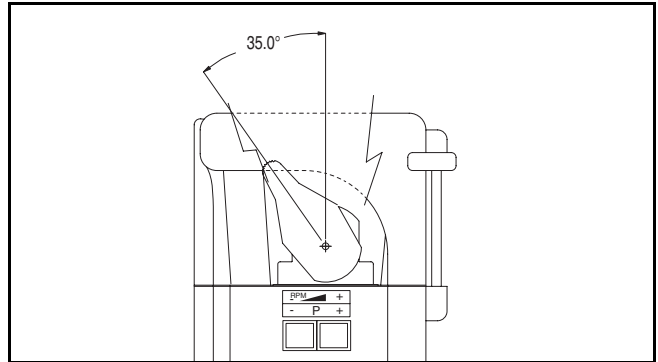
9. To set minimum speed - Deflect the requested joystick/paddle slowly until you hear the vehicle's horn. If the horn is connected to the receiver, it will sound for a brief moment when the joystick/paddle reaches the minimum movement position. Keep the joystick/paddle in this position.



10. Adjust the speed of this function by using the program "T-O-T" toggle switch (momentary - zero - momentary). Push the toggle switch toward "+" to increase speed, toward "-" to decrease speed.

Adjust the function speed to move as slowly as possible. This helps to achieve a smooth start when this function is activated.

11. To set maximum speed - Deflect the joystick/paddle to its maximum position. Push the program toggle switch toward "+" to increase speed, toward "-" to decrease speed.



WARNING: AVOID INJURY - The crane is moving during the adjustment of the functions. Be sure the work area is clear of obstacles and bystanders.

The receiver can program only one function at a time. For joysticks, make sure that only one axis is deflected at a time. When function adjustment is complete in one direction, repeat the procedure above for the other directions and functions. Remember to set values for both high and low ranges.

After all adjustments are complete, wait at least 10 seconds before turning the transmitter off. The new values will be automatically stored into the system's memory.

Hetronic Proprietary Software

The software that accompanies this radio remote control system is customized per each customer's requirements. Refer to the Software Technical Documentation for specific instructions on the set-up and operation of this system.

FREQUENCY AND ADDRESS SETTINGS

Each Hetronic radio remote control system contains a transmitter RF unit and a receiver RF unit.

The address settings are pre-set at the factory in the ADMO module. However, if the transmitter coder board, the base board, or if the entire transmitter or receiver are replaced, the ADMO addresses must match in the system.



CAUTION: AVOID INJURY OR DAMAGE - Operating the transmitter without its antenna could destroy the final stage of the RF module. DO NOT attempt to change the Hetronic pre-set frequency or the 16-bit address. Personal injury and property damage could result from transmission interference and may void the warranty.

IMPORTANT: If the ADMO settings of the transmitter and receiver do not match, the system will not function.

OPERATION



WARNING: FAILURE TO FOLLOW INSTRUCTIONS could result in personal injury and/or damage to equipment. Read and understand the safety instructions in all manuals provided.

HOLDING THE TRANSMITTER

Hold the transmitter with the control panel facing you. Be sure that you are able to easily read any text and understand operation symbols. If your transmitter contains a Tilt Sensor Switch, be sure it is not activated or the transmitter will not start.

If a belt or strap is provided with your transmitter, use it at all times. The belt or strap is designed to reduce stress and increase safety.



WARNING: FAILURE TO FOLLOW INSTRUCTIONS could result in personal injury and/or damage to equipment. Always hold the transmitter in the proper orientation. Holding the transmitter improperly while operating the crane/machine could result in unexpected crane/machine response.

The safety checks described in the following paragraphs must be completed before the radio remote control system is activated. These checks must be performed at least once a day, before the start of any operation and at all shift changes.

IMPORTANT: A transmitter drawing is included with each system. Transmitter layout and inscriptions may vary according to customer requests.



WARNING: FAILURE TO FOLLOW INSTRUCTIONS could result in personal injury and/or damage to equipment. Test the "E-STOP" function as described in the crane/machine manufacturer's operator manual before beginning any operation.

VISUAL CHECK

Always check the transmitter for any physical damage before any operation.

- Always keep safety features, guards and controls in good repair, in place and securely fastened.
- Check equipment for wear or damage.
- Check rubber cuffs and pushbutton caps for wear or damage.

IMPORTANT: Never operate a transmitter with worn or damaged parts. Replace immediately with only Hetronic parts. Contact Hetronic or your Dealer.

START-UP PROCEDURE

This procedure must be carefully followed before beginning any operation.

1. Be sure that all safety measures required by the equipment manufacturer have been followed. (i.e. crane level, stabilizers down, etc.)
2. Be sure the transmitter battery is fully charged.
3. Be sure that power is supplied to the receiver. The receiver display should read "0 0 4".
4. Push in the transmitter E-stop pushbutton.
5. Be sure that all controls, joysticks or paddle levers are in the Off (neutral) position.

NOTE: If any control, joystick or paddle lever is NOT in the Off (neutral) position when the Start/Horn button is pushed, the transmitter will not turn on.

6. Switch the transmitter "ON". A short buzzer signal will sound.
7. Wait for the second buzzer signal (approx. 3 seconds).
8. Press the Start/Horn button again.
9. The green LED on the transmitter control panel will flash. This indicates that the transmitter is working and is ready to use. The receiver display should read "0 0 2".
10. Disengage the E-stop pushbutton. The receiver display should now read "0 0 0".
11. Push the green "Start/horn" pushbutton on the transmitter.
12. Check that the machine functions correspond with the transmitter functions. The receiver display will change according to which motion is activated.

IMPORTANT: The machine functions will operate during this check. Be certain that there are no obstacles near the machine.

13. Push the "EMERGENCY STOP" pushbutton on the transmitter. Be sure that no functions can be activated with the "EMERGENCY STOP" pushbutton depressed. The receiver display should again read "0 0 2".

IMPORTANT: If any function of the radio remote control activates with the "EMERGENCY STOP" engaged, the radio remote control must not be used until it is repaired.

14. Pull out the "EMERGENCY STOP" pushbutton.
15. Push the green pushbutton "Start/horn" on the transmitter.
16. Both the radio remote control and the machine are now ready for operation.

IMPORTANT: To avoid accidental start-up, always engage the E-stop pushbutton and switch the transmitter "OFF" when not in use. When the transmitter is not attached to the operator, the key switch should be removed and stored in a secure place.



WARNING: TO AVOID SERIOUS INJURY OR DEATH. Switch the machine "OFF" if there is a fault or any problems with the safety check. Contact Hetronic or your dealer immediately to repair the system. NEVER operate the machine if the "EMERGENCY STOP" function does not operate properly. Improper operation, maintenance or adjustment may cause serious injury or damage to equipment and may void the warranty.

EMERGENCY STOP

For all emergency situations, push the E-Stop pushbutton in. To restart the system, disengage the E-Stop pushbutton and press the Start/Horn pushbutton. Be sure any dangerous conditions are corrected and follow the Start Up Procedure above.

SAFE MODE

When the transmitter battery voltage drops below approximately 3.4 volts, the system signals a low battery condition. The red LED and green LED illuminate and flash alternately. At this point, there are 10 minutes to locate the crane/machine in a safe position and turn the transmitter off. When 9 minutes have passed, the buzzer activates. There is then one minute remaining before the system automatically goes into Safe Mode. At the end of the timeout period, the transmitter sends the E-Stop signal and all crane/machine motion commands are stopped.

To restart the system, a fully charged battery must be inserted into the transmitter. Proceed with startup instructions. Always place the discharged battery directly into the charger.

If transmitter start-up is attempted with a discharged battery (less than 3.1 V), the system will shut down within 2 seconds after detecting the E-stop signal. This safeguard helps ensure the transmitter has enough power to safely operate the crane/machine.

SAFETY (DUMP) VALVE

The BMS-2 provides an output which is activated every time a joystick/paddle is moved out of the neutral position. This output should be connected to the safety (dump) valve to ensure that there is no hydraulic system pressure when the system is in standby mode (joystick/paddle in neutral position).

PROPORTIONAL FUNCTIONS

The proportional functions and speed ranges are set with the Hetronic proprietary software included with your system. You can modify the adjustments at any time. Please refer to the software technical documentation that is specific for your system.

JOYSTICKS OR PADDLE LEVERS

Joysticks and paddle levers are equipped with a spring return to the center (OFF) position. If the crane/machine motion is multi-speed, the farther the lever is pushed, the faster the crane/machine motion will move. Return the lever to the center position to stop the crane/machine motion.

OPTION CONTROLS

Each transmitter can be equipped with a variety of rotary switches, toggle switches or pushbuttons. Each function is labeled. For specific operational instructions, refer to the technical documentation supplied with your transmitter, or contact Hetronic.

TRANSMITTER SHUTDOWN

To shut down the transmitter, turn the key switch to OFF. Remove the key and place it in a secure location to prevent unauthorized or unintentional use.

OPTICAL DISPLAYS AND ACOUSTIC SIGNALS

The radio remote control system uses optical displays and acoustic signals to show current working status.

Transmitter

1. Turn keyswitch to "ON".
2. One long acoustic signal (buzzer) sounds.
3. After the self-test routine, another buzzer sounds to indicate that the system is ready to operate.

- Then press the Start/Horn button to begin system operation.

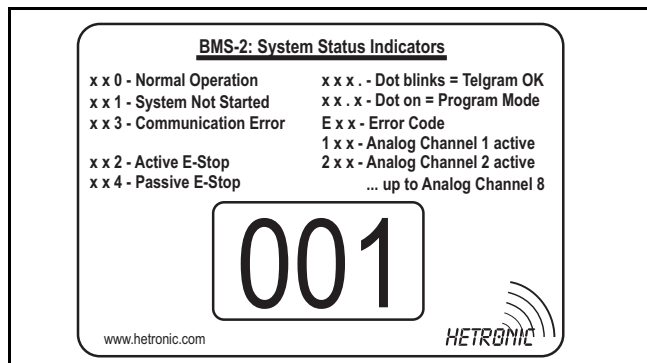
NOTE: If the Start/Horn button is pressed before the second buzzer, the system will not start up.

During transmitter operation, a buzzer signal indicates when the battery is nearly discharged. The transmitter will operate for another 30 seconds before going into E-Stop. Use this time to place the crane/machine in a safe position.

A green LED on the transmitter control panel illuminates while the system is operational.

Receiver

The 3 digit display shows operational status and error codes. A label on the receiver shows the basic operational status codes.



SYSTEM FEATURES

Receiver Display

The receiver has a 3-digit, 7-segment display on the outside of the housing to show operation status and Error Codes. The following table shows basic operational status codes. Error Codes are assigned per specific customer requirements.



x x 0	Receiving correct signal, no E-Stop, system started Example: 0 0 0 means the receiver is getting a valid control telegram and all joysticks are in neutral position
x x 1	Receiving correct signal, BMS-2 in E-Stop, no E-Stop from TX Example: 0 0 1 means the receiver is getting a valid control telegram, all joysticks are in neutral position, with E-Stop condition in receiver
x x 2	Receiving correct signal, BMS-2 in E-Stop, E-Stop transmission from TX Example: 0 0 2 means the receiver is getting a valid E-Stop telegram and the transmitter E-Stop is engaged
x x 3	RF interference
0 0 4	Not receiving signal, no RF communication, or TX is turned off
0 0 0 .	Flashing dot after third digit, change the status with each correct received telegram (green LED)
0 0 . 0	Flashing dot after second digit indicates programming mode (Quick-Set)
1 x x	Analog output 1 (up to 8) activated, joystick not in neutral position. System will not start if joystick is not in neutral position.
E x x	Error Codes are assigned numbers based on customer requirements. See Technical Documentation for specific codes.

Speed Reduction/Speed Select Function

This radio remote control system is equipped with a speed control function. It allows speed reduction to 75%, 50%, and 25% of the maximum speed using a switch on the transmitter. Other speed select options can be programmed with the BMS-2 software.

Ramp Function

The purpose of the Ramp Function is to allow a gradual start or stop to a machine movement to help prevent load or basket swing. The rate of increase and decrease is set with the BMS-2 software.

Interlocking Functions

This feature prevents contradictory operator commands from the transmitter. Certain functions can be enabled or disabled when another function is activated or inactive. An example is hoist up and hoist down. Activating both functions would most likely damage the equipment. Therefore, hoist up is interlocked with hoist down so that when one is activated the other can not be.

Dead Man Function

With this function activated, it is necessary to press a switch at the same time as a joystick/paddle in order for the crane/machine motion to operate.

Hold Function

This function makes it possible to "Hold" a position of a joystick without actually holding the joystick in place. Pressing the "Hold" button when the joystick is in its desired position allows the operator to release the joystick while having the crane/machine motion still active. The crane/machine motion remains active until the "Hold" button is released.

Optional Feedback

This feature allows the transmitter to receive and display information such as crane/machine status, warnings, etc. The feedback can be displayed as visual graphics or buzzers.

Optional Cable Back-Up

This option makes it possible to operate the crane/machine with the transmitter connected to the receiver with a cable. It is useful in situations where radio interference or the absence of a fully charged battery make radio remote control impossible. The cable provides power to the transmitter, so a battery is not necessary. The system will operate even if a battery is not present in the battery compartment.

TROUBLESHOOTING

If the system does not operate after normal start-up as described in Operation Section of this manual, follow the recommended troubleshooting sequence to help isolate the cause and determine corrective action.

The BMS-2 Receiver displays Operational Status and Error Codes to help diagnose problems that may occur with the system. The Operational Status codes are shown in the Operation Section of this manual.

Error Codes are defined by the customer. See Technical Documentation provided with your system for specific Error Codes. If the Error Code is not listed in your Technical Documentation, please contact Hetronic or your Dealer for more information.

If the system will not respond to the steps below or the Receiver Display indicates a failure, contact the Hetronic Service Department or your authorized dealer.

PROBLEM	PROBABLE CAUSE	CORRECTION
System will not initialize after normal start-up procedure	E-Stop reset	Push the Start button again. If the system is being initialized from an E-Stop condition, the Start button must be pressed twice - first to clear the E-Stop, then again, to start the system.
	Joystick or paddle lever not in center position	Be sure that all joysticks and paddle levers are in center position when the Start button is activated.
	E-Stop switch engaged	Pull out E-Stop switch. Restart system by pressing Start twice.
	Battery fully discharged	Check battery to ensure a full charge. Replace with fully charged battery if necessary.
	No power to the receiver	Check the diagnostic Display on the side of the receiver to be sure power is applied. Ensure that the system is securely grounded to the negative battery terminal. The Display also indicates normal transmitter communication, interference, and E-Stop conditions.
The transmitter is turned on, but does not transmit (Power LED not flashing)	Battery is discharged	Replace battery with a fully charged battery.
	Coder board fuse	Check fuse and replace if necessary.
	Broken key switch	Check wiring on key switch. Replace key switch, wiring or contact element.
	Coder board failure	Contact Hetronic or your Dealer.

PROBLEM	PROBABLE CAUSE	CORRECTION
Transmitter is transmitting (Power LED flashing), but crane/machine will not respond	E-Stop switch engaged	Pull out the E-Stop pushbutton and press the Start/Horn pushbutton
	Transmitter out of range	Take the transmitter back into the range of the receiver. Press the Start/Horn pushbutton.
	Joystick, paddle lever or switch not in center position when transmitter turned on	Ensure that all control devices are in center (neutral) position when the Start button is activated.
	Receiver power off	Turn on power to receiver.
	Blown fuse in receiver	Check all fuses. Replace if necessary.
	E-Stop failure in transmitter	Check E-Stop pushbutton for damage. Check wiring to contact element for broken or disconnected wires. Repair or replace E-stop pushbutton or wiring.
	E-Stop failure in receiver. Red E-Stop LED on decoder board is illuminated	Check wiring on E-Stop module, decoder module, E-Stop decoder module. Secure any loose connections.
	E-Stop module failure	Replace E-Stop module.
All crane/machine motions operate intermittently	Receiver antenna loose or missing	Tighten or replace antenna.
	External antenna (if used) has loose connection, poor grounding or interference	Tighten antenna and ground connection. See "Connecting an External Antenna" Section for operational precautions.
	Connector wiring too close to power wiring	Control wiring must be run separately from power wiring.
	Connector inside receiver is loose	Check all connectors, reseal if necessary.
Some crane/machine motions operate intermittently	Crane/machine motion wiring may be loose.	Check wiring from receiver to plug and from plug to crane/machine motion actuator.
	Connector inside receiver is loose	Check all connectors, reseal if necessary.
	Connector wiring too close to power wiring	Control wiring must be run separately from power wiring.

DIAGNOSTIC DISPLAY PANEL CODES

The following table is a brief description of diagnostic, operational and error codes that may be displayed.

Error codes can be designated for specific customer requirements and may not be listed here. Refer to the technical documentation that accompanies your system for specific customer defined error code designations.

Operational Codes	
x x 0	Receiving correct signal, no E-Stop, system started
x x 1	Receiving correct signal, BMS-2 in E-Stop, no E-Stop from TX
x x 2	Receiving correct signal, BMS-2 in E-Stop, E-Stop transmission from TX
x x 3	RF interference
0 0 4	Not receiving signal, no RF communication, or TX is turned off
0 0 0 .	Flashing dot after third digit, change the status with each correct received telegram (green LED)
0 0 . 0	Flashing dot after second digit indicates programming mode (Quick-Set)
1 x x	Output 1 (up to 8) activated, joystick not in neutral position. System will not start if joystick is not in neutral position.
Error Codes	
E x x	Error Codes are assigned numbers based on customer requirements. The errors listed below may or may not be applicable to your system. See Technical Documentation for specific codes.
E 0 0	Joystick 1 error - joystick 1 out of neutral without closed safety switch
E 0 1	Joystick 2 error - joystick 2 out of neutral without closed safety switch
E 0 2	Joystick 3 error - joystick 3 out of neutral without closed safety switch
E 0 3	Joystick 4 error - joystick 4 out of neutral without closed safety switch
E 0 4	Joystick 5 error - joystick 5 out of neutral without closed safety switch
E 0 5	Joystick 6 error - joystick 6 out of neutral without closed safety switch
E 0 6	Joystick 7 error - joystick 7 out of neutral without closed safety switch
E 0 7	Joystick 8 error - joystick 8 out of neutral without closed safety switch
E 0 8	Over-current 0 error, over-current on E-Stop circuit
E 0 9	Over-current 1 error, over-current on switching output 1-6
E 1 0	Over-current 2 error, over-current on switching output 7-12
E 1 1	Over-voltage error >35V
E 1 2	Under-voltage error <8V
E 1 3	DV1 (Y0) read back error
E 1 4	SW output 1 read back error
E 1 5	Valve Supply 1 read back error
E 1 6	Valve Supply 2 read back error
E 1 7	Valve Supply 3 read back error
E 1 8	Valve Supply 4 read back error
E 1 9	Valve Supply 5 read back error
E 2 0	Valve Supply 6 read back error
E 2 1	Valve Supply 7 read back error
E 2 2	Valve Supply 8 read back error
Error codes of 50 or greater are start-up or online test errors and require device re-start to clear.	
E 5 0	CPU_TEST_FAILED
E 5 1	WATCHDOG_TEST_FAILED
E 5 2	INTERRUPT_TEST_FAILED
E 5 3	TIMER_TEST_FAILED
E 5 4	EXTRAM_TEST_FAILED
E 5 5	INTRAM_TEST_FAILED
E 5 6	INTPRAM_TEST_FAILED
E 5 7	PFLASH_TEST_FAILED
E 5 8	STACK_OVERFLOW_DETECTED
E 5 9	MAIN_LOOP_TIME_FAILED
E 6 0	OP_COUNTER_ERROR
E 6 1	Serial EEPROM checksum error

SPECIFICATIONS

Model	BMS-2 (Baseboard Module System)
System	GA 610
General Data	
Frequency	70 cm Band (Selectable 458.800 Mhz to 459.175 Mhz) or CS434
Range	approx. 100 m (328 ft.)
Address	20-bit - 1,000,000 possible
Operating temperature	-30° to +70° C (-22° F to 158° F)
Data Format	2400/4800 Baud, even parity, 8 data bits, 2 stop bits, hamming distance 4
Receiver	
Protective System	IP 65
System	Synthesizer Technology
Voltage Supply	12 to 24 VDC (-50% - +20%)
Decoding	Multiple bit scanning, self-monitoring
Fuses	7.5 amp. / 80 V car fuse
Output	Intrinsically safe emergency stop with double - FET, 1 safety valve (dump valve), 11 digital, 16 internal digital
Antenna connection	TNC - socket
Dimensions L x B x H	245 mm x 161 mm x 90 mm (10.4 in x 6.3 in x 4.4 in)
Weight -	2,5 kg (5.5 lbs)
Transmitter	
Protective System	IP 65
Battery Pack	3.6 V / 1200 mAh (NiMh)
Transmitting power	< 10 mW
Current rating, Self test	approx. 75 mA
Current rating, Transmission	approx. 83 mA
Dimensions	Depends on Transmitter type
Weight - including battery	Depends on Transmitter type

INSTALLATION AND SAFETY TEST DATA

This form must be completed and signed by the person responsible for installation of this radio remote control system.

Hetronic assumes no responsibility for the correct installation of the radio remote control system. The equipment operator must ensure that the radio remote control system and the crane/machine operate correctly together. The operator must also ensure that all safety devices and features are in place and operating correctly. The operator is responsible for understanding and following all safety precautions in this and other applicable operator manuals.

Crane Data	
Manufacturer	
Model Number	
Serial Number	
Year of Production	
Radio Remote Control Data	
Manufacturer	Hetronic
Model	BMS-2
System/Transmitter Type	
Transmitter Production Number	
Receiver Production Number	
System Number	
I/We installed the radio remote control system, performed the safety test and inspected the crane/machine. The appropriate instructions and rules of this machine type are followed.	
Place	
Date	
Company	
Name of Installation Technician	
Signature	

DEFINITIONS

Acoustic signal	A buzzer or other sound intended to be heard as an alert.
Analog signal	Proportional - stepless or infinite control
Belly box	A transmitter that is secured to the front of the operator's body by a belt, strap or breastplate/harness.
Coder	Converts parallel signals into a serial data message
Decoder	Coverts a serial data message into parallel signals
Digital signal	On/off control
Latching control	The function activates when the control is pushed and released. The function stays on until the control is pushed and released again.
Mainline contactor	The primary power supply contactor to the crane/machine controls.
Maintained control	The function activates when the control is placed in the ON position. The function stops when the control is placed in the OFF position.
Momentary control	The function activates when the control is placed in the ON position. The control must be held in place to stay ON. When the control is released, it returns to the OFF position and the function is stopped.
Proportional control	A multi-speed function control that goes faster as the control is pressed further.

AWG - METRIC CONVERSIONS

AWG	Metric Equivalent mm sq.	Metric Cable Size mm sq.
20	0.52	0.75
18	0.82	1.0
16	1.32	1.5
14	2.1	2.5
12	3.3	4
10	5.32	6
8	8.5	10
6	13.5	15
4	21.3	25
2	33.7	35
1/0 (0)	53	70.0 (50.0 if current capacity not exceeded)
2/0 (00)	67.6	70
3/0 (000)	84.4	95
4/0 (0000)	107	120

ABBREVIATIONS	
A/D	Analog to digital conversion
AK	Analog channel (German: Analog Kanal)
AMP	Ampere
AWG	American Wire Gauge
BPS	Bits per second
CPU	Central Processing Unit
DK	Digital channel (German: Digital Kanal)
EMC	Electromagnetic compatibility
EMI	Electromagnetic immunity
EPROM	Electrical programmable read-only memory
FM	Frequency modulation
GND	Ground
HF	High frequency
KHz	Kilohertz
LED	Light emitting diode
LTO	Lift to operate
mAh	Milliampere hours
mA	Millampere
msec	Millisecond
MHz	Megahertz
MOV	Metal Oxide Varistor type of surge suppressor
mW	Milliwatt
NiCd	Nickel Cadmium
NiMH	Nickel Metal Hydrite
PLC	Programmable logic controller
PLL	Phased locked loop
PTO	Press to operate
PWM	Pulse width modulation
R/C	Resistor/Capacitor type of surge suppressor
RF	Radio frequency
RMS	Root mean squared
Rx	Receiver
RxD	Receiving data
SMD	Surface mount device
SMT	Surface mount technology
TTL	Transistor transistor logic
Tx	Transmitter
TxD	Transmitting data
Ub	Operating power
Uv	Microvolts
VAC	Volts alternating current
VDC	Volts direct current

WARRANTY

	Limited Warranty and Terms of Sale	Hetronic USA WRTY_002 Warranty & Terms April 2003
Price: Subject to Change Without Notice Terms: Net 30 Days F.O.B: Hetronic USA, Inc. Oklahoma City, Oklahoma Hetronic, Inc., hereafter referred to as Company, guarantees all items manufactured by it against any defects of material and/or workmanship for a period of one year from the date of shipment. Company makes NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AS TO THE MERCHANTABILITY OR FITNESS OF THE ITEMS FOR THEIR INTENDED USE OR AS TO THEIR PERFORMANCE. Any statement, description or specification in Company's literature is for the sole purpose of identification of items sold by the Company and imparts no guarantee, warranty or undertaking by Company of any kind. Components and accessories not manufactured by Hetronic are not included in this warranty and are warranted separately by their respective manufacturers. Company's sole liability shall to be to repair at its factory, or replace, any item returned to it within one year from date of shipment, which Company finds to contain defective material or workmanship. All items to be repaired or replaced shall be shipped to Company (Note: return authorization by Company is required) within said one year period, freight prepaid, as a condition to repair or replace defective material or workmanship. Company's herein assumed responsibility does not cover defects resulting from improper installation, maintenance, or improper use. Any corrective maintenance performed by anyone other than the Company during the warranty period shall void the warranty. Company shall not be liable for damages of any kind from any cause whatsoever beyond the price of the defective Company supplied items involved. Company shall not be liable for economic loss, property damage, or other consequential damages or physical injury sustained by the purchaser or by any third party as a result of the use of any Company supplied items or materials. List prices or discounts are subject to change without notice. Quoted prices will be honored for a period of 90 days from the date of the written quotation unless otherwise stated. Orders are not subject to alteration or cancellation except upon written consent of Company and payment of proper cancellation charges, when deemed applicable by Company. Materials or items may not be returned for credit, without the prior written consent of the Company. Any authorized return of materials or items shall be subject to a restocking charge equal to 20% of the net invoiced amount after Company determines that the material or item is in good condition and may be resold without alteration or service. Terms of payment are NET 30 days. All materials and items are sold F.O.B. Company's shipping point. Company retains a security interest in all items sold by it so long as they remain in Company's possession to secure all obligations of purchaser to Company. A processing fee will be applied to all invoices for requested prepaid freight charges other than UPS. A service charge will be incurred on past due accounts extending beyond the terms of sale described above, at a rate of 1.5% per month of the net balance extending beyond 30 days. The buyer should inspect the goods immediately on their arrival and shall within five days of their arrival give written notice to the Company of the claim that the goods do not conform with the terms of the contract. If the buyer shall fail to give such notice, the goods shall be deemed to conform with the terms of the contract. Any claim for material or item shortages must be accompanied by copies of the bill of lading and packing slip. Delivery schedules or commitments are based upon current production capacities, material or component availability and inventory and may be changed as conditions require. Company shall not be liable for loss or damage of any kind resulting from delay or inability to deliver on account of fire, labor troubles, accident, acts of civil or military authorities, or from any other cause beyond Company's control.  HETRONIC www.hetronic.com		