

# Radio Crane Control Systems

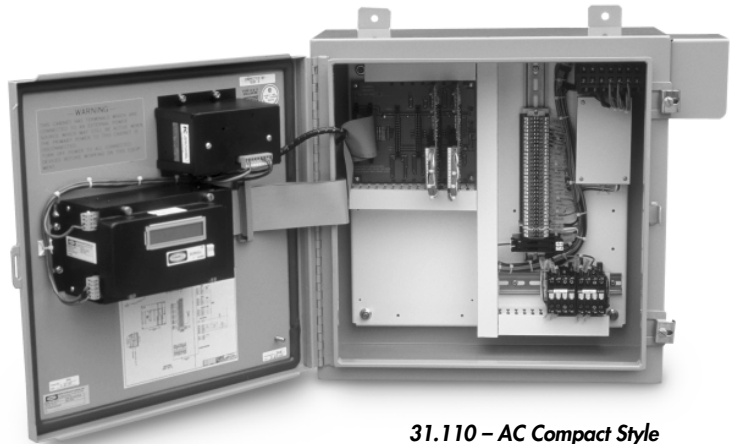
Hubbell Radio Remote Control Systems

Catalog 31.100 • September 2000  
Replaces: Brochure 31100 of June 96  
Catalog Sheet 31100 AC Compact Radio  
Catalog Sheet 31100 Diagnostic Display  
Catalog Sheet 31132 License-Free Radio

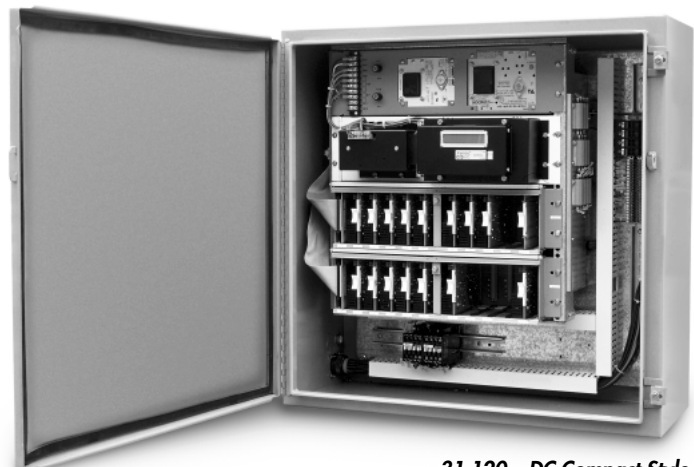
Hubbell Radio Control Systems use the latest micro-controller technology and ultra reliable Manchester II (bi-phase) digital FM signal coding. Each radio control system operates on a licensed frequency in the 72 to 76 MHz or the 450 to 470 MHz bands.

The security of any remote control system is of the utmost importance. Hubbell radio control systems' security is enhanced through multiple checks before any function can become operational:

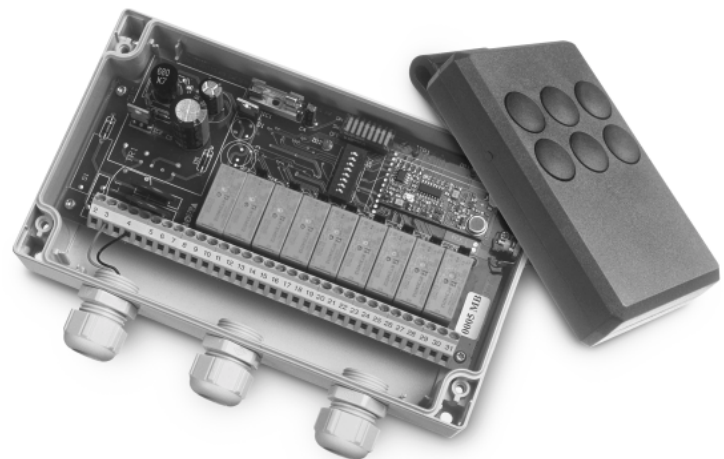
- The received signal must be of the proper frequency.
- The received message must have the proper address and must be in the correct format.
- The receiver calculated CRC code must be identical to the CRC code calculated by the transmitter and sent as part of each message.
- The preceding items must be met and all transmitter lever switches must be centered before the Crane Main Contactor can be energized.
- To continue or change an energized function, requires the receipt of a "valid message" prior to timeout of the message timer. If no valid message is received, the system turns off all outputs.
- Two separate "watchdog timers" assure that all outputs are switched off in case of a receiver malfunction.



**31.110 – AC Compact Style  
with Micro-Controller**



**31.120 – DC Compact Style  
with Micro-Controller**



**31.130 AC License-Free  
with Belt-Clip Transmitter**

## Radio Crane Control Systems

A typical radio crane control system consists of a portable transmitter carried by the operator, and a receiver installed on the crane. Each system operates on a licensed frequency in the 72 to 76 MHz or the 450 to 470 MHz bands.

The receiver is crystal controlled. A synthesized receiver is an option for 72–76 MHz. An 8-bit micro-controller, operating at 4.9 MHz, decodes the signal coming from the rf module and passes the output commands through the I/O boards to the output modules.

The **ac receiver** uses 120V ac Solid State Relay output modules. No interface relays are needed for controllers up to and including size 4 contactors. An LED shows the status of the output module. A stepless, analog output module is available, as is a relay card using electro-mechanical output relays. Input modules monitor the status of the 120V ac Control Power, Main Contactor, plus M, F, R for each motion.

The output modules on the **dc receiver** are 270V dc Solid State Relays. No interface relays are needed for controllers up to and including size 5 contactors. The output module status is shown by LED's: red = output activated; green = output current flowing. Input modules monitor the status of the 250V dc Control Power, Main Contactor, plus M, F, R for each motion.

Each transmitter/receiver pair has their own unique 7-bit address code (the first seven bits of the digital message). Unless the transmitter address and receiver address are identical, the system will not respond to any command, regardless of the frequency.

Message integrity is assured by use of an 8-bit Cyclic Redundancy Check (CRC) code. Cyclic redundancy check is a division performed in the transmitter logic, which produces a remainder that is transmitted last as the 8-bit check code. The receiver logic performs a like division on the received message (without the CRC) to produce its own 8-bit CRC code. If the two CRC codes are identical, the received message will be decoded as a "valid message" and the appropriate outputs will be turned on or off, as directed.

The crystal controlled **transmitter** uses an 8-bit micro-controller, operating at 2.5 MHz, to scan the command switches. All major function switches must be in the center or "off" position before the Crane Main Contactor can be energized. When the transmitter is "on" and the command switches are "off" or centered, then the transmitter actually sends a "stop" command to the system. Motion can occur only with the removal of the "stop" command and the addition of a speed point/directional command within a certain time sequence. Using the key-switch to turn off the transmitter power causes the transmitter to send five consecutive "E-STOP" messages before shutting down.

The switch position data is transmitted as a digital signal at the licensed frequency, using Manchester II coding. The digital message has a specific format and is repeated 2 to 9 times per second. The repeat rate is programmable. The transmitter is turned off between messages to conserve battery life and rf spectrum. This makes it possible to have several transmitters operating in the same area, on the same frequency, with practically no interference because of the different transmission rates. The unique address code of each transmitter and receiver assures that only the matching receiver responds to the radio commands. All other signals on the same frequency are ignored.

The use of Manchester II (bi-phase) digital FM signal coding makes the message less sensitive to corruption from interference. Please consult **Tech Info 31.100**, page 2, for a detailed discussion on the message format and Manchester II coding.

## Diagnostic Display Module

### Standard Features

- For new and existing microprocessor based crane and locomotive controls
- 2 line x 20 character backlit LCD display for message and time stamp
- English descriptions of faults
- Display mounted in receiver rack or on microprocessor unit
- Fault logging with local or remote down load capability
- Control button for setting battery backed real time clock



### Typical Fault Messages

*Start-up & Run Mode Status/Faults*

POWER-UP WAITING NO MSG 16:21:56	DIAG TEST OK NO MSG FROM TX 16:21:56
NORMAL OPERATION MSG OK 6.2 MPS 16:21:56	TIMED OUT NO MSG FROM TX 16:21:56
TROLLEY TX SW NOT CENTERED 16:21:56	BRIDGE M STUCK ON FAULT 16:21:56
BRIDGE M STUCK OFF FAULT 16:21:56	RUN RELAY STUCK OFF RUN FAULT 16:21:56
RUN RELAY STUCK ON RUN FAULT 16:21:56	RUN OUTPUT STUCK ON RESET FAULT 16:21:56
WATCHDOG MONITOR MCB FAULT 16:21:56	MCB SELF TEST RAM FAILURE 16:21:56

## 31.110

### 120V AC, 72 or 450 mHz, Compact Style with Micro-Controller

#### Hubbell Performance

- High speed microprocessor
- Bi-phase, digital signal transmission

#### Increased Flexibility

- Very compact receiver
- Fits even the smallest crane

#### Internal Diagnostics

- Run by microprocessor on internal programs
- Run by microprocessor on commands and I/O
- Power-up diagnostics
- Continuous monitoring

#### Operational Status

- English language diagnostic display

#### Transmitter

- High speed microprocessor
- Compact, light weight
- Up to four lever switch control functions
- Toggle switch and pushbutton functions



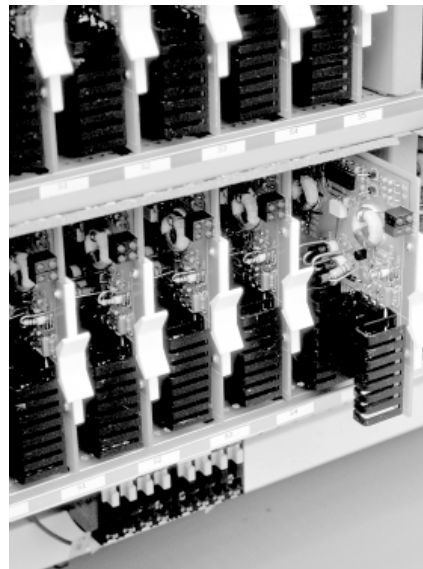
## 31.120

### 250V DC, 72 or 450 mHz, Compact Style with Micro-Controller

The Hubbell Microprocessor Radio Crane Control Systems features a microcomputer with status display and built-in diagnostics along with our high speed, digital, biphas modulation to provide reliable, efficient and economical operation of electric overhead cranes from a portable transmitter.

#### Benefits

- **Easy to Maintain** — Self diagnostics identify problem areas via the status display.
- **Fast Response** — High Speed data rate offers fast, responsive operation.
- **Frequency Conservation** — Up to four systems can share the same radio frequency, which also saves on spare parts requirements.
- **Improved Control** — Remote control takes the operator out of the cab providing him with improved visibility and total control from a ground floor position.
- **Simple Operation** — Portable, lightweight transmitter is easier to operate than manual cab controls.



Typical 250V DC Output Section

## 31.130

### 120V AC, License-Free with Micro-Controller

- **System approved for operation under FCC Part 15 rules** — no user license required.
- **Digital FM signal** — exceptional immunity to noise.
- **Security** — 6000+ address codes available.
- **State of the art design** — surface mount, micro-controller electronics.
- Auto power off extends battery life.
- Extremely compact and cost effective systems.

Select one of several single-speed transmitters or a two-speed transmitter:

- Key-Ring - with 1 or 4 buttons
- Belt-Clip - with 1, 2, 3, 4, or 6 buttons
- Hand-Held - with 6 or 8 buttons
- Hand-Held - with 8 two-speed buttons.

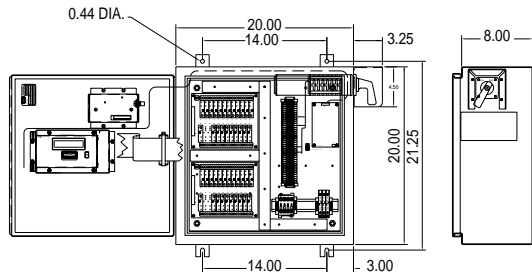
All transmitters are rated NEMA 3 for indoor/outdoor use.

Select receivers with the number of output relays to match the transmitter functions. A flexible half-wave antenna mounts directly to the receiver by BNC connector. All receivers are rated NEMA 4X for indoor/outdoor use.

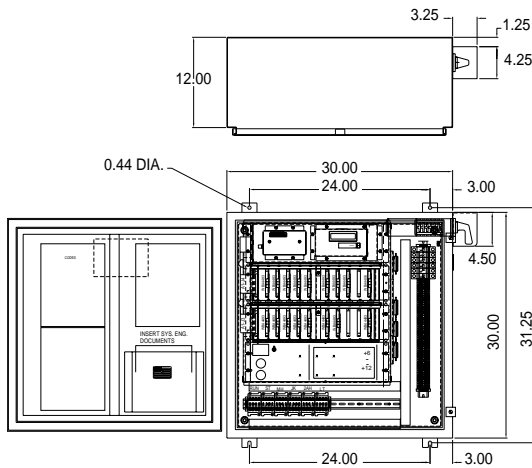
Please refer to Spec Sheet 31.130 for more detailed information on this equipment.



## Outline Drawings



31.110 AC Compact Style  
Weight — ??



31.120 DC Compact Style  
Weight — ??

## Specifications

### Typical to All Systems

Supply Voltage .....	AC: 108–132V ac, 50/60 Hz. DC: 175–350 V dc
Internal Power Requirements .....	+11.9–13.1V dc, 0.2 A & +4.5–5.5V dc, 2 A max
Operating Temperature .....	–22°F (–30°C) to 140°F (+60°C)

### Radio Receiver

Frequency Range .....	72–76 MHz or 450–470 MHz
Channel Availability .....	30 @ 72 MHz, 8 protected, over 200 shared @ 450 MHz
Frequency Stability .....	±10 ppm
Sensitivity .....	1 µV @ 20 dB quieting nominal
Data Reception .....	compatible with Hubbell transmitters
Modulation .....	Manchester II (bi-phase)
Baud Rate .....	4800 bps
Message Format .....	preamble, sync, start flag, address, control, CRC check code

### Control Section

Single board computer consisting of 80C31BH controller, 64k EPROM, EPLD containing circuits for message synchronizing, and processor watchdog

### AC Output Section (Triac modules)

Panel mounted mother-board to accommodate up to 24 triac ac input or output modules

Indicators .....	LED on each output
Feedback Sensing .....	opto-isolated input from: MAIN CONTACTOR; UP, DOWN, FORWARD, REVERSE relay outputs
Modules .....	Industry standard or equivalent design, solid state
Output Rating .....	115/230V ac, 50/60 Hz, 2A resistive; 100V ac, 50/60 Hz, 0.5 A dry contact resistive
Isolation .....	2500V

### AC/DC Output Section (Electro-mechanical relays)

Panel mounted mother-board to accommodate 4 plug-in relay boards, each with 6 output relays, for a maximum of 24 ac output relays and 12 sense inputs

Indicators .....	LED on each output
Feedback Sensing .....	opto-isolated input from: MAIN CONTACTOR; UP, DOWN, FORWARD, REVERSE relay outputs
Relays .....	Standard PC board relays
Output Rating .....	115/230V ac, 50/60 Hz, 5A resistive; 12/24V dc, 5A resistive
Isolation .....	5000V

### AC/DC Output Section (PNP open collector outputs)

Panel mounted mother-board to accommodate 4 plug-in boards, each with 6 output transistors, for a maximum of 24 dc outputs and 12 sense inputs

Indicators .....	LED on each output
Feedback Sensing .....	opto-isolated input from: MAIN CONTACTOR; UP, DOWN, FORWARD, REVERSE relay outputs
Output Rating .....	12V dc, 100mA
Isolation .....	5000V

### AC/DC Output Section (Stepped analog outputs)

Panel mounted mother-board to accommodate 4 plug-in boards, each with 1 analog output.

Indicators .....	LED on each of 8 levels
Output Rating .....	0–10V dc, 20mA, in 8 steps
Isolation .....	5000V

### AC/DC Output Section (Stepless analog outputs)

Panel mounted PC board with 4 analog outputs, and 4 sense inputs

Indicators .....	LED on each output
Output Rating .....	±10V dc, ±20V dc, into a 600 ohm load
Isolation .....	5000V

### 250V DC Output Section

Dual solid state relay PC boards in 10 slot card cage allowing for up to 20 outputs. (WB4 4493)

Type .....	Oscillator driven transformer coupled
Indicators .....	Red: output activated, Green: output on (15 ma min. current flowing in output circuit)
Output Voltage .....	150–350V dc
Reverse Polarity Protection .....	2kV transient voltage protected, 40 µJ
Input Voltage .....	4.5–6.5V dc, active high
Load .....	1.8A, 250V dc, inductive
Arc Suppression .....	700V (built-in), 40 J
Isolation .....	4000V
Feedback Sensing .....	opto-isolated input from: MAIN CONTACTOR; UP, DOWN, FORWARD, REVERSE

### 250V DC Input Board

Dual input 250V dc voltage sensing PC board (occupies 1 slot in card cage) (WB4 4306)

Indicator .....	Green: on (250V input present)
Input .....	250V nominal
Isolation .....	3.5kV into, out, & between sections
Output .....	Opto-isolated; active low



**Hubbell Industrial  
Controls, Inc.**

*a subsidiary of  
Hubbell Incorporated*

50 Edwards Street  
Madison, Ohio 44057  
(440) 428-1161  
Fax (440) 428-7635

4301 Cheyenne Drive  
Archdale, NC 27263  
(336) 434-2800  
Fax (336) 434-2801