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.
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 electromechanical 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

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Typical Fault Messages

Startup & Run Mode Status/Faults

<table>
<thead>
<tr>
<th>Message Type</th>
<th>Display Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER-UP WAITING NO MSG</td>
<td>16:21:56</td>
</tr>
<tr>
<td>DIAG TEST OK NO MSG FROM TX</td>
<td>16:21:56</td>
</tr>
<tr>
<td>NORMAL OPERATION MSG OK 1-2 MPS</td>
<td>16:21:56</td>
</tr>
<tr>
<td>TIME OUT NO MSG FROM TX</td>
<td>16:21:56</td>
</tr>
<tr>
<td>TROLLEY TX SW NOT CENTERED</td>
<td>16:21:56</td>
</tr>
<tr>
<td>BRIDGE M STUCK ON FAULT</td>
<td>16:21:56</td>
</tr>
<tr>
<td>BRIDGE M STUCK OFF FAULT</td>
<td>16:21:56</td>
</tr>
<tr>
<td>RUN RELAY STUCK OFF FAULT</td>
<td>16:21:56</td>
</tr>
<tr>
<td>RUN RELAY STUCK ON FAULT</td>
<td>16:21:56</td>
</tr>
<tr>
<td>RUN OUTPUT STUCK ON RESET FAULT</td>
<td>16:21:56</td>
</tr>
<tr>
<td>WATCHDOG MONITOR MCB FAULT</td>
<td>16:21:56</td>
</tr>
<tr>
<td>MCB SELF TEST RAM FAULT</td>
<td>16:21:56</td>
</tr>
</tbody>
</table>
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, bi-phase 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.

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

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.
### 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 output
  - **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. (WBA 4493)
  - **Type**: Oscillator driven transformer coupled
  - **Indicators**: Red: output activated, Green: output on (15 ma min. current flowing in output circuit)
  - **Output Voltage**: 130–350V dc
  - **Reverse Polarity Protection**: 24V transient voltage protected, 40 µJ
  - **Input Voltage**: 4.5–6.5V dc, active high
  - **Load**: 1.8A, 250V dc, inductive
  - **Arc Suppression**: 700V (buil-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) (WBA 4306)
  - **Indicators**: Green: on (250V input present)
  - **Input**: 250V nominal
  - **Isolation**: 3.5kV into, out, & between sections
  - **Output**: Opto-isolated, active low

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"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

http://www.hubbellicd.com/radiocontrols/