IQ5 Remote Blanket Control

The IQ5 Remote Blanket System allows the blanket user to program start / stop times and power setting of their heating blanket via wireless control. The control also allows manual operation, room temperature measurement and a built-in LCD clock. The remote control is powered by four "AAA" batteries, giving a one-year operation of control. The base unit (receiver) connects to the blanket and wall outlet. A visual indicator (LED) shows when blanket is powered along with a sonalart which beeps when a control command is received. The remote unit sends an ID code at the start of each command message, which the base unit uses to verify signals are from the intended remote control.

Remote Controller. The remote consists of a Microcontroller, transmitter, keypad, and a back lit LCD.

Microcontroller. The Microcontroller has a built in LCD driver and performs software control of keyboard debounce, key repeat, user program storage, real time clock operation, ID generation and transmitter command encoding. The micro also turns on the LCD backlight, low battery measurement and room temperature measurement. If a key is held down for greater then one minute the drive to the transmitter turns off. In manual mode the transmitter is keyed when the user turns ON or OFF the blanket and also when ON and the heat setting is changed up or down. In automatic mode, the micro keys the transmitters to send the control commands based on the user programmed times and heat setting.

RF Transmitter. The RF transmitter in the remote control unit is an On-Off- Keying (OOK), oscillator operating at 418 MHz. Data is sent as a rate of 875 bits per second with a command message containing 40 bits of data and preceded by a wake-up preamble symbol. The command message format is shown in Figure 4 and Table 1.. Each data bit is pulse width encoded with a period of 1.14 msec. and a pulse width of 300 usec. for a logic "0" or 700 usec. for a logic "1". The 40 bit message consists of 5 bytes of data with each byte transmitted LSB first. The Wake up preamble symbol preceding the message consists of six 940 usec. wide pulses as shown below. Repeat messages with wake up symbols are sent with a minimum gap of 300 msec. between messages.

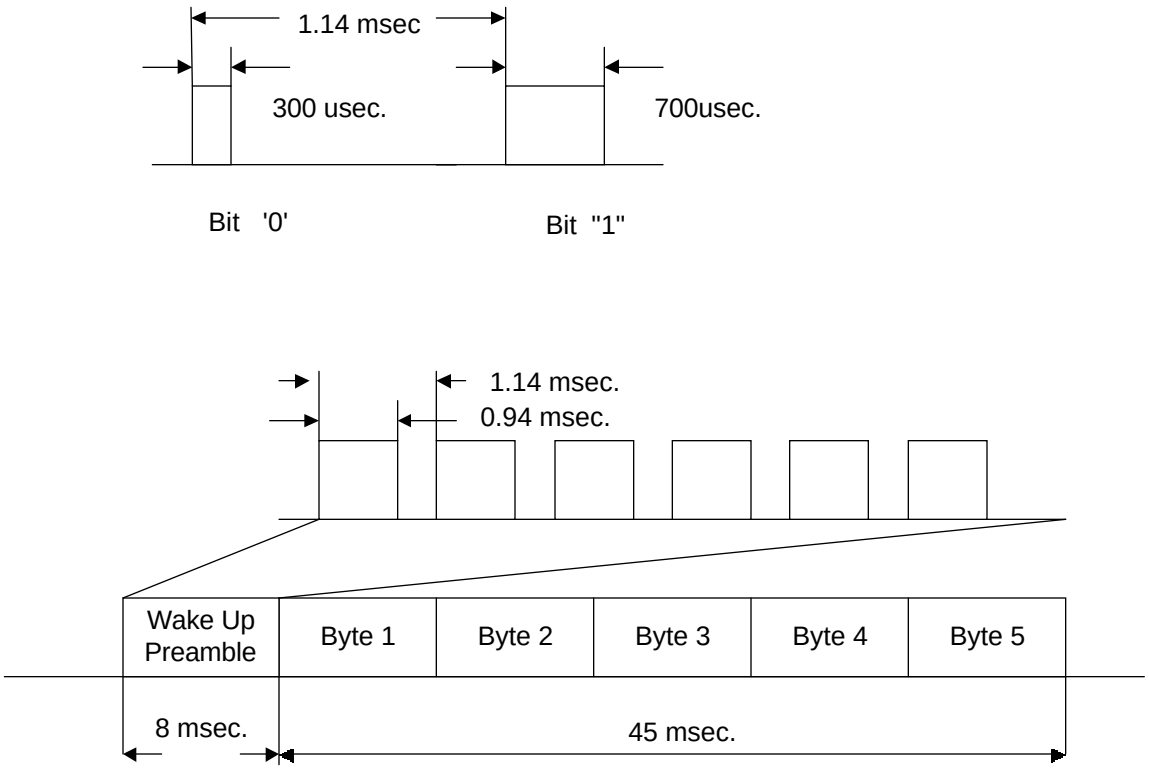

Figure 4. Transmitted Data Format

The 40 bit message consists of 5 bytes of information with each bit assigned as follows:

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	ST7	ST6	ST5	ST4	ST3	ST2	ST1	ST0
Byte 2	I07	I06	I05	I04	I03	I02	I01	I00
Byte 3	I15	I14	I13	I12	I11	I10	I09	I08
Byte 4	C02	C01	C00	HL4	HL3	HL2	HL1	HL0
Byte 5	CS7	CS6	CS5	CS4	CS3	CS2	CS1	CS0

ST7- ST0 is the one byte start symbol D2H.

I15-I00 is the two byte remote ID code.

C02-C00 are the remote mode control bits.
C00 is '1' for a right side command.
C01 is '1' for a left side command.
C02 is '1' for a manual command, '0' for an auto command.

HL4-HL0 is the heat level. (00H = off, 19H = max heat);

CS7-CS0 is the checksum of bytes 2,3, and 4;

Table 1. Command Message Format

Each remote has an essentially random ID code that is determined by a timer in the remote when the first command is transmitted after a set of batteries has been installed. Each command thereafter will have the same ID code until the batteries are replaced. The base unit uses the transmitted remote ID code to identify a transmitted command as a valid message. The base unit will recognize and "learn" the first two unique remote ID codes it receives after it is plugged in to the AC power outlet. Thereafter the base unit only responds to commands containing these two ID codes. When the base is unplugged from the AC outlet, the ID codes are forgotten and will be relearned the next time the base is plugged in.

Keypad. The keypad is carbon tipped silicone rubber, custom molded. Contacts are PCB etched pads, multiplexed by Microcontroller. One contact is ON OFF, four are for setting time and selecting start stop heating times, one contact is used to select or deselect AUTO mode.

LCD. The LCD uses custom segments to display current time and temperature; another are of display indicates blanket control status and LOW BAT. IN the auto mode, AUTO would be active on display. The LCD is back-lit by an EL panel; this panel is powered from a boast switching regulator. The back-lit is turned on for one minute when any key is pressed.

Base Unit The base unit interfaces the RF control signals with the blanket power, this unit consists of a power supply, receiver, Microcontroller and TRIAC power control.

RF Receiver. The RF receiver is a single chip OOK data receiver, feed from a loop antenna.

Power supply. The power for the receiver and Microcontroller is derived from a capacitor limited AC line source. Voltage is zener diode regulated to 5 volts.

Microcontroller. Signal decoding, LED indicator control and TRIAC drive commands are processed by the base unit Microcontroller. The Microcontroller receives the digital output for the receiver and checks for the matching ID 'word', then the information data bits are error checked and the ON / OFF drive commands generated to the TRIACs and LEDs. The Microcontroller also monitors a safety signal from the blanket to shut down power if a failure occurs in the blanket. The drive signal is duty cycle control of the blanket power, not phase control of the AC sine wave. The cycle time is 90 seconds with each on time on the TRIACs starting at the zero crossing of the AC line and continuing through the full sine wave. This is to reduce EMI noise from the power switching stage.

TRIAC Power Control. The power to the blanket is turned on and off by the signal from the Microcontroller through the TRIAC power device. The gate drive to the TRIAC is capacitively coupled to prevent a constant "ON" from a hung signal out of the processor.