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swift comm™
wireless industrial sensor interface

2.4 GHz Transceiver Module
Model # 924-41484

20 Channel Hop Sequence Explanation
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A static table of 256 numbers (called the Randomizer), each between 0 and 19, is hardcoded into the microprocessor's program. The sequence of the numbers was randomly generated. These numbers are used to point the channel selection routine to one of the 20 slots in the Active Channel Set.

The Active Channel Set is a dynamic table which contains 20 memory slots. Each slot will contain a channel number (between 2 and 78). When the transmitter and receiver connect with one another, the transmitter selects which channels to fill the Active Channel Set with. When a channel is deemed 'bad' (from too much interference), it is removed from it's slot in the table and replaced with one that has a better history.

Every 600uS, both the transmitter and receiver hop to a new channel for the next communication cycle. The following process selects the channel that they hop to:

1. The next number in the Randomizer is read. When the last number in the randomizer has been used, it starts over at the beginning of the table.
2. The number that is read from the Randomizer (between 0 and 19) selects which slot to read from the Active Channel Set. For instance, if we use the first number in the randomizer table, 11, this would select slot 11.
3. The contents of the selected slot is read, which contains a channel number (between 2 and 78). This is the new channel that both the transmitter and receiver will hop to.

Following is the complete Randomizer Table that shows the random channel sequence.

11,12,3,2,13,1,14,7,11,15,5,0,11,12,10,8,4,7,10,7,5,8,2,11,2,8,7,11,2,14,7,10,8,6,13,11,15,9,8,11,8,2,11,1,4,13,5,6,13,12,9,14,6,15,7,9,12,14,2,15,7,7,2,0,14,11,4,11,3,10,1,10,14,12,3,14,10,1,15,8,4,6,10,12,10,7,5,14,14,10,6,1,3,10,12,9,4,15,11,1,7,14,4,0,15,10,5,8,12,8,10,11,2,13,6,13,6,1,12,8,5,0,5,6,13,8,3,10,7,13,3,0,6,11,12,6,13,2,2,7,11,8,0,11,3,10,9,13,9,3,15,10,5,11,0,8,8,2,4,7,13,3,10,3,1,5,12,13,11,13,10,7,6,2,12,7,12,10,8,9,10,3,15,13,7,1,1,11,6,3,6,13,11,5,10,11,13,8,14,8,13,2,6,2,5,3,5,13,5,10,9,0,0,7,5,14,7,8,2,7,8,10,9,2,6,0,3,7,5,7,2,9,12,7,1,2,2,5,8,8,3,11,6,0,12,2,8,2,12,0,11,13,2,4,11

Each of its hopping channels is used equally on average because the Randomizer was pre-calculated to be a statistically random sequence between 0 and 19 distributed on average over 256 cells. Therefore it will provide a pseudo-random sequence of all 20 active channels, each channel averaging use is equal over time. The pattern will repeat every 256 hops (~6 times per second when changing channels every 600 uS).

The associated receiver's ability to shift frequencies in synchronization with the transmitted is assured when the transmitter and receiver connect, they synchronize their Active Channel Set, as well as their index locations within the Randomizer. Each unit then uses an internal clock (600 uS ticks) to determine when the next frequency hop needs to take place. Additionally, the receiver compares it's own internal timing to the timing from the transmitter and adjusts accordingly. This was implemented to remove any timing errors induced from slight differences in clock rates between the transmitter and receiver. So each packet that is sent resynchronizes the timing between them.

The number of hopping channels used at any given time will be the 20 Active Channel Set. If a particular channel within the set becomes too noisy, it is replaced with a different one, but there are never less (or more) than 20 channels being used at any one time.

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