

PCM Protocol

1. Interface

The protocol is applied between the Transmitter and the transmitting module.

The pins between the Transmitter and the transmitting module are:

[Signal] [Vbat] [Gnd]

Both signals are from Transmitter to transmitting module.

The signal might be CPPM signal or PCM signal.

2. PCM Signal

2.1. Physical bits:

An interval of 16us pulse with 8us high interprets as bit "0", and an interval of 24us pulse with 8us high interprets as bit "1".

Pulse high: high level, floating, or weakly driven.

Pulse low: strongly driven, or open drain/open collector.

Idle: high level, floating, or weakly driven.

The frame is composed of a stream of bits.

2.2. The frame format:

Byte 1: Header (0x7E)

Byte 2: Rx Number

Byte 3: FLAG1,

b0: set Rx number -> if this bit is set, every rx listening should change it's rx number to the one described in byte 2

b1...b3: set failsafe position -> if set the following positions should be used as "Failsafe" positions.

b4..b7: reserved for future use, must be "0" in this version

Refer to chapter 2.4 for supporting 16 channels and failsafe setting.

Byte 4: FLAG2, Reserved for future use, must be "0" in this version.

Byte 5...Byte 16: PPM signals, the PPM bytes may be like below

| Byte 5.H | Byte 5.L | Byte6.H | Byte6.L | Byte7.H | Byte7.L |
|-------------|-------------|--------------|--------------|---------------|--------------|
| CH1/9:b7..b | CH1/9:b3..b | CH2/10:b3..b | CH1/9:b11..b | CH2/10:b11..b | CH2/10:b7..b |
| 4 | 0 | 0 | 8 | 8 | 4 |

Byte 17: CRC.L

Byte 18: CRC.H
 CRC polynomial: 0x1189
 Byte 19: TAIL(0x7E)

2.3. Bit stuffing

Any time that 5 consecutive 1-bits appear in the transmitted data, the data is paused and a 0-bit is transmitted. This ensures that no more than 5 consecutive 1-bits will be sent. The receiving device knows this is being done, and after seeing 5 1-bits in a row, a following 0-bit is stripped out of the received data. If the following bit is a 1-bit, the receiver has found a flag.

2.4. Extending To 16 Channels

The PPM ranges from 800us to 2200us, and thus, the PPM value ranges from $800 \times 1.5(1200)$ to $2200 \times 1.5(3300)$, and the PPM value have 12bits, value ranges from 0-4095, so, 0-1199, 3300-4095 is not used.

These value ranges could be used for other channels, ch9 – ch 16.

So, the PPM value range could be divided into two parts, 0-2047 representing for channel 1, and 2048-4095 for channel 9.

When the PPM value is for channel 1, value “1024” represents for PPM length 1500, value “0” represents for PPM length 817, value “2047” represents for PPM length 2182.

This is also true for other channels.

So, the Frame could extend to support 16 channels.

The failsafe position could be set individually. When $\text{Flag1.b1-b3} = 3'b000$, PPM ch1/9 is failsafe position.

| | | |
|--------------------|---|---|
| FLAG1: b4b3b2b1 | | |
| 1000 | BYTE6L/BYTE5H/BYTE5L 0-2047 0-2047 for ch1 failsafe position | BYTE6L/BYTE5H/BYTE5L 2048-4095 for ch9 failsafe position |
| 1001 | BYTE7H/BYTE7L/BYTE6H 0-2047 for ch2 failsafe position | BYTE7H/BYTE7L/BYTE6H 2048-4095 for ch10 failsafe position |
| 1010 | BYTE9L/BYTE8H/BYTE8L 0-2047 for ch3 failsafe position | BYTE9L/BYTE8H/BYTE8L 2048-4095 for ch11 failsafe position |
| 1011 | BYTE10H/BYTE10L/BYTE9H 0-2047 for ch4 failsafe position | BYTE10H/BYTE10L/BYTE9H 2048-4095 for ch12 failsafe position |
| 1100 | BYTE12L/BYTE11H/BYTE11L 0-2047 for ch5 failsafe position | BYTE12L/BYTE11H/BYTE11L 2048-4095 for ch13 failsafe position |
| 1101 | BYTE13H/BYTE13L/BYTE12H 0-2047 for ch6 failsafe position | BYTE13H/BYTE13L/BYTE12H 2048-4095 for ch14 failsafe position |
| 1110 | BYTE15L/BYTE14H/BYTE14L 0-2047 for ch7 failsafe position | BYTE15L/BYTE14H/BYTE14L 2048-4095 for ch15 failsafe position |
| 1111 | BYTE16H/BYTE16L/BYTE15H 0-2047 for ch8 failsafe position | BYTE16H/BYTE16L/BYTE15H 2048-4095 for ch16 failsafe position |

Normal PPM positions:

| | | |
|--------------------|--|--|
| FLAG1: b4b3b2b1 | | |
| 0xxx | BYTE6L/BYTE5H/BYTE5L 0-2047 for ch1 position | BYTE6L/BYTE5H/BYTE5L 2048-4095 for ch9 position |
| 0xxx | BYTE7H/BYTE7L/BYTE6H 0-2047 for ch2 position | BYTE7H/BYTE7L/BYTE6H 2048-4095 for ch10 position |
| 0xxx | BYTE9L/BYTE8H/BYTE8L 0-2047 for ch3 position | BYTE9L/BYTE8H/BYTE8L 2048-4095 for ch11 position |
| 0xxx | BYTE10H/BYTE10L/BYTE9H 0-2047 for ch4 position | BYTE10H/BYTE10L/BYTE9H 2048-4095 for ch12 position |
| 0xxx | BYTE12L/BYTE11H/BYTE11L 0-2047 for ch5 position | BYTE12L/BYTE11H/BYTE11L 2048-4095 for ch13 position |
| 0xxx | BYTE13H/BYTE13L/BYTE12H 0-2047 for ch6 position | BYTE13H/BYTE13L/BYTE12H 2048-4095 for ch14 position |
| 0xxx | BYTE15L/BYTE14H/BYTE14L 0-2047 for ch7 position | BYTE15L/BYTE14H/BYTE14L 2048-4095 for ch15 position |
| 0xxx | BYTE16H/BYTE16L/BYTE15H 0-2047 for ch8 position | BYTE16H/BYTE16L/BYTE15H 2048-4095 for ch16 position |