



Preamble, mandatory for all Packets

AA	AA	AA	2D	XX	LEN	LEN Bytes of Data	
0	1	2	3	4	5	6	7...

Preamble is required by RFM69 mode of operation

Byte	Remarks
0,1,2	Preamble for frequency Sync
3	Syncword 1. fixed to 2D for compatibility with RFM12B
4	Syncword 2. Network ID, defined by user, set to D2 for compatibility with RFM12E
5	LEN = length of Data block
6...6+LEN	Data Block

Data Block (TiNo Sensor Protocol)

D	S	F	V	C	T	H
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LEN = 8

Param.	#Bits	Remarks																
D	8	Destination, the Target ID																
S	8	Sender Node ID																
F	8	Flags:																
		<table border="1"><tr><td>x</td><td>0</td><td>0</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr><tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr></table>	x	0	0	x	x	x	x	x	7	6	5	4	3	2	1	0
x	0	0	x	x	x	x	x											
7	6	5	4	3	2	1	0											
		x= 1 or 0 depending on function																
0		Heartbeat (system is healthy)																
1		PCI 0																
2		PCI 1																
3		PCI 2																
4		PCI3																
5		0 = TiNo Sensor Protocol, 1= Alternate Protocol																
6		ACK Must be set to 0.																
7		Request ACK from receiver, when set to 1																
V	12	unsigned int Voltage measurement. resolution 1 mV, offset 0 mV possible values range from 0 to 4096 (0 to 4.096V)																
C	8	unsigned char counter, incremented for each packet sent, runs over from 255 to 0																
T	12	unsigned int Temperature Measurement Resolution 0.04 degC, offset +40 degC encode: $T = (t[\text{degC}] + 40) * 25$ decode: $t[\text{degC}] = T/25.0 - 40$																
H	8	unsigned char Humidity Measurement Resolution 0.5 %RH, offset 0%RH encode: $H = h[\%RH] * 2$ decode: $h[\%RH] = H/2.0$																

## Data Block - Alternate Protocol (General Description)



D	S	F	C	Any other data
0	1	2	3	4...LEN

LEN = user defined , must be modulo 4 if encryption is used

LEN=4 indicates empty data block

Param. #Bits Remarks

**D** 8 Destination, the Target ID

**S** 8 Sender Node ID

**F** 8 Flags:

x	0	1	x	x	x	x	x
7	6	5	4	3	2	1	0

x=undefined

0  
1  
2  
3  
4 } user defined Flags.

5 Must be set to 1 (indicates an alternate Protocol)

6 ACK Must be set to 0.

7 when set to 1, request ACK from receiver

**C** 8 unsigned char incremented for each packet sent, runs over from 255 to 0

## Data Block - ACK Packet

D	S	F	FEI	C	RSSI	T
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LEN = 8

Param. #Bits Remarks

0 **D** 8 Destination, the Target ID

1 **S** 8 Sender Node ID

2 **F** 8 Flags:

0	1	0	x	x	x	x	x
7	6	5	4	3	2	1	0

x=undefined

Bit 7: must be 0 to avoid acknowledge of an ack packet

Bit 6: must be one to indicate an ACK

Bit 5: must be 0, indicates the response to a TiNo Sensor Packet

3 **FEI** 16 signed int Frequency Error Indicator [ frequency Steps ]  
1 Step = 61.03515625 Hz, see Data Sheet of RFM69

5 **C** 8 unsigned char must be identical to the count of the packet that is acknowledged

6 **RSSI** 8 unsigned char Received Signal Strength Indicator  
 $rss_i[dB] = -RSSI / 2.0$

Tells the Sender about the channel quality

7 **T** 8 Temperature Measurement of the receiver's RFM69  
resolution: 1 degC/LSB

rough temperature indicator, currently not calibrated, can be wrong by several degrees.

note: FEI, RSSI and Temperature Values of the receiver are currently unused

### Alternate Packet Type 3 (for BME280)



D	S	F	C	0x03	V	T	H	P
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LEN =12

Param.	#Bits	Remarks
D	8	} see General Description for alternate Packets
S	8	
F	8	
C	8	
0x03	8	Packet Type Identifier, must be 3
V	12	unsigned int Voltage measurement. resolution 1 mV, offset 0 mV possible values range from 0 to 4096 (0 to 4.096V)
T	12	unsigned int Temperature Measurement Resolution 0.04 degC, offset +40 degC encode: $T = (t[\text{degC}] + 40) * 25$ decode: $t[\text{degC}] = T/25.0 - 40$
H	8	unsigned char Humidity Measurement Resolution 0.5 %RH, offset 0%RH encode: $H = h[\%RH] * 2$ decode: $h[\%RH] = H/2.0$
P	24	unsigned int Pressure measurement Resolution: 0.01 hPa, offset 0 hPa encode: $P = p[\text{hPa}] * 100$ decode: $p[\text{hPa}] = P/100.0$

### Alternate Packet Type 4 (for up to 3 Temperature sensors)

D	S	F	C <sub>LSB</sub>	0x03	V	T	T1	T2	C <sub>MSB</sub>
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LEN =12

Param.	#Bits	Remarks
D	8	} see General Description for alternate Packets
S	8	
F	8	
C <sub>LSB</sub>	8	
0x04	8	Packet Type Identifier, must be 4
V	12	unsigned int Voltage measurement. resolution 1 mV, offset 0 mV possible values range from 0 to 4096 (0 to 4.096V)
T	14	unsigned int Temperature Measurement Tmax =615 degC Tmin= -40 degC Resolution 0.04 degC, offset +40 degC encode: $T = (t[\text{degC}] + 40) * 25$ decode: $t[\text{degC}] = T/25.0 - 40$
T1	12	unsigned int Temperature Measurement Tmax = 123.8 degC Tmin = -40 degC
T2	12	unsigned int Temperature Measurement Tmax = 123.8 degC Tmin = -40 degC
C <sub>MSB</sub>	6	unsigned int Counter MSB