The TiNo Radio Data Protocol

V3.0.2

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 RFM12B
5	LEN = length of Data block
6…6+LEN	Data Block

Data Block (TiNo Sensor Protocol)

D	S	F	V	C	T	H	P	T	B

LEN = 8 (optional 12)

Param.	#Bits	Remarks
D	8	Destination, the Target ID
S	8	Sender Node ID
F	8	Flags:

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

Pin Change Events, mapped to Ports in EEPROM of Sender. 1 = a event happened, 0 = no event happened

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[degC] + 40) *25 decode: t[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	22	unsigned int	Air Pressure Measurement Resolution: 0.01 hPa, offset 0 hPa encode: P = p[hPa] * 100 decode: p[hPa] = P/100.0
B	10	unsigned int	analog Value, for example Brightness Measurement

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

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 acknoledge 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 acknoledged
6	**RSSI**	8	unsigned char	Received Signal Strength Indicator rssi[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

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[degC] + 40) *25 decode: t[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[hPa] * 100 decode: p[hPa] = P/100.0

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

D	S	F	C_{LSB}	0x03	V	T	T1	T2	C_{MSB}

LEN =12

Param.	#Bits		Remarks		
D	8		see General Description for alternate Packets		
S	8				
F	8				
C_{LSB}	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 Resolution 0.04 degC, offset +40 degC encode: T = (t[degC] + 40) *25 decode: t[degC] = T/25.0 - 40	Tmax =615 degC	Tmin= -40 degC
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_{MSB}	6	unsigned int	Counter MSB		

Alternate Packet Type 5 humidity sensor and additional temperature reading (DS18B20 or MAX31865)

D	S	F	C_{LSB}	0x05	V	T	H	T2	B

LEN =12

Param.	#Bits	Remarks			
D	8	see General Description for alternate Packets			
S	8				
F	8				
C	8				
0x05	8	Packet Type Identifier, must be 5			
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[degC] + 40) *25 decode: t[degC] = T/25.0 - 40	Tmax =615 degC	Tmin= -40 degC
H	8	unsigned char	Humidity Measurement Resolution 0.5 %RH, offset 0%RH encode: H = h[%RH] * 2 decode: h[%RH] = H/2.0		
T1	14	unsigned int	Temperature Measurement	Tmax = 615.32 degC	Tmin = -40 degC
B	10	unsigned int	Analog Reading i.e. Brightness	values: 0 - 1023	