TC-Link Logging Heartbeat Mode

REV 0.5

Overview

This mode is designed to be used by the TC-Link module in a low-power wake and sample to flash mode. The node will send out a heartbeat (send data over the air to the base station) at a programmed interval.

Some Useful Data Formatting Information

Baud rate = 115200bps (115.2kbps)

Each Chan# data point is a single precision float (4bytes)

Stored in IEEE format
1.25465e3 = 449CD4CC

```
BYTE1                ---- MSB
BYTE2                ---- ..
BYTE3                ---- ..
BYTE4                ---- LSB
```

Time stamp Tick Format each tick is 1\64th of a second

```
BYTE1                ---- MSB
BYTE2                ---- ..
BYTE3                ---- ..
BYTE4                ---- LSB
```

Each Time stamp on the serial flash contains the following data

```
BYTE1                ---- century bits
BYTE2                ---- year
BYTE3                ---- month
BYTE4                ---- day of month
BYTE5                ---- hour
BYTE6                ---- min
BYTE7                ---- seconds
BYTE8                ---- tenth of seconds
```

For a detailed description of this data see "time date format"

APP Data Type 0x09

Cannel Mask

8 bits bits, 0-5 are thermocouple channels bit 6 is CJC and bit 7 is %RH (if present)

Heartbeat \ LDC Packet

A heart\LDC Packet beat is sent out every XX seconds (programmable) and is presented in this format from the base station

BYTE 1	S.O.P. (start of packet, 0xAA)
BYTE 2	D.S.F .(Delivery Stop Flag, 0x07)
BYTE 3	A.D.T. (Application Data Type, 0x09)
BYTE 4,5	N.A. (16bit Node Address)
BYTE 6	App Data Length
BYTE 7	LDC Application identity
BYTE 8	Channel Mask
BYTE 9	Data Format \ Sample Rate
BYTE 10-13	Timestamp, Tick Format
BYTE 14-17	Chan 1
BYTE 18-21	Chan 2 (if present)
BYTE 22-25	Chan 3 (if present)
BYTE 26-29	Chan 4 (if present)
BYTE 30-33	Chan 5 (if present)
BYTE 34-37	Chan 6 (if present)
BYTE 38-41	Chan 7 CJC Temp (if present)
BYTE 42-45	Chan 8 % RH (if present)
BYTE 46,47	RSSI\LQI
BYTE 48,49	Checksum

LDC Application identity

`0x02` – generic
`0xC1` – original TC-Link data format
`0x03` - channel mask able LDC format with 32bit timestamp

Channel Mask

A bit is set for each active bit

Example: 0x04 = 0b00000100 so channel 2 is on and the other channels are off

Data Format \ Sample Rate

Upper nibble Channel Data Format

0 - int8
1 - int16
2 - single precision float
3 - 2 byte integer + 2 bytes of units
4 - 4 bytes of float + 2 bytes of units
5 - int24
6 - int32
7 - single precision float while logging
8 - single precision float while not logging

Lower nibble Sample rate ($2^{(15-n)}$Hz, where n is the upper nibble)

Example:0x29

Upper nibble is 2 so the data type is single precision float
Lower nibble is 9 so the rate is $2^{(15-9)}$Hz = 64Hz

Example - AA 07 09 00 C9 14 00 00 98 08 20 98 44 9C D4 CC 3F 80 00 00 00 00 00 00 44 9C D4 CC 2E B8 xx xx

0xAA	----	S.O.P.	
0x07	----	D.S.F.	
0x09	----	A.D.T.	
0x00C9	----	N.A. (201)	
0x14	----	App Data Length	
0x03	----	LDC application identity	
0x47	----	Channel Mask (0x07 is 0b01000111, channels 1,2,3 and CJC)	
0x29	----	Data Format\Sample Rate	
0x98	----	Timestamp MSB	
0x08	----	…	
0x20	----	…	
0x98	----	Timestamp LSB	
0x44	----	CH1	(last sample)
0x9C	----	CH1	(last sample)
0xD4	----	CH1	(last sample)
0xCC	----	CH1	(last sample)
0x3F	----	CH2	(last sample)
0x80	----	CH2	(last sample)
0x00	----	CH2	(last sample)
0x00	----	CH2	(last sample)
0x00	----	CH3	(last sample)
0x00	----	CH3	(last sample)
0x00	----	CH3	(last sample)
0x00	----	CH3	(last sample)
0x44	----	CJC	(last sample)
0x9C	----	CJC	(last sample)
0xD4	----	CJC	(last sample)
0xCC	----	CJC	(last sample)
0x2E	----	LQI	
0xB8	----	RSSI	
0x0D1D	----	checksum	

So the time would be 0h98082098 or 2550669464 in decimal, converting this value to seconds yields 39854210.375 seconds (provided each tick is 1/64th of a second)

And the data would be Chan 1 = 1.25465e3, Chan 2 = 1.00, Chan 3 = 0.0 and CJC Temp would be 1.254e3

Serial Flash Storage

Each sample is stored in the onboard serial flash in the following format.

BYTE 1	S.O.P. (0xBB)
BYTE 2	Data Format \ Sample Rate
BYTE 3-10	Timestamp
BYTE 11-14	Chan 1
BYTE 15-17	Chan 2
BYTE 19-22	Chan 3
BYTE 23-26	Chan 4
BYTE 27-30	Chan 5
BYTE 31-34	Chan 6
BYTE 35-38	Chan 7
BYTE 39-42	Chan 8
BYTE 43,44	Checksum

Two pages of flash (download via software) equal one physical page (page two appended to page one and so on for a total of 528 bytes). Each of those pages contain 12 sample sets in the above date format (12sample*44bytes per sampl = 528)

Data will be saved in this format regardless of the Channel mask although the data saved will be garbage if the channel is off (bit set to 0) so make note of the channel mask.

To download a page from the device see "*Download a page of data from a Node* " from the SDK

Read Device Time (command 0x00c1)

Reads the current device time

Command

BYTE 1	S.O.P. (start of packet, 0xAA)
BYTE 2	D.S.F. (Delivery Stop Flag, 0x05)
BYTE 3	A.D.T. (Aplication Data Type, 0x00)
BYTE 4,5	N.A. (16bit Node Address)
BYTE 6	App Data Length
BYTE 7,8	Command (0x00C1)
BYTE 9,10	Checksum

Return

BYTE 1	S.O.P. (start of packet, 0xAA)
BYTE 2	D.S.F. (Delivery Stop Flag, 0x07)
BYTE 3	A.D.T. (Aplication Data Type, 0x00)
BYTE 4,5	N.A. (16bit Node Address)
BYTE 6	App Data Length
BYTE 7-14	Current Device Time
BYTE 15,16	Checksum

Example

```
AA 05 00 00 c9 02 00 c1 01 91

0xAA          ----   S.O.P.
0x05          ----   D.S.F. (0b0101)
0x00          ----   A.D.T.
0x00C9        ----   N.A. (201)
0x02          ----   App Data Length
0x00c1        ----   command
0x01f6        ----   checksum
```

Returns

```
Basestation          AA
Node                 AA 05 00 00 C9 08 01 98 08 20 02  58 57 55 2D B4 03 D3
```

Explanation of returned data

```
0xAA                 ---- S.O.P.
0x05                 ---- D.S.F. (0b0101)
0x00                 ---- address mode
0x00C9               ---- node address (201)
0x08                 ---- payload length
0x01                 ---- century bits
0x08                 ---- year
0x98                 ---- month
0x20                 ---- day of month
0x02                 ---- hour
0x58                 ---- min
0x57                 ---- seconds
0x55                 ---- tenth of seconds
0x2D                 ---- LQI
0xB4                 ---- RSSI
0x03D3               ---- checksum
```

See Time Date Format for explanation of the time formats

Set Device Time (command 0x00c2)

Sets the desired time to the device

Command

BYTE 1	S.O.P. (start of packet, 0xAA)
BYTE 2	D.S.F. (Delivery Stop Flag, 0x05)
BYTE 3	A.D.T. (Aplication Data Type, 0x00)
BYTE 4,5	N.A. (16bit Node Address)
BYTE 6	App Data Length
BYTE 7-14	Current Device Time
BYTE 15,16	Checksum

Return

From Basestation

Byte 1	0xAA

From Node

BYTE 1	S.O.P. (start of packet, 0xAA)
BYTE 2	D.S.F. (Delivery Stop Flag, 0x05)
BYTE 3	A.D.T. (Aplication Data Type, 0x00)
BYTE 4,5	N.A. (16bit Node Address)
BYTE 6	App Data Length (0x02)
BYTE 7,8	Response (0x0000)
BYTE 9,10	Checksum

Example

```
AA 00 00 00 C9 08 01 98 08 20 08 02 58 57 55 xx xx **
** Where xx xx is the checksum

0xAA        ---- sop
0x05        ---- msg type (0b0101)
0x00        ---- address mode
0x00C9      ---- node address (201)
0x08        ---- payload length
0x01        ---- century bits
0x08        ---- year
0x98        ---- month
0x20        ---- day of month
0x02        ---- hour
0x58        ---- min
0x57        ---- seconds
0x55        ---- tenth of seconds
0xXX XX     ---- checksum
```

Returns

```
Basestation       - AA
Node              - AA 00 00 00 C9 02 00 00 2E B8 00 CB
```

(Normal packet protocol with a 0x0000 for a payload)

Time Date Format

Time is in BCD (binary coded decimal)

For the examples above the time would translate like this

```
Century is 00 – (0 = 20, 1 = 21, 2 = 22, 3 = 23)
Year is 98
Month is 8
Day of month is 20
Hour is 2
Min is 58
Second are 57.55
```

So the time would be 2:58:57.55 on August 20, 2098

Or in ISO 8601 standard

```
2098-08-20-T-02-58-57.55
20980820T025857.55
```

Other Commands and Information

EEprom locations for system setup

Logging interval times (loc 84)

Setting this value will control the time between each data point sampled and logged to flash when in beacon save mode. the value written into EEprom will be 1\64th or a second, for example to get the interval time to be 1 second the value would need to be 64. Valid values are 32-65535

Setting this value will also control how much time between each beacon (status packet sent over the air with current values).

Filter (loc 130)

This value sets the filter value of the not user settable

Gain (loc 128)

This sets the gain of the input
This writes to EEprom location 128
Valid values and their gain

Value	Gain	Full Scale Input Range
0	1	3V
1	2	1.5V
2	4	750mV
3	8	375mV
4	16	187.5mV
5	32	93.75mV
6	64	46.875mV
7	128	23.4375mV