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Temperature Monitor Untethered (set of four sensors)

TMU04 – Tire Monitor Untethered
BMU04 – Brake Monitor Untethered

Manual

(11.06.2025)

v1.0 – Initial version
v1.1 – Add new connector information
v1.2 – V2 Dimensions Added
v1.3 – first CANchecked release

Table of Contents

Temperature Monitor Untethered

1. Introduction

Thank you for purchasing the Temperature Monitor Untethered. The following guide is aimed at providing an overview of the typical install process and configuration steps.

2. Specifications

SENSOR	Number of Channels	8
	Sample Rate	1-50Hz (10Hz default)
	Field of view	110°
	Battery	250 mAh (built-in charger)
	Autonomy	15 hrs (track use)
	Dimensions	64 x 42 x 17.5 mm
	Accuracy	1°C
	Emissivity	0.01 – 1
	IP Rating	IP65
RECEIVER	Supply Voltage	5 – 20V
	Supply Current	50 mA
	Connector	DTM04-4P
	Mating Connector	DTM06-4S
	CAN	2.0A (11bit identifier)
	Bit Rate	500kbps/1Mbps (500kbps default)

3. Quick Install

a. Initial Setup

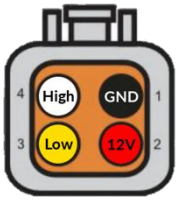
First step after receiving the product is putting the sensors on charge using the supplied cables and any USB adapter (including external batteries).

b. Receiver – Installation

The receiver comes with a DTM04-4P Connector. Its mating connector number is DTM06-4S.

Pinout is:

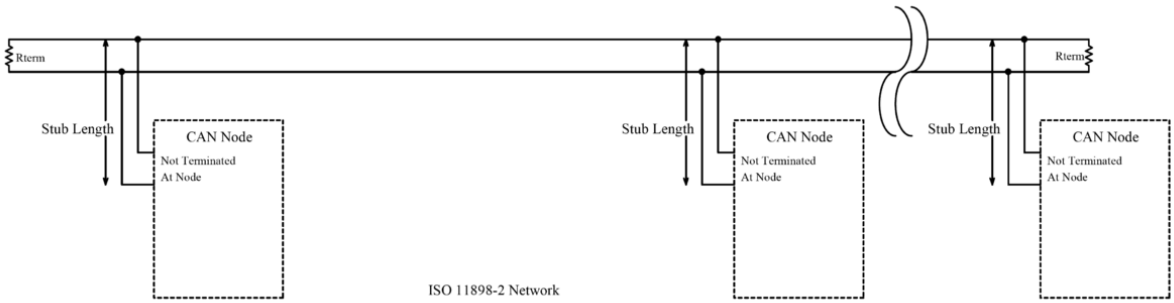
1. GND (Black)
2. 12V (Red)
3. CAN Low (Yellow)
4. CAN High (White)



The receiver should be mounted so the status LED can be seen easily to verify the connection before each use.

CAN Connectivity

Every CAN bus network requires two 120 Ohm resistors placed at each end, as the diagram below (Rterm = 120 Ohms) shows. If you are not familiar with CAN bus, we recommend that you consult with a professional. Incorrect installation can damage the devices or produce unsatisfactory performance.



Always use twisted paired cable for CAN Low and CAN High wiring as it greatly improves the signal's tolerance to electrical noise. Also try and keep wiring stubs (cables going from the main CAN bus lines to individual devices) at a minimum.

c. Config

For the full configuration please see chapter 7 “Configuration”.

d. Power-up

After the sensors are fully charged now the system can now be powered up starting with the receiver. After doing so, the STATUS LED (S) on the receiver should turn blue and, after the configuration period passes, green. This signals that the device is transmitting data over CAN.

With the receiver powered and transmitting data over CAN, the next step is turning on the first sensor by removing the magnetic override. The LED on the sensor will start to blink blue and when connected to the receiver successfully stop blinking. The receiver will show the successful paired sensor as a corresponding LED lit up in green.

After successfully connecting the first sensor you can remove the magnetic override of the second sensor to repeat this process and pair it successfully too. Please repeat this step for all the sensors in your kit.

After ~1 minute, each sensor will start transmitting data and the corresponding LED on the receiver should blink green.

If one sensor does not connect to the receiver, please place it in the magnetic override for a few seconds to turn off and then try to pair it again.

4. Physical Installation

Before installing the sensor in its final position, please ensure that the sensor is correctly linked with the receiver!

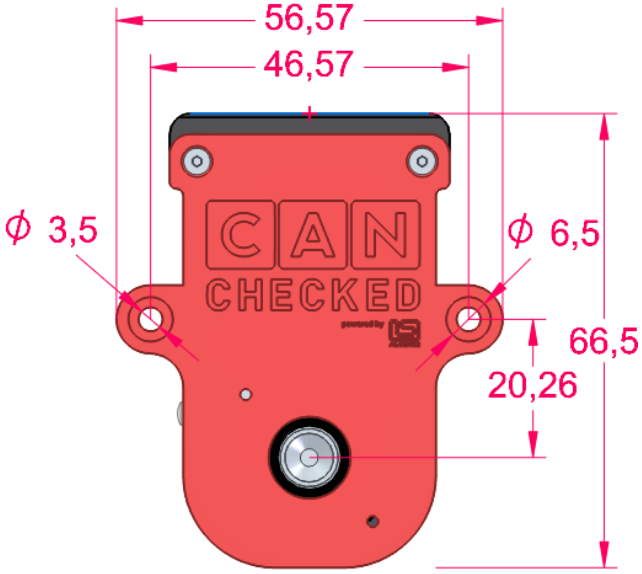


Figure 1 – Mounting sensor (All dimensions in mm)

Figure 2 – Mounting reciever (All dimensions in mm)

The sensor should be mounted in its final position using the mounting holes situated on the sides of the housing. For temporary installations we've successfully used 3M Dual-Lock tape, but extra care should be provided when using such a solution.

We do recommend placing the sensors away from direct exposure to significant heat sources (i.e. exhausts).

The IR sensor has a horizontal field of view of 110°. As the sensor is placed further away, the maximum width of measured surface increases. Please consult the table and the graph below or get in touch if you have any questions. Please consult 'Figure 1' to determine how to orient the sensor.

After installing the sensor in its final position, please check that the corresponding LED on the receiver continues blinking green. If the LED turns red it means that the sensor went outside of range and a range extender option should be used. Please get in touch with us for more details.

For best wireless range please ensure that the receiver and sensors are all oriented vertically.

Maximum Brake Width (mm)	Mounting Distance (mm)
100	35
150	52
225	79
250	88
275	96
300	105
350	123
400	140

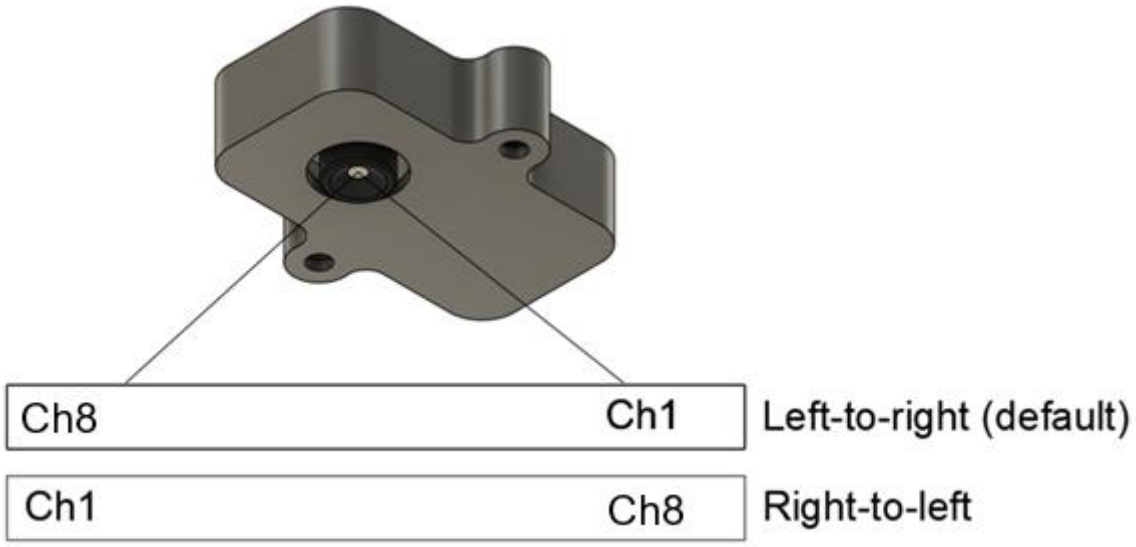


Figure 2 – Channel assignment / sensor data order

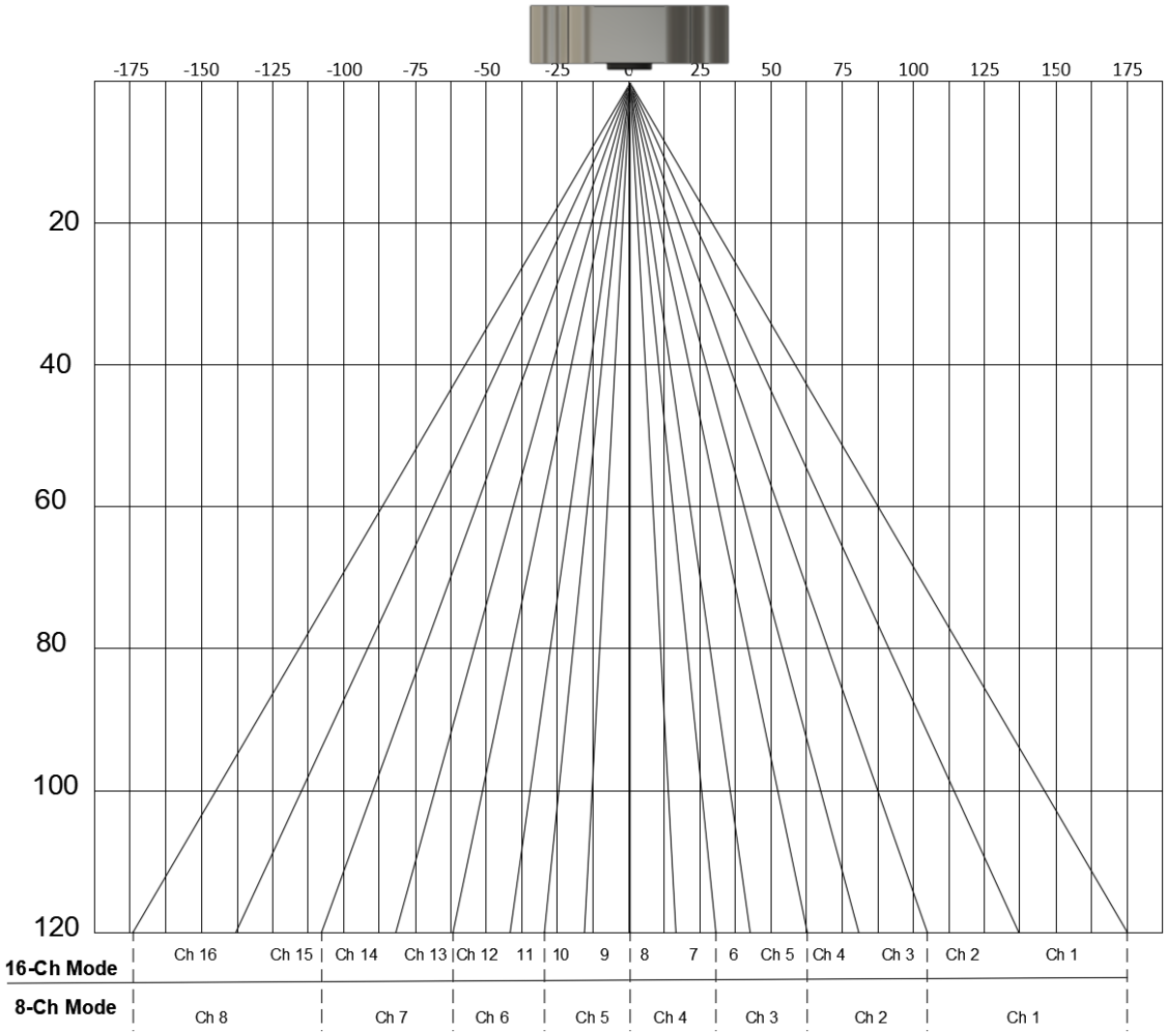


Figure 3 - Visual Representation of channel assignments (measures in millimeters)

Example: 245/35 Tire has a width of 245mm -> Round to 250mm. So, the Sensor must be placed 125mm from each side in the middle. This leads to a mounting distance of roughly 90mm above the surface of the tire when the car is standing still on the ground.

5. Operation & Charging

Each sensor has a 250mAh battery that can be charged using the built-in USB-C connector. When in use, it allows for up to 15 hours of track time.

Low battery indication – the sensor will notify the user that it's approaching the end of its battery life (3% state-of-charge) by flashing the receiver's LED yellow, instead of green, as usual. Charging is done using the cables supplied from any USB port. External batteries can be used as well. The full charge takes around 90 minutes, and the sensor must be charged with a USB-A to USB-C cable. USB-C to USB-C will not be suitable.

There's also a battery indication when powering up the sensor (after removing the magnetic overrides).

- **Quick Flash** – low battery
- **Slow flashes** – each flash will signify 10% of battery life (i.e. 5x flashes will mean the sensor has 50% battery life remaining)

Preserving battery life when not in use – while active, the sensors continuously send data to the receiver, draining the battery. When not in use, they can be deactivated by placing a magnet in a similar position to the ones in the charging dock. Alternatively, the sensors can be placed in their carrying case which has the magnets pre-fitted. Please confirm that they have been deactivated by checking the corresponding LED on the receiver to turn red.

Demo units need to be placed in the charging dock or magnetically deactivated while charging!

6. Factory Reset

In some scenarios you might need to reset the network and configuration parameters of the receiver or the sensors. The following scenarios are instances when a factory reset is required:

- **Changing the order of the sensors connected to a receiver**
- **Connecting a new sensor to an existing network**

Factory reset steps:

- Expose the PCB of the receiver by removing the two mounting screws in the case
- Ensure the receiver is powered (STATUS LED is blue or green)
- Press & hold the control button of the receiver (S1) for around 10s.
- Ensure the sensor is powered and has enough battery life. Please make sure no magnetic override is present.
- Press & hold the control button of the sensor (S3) for around 8s until the status LED briefly turns on.
- Wait for the sensor to connect to the receiver.
- Move on to the next sensor to connect to the receiver until all 4 sensors are connected.

7. Configuration

The default settings are as follows, along with a short description of what their function is:

Parameter	Default Value	Function
CAN Base ID	Tire: 0x310 – Front Left 0x330 – Front Right 0x350 – Rear Left 0x370 – Rear Right Brake: 0x210 – Front Left 0x230 – Front Right 0x250 – Rear Left 0x270 – Rear Right	Base CAN ID for all messages sent from the sensor
Emissivity	Tire: 0.75 Brake: 0.83	Lowering the emissivity increases the temperature. Suggested tire values depending on mounting distance: • 50mm – 0.86 • 150mm – 0.8 • 200 – 0.77 Suggested brake values depending on material of the disk: • 0.83 - for ceramic disks • 0.55 - for normal steel disks Accepted values (1 is 0.01): 1-100

Sample Rate	20 Hz	Sampling and reporting rate for the sensor
Number of Channels	8	Number of channels used for sampling
Sensor Data Order	Left to Right *(Figure 2)*	Channel numbering direction when looking at the sensor's camera
CAN Bit Rate	500 kbps	
Initial Configuration Delay	30 seconds	The delay, in seconds, between the sensor powering up and it starting to send temperature data over CAN. This is when new configuration parameters can be sent.

Please consult Appendix A: Temperature Monitoring Untethered CAN Protocol for complete information on the CAN protocol.

Typical Configuration Procedure:

1. The parameters for the whole system are configured by sending configuration messages to the receiver. The sensors retrieve those parameters on power-up.
2. Ensure the receiver is powered and with correct CAN connectivity to the device you're using to transmit CAN messages from.
3. If you are using a device with CAN sniffing capabilities, please confirm that, after powering the sensor, you're seeing the SYS_INFO_1 CAN (Base CAN ID + 0x08) message come in every 5 seconds during the initial configuration delay.
4. Form the configuration messages (CFG_REQ_1/2) in your CAN transmit tool and, if valid, you will receive back a response (CFG_RSP_1)/2 to confirm the new settings.
5. Power cycle the receiver and reset (not factory reset) each sensor to make sure it receives its updated configuration. Resetting the sensor means simply putting the magnetic override next to it, keeping it for 1-2 seconds, then removing it.

8. Troubleshooting / FAQ

Situation 1: Sensor's LED lighting up red

a. Make sure the sensor has been fully charged.
b. Bring the sensor near the receiver. Try resetting it using the magnetic override.
c. Try bringing it back to factory settings using the steps described in section **Factory Reset**
d. If this happens during use, try

Situation 2: Not getting any data in my CAN dash/logger

a. Use a multimeter to check that the sensor is getting 12V on its power supply pins.
b. Double check wiring and make sure your CAN stubs' length is not more than 150cm. Ensure the correct 120 Ohm termination resistors are installed. If possible, simplify the connectivity by wiring the sensor directly to a CAN sniffer.
c. If your CAN logger/dash allows you to, check that CAN receive count is increasing.
d. Double-check the configuration parameters on your CAN dash/logger.

- Baut rate
- CAN Ids
- Formulas and byte order

Situation 3: Can you suggest a USB-CAN configuration tool?

a. CAN BUS Analyzer Tool (Microchip, APGDT002)
b. PCAN-USB (requires DB9 wiring adaptor)

9. Support

Please make sure to check the downloads section of our support page as it provides the product's datasheet and configuration files for the most common CAN dashboards/loggers.

Downloads:
http://www.canchecked.de/tmu04

Appendix A: Temperature Monitor Untethered

CAN Communication Protocol V1.0

Updated 10.06.2025

A. Default CAN Specifications

1.

Base ID Tire: 0x300

- FL – 0x310
- FR – 0x330
- RL – 0x350
- RR – 0x370

Base ID Brake: 0x200

- FL – 0x210
- FR – 0x230
- RL – 0x250
- RR – 0x270

2. Baud Rate: 500kbps

B. System Configuration

Name: CFG_REQ_1
Direction: To Device
CAN Id: <Base Id>

Byte	Name	Formula	Description
0	New Base Id MSB		New Base ID for CAN messages. Requires a power cycle. I.e. 0x310 would be: Byte 0 - 0x03 Byte 1 - 0x10
1	New Base Id LSB		
2	Emissivity	= Value / 100	I.e. setting to 75 is 0.75
3	Sample Rate	= Value	1 - 50 Hz (Values outside this range are replaced with the closest valid one)
4	Global Sensor Data Order	=Value	0 - temperatures are output right to left 1 - temperatures are output left to right
5	Initial Configuration Duration (seconds)	= Value	Duration for the “Initial Configuration” phase. In seconds. Minimum value is 10s.

6	CAN Baud Rate	= 0 – 500kbps 1 – 1Mbps	Any value different than ‘0’ or ‘1’ will make the system default to 500kbps.
7	Number of Channels	= Value	Any value different than ‘4’ or ‘8’ will make the system default to 8.

Name: CFG_RSP_1
Direction: From Device
CAN Id: <Old Base Id> + 0x01

Byte	Name	Formula	Description
0	New Base Id MSB		New Base ID for CAN messages. Requires a power cycle. I.e. 0x310 would be: Byte 0 - 0x03 Byte 1 - 0x10 **0xFF & 0xFF for default address**
1	New Base Id LSB		
2	Emissivity	= Value / 100	I.e. setting to 75 is 0.75
3	Sample Rate	= Value	1 - 50 Hz (Values outside this range are replaced with the closest valid one)
4	Global Sensor Data Order	=Value	0 - temperatures are output right to left 1 - temperatures are output left to right
5	Initial Configuration Duration (seconds)	= Value	Duration for the “Initial Configuration” phase. In seconds. Minimum value is 10s.
6	CAN Baud Rate	= 0 – 500kbps 1 – 1Mbps	Any value different than ‘0’ or ‘1’ will make the system default to 500kbps.
7	Number of Channels	= Value	Any value different than ‘4’ or ‘8’ will make the system default to 8.

The device echoes back the settings sent in the first message. <Base Id> is still the one previous to the change. New settings are applied after power cycle of both the Receiver and of the individual sensors (by using the magnetic pad)

C. System Information

SYS_INFO_1 is sent until the “Initial Configuration” period expires.

Name: SYS_INFO_1
Direction: From Device
CAN Id: <Base Id> + 0x08
Time Interval: Every 5s

Byte	Name	Formula	Description
0	Receiver FW Major		
1	Receiver FW Major		
2	Emissivity	= Value / 100	I.e. setting to 75 is 0.75
3	Sample Rate	= Value	1 - 50 Hz (Values outside this range are replaced with the closest valid one)
4	Initial Configuration Duration (seconds)	= Value	Number of seconds to allow at startup for configuration.
5	Channel	= Value	Wireless channel number
6	Reserved		
7	Reserved		

D. Data Reporting

Name: DATA_SENS_INFO
Direction: From Device
Description: Sent once for each sensor, after it joins, before it begins reporting.
CAN Id: <Base Id> + 0x05
Time Interval: Once

Byte	Name	Formula	Description
0	Sens 1 FW Major		
1	Sens 1 FW Major		
2	Sens 2 FW Major		
3	Sens 2 FW Major		
4	Sens 3 FW Major		
5	Sens 3 FW Major		
6	Sens 4 FW Major		
7	Sens 4 FW Major		

After the <Initial Configuration Delay> expires, the following messages will be sent over CAN.

8 x DATA_TEMPS (2 frames for each sensor)
1 x DATA_SUMMARY (like SYS_INFO_1)
2 x SENS_SUMMARY (information about battery state and signal strength)

Name: DATA_TEMPS_1
Direction: From Device
CAN Id: <Base Id> + 0x10
Time Interval: Depending on <Sample Rate>

Byte	Name	Formula	Description
0	Chan 0 MSB	= (Value + 200) * 10	The temperature reading is offset by 200* C and then multiplied by 10. This gives a usable reporting range of: -200 *C -> 6300* C with 0.1 *C per bit. I.e. 88.9*C => 2889 MSB: 0x0B LSB: 0x49
1	Chan 0 LSB		
2	Chan 1 MSB		
3	Chan 1 LSB		
4	Chan 2 MSB		
5	Chan 2 LSB		
6	Chan 3 MSB		
7	Chan 3 LSB		

Name: DATA_TEMPS_2
Direction: From Device
CAN Id: <Base Id> + 0x11
Time Interval: Depending on <Sample Rate>

Byte	Name	Formula	Description
0	Chan 4 MSB	= (Value + 200) * 10	The temperature reading is offset by 200* C and then multiplied by 10. This gives a usable reporting range of: -200 *C -> 6300* C with 0.1 *C per bit. I.e. 88.9*C => 2889 MSB: 0x0B LSB: 0x49
1	Chan 4 LSB		
2	Chan 5 MSB		
3	Chan 5 LSB		
4	Chan 6 MSB		
5	Chan 6 LSB		
6	Chan 7 MSB		
7	Chan 7 LSB		

Name: DATA_TEMPS_3
Direction: From Device
CAN Id: <Base Id> + 0x30
Time Interval: Depending on <Sample Rate>

Byte	Name	Formula	Description
0	Chan 0 MSB	= (Value + 200) * 10	The temperature reading is offset by 200* C and then multiplied by 10. This gives a usable reporting range of: -200 *C -> 6300* C with 0.1 *C per bit. I.e. 88.9*C => 2889 MSB: 0x0B LSB: 0x49
1	Chan 0 LSB		
2	Chan 1 MSB		
3	Chan 1 LSB		
4	Chan 2 MSB		
5	Chan 2 LSB		
6	Chan 3 MSB		
7	Chan 3 LSB		

Name: DATA_TEMPS_4
Direction: From Device
CAN Id: <Base Id> + 0x31
Time Interval: Depending on <Sample Rate>

Byte	Name	Formula	Description
0	Chan 4 MSB	= (Value + 200) * 10	The temperature reading is offset by 200* C and then multiplied by 10. This gives a usable reporting range of: -200 *C -> 6300* C with 0.1 *C per bit. I.e. 88.9*C => 2889 MSB: 0x0B LSB: 0x49
1	Chan 4 LSB		
2	Chan 5 MSB		
3	Chan 5 LSB		
4	Chan 6 MSB		
5	Chan 6 LSB		
6	Chan 7 MSB		
7	Chan 7 LSB		

Name: DATA_TEMPS_5
Direction: From Device
CAN Id: <Base Id> + 0x50
Time Interval: Depending on <Sample Rate>

Byte	Name	Formula	Description
0	Chan 0 MSB	= (Value + 200) * 10	The temperature reading is offset by 200* C and then multiplied by 10. This gives a usable reporting range of: -200 *C -> 6300* C with 0.1 *C per bit. I.e. 88.9*C => 2889 MSB: 0x0B LSB: 0x49
1	Chan 0 LSB		
2	Chan 1 MSB		
3	Chan 1 LSB		
4	Chan 2 MSB		
5	Chan 2 LSB		
6	Chan 3 MSB		
7	Chan 3 LSB		

Name: DATA_TEMPS_6
Direction: From Device
CAN Id: <Base Id> + 0x51
Time Interval: Depending on <Sample Rate>

Byte	Name	Formula	Description
0	Chan 4 MSB	= (Value + 200) * 10	The temperature reading is offset by 200* C and then multiplied by 10. This gives a usable reporting range of: -200 *C -> 6300* C with 0.1 *C per bit. I.e. 88.9*C => 2889 MSB: 0x0B LSB: 0x49
1	Chan 4 LSB		
2	Chan 5 MSB		
3	Chan 5 LSB		
4	Chan 6 MSB		
5	Chan 6 LSB		
6	Chan 7 MSB		
7	Chan 7 LSB		

Name: DATA_TEMPS_7
Direction: From Device
CAN Id: <Base Id> + 0x70
Time Interval: Depending on <Sample Rate>

Byte	Name	Formula	Description
0	Chan 0 MSB	= (Value + 200) * 10	The temperature reading is offset by 200* C and then multiplied by 10. This gives a usable reporting range of: -200 *C -> 6300* C with 0.1 *C per bit. I.e. 88.9*C => 2889 MSB: 0x0B LSB: 0x49
1	Chan 0 LSB		
2	Chan 1 MSB		
3	Chan 1 LSB		
4	Chan 2 MSB		
5	Chan 2 LSB		
6	Chan 3 MSB		
7	Chan 3 LSB		

Name: DATA_TEMPS_8
Direction: From Device
CAN Id: <Base Id> + 0x71
Time Interval: Depending on <Sample Rate>

Byte	Name	Formula	Description
0	Chan 4 MSB	= (Value + 200) * 10	The temperature reading is offset by 200* C and then multiplied by 10. This gives a usable reporting range of: -200 *C -> 6300* C with 0.1 *C per bit. I.e. 88.9*C => 2889 MSB: 0x0B LSB: 0x49
1	Chan 4 LSB		
2	Chan 5 MSB		
3	Chan 5 LSB		
4	Chan 6 MSB		
5	Chan 6 LSB		
6	Chan 7 MSB		
7	Chan 7 LSB		

Name: DATA_SUMMARY
Direction: From Device
CAN Id: <Base Id> + 0x14
Time Interval: Every 10s

Byte	Name	Formula	Description
0	Receiver FW Major		
1	Receiver FW Major		
2	Emissivity	= Value / 100	I.e. setting to 75 is 0.75
3	Sample Rate	= Value	1 - 50 Hz (Values outside this range are replaced with the closest valid one)
4	empty		
5	empty		
6	Num Chans	= Value	
7	Receiver Ambient Temp	= Value	Receiver's Ambient Temp in Deg C

Name: SENS_SUMMARY_1
Direction: From Device
CAN Id: <Base Id> + 0x3A
Time Interval: Depending on <Sample Rate>

Byte	Name	Formula	Description
0	Sens 1 SoC	= Value	0 - 100% reading for each sensor's battery level
1	Sens 2 SoC	= Value	
2	Sens 3 SoC	= Value	
3	Sens 4 SoC	= Value	
4	Sens 1 Link Quality	= Value	Indication for each sensor's wireless signal strength.
5	Sens 2 Link Quality	= Value	
6	Sens 3 Link Quality	= Value	
7	Sens 4 Link Quality	= Value	

Name: SENS_SUMMARY_2
Direction: From Device
CAN Id: <Base Id> + 0x3B
Time Interval: Depending on <Sample Rate>

Byte	Name	Formula	Description
0	Sens 1 Ambient Temp	= Value	Sensors´Ambient Temp in Degrees Celsius
1	Sens 2 Ambient Temp	= Value	
2	Sens 3 Ambient Temp	= Value	
3	Sens 4 Ambient Temp	= Value	
4	Sens 1 Voltage	= Value	Sensors´ Battery Voltage
5	Sens 2 Voltage	= Value	
6	Sens 3 Voltage	= Value	
7	Sens 4 Voltage	= Value	