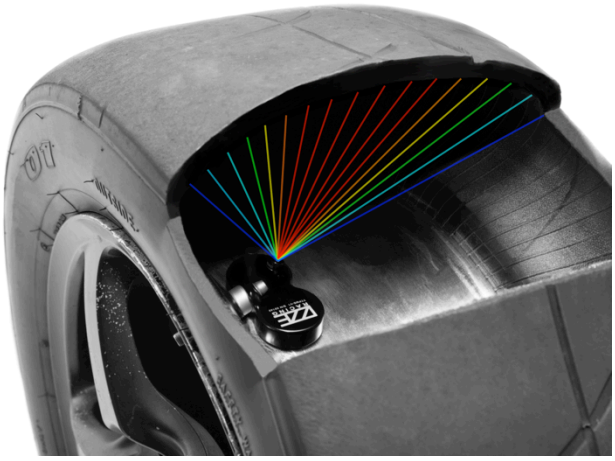
Tire Temperature and Pressure Monitoring System - Datasheet

The Izze-Racing wireless Tire Temperature and Pressure Monitoring System (TTPMS) consists of small, lightweight, wheel-mounted sensors and an equally small receiver with a built in pressure transducer for high-accuracy gauge pressure measurements. The wireless sensor measures the lateral temperature distribution of the inner tire carcass with an ultra-wide 16-channel infrared sensor and pressure with a high-resolution 24-bit pressure transducer, providing invaluable tire data for motorsport and R&D applications.



SPECIFICATIONS – TTPMS SENSOR

Pressure, Range (Gauge)	0 to 5000 mBar
Pressure, Resolution	1 mBar
Pressure, FS Accuracy (typ)	±10 mBar
Internal Temperature, Range	-40 to 150˚C
Internal Temperature, Resolution	0.1˚C
Internal Temperature, FS Accuracy	±1.0˚C
IR Temperature, Range	-20 to 300˚C
IR Temperature, Resolution	0.1˚C
IR Temperature, Accuracy (typ)	±3.0˚C
Sampling Period at Speed	1.2 seconds
Operating Temperature Range*	0 to 135˚C
Battery Life (typ)	> 2 million transmissions
Encryption	AES-128
RF Frequency, Center	915 MHz (adjustable)
RF Output Power	1mW
Wireless Range, Open Space	> 100m

*Will survive brief temperature excursions < 150˚C

SPECIFICATIONS – RECEIVER

Voltage Input	5 to 16 V
Supply Current	30 mA
Temperature Range	-20 to 85˚C
Max No. of Sensors	120 (30 per corner)
RF Frequency, Center	915 MHz (adjustable)
Sensitivity (typ)	110dBm

MECHANICAL SPECS – SENSOR

Weight	42 ± 1g
Material	7075-T6
Max. Centrifugal Accel.	2200G (SF = 3)
L x W x H (max)	73.5 x 37.5 x 19.5 mm
Protection Rating	IP61

MECHANICAL SPECS – RECEIVER

Weight	18 ± 1g
Material	6061-T6
L x W x H (max)	50.5 x 35.5 x 8 mm
Protection Rating	IP65

CAN SPECIFICATIONS – RECEIVER

Standard	CAN 2.0A, ISO-11898	
Bit Rate	1 Mbit/s (configurable)	
Byte Order	Big-Endian / Motorola	
Data Conversion	1 integer per bit	SN, TC, Node ID
	1 dBm per bit	RSSI
	1mV per bit	Battery Voltage
	1 mBar per bit	Pressure
	0.1˚C per bit, -100˚C offset	Temperature
	(all variables unsigned except RSSI)	
Base CAN ID (default)	1030 (Dec) / 0x406 (Hex)	
Termination	None	

WIRING SPECS – RECEIVER:

Wire	M22759/32-26, DR25
Cable Length	500 mm
Connector	None

Supply Voltage, V_s	Red
Ground	Black
CAN +	Blue
CAN -	White

CAN MESSAGE STRUCTURE – RECEIVER:

CAN ID: 0x406 (LF) / 0x40C (RF) / 0x412 (LR) / 0x418 (RR)

Serial Number		Battery Voltage		Pressure		Gauge Pressure	
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3 (LSB)	Byte 4 (MSB)	Byte 5 (LSB)	Byte 6 (MSB)	Byte 7 (LSB)

CAN ID: 0x407 (LF) / 0x40D (RF) / 0x413 (LR) / 0x419 (RR)

Infrared Temp, CH 1		Infrared Temp, CH 2		Infrared Temp, CH 3		Infrared Temp, CH 4	
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3 (LSB)	Byte 4 (MSB)	Byte 5 (LSB)	Byte 6 (MSB)	Byte 7 (LSB)

CAN ID: 0x408 (LF) / 0x40E (RF) / 0x414 (LR) / 0x41A (RR)

Infrared Temp, CH 5		Infrared Temp, CH 6		Infrared Temp, CH 7		Infrared Temp, CH 8	
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3 (LSB)	Byte 4 (MSB)	Byte 5 (LSB)	Byte 6 (MSB)	Byte 7 (LSB)

CAN ID: 0x409 (LF) / 0x40F (RF) / 0x415 (LR) / 0x41B (RR)

Infrared Temp, CH 9		Infrared Temp, CH 10		Infrared Temp, CH 11		Infrared Temp, CH 12	
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3 (LSB)	Byte 4 (MSB)	Byte 5 (LSB)	Byte 6 (MSB)	Byte 7 (LSB)

CAN ID: 0x40A (LF) / 0x410 (RF) / 0x416 (LR) / 0x41C (RR)

Infrared Temp, CH 13		Infrared Temp, CH 14		Infrared Temp, CH 15		Infrared Temp, CH 16	
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3 (LSB)	Byte 4 (MSB)	Byte 5 (LSB)	Byte 6 (MSB)	Byte 7 (LSB)

CAN ID: 0x40B (LF) / 0x411 (RF) / 0x417 (LR) / 0x41D (RR)

Transmission Count		RSSI		Sensor Temperature		Sensor Node ID	
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3 (LSB)	Byte 4 (MSB)	Byte 5 (LSB)	Byte 6 (MSB)	Byte 7 (LSB)

* The base CAN ID (0x406) is adjustable

BASE CAN ID PROGRAMMING – RECEIVER:

To modify the wireless receiver's base CAN ID, sensor assignment mode, or bit rate, send the following CAN message at 1Hz for at least 10 seconds and then reset the receiver by disconnecting power for 5 seconds. For more details and options, refer to the Appendix.

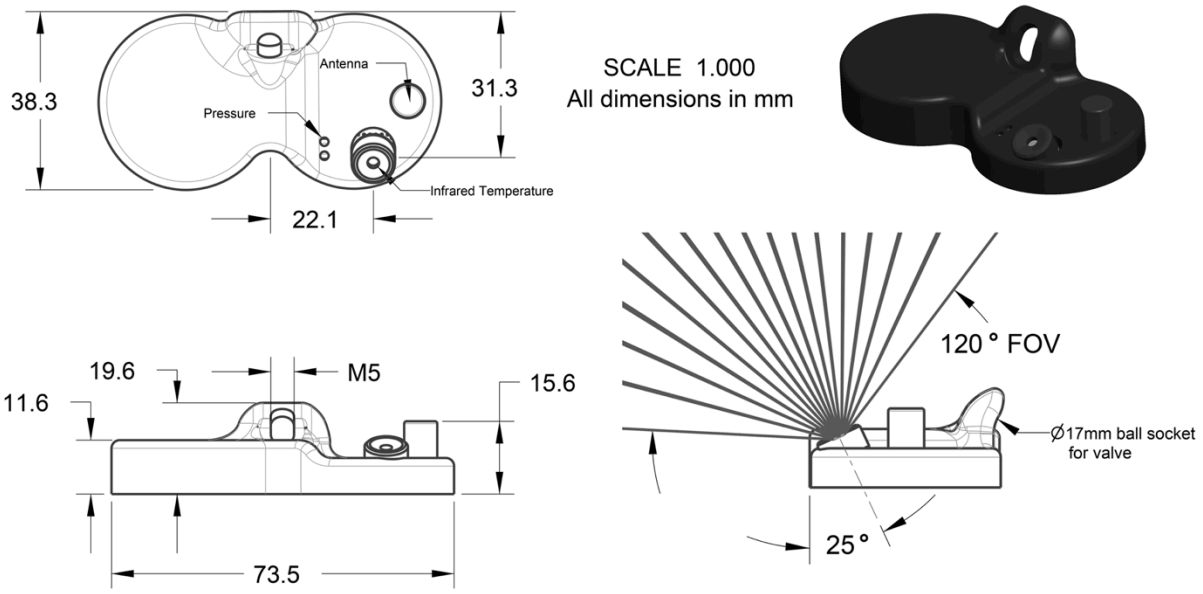
CAN ID: Current Base ID

Programming Constant		New CAN Base ID (11-bit)		Sensor Assignment	Bit Rate		
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3 (LSB)	Byte 4	Byte 5	Byte 6	Byte 7
30000 = 0x7530		1 = 0x001 ⋮ 2047 = 0x7FF		1 = Default 2 = Custom	1 = 1 Mbit/s 2 = 500 kbit/s 3 = 250 kbit/s 4 = 125 kbit/s		

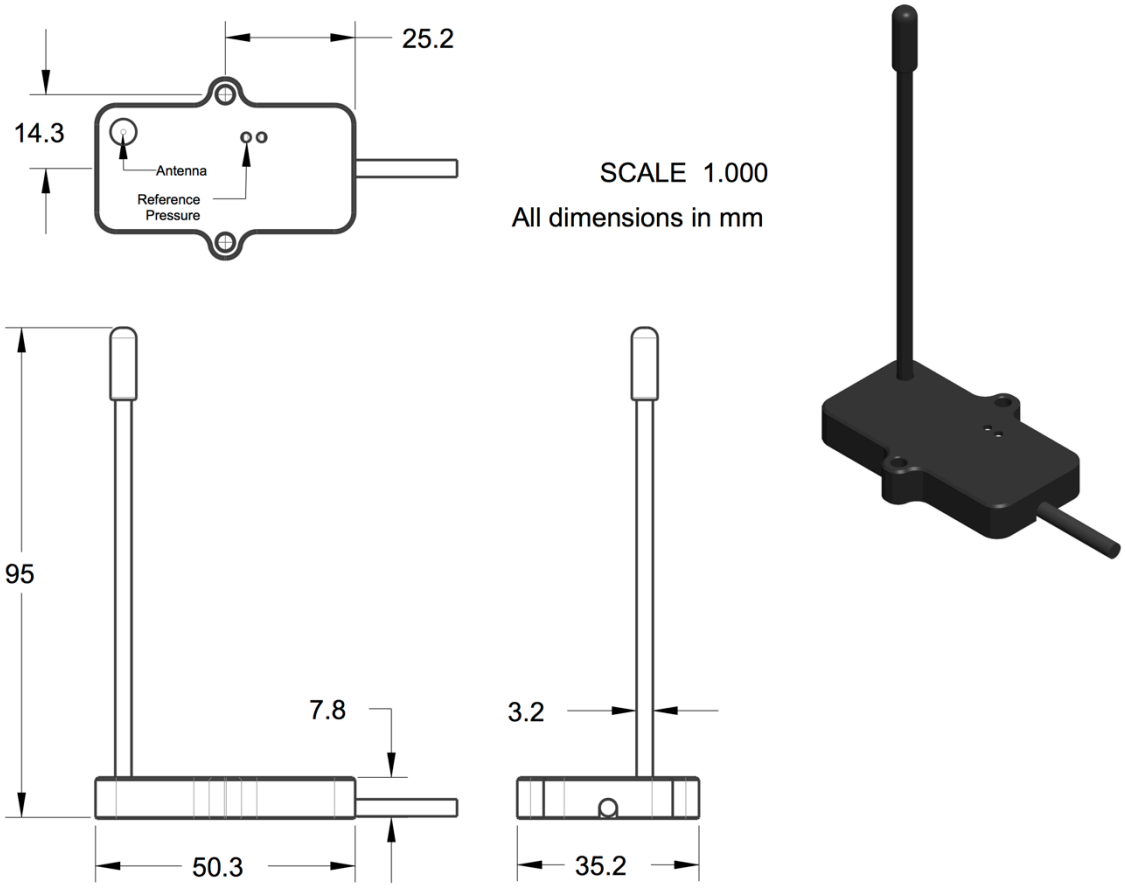
CAN messages should only be sent to the receiver during the configuration sequence.
DO NOT continuously send CAN messages to the receiver.

DIMENSIONS:

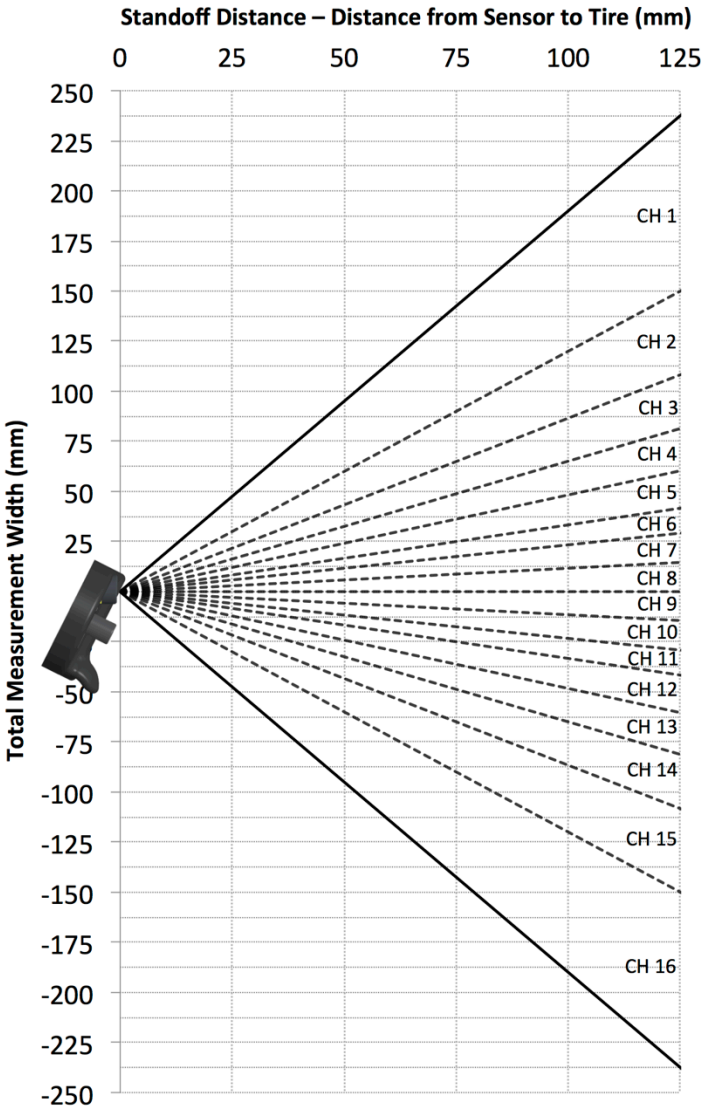
TTPMS Sensor, TTPMS-V1



TTPMS Receiver, W-REC-V1



120˚ Field-of-View, Spatial Mapping of Temperature Channels:



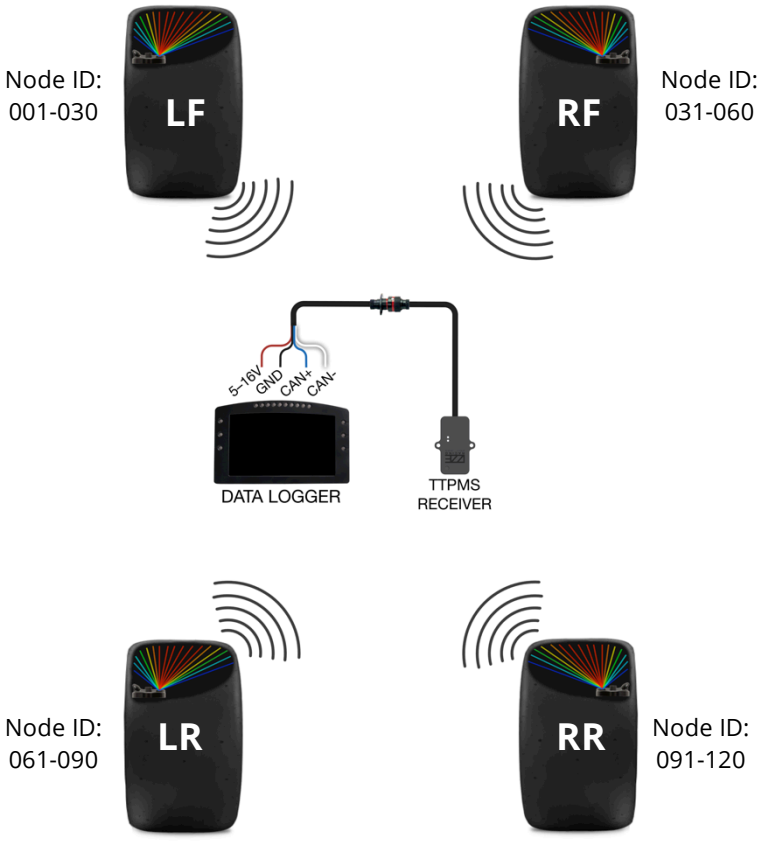
CAD model available with temperature channel rays

TRANMISSION RATE:

State	Criteria	Data	Update Period
Uninflated or Cold	P_{gauge} < 250mBar T_{sensor} < 5˚C	None	N/A (sleeping)
Inflated	P_{gauge} > 250mBar	Pressure	240 seconds
Inflated & Heated	P_{gauge} > 250mBar T_{sensor} > 40˚C	Pressure	10 seconds
Inflated & ΔP	P_{gauge} > 250mBar ΔP_{gauge} > 10mBar	Pressure, Infrared	1.2 seconds*
Rotation	Wheel movement	Pressure, Infrared	1.2 seconds*

* 10 second overrun before switching to lower state / longer update period

SYSTEM LAYOUT (DEFAULT):



- Place receiver near center of car, in cockpit, with antenna perpendicular to any metal or carbon-fiber surface. Most applications will only require one receiver, given the TTPMS sensor's exceptional range.

TIRE CORNER ASSIGNMENT – TTPMS SENSOR:

- By default, each TTPMS sensor is assigned to a specific corner/tire with a unique Node ID:

  LF Node ID's: 001 to 030

  RF Node ID's: 031 to 060

  LR Node ID's: 061 to 090

  RR Node ID's: 091 to 120

- The corner assignment for each Node ID is adjustable; refer to the Appendix for details.
- Each team/set will be assigned a receiver with a unique Network ID and AES-128 encryption, therefore, keeping data private between teams and cars.
- The receiver will acquire data from all active TTPMS sensors in the pits but will only receive data from the fitted, active tires when away from the pits.

INSTALLATION INSTRUCTIONS - SENSOR:

1.) Insert valve (C) into wheel hole (hole diameter = 11.3mm +/- 0.4mm), from the inside of the wheel.

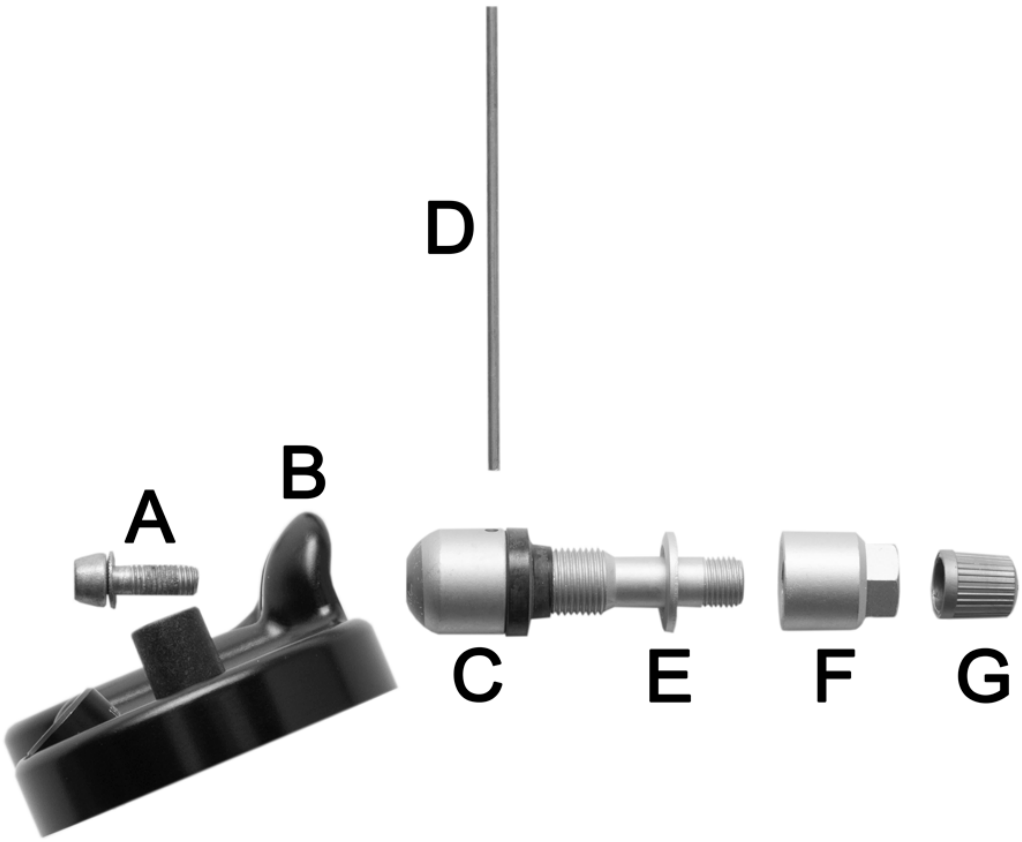
2.) Add crush washer (E) with the beveled face towards the wheel hole, install collar nut (F), insert pin (D) into radial boring, and torque collar nut (F) to 4 N-m (6 N-m for AV-ASC-U)

3.) Attach TTPMS sensor (B) to valve (C) using the M4 Torx fastener (A). Assure the bottom of the sensor is in contact with the wheel's surface and then torque (A) to 4 N-m.

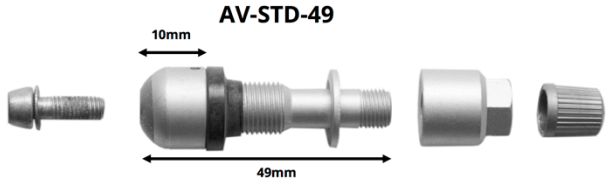
> NOTE: The M4 Torx fastener is pre-impregnated with pink thread locker. The fastener may be reused, but **must** be cleaned and have Loctite 242 applied before reinstalling.

4.) Install tire, being careful **NOT TO PRESS AGAINST THE SENSOR WITH THE TIRE'S BEAD OR INSTALLATION HEAD**.

5.) Fill tire with air and install valve cap (G).



TTPMS SENSOR VALVES:



- AV-STD-49 is suited for applications with speeds less than 160mph.
- AV-ASC-U is suited for applications with speeds in excess of 160mph.
- The TTPMS sensor is compatible with any Beru/Huf/Alligator style (ball-joint) valve design.

ADDITIONAL INFORMATION:

- Battery life depends on a multitude of operating conditions but will typically exceed 2 million transmissions (460 track hours) or up to approximately 3 years.
    - The TTPMS sensor may be fitted with an **optional removable battery**, and may be serviced by Izze-Racing or the customer.
- The maximum recommended sensor temperature is 120˚C for utmost reliability and battery life, but transient temperature excursions up to 150˚C are survivable.
- To avoid dropped packets, the average Received Signal Strength Indication (RSSI) should be no less than -90dBm.
- **Do not wash the TTPMS sensors** – keep dry.
- Do not repeatedly remove and reinstall the sensor & valve assembly.

ORDERING INFORMATION:

Part No.	Description
TTPMS-V1	TTPMS Sensor
W-REC-V1	TTPMS Receiver
AV-STD-49	TTPMS Sensor Valve, < 180mph
AV-ASC-U	TTPMS Sensor Valve, > 180mph

APPENDIX

BASIC RECEIVER PROGRAMMING:

To modify the wireless receiver's base CAN ID, sensor assignment mode, or bit rate, send the following CAN message at 1Hz for at least 10 seconds and then reset the receiver by disconnecting power for 5 seconds.

CAN ID = Current Base ID

Programming Constant		New CAN Base ID (11-bit)		Sensor Assignment	Bit Rate		
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2 (MSB)	Byte 3 (LSB)	Byte 4	Byte 5	Byte 6	Byte 7
30000 = 0x7530		1 = 0x001 ⋮ 2047 = 0x7FF		1 = Default 2 = Custom	1 = 1 Mbit/s 2 = 500 kbit/s 3 = 250 kbit/s 4 = 100 kbit/s		

CAN messages should only be sent to the receiver during the configuration sequence.
DO NOT continuously send CAN messages to the receiver.

CUSTOM CORNER ASSIGNMENT OF TTPMS SENSOR NODE ID's:

- Each sensor is assigned a unique Node ID; the receiver may be programmed to assign any Node ID to any of the four wheels (LF, RF, LR, or RR).
- "Sensor Assignment" (Byte 4 in CAN message above) must be set to "Custom" (i.e., Byte 4 = 2) in order to activate custom corner assignments.

LEFT FRONT NODE ID ASSIGNMENTS:

CAN ID = Current Base ID

Programming Constant		LF ID - 1	LF ID - 2	LF ID - 3	LF ID - 4	LF ID - 5	LF ID - 6
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20000 = 0x4E20		0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78

CAN ID = Current Base ID

Programming Constant		LF ID - 7	LF ID - 8	LF ID - 9	LF ID - 10	LF ID - 11	LF ID - 12
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20001 = 0x4E21		0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78

RIGHT FRONT NODE ID ASSIGNMENTS:

CAN ID = Current Base ID

Programming Constant		RF ID - 1	RF ID - 2	RF ID - 3	RF ID - 4	RF ID - 5	RF ID - 6
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20002 = 0x4E22		0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78

CAN ID = Current Base ID

Programming Constant		RF ID - 7	RF ID - 8	RF ID - 9	RF ID - 10	RF ID - 11	RF ID - 12
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20003 = 0x4E23		0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78

LEFT REAR NODE ID ASSIGNMENTS:

CAN ID = Current Base ID

Programming Constant		LR ID - 1	LR ID - 2	LR ID - 3	LR ID - 4	LR ID - 5	LR ID - 6
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20004 = 0x4E24		0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78

CAN ID = Current Base ID

Programming Constant		LR ID - 7	LR ID - 8	LR ID - 9	LR ID - 10	LR ID - 11	LR ID - 12
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20005 = 0x4E25		0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78

RIGHT REAR NODE ID ASSIGNMENTS:

CAN ID = Current Base ID

Programming Constant		RR ID - 1	RR ID - 2	RR ID - 3	RR ID - 4	RR ID - 5	RR ID - 6
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20006 = 0x4E26		0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78

CAN ID = Current Base ID

Programming Constant		RR ID - 7	RR ID - 8	RR ID - 9	RR ID - 10	RR ID - 11	RR ID - 12
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20007 = 0x4E27		0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78	0 = 0x00 ⋮ 120 = 0x78

FILTERING SELECTED CORNER TTPMS SENSORS:

- The receiver may be programmed to only receive data from selected corners (e.g., LF and RF wheel TTPMS sensors)
- When using multiple receivers on the same CAN Bus, each receiver must be assigned a unique Base CAN ID.

CAN ID = Current Base ID

Programming Constant		LF Sensors	RF Sensors	LR Sensors	RR Sensors		
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20010 = 0x4E2A		1 = Enabled 2 = Disabled	1 = Enabled 2 = Disabled	1 = Enabled 2 = Disabled	1 = Enabled 2 = Disabled	0 = 0x00	0 = 0x00

RECEIVER NETWORK & NODE ID:

- The receiver's Network and Node ID may be changed in order to communicate with another set of TTPMS sensors.
- Each team is assigned a unique AES-128 encryption key, so sensors may only be used with different receivers *within the same team*.

CAN ID = Current Base ID

Programming Constant		Network ID	Node ID				
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20020 = 0x4E34		0 = 0x00 ⋮ 255 = 0xFF	0 = 0x00 ⋮ 255 = 0xFF	0 = 0x00	0 = 0x00	0 = 0x00	0 = 0x00