Wireless Infrared Temperature Sensor, W-IRTS-V1 - Datasheet

The Izze-Racing Wireless Infrared Temperature Sensor (W-IRTS) consists of a small, lightweight infrared temperature sensor capable of measuring temperature at 16 laterally-spaced points with a wide 120˚ FOV, at a sampling frequency of 10Hz, object temperature between -20 to 300˚C, and enclosed in a compact IP66 rated aluminum enclosure – perfectly suited for tire temperature measurement. Each wireless receiver can handle up to four active sensors simultaneously and broadcasts all data via CAN.

SPECIFICATIONS – TTPMS SENSOR

Infrared Temperature, Range	-20 to 300˚C
Infrared Temperature, Resolution	0.1˚C
Accuracy (Central 10 Channels, Nominal) (16-Ch Sensor)	±1.0˚C for 0˚C < T < 50˚C ±2.0˚C for T < 0˚C and T > 50˚C
Accuracy (First & Last 3 Channels, Nominal) (16-Ch Sensor)	±2.0˚C for 0˚C < T_p < 50˚C ±3.0˚C for T < 0˚C and T > 50˚C
IR Temperature, Resolution	0.1˚C
Noise Equivalent Temperature Difference	0.5˚C at 10Hz, ε = 0.85, T_o = 25˚C
Package Temperature Range	0 to 125˚C
Field of View, FOV	120˚x 15˚
Sampling Frequency	16Hz, transmitted at 10Hz
Thermopile Thermal Time Constant	2 ms
IR Temperature, Accuracy (typ)	±3.0˚C
Effective Emissivity	0.01 to 1.00 (default = 0.85)
Spectral Range	8 to 14 µm
Operating Temperature Range*	0 to 135˚C
Battery Life (typ)	70 hrs, 25˚C, -10dBm
RF Frequency	868, 915, 920 MHz
RF Output Power (default)	0.1mW, -10dBm
Wireless Range, Open Space	> 100m

*Will survive brief temperature excursions < 150˚C

SPECIFICATIONS – RECEIVER

Voltage Input	5 to 16 V
Supply Current	30 mA
Temp Range	-20 to 85˚C
Max Sensors	120 (30 / corner)
Center Freq.	868, 915, 920 MHz
Sensitivity	-110dBm

MECHANICAL SPECS – SENSOR

Weight	21 ± 1g
Material	6061-T6
L x W x H (max)	28 x 29 x 17 mm
Protection Rating	IP66

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	Serial Number
	1 dBm per bit	RSSI
	1mV per bit	Battery Voltage
	0.1˚C per bit, -100˚C offset	Temperature
	(all variables unsigned except RSSI)	
Base CAN ID (default)	930 (Dec) / 0x3A2 (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: 0x3A2 (LF) / 0x3A7 (RF) / 0x3AC (LR) / 0x3B1 (RR)

Serial Number		RSSI		Sensor Temperature		Battery Voltage	
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: 0x3A3 (LF) / 0x3A8 (RF) / 0x3AD (LR) / 0x3B2 (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: 0x3A4 (LF) / 0x3A9 (RF) / 0x3AE (LR) / 0x3B3 (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: 0x3A5 (LF) / 0x3AA (RF) / 0x3AF (LR) / 0x3B4 (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: 0x3A6 (LF) / 0x3AB (RF) / 0x3B0 (LR) / 0x3B5 (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)

* The default base CAN ID (0x442) is adjustable

BASE CAN ID PROGRAMMING – RECEIVER:

To modify the wireless receiver's base CAN ID 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.

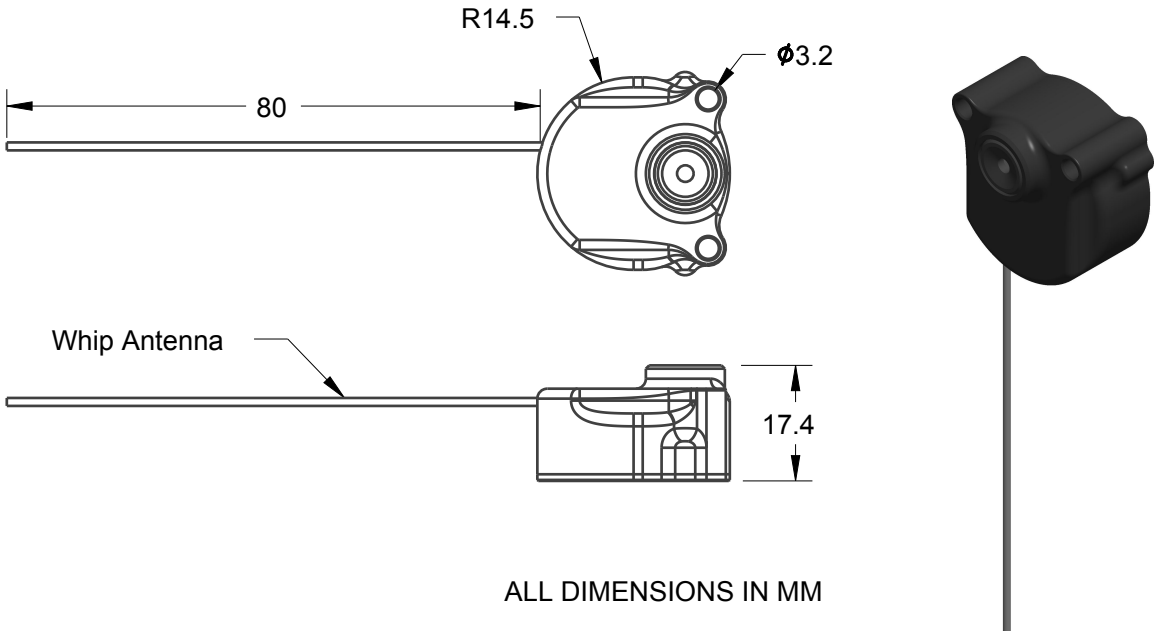
CAN ID = Base ID (Default = 0x3A2)

Programming Constant		New CAN Base ID (11-bit)		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 = 1 Mbit/s 2 = 500 kbit/s 3 = 250 kbit/s 4 = 100 kbit/s	0 = 0x00	0 = 0x00	0 = 0x00

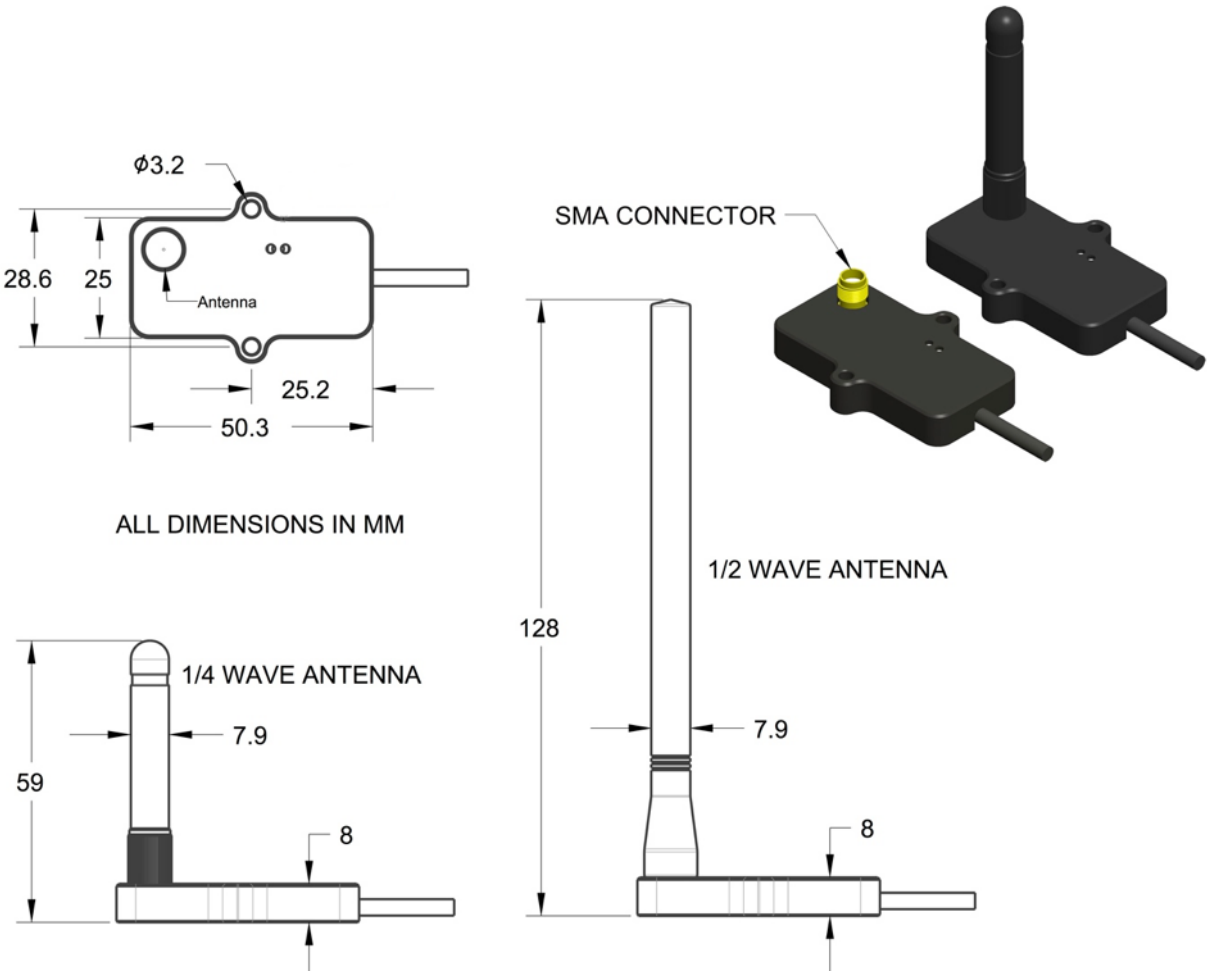
CAN messages should only be sent to the receiver during the configuration sequence.
DO NOT continuously send CAN messages to the receiver.

DIMENSIONS:

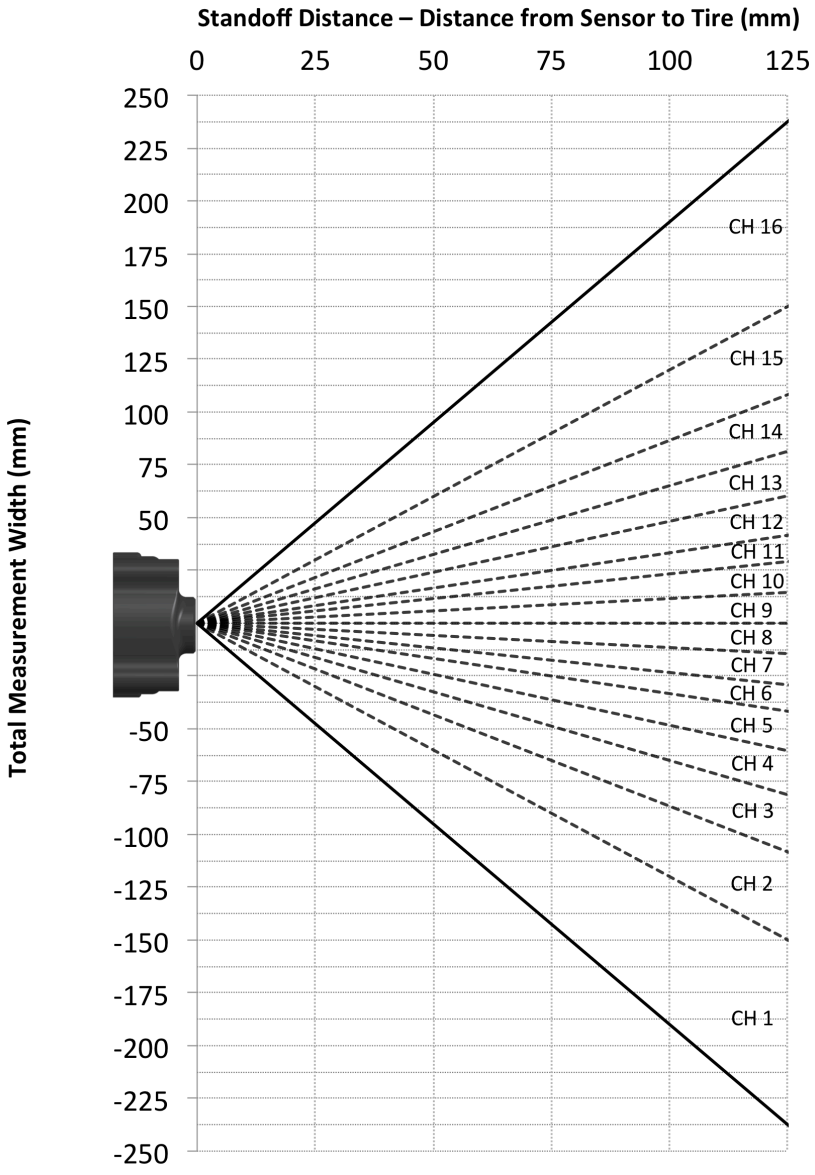
Wire Infrared Temperature Sensor, W-IRTS-V1



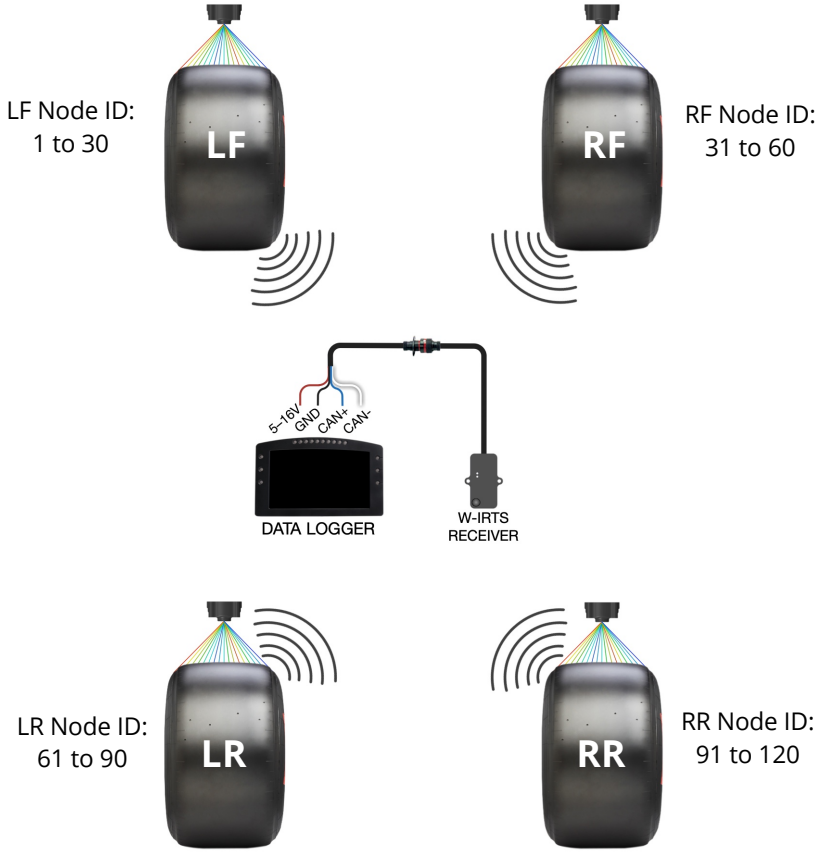
Receiver, W-REC-V2



Spatial Mapping of Infrared Temperature Channels:



SYSTEM LAYOUT (DEFAULT):



- Place receiver near center of car, in cockpit, with antenna perpendicular to any metal or carbon-fiber surface

SENSOR ASSIGNMENT:

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

  LF Node ID's: 1 to 30

  RF Node ID's: 31 to 60

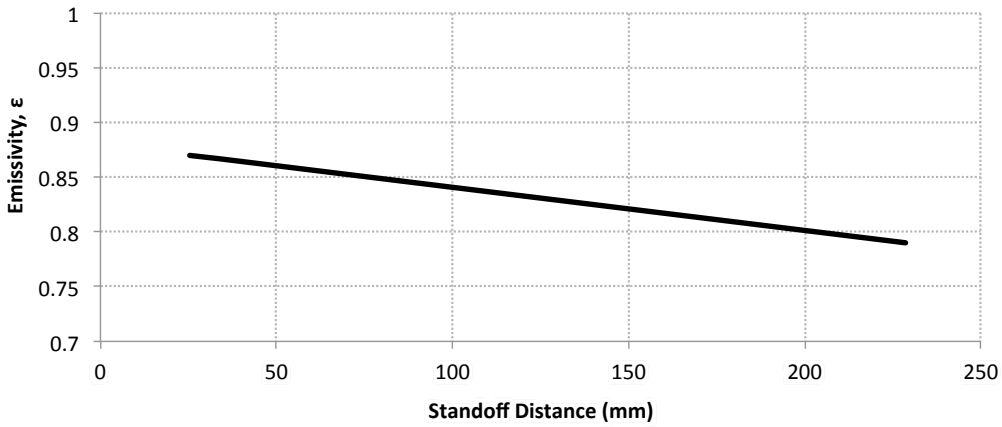
  LR Node ID's: 61 to 90

  RR Node ID's: 91 to 120

- The sensor's Node ID is adjustable; refer to the Appendix for details.

ADDITIONAL INFORMATION:

- Battery life depends on a multitude of operating conditions but will typically exceed 40 track hours or up to approximately 3 years.
    - The sensor is fitted with a user-serviceable battery (remove two Philips screws, pry lid).
        - Battery Part Number: Tadiran TLH-2450/P
- 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.
    - Avoid laying the sensors antenna along any carbon or metal surface (electrical conductive), it should preferably be perpendicular.
- Point the sensor in the downstream direction (facing front of tire) to avoid contamination, pitting, and/or destruction of the sensor's lens from debris.
- The *effective* emissivity of most tires ranges from approximately 0.75 to 0.90 in the 8 to 14 µm spectrum.
    - Generally, the emissivity should be lowered as the standoff distance (distance from tire to sensor) increases. The suggested emissivity vs. standoff distance is shown in the graph below:



    - Lowering the emissivity increases the measured object temperature and vice versa.

PART NUMBERS:

Part No.	Description
W-IRTS-V1	Wireless Infrared Temperature Sensor
W-REC-V2	Wireless Infrared Temperature Sensor Receiver

APPENDIX

A.1 – BASIC RECEIVER PROGRAMMING:

To modify the wireless receiver's base CAN ID 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 = Base ID (Default = 0x3A2)

Programming Constant		New CAN Base ID (11-bit)		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 = 1 Mbit/s 2 = 500 kbit/s 3 = 250 kbit/s 4 = 100 kbit/s	0 = 0x00	0 = 0x00	0 = 0x00

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

A.2 – SENSOR EMISSIVITY & NODE ID:

- The sensor's emissivity, node ID, frequency, and RF output power are adjustable.
- Send the following message at ~1Hz until the emissivity, node ID, frequency, and/or RF output power changes.

CAN MESSAGE for PROGRAMMING SENSOR EMISSIVITY:

CAN ID = Base ID (Default = 0x3A2)

Programming Constant		Sensor Serial Number		Emissivity			
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20001 = 0x4E21		1 = 0x001 ⋮ 65535 = 0xFFFF		.01 = 0x01 ⋮ 1.0 = 0x64	0 = 0x00	0 = 0x00	0 = 0x00

CAN MESSAGE for PROGRAMMING SENSOR NODE ID:

CAN ID = Base ID (Default = 0x3A2)

Programming Constant		Sensor Serial Number		Node ID			
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20002 = 0x4E22		1 = 0x001 ⋮ 65535 = 0xFFFF		0 = 0x00 ⋮ 120 = 0x78	0 = 0x00	0 = 0x00	0 = 0x00

CAN MESSAGE for PROGRAMMING SENSOR FREQUENCY, NETWORK ID:

CAN ID = Base ID (Default = 0x3A2)

Programming Constant		Sensor Serial Number		Radio Frequency		Network ID	
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20003 = 0x4E23		1 = 0x001 ⋮ 65535 = 0xFFFF		Decimal Value x 10^5 Hz (ex: 9155 = 915,500,000 Hz)		0 = 0x00 ⋮ 255 = 0xFF	0 = 0x00

CAN MESSAGE for PROGRAMMING SENSOR RF OUTPUT POWER:

CAN ID = Base ID (Default = 0x3A2)

Programming Constant		Sensor Serial Number		RF Output Power			
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
20004 = 0x4E24		1 = 0x001 ⋮ 65535 = 0xFFFF		0 = -18 dBm ⋮ 18 = 0 dBm	0 = 0x00	0 = 0x00	0 = 0x00

A.3 – RECEIVER NETWORK, NODE ID, and RF FREQUENCY:

- The receiver's Network, Node ID, and Radio Frequency (from 868 to 920MHz) may be changed in order to communicate with another set of W-IRTS sensors.

CAN MESSAGE for PROGRAMMING NETWORK, NODE ID, and RF FREQUENCY:

CAN ID = Base ID (Default = 0x3A2)

Programming Constant		Network ID	Node ID	Radio Frequency			
Byte 0 (MSB)	Byte 1 (LSB)	Byte 2	Byte 3	Byte 4 (MSB)	Byte 5 (LSB)	Byte 6	Byte 7
20020 = 0x4E34		0 = 0x00 ⋮ 255 = 0xFF	0 = 0x00 ⋮ 255 = 0xFF	Decimal Value x 10^5 Hz (ex: 9155 = 915,500,000 Hz)		0 = 0x00	0 = 0x00