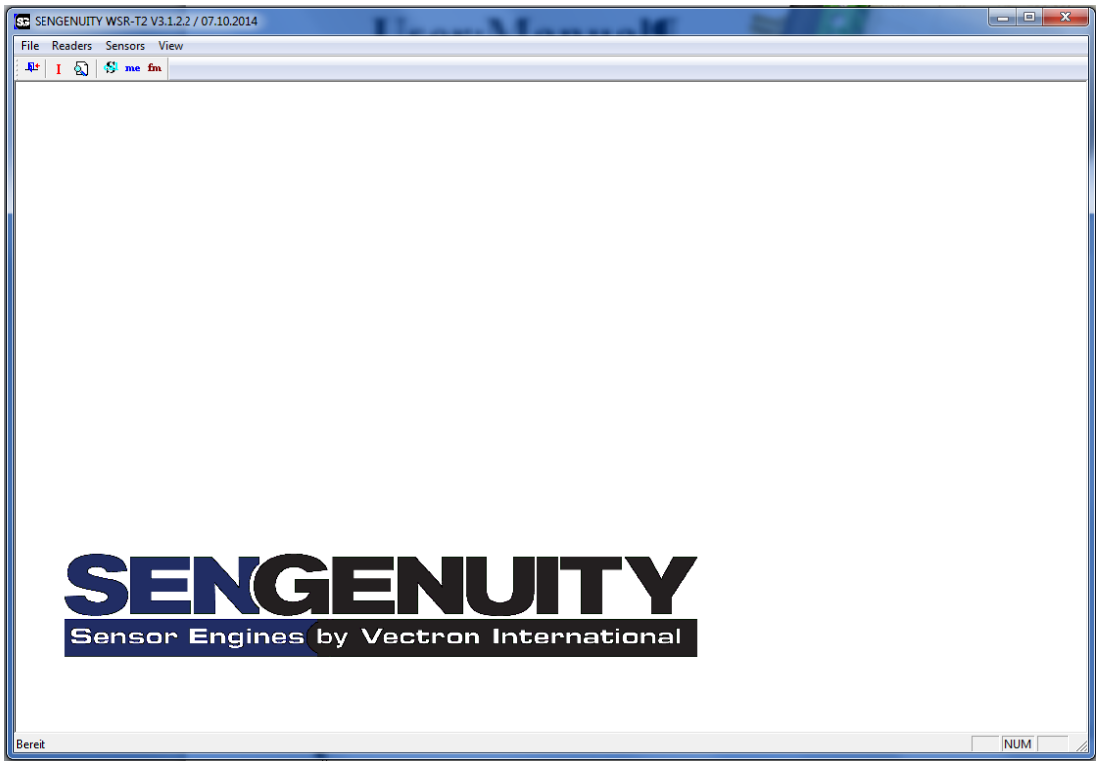
WSR-T2
TempTrackr®
User Manual



Revision	Date	Change	Name
1.9	2015-12-11	Modelname updated on 1st page	RO
1.8	2015-12-07	3.3 List updated	RO
1.7	2015-11-09	3.3 List added; 1.5 updated	RO
1.6	2015-02-06	2.2 NOTE added; 1.5.3 Labelling added; 3.3 and 3.4 added	RO
1.5	2014-12-03	4.1	RO
1.4	2014-11-17	Added Regulatory Statements; added 5.1	SE, RO
1.3	2014-11-04	4.1; 4.6	RO
1.2	2014-10-24	Minor changes	RO,SE
1.1	2014-10-14	Minor changes	RO
1.0	2014-10-07	Created	MB, RO, RP

Contents

1 General Information

1.1 Copyright

1.2 Disclaimer

Vectron International has reviewed this manual thoroughly to ensure that it will be an easy-to-use document. All statements, technical information and recommendations in this manual and in any guides or related documents are believed reliable, but the accuracy and completeness thereof are not guaranteed or warranted, and they are not intended to be, nor should they be understood to be, representation or warranties concerning the products described. Specifications are subject to change without notice.

1.3 Contact

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Tel: 49 (0) 7268 801 100
www.vectron.com
www.sengenuity.com

1.4 Safety

Thank you for the confidence in Vectron products. Please read the manual prior to operating the unit in order to avoid fault conditions which may cause Fire or Accidents.

1.5 Regulatory Statements

1.5.1 FCC Declaration of Conformity

FCC § 15.105
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.
These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in residential area is likely to cause harmful interferences in which case the user will be required to correct the interference at his own expense.

FCC § 15.19
This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC § 15.21 (Warning Statement)
[Any] changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Compliance Information Statement
(Declaration of Conformity)

Responsible Party:	Vectron International
Address:	267 Lowell Road, Suite 2 Hudson, New Hampshire 03051-4916, USA
Telephone:	+1-888-328-7661

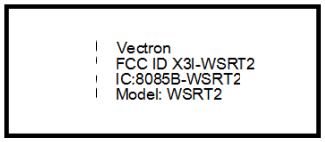
1.5.2 Canadian ICES-003

This Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Canada CNR-Gen
This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.
Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

1.5.3 FCC Labelling

The FCC Label will be laser marked on the reader



Note: The Label will not include the FCC sign, because the system is for Professional Use only.

2 Introduction

2.1 Technology Description

The **W**ireless **S**ensor **R**eader WSR-T2 is able to measure temperatures of passive SAW (Surface Acoustic Wave)-Sensors. These Sensors require no power supply. Basically the Wireless Sensor Reader transmits short bursts of high frequency signals via an antenna to the SAW Sensor Module, which is equipped with an antenna in order to receive the signal.
The SAW Sensor Module reflects the received signal for a short period of time, which is then received by the Wireless Sensor Reader.
The Wireless Sensor Reader analyses the received signal and calculates the sensor temperature.
Since the interrogation of the sensors is performed wireless, other transmitters may have an impact on the system performance.

2.2 Required Components

-Software Files WSR-T2.exe; Pcan_usb.dll
-PC with Windows XP; 7; 8
-Wireless Sensor Reader WSR-T2-A4B7C0D0E2
-Reader-Antenna 428-439MHz (PIF-ANT-0002 or Dipole-Antenna)
-SAW Sensor-Modules
-Interface Cable:

For Operation with USB-RS485-Interface (included in Starter Kit):
-Use Cable 1.8m USB to RS485 biased

Cable USB to RS485[1]	WSR-T2-A4B7
RED	+5V DC (Pin 1)
BLACK	GND (Pin 3)
GREEN	RS485 A+ (Pin 5)
BLUE	RS485 B- (Pin 6)

(Included Bias Resistors: RED–GREEN 1 kOhm; GREEN–BLUE 120 Ohm; BLUE–BLACK 1 kOhm)

For Operation with CAN-USB-Interface (not included in Starter Kit):
-Use Peak PCAN-USB IPEH-002021 USB to CAN Interface, not optoisolated
must be set internally to output +5V at Pin9 of DB9-Connector.
Refer to Peak PCAN-USB Manual.
-Use Sengenuity Cable AMP to DB9 SEN0008;
Refer to Pinning Diagram below.

[1] Colours stated are only valid when using the cable included with the Starter Kit

AMP	CAN Sub-D 9pol SEN0008
1=+5V DC 200mA	9
2=GND	3
3=CANL	2
4=CANH	7
120 Ohm Pin 3 to Pin 4	YES

NOTE: Interface Cables can only Power one Reader.
Please use a separate Power Supply if multiple Readers should be powered.

NOTE: For use of the 5V supply with the RS485/USB converter cable:
Working with the RS485/USB converter cable you should not work with another USB cable to extend the length. The reason is that the voltage of the converter cable supplied to the reader only delivers the minimum of +4,7 to 4.8V.
An extension of the USB cable will drop the voltage below the specified min. voltage of 4,75V and the reader will not work correctly.
If you need a long supply line, please use the separate screw terminals for the supply voltage.

3 Getting Started

3.1 Software Installation

-Install Drivers for USB-RS485-Interface
    -Windows XP: Drivers can be found on FTDIChip Webpage (www.ftdichip.com)
    -Windows 7 + 8: Drivers install automatically after Interface is plugged in (user has to be online)
(-Install Drivers for PCAN-USB-Interface if CAN-Bus operation is required)
-Copy the files WSR-T2.exe and Pcan_usb.dll to a directory of your selection.

3.2 Hardware Installation

- Connect the Reader-Antenna to one of the SMA connectors of the WSR-T2
- Connect the WSR-T2 to your PC via USB Interface (CAN or RS485)
- As a starting point, put the Sensor Modules on a metal surface in a distance of about 30cm to the Reader-Antenna. The metal surface will increase the RF ground and therefore the reading distance
- The distance of one module to the other should be minimum 10 cm
- Below picture shows a typical first test setup:
    - Reader connected to USB-RS485-Interface
    - PIF-Antenna ANT-PIF-0002 magnet mounted on steel plate and connected to Reader Antenna Port 1
    - Dipole Antenna mounted on Magnet Mount and connected to Reader Antenna Port 2
    - 2 Sensor Modules (SM-S431 & SM-S432) placed on Metal sheet for better RF ground

3.3 Reader Antenna datasheet

Parameter	Min	Typical	Max	Units	Condition
Center frequencies [f_c]		433		MHz	
Bandwidth		5		%	
Gain			+3.5	dBi	
VSWR1)		1.3			at center frequency
Impedance		50		ohm	
Operating temperature range	-40		+85	°C	

List of Reader Antenna types which full fill the parameters above:

Antenna Name	RF-Connector	Cover	Gain max. [dBi]	Impedance [ohm]
ANT-PIF-0001	SMA	Plastic cover	+3.5	50
ANT-PIF-0002	SMA	No cover	+3.5	50

This radio transmitter (FCC ID X3I-WSRT2, IC:8085B-WSRT2, Model:WSRT2) has been approved by Industry Canada to operate with the antenna types listed above with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with ths device.

3.4 Professional Use / Professional Hardware Installation

Where and in which direction to place the reader antenna and sensor modules is absolutely depended on the environmental (geometry, material, temperature, etc.) where the system has to be used. Always several trial runs have to be done to improve the receiving signal and fix the installation. Therefore the hardware components cannot simply be purchased and installed by the average (technical inclined) person. It cannot be sold retail to the general public or by mail order. The system (hardware components) will mainly be sold via dealers or system integrators.

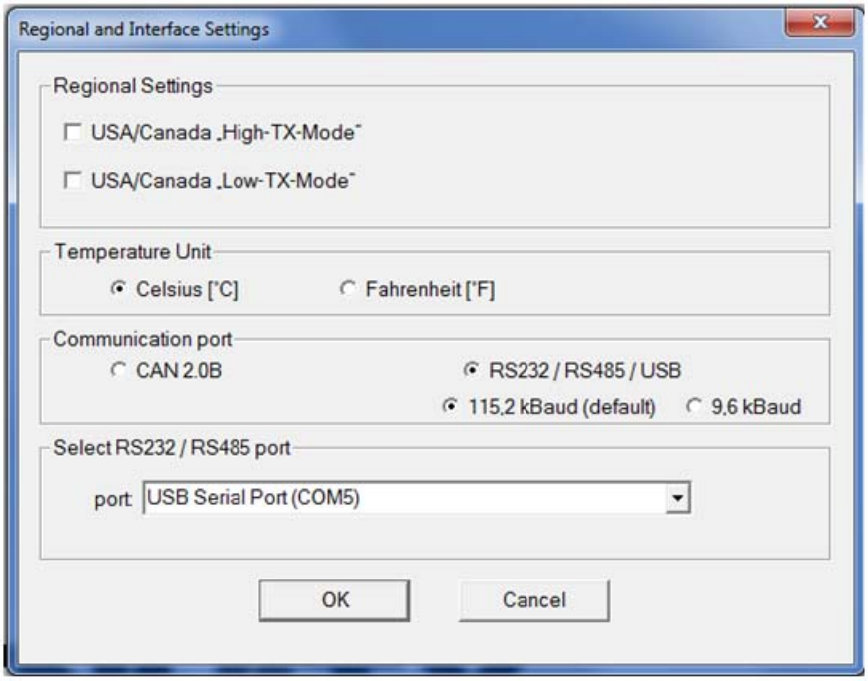
The dealers and integrators will be trained from VECTRON how to install the system and what has to be considered. The people which have to be trained by VECTRON need a technical background. Mainly VECTRON will do measurements with them together at their customer applications.

The intended, professional use of the TempTrackr is generally not for the general public. It is generally for the industry / commercial use.

4 WSR-T2 Software

4.1 Start Software / Readers -> Regional and Interface Settings

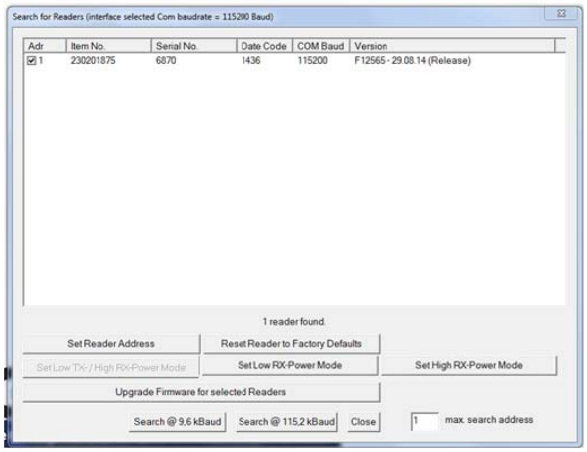
1. Execute WSR-T2.exe
2. Afterwards below window will appear at each start of the WSR-T2.exe.
   The Menu can also be opened from Readers -> Regional and Interface Settings.



3. Choose the correct Regional Settings depending on your application
   - USA/Canada "High TX - Mode"
     FCC will force the reader (according FCC 15.231) to read every selected sensor with a pause time of 30s between the measurements. Maximum TX-Power will be set to+1dBm.
     All sensors are enabled within the 428 – 439,5MHz Band
   - USA/Canada "Low TX - Mode"
     FCC will force the reader (according FCC 15.209) to read every selected sensor without any pause time between the measurements. Maximum TX-Power will be reduced accordingly, to keep the 200µV/m @ 3m distance.
     All sensors are enabled within the 428 – 439,5MHz Band.
4. Select the Temperature Unit [°C] or [°F]
5. Choose the communication port you are going to use.
   For Starter Kit ➔ RS232/RS485/USB
6. Choose the Bus Baud Rate. Default for RS232/RS485 is 115.2 kBaud. Slower Baud Rates may be needed at long cable length in combination with termination resistors.
7. Choose the USB Serial Port. For the right Port number refer to device Manager USB Serial Port (COM Number)
8. Press OK.

4.2 Readers -> Search for Readers

Press “Search @ 115.2 kBaud”.
The connection from Reader to PC will be verified.
The Software will scan for Readers up to the “max. search address”
If the Reader is properly connected it will be displayed.
Otherwise please verify connection and Baud Rate settings.
Finally select one Reader to enable the functions under 4.2.1 to 4.2.4

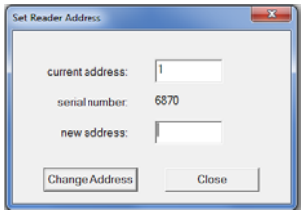


4.2.1 Set Reader Address

The default Reader Address is 1. The Address must only be changed if multiple Readers operate on one Bus to avoid bus collision.

4.2.2 Reset Reader to Factory Defaults

All Reader settings will be reset to Factory defaults.



4.2.3 Set RX Power Mode

The default setting is “Low-RX-Power-Mode”. Other choices are not recommended.

4.2.4 Upgrade Firmware for selected readers

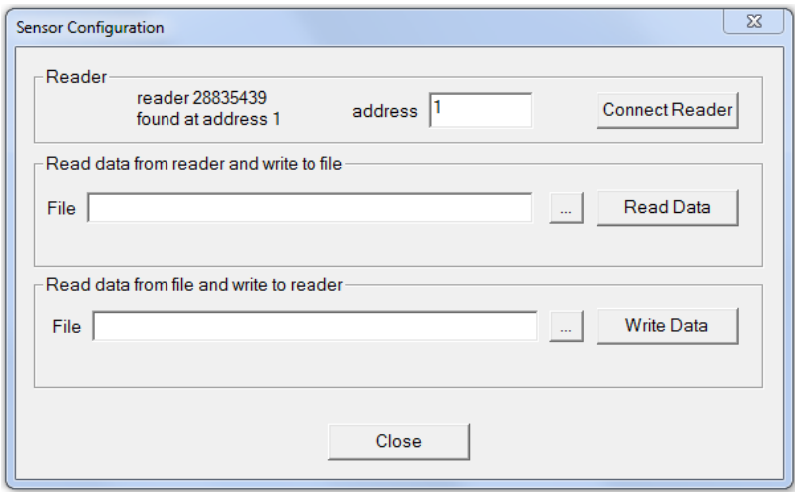
With this feature you have the possibility to upgrade the Firmware which has to be provided by SENGENUITY.

4.3 Sensors -> Configuration

The reader provides 32 different Sensor ID's [0]-[31].
Each ID represents a specific Sensor Module by Frequency related to an Antenna Port.
Below Table shows the default configuration.

Sensor Module	Antenna 1	Antenna 2	Antenna 3
Reserved	[0]-[3], [10]	[4]-[6]	[7]-[9]
SM-S429	[11]	[18]	[25]
SM-S431	[12]	[19]	[26]
SM-S432	[13]	[20]	[27]
SM-S433L	[14]	[21]	[28]
SM-S435	[15]	[22]	[29]
SM-S436	[16]	[23]	[30]
Food Probe (FM-S433S) (Differential SAW)	[17]	[24]	[31]

With the Sensors-> Configuration Menu this configuration can be read out and stored in a .spf-File (Read data from reader and write to file).
The file can be read and modified with a text editor.
Afterwards the file can be written to the reader (Read data from file and write to reader).



For the 12 sensor system the sensor configuration is provided in the file *"12sensors_3.spf"*using Sensor ID [11] – [22] at Antenna 1.
The 12 sensor system differs in frequency range and slope from the 6 sensor system.

Any modified configurations will be reset, if "Reset reader to factory defaults" is performed.

4.4 Sensors -> Calibration

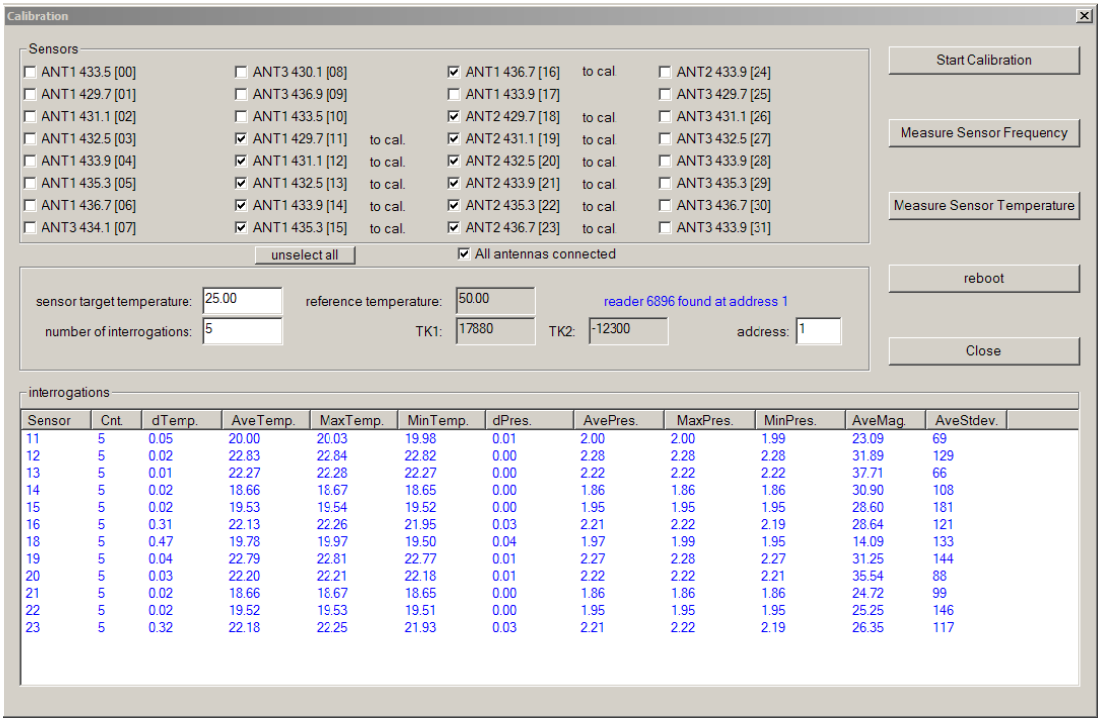
Since the Sensors have an initial tolerance of ~±10°C the calibration can be performed to meet the specified accuracy of the temperature measurements.

-Enter the reader “address” (default address is 1)
-Use the check box to select the Sensors you want to calibrate
-Press “Measure Sensor Temperature” to verify the setup

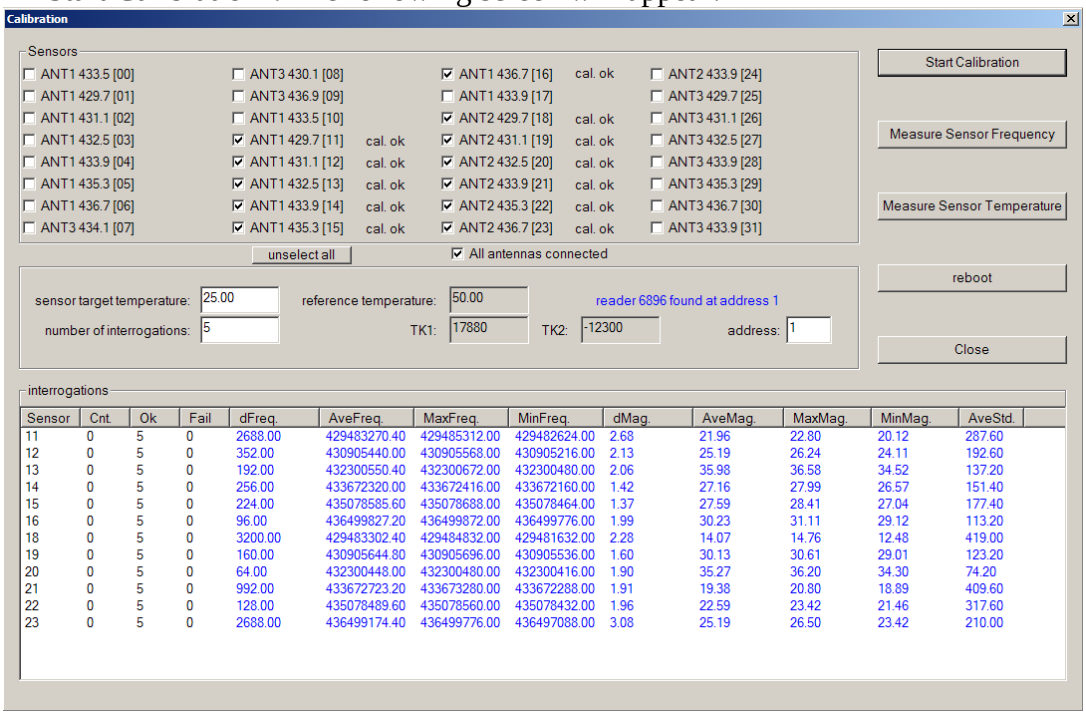
Below is an example from the setup in Chapter 3.2.
At this point the column “AveMag.” (Average Magnitude) should be observed, which is an indicator for the received signal strength.
If the Magnitude is below 10 dB the setup should be optimized. Magnitudes above 30dB are excellent.

Sensors [11]-[16] are read by the PIF-Antenna and the same Sensors are read by the Dipole Antenna [18]-[23]. Both Antennas show similar performance, while the PIFA is optimized for use in metal cabinets.

Sensor [11]/[18] has 21mm height and is not placed on a metal surface.
Therefore this Sensor shows the lowest Magnitude.
Sensor [12]/[19] has 21mm height and is placed on a metal sheet.
Therefore the Magnitude is higher.
Sensor [13]/[20] has 35mm height and is placed on a metal sheet.
Therefore this Sensor shows the highest Magnitude.
Sensor [14]-[16]/[21]-[23] have 35mm height and are not placed on a metal surface.

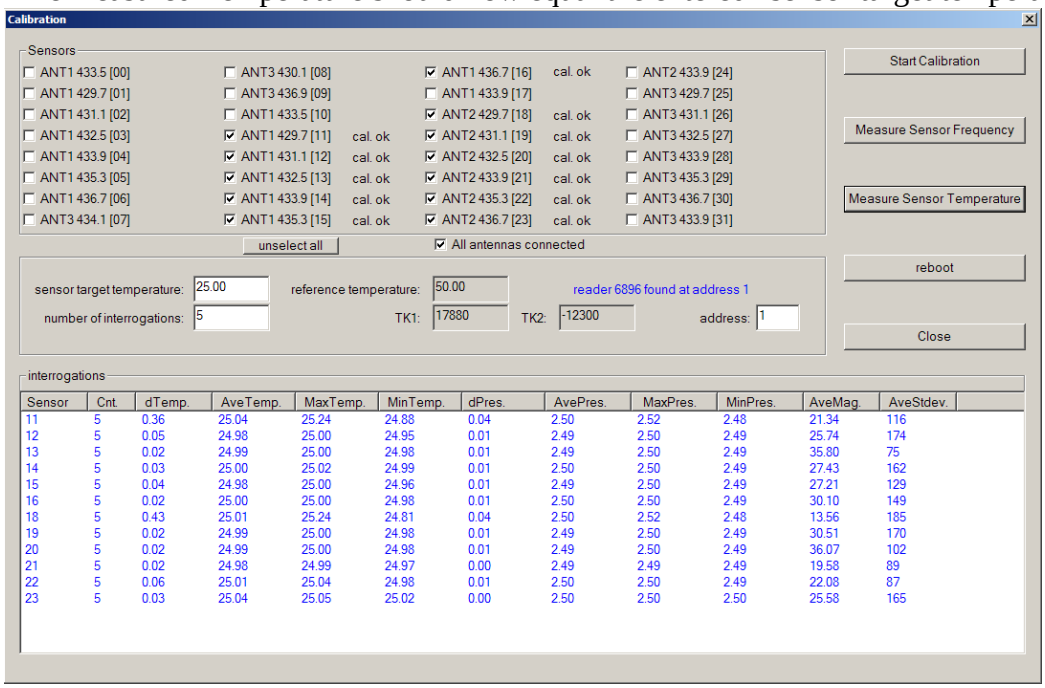


Once the setup is completed the calibration should be performed in order to achieve the specified accuracy. Please enter the correct “sensor target temperature” and press “Start Calibration”. The following screen will appear:



The same screen will be displayed if “Measure Sensor Frequency” is pressed, but in this case no calibration will be performed.

The next step is to verify the Sensor Temperature. Please press “Measure Sensor Temperature”. Below screen will appear and the calibration will be finished.
The measured Temperature should now equal the entered “sensor target temperature”.



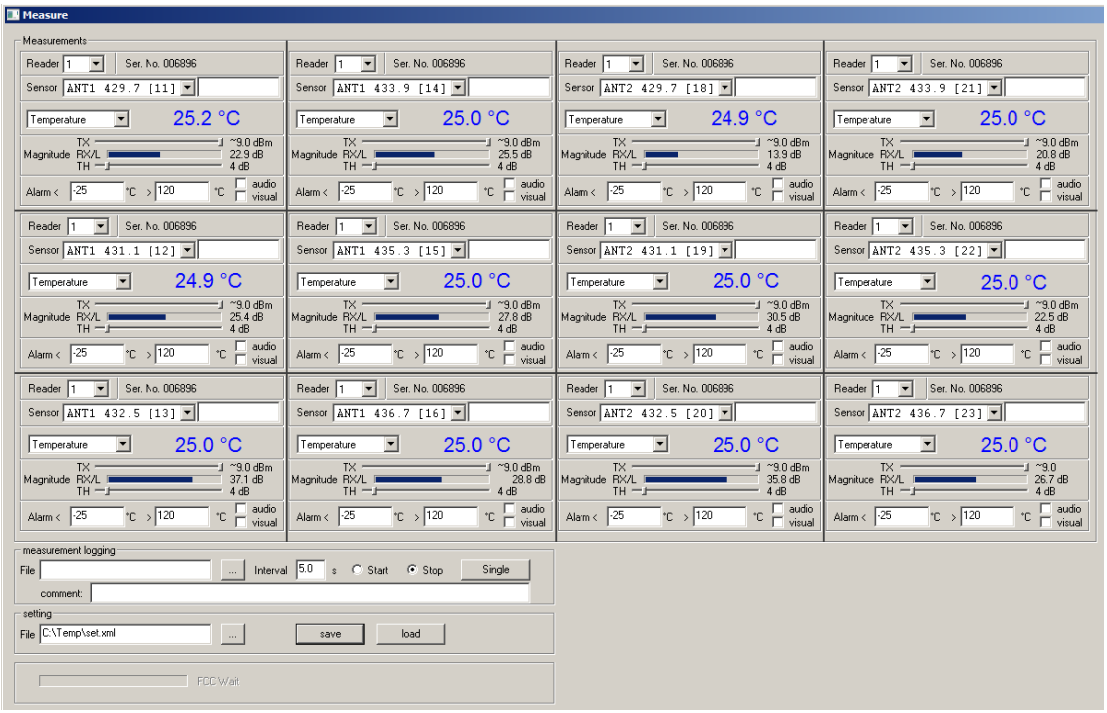
Short Description of displayed columns:

Sensor ➔ Sensormodule number
Cnt ➔ n/a or Counter of good interrogations
Ok ➔ number of good interrogations
Fail ➔ number of failed interrogations
dFreq ➔ Difference between MaxFreq and MinFreq [Hz]
AveFreq ➔ Frequency average value of all interrogations [Hz]
MaxFreq ➔ Frequency maximum value of all interrogations [Hz]
MinFreq ➔ Frequency minimum value of all interrogations [Hz]
dMag ➔ Difference between MaxMag and MinMag of the RX signal [dB]
AveMag ➔ Magnitude average value of all interrogations of the RX signal [dB]
MaxMag ➔ Magnitude maximum value of all interrogations of the RX signal [dB]
MinMag ➔ Magnitude minimum value of all interrogations of the RX signal [dB]
AveStd ➔ Standard deviation of the Frequency average value
dTemp ➔ Difference between MaxTemp and MinTemp [°C]
AveTemp ➔ Temperature average value of all interrogations [°C]
MaxTemp ➔ Temperature maximum value of all interrogations [°C]
MinTemp ➔ Temperature minimum value of all interrogations [°C]
dPres ➔ Difference between MaxPres and MinPres [bar]
AvePres ➔ Presure average value of all interrogations [bar]

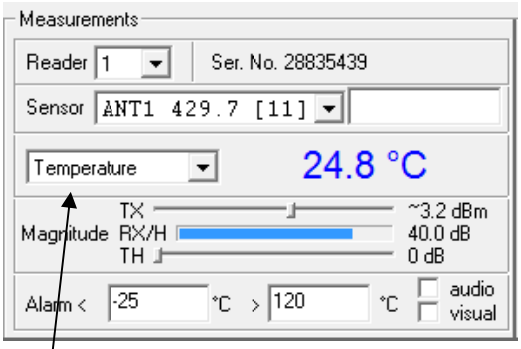
Note: If you have selected a Food Probe sensor [17, 24 or 31] the displayed frequencies are not the absolute measured frequencies, but the differences of two frequencies.
The Food Probe includes a differential sensor element.
Typically the displayed frequency of the differential sensor element is in the range of 500 to 600kHz at 25°C.

4.5 Sensors -> Measure

At the Measure Menu up to 12 sensor values can be displayed separately.
For each Sensor the Reader Address and Sensor must be selected. You have the ability to measure Sensors, communicating with different readers.



Description of the Measurements:



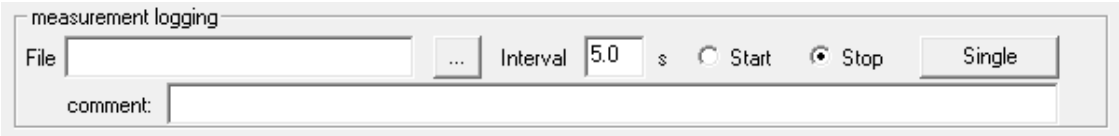
Reader ➔ Select Reader address (default address 1)
Sensor ➔ Select Antenna Number_Frequency_[Sensor ID]
Note: The Sensor wording includes the Antenna number at which the Sensor should be measured, the Sensor Center Frequency and the Sensor ID. The box right to the Sensor box is for short notes

Check-Box➔You can select if Temperature or Frequency shall be displayed.
If the selected Sensor is a Food probe you can select between two frequencies and temperature.
If the selected Sensor is a pressure sensor you can select between three frequencies, temperature and pressure.

Magnitude ➔ **TX:** With the TX slider the TX Power level can be tuned. The Maximum TX Power is limited according the TX-Mode settings (see 4.1)
RX/H or **RX/L**: shows if the High RX- or Low RX –Power Mode is Selected (see 4.2).
TH: With the Threshold slider the minimum RX limit can be set.

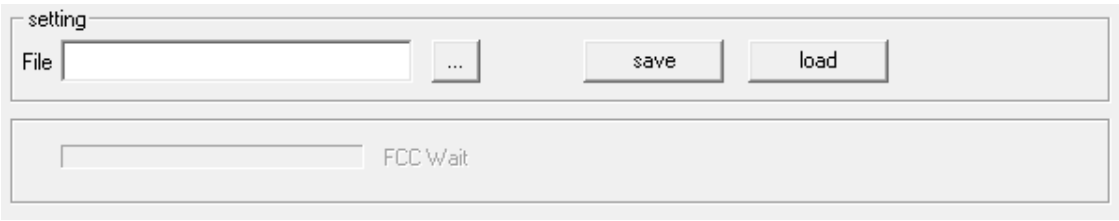
Alarm ➔ If the temperature limit is exceeded and the audio check box is selected, a "Beep" will be generated.
If the visual check box is selected, the colour of the temperature reading will be turned into red.

Description of the measurement logging (data log function):



File ➔ Input a file name for the log file
Interval ➔ Input the time in seconds of the measurement interval
Selecting the Start box the temperature will continuously be observed and the values will be stored in the corresponding log file. The log file can be imported to Excel and evaluated.
Comment ➔ A single information can be entered and by pressing the <Single> shot button this information will be stored in the log file directly behind the current measurement value.

Description of the setting:

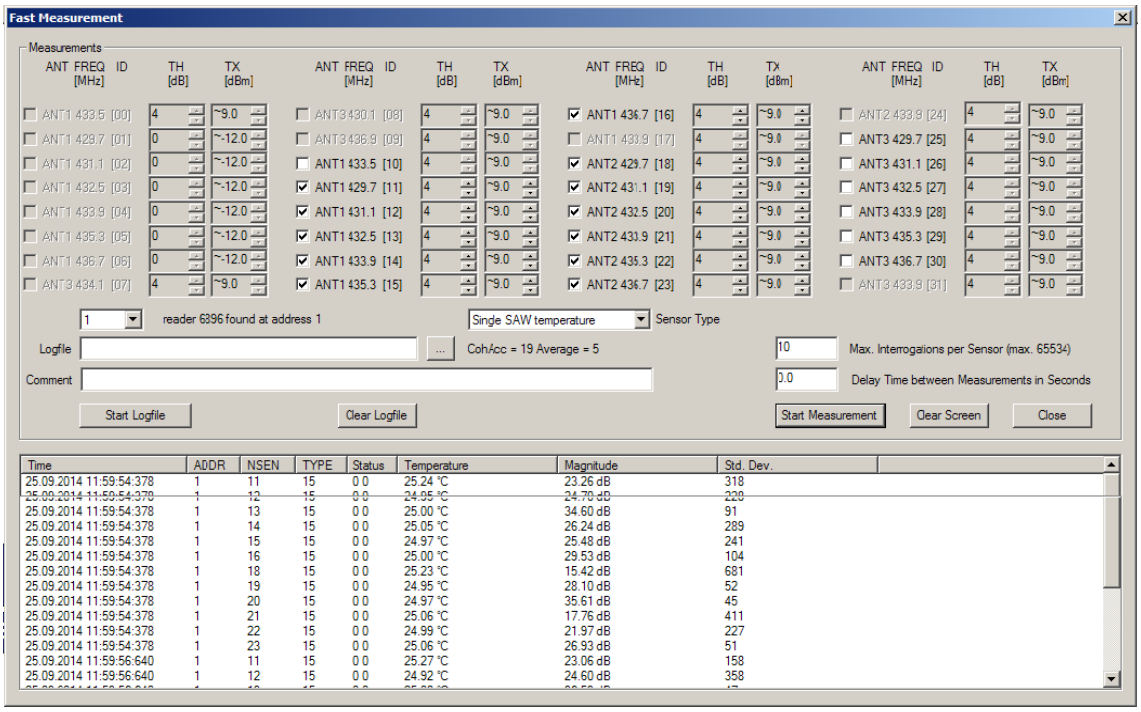


File ➔ Input or select a file name before saving or loading
Save ➔ Will store all settings made on the screen to the selected file
Load ➔ Will load the settings which were stored in the selected file

FCC Wait ➔ Shows the remaining Pause time before the next measurement starts (see 4.1)

4.6 Sensors -> Fast Measurement

At the Fast Measurement Menu up to 32 sensor values can be displayed.
Only one Reader can be used. The selected reader address is valid for all sensors.



Description of the Measurements:

ANT FREQ ID ➔ Select Antenna number_Frequency_Sensor ID.

TH ➔ The Threshold Select Box sets the minimum RX limit.

TX ➔ With the TX Select Box the TX Power level can be tuned
The maximum TX Power is limited according the TX-Mode settings (see 4.1)

Sensor Type ➔ Select Sensor Type
”Single SAW” for Switchgear+Rotating
”Differential SAW” for Foodprobe

Logfile ➔ Input a file name for the log file

CohAcc / Average ➔ Measurement time per sensor can be reduced with lower values

Max. Interrogations per Sensor
➔ In case of rotating applications this value has to be adjusted properly

Start Measurement ➔ The Measurement for the selected Sensors will be started. The results will be shown continuously.

Start Logfile ➔ The measured values will be stored in the corresponding log file. The log file can be imported by Excel and evaluated

5 Trouble Shooting

5.1 Setcommstate (error 87)

a) If this error occurs there is most likely an issue with the SenGenuity file „WSRT2.dat“.
This file is automatically created and saved on the computer when first starting the WSR-T2 software.
Before starting the WSRT2 software again, you need to open the file via the Editor and delete the complete content and resave the empty file under the same name.

The file is to be found and has to be resaved under:

C:\Documents and Settings\”*UserName*”\AppData\Sengenuity\WSRT2\WSRT2.dat
(for WINDOS XP)

C:\User\”*UserName*”\AppData\Roaming\Sengenuity\WSRT2\WSRT2.dat
(for WINDOS 7&8)

b) In some cases the system does not allow to create automatically the WSRT2.dat file when first starting the WSR-T2 software.
Before starting the WSRT2 software again, you need to create this file via Editor and save the empty file.

The file has to be saved under:

C:\Documents and Settings\”UserName”\AppData\Sengenuity\WSRT2\WSRT2.dat
(for WINDOS XP)

C:\User\”*UserName*”\AppData\Roaming\Sengenuity\WSRT2\WSRT2.dat
(for WINDOS 7&8)

In some cases the “AppData”-directory is hidden and must be unhidden at first.