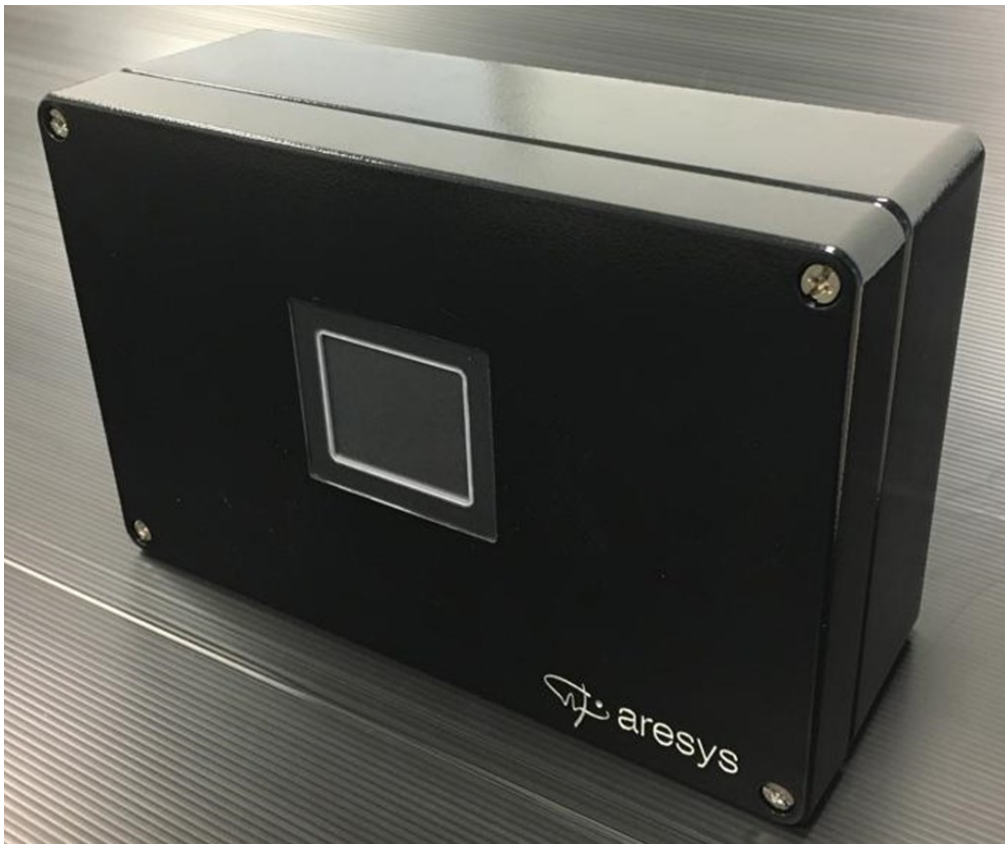
ScanBrick® W

Modular MIMO Radar

– User Guide –

aresys
Advancing remote sensing

Document ARE-016631
Issue 7.2
Sept 2022


aresys

Summary

TÜVRheinland CERTIFIED
Management System ISO 9001:2015
www.tuv.com ID 9105081902

1. System overview and specifications

Scanbrick® is a compact advanced MIMO RADAR sensor specifically designed for high resolution measurements at short-medium range (up to 100 m). The system mounts a powerful on-board real-time data processing HW that is able to support any data processing task requested by the specific customer application.

The MIMO (multi-channel) recording feature allows ScanBrick® to be easily configured in term of acquisition beams and virtual target illumination in order to improve system angular resolution in elevation and range.

The system is provided a metallic case (IP67 case) for industry and harsh environments.

1.1. Main Features

- Excellent deformation/displacement measurement performances (up to 10 micrometre accuracy, range dependent)
- 2D/3D capabilities depending on number of channels
- Vibration measurements up to 1 KHz
- Speed measurement
- Non-contact measurement
- No need to install artificial targets/pointers
- Excellent resistance to dust, steam, heat, etc.
- International Protection Rating IP67

1.2. Applications

- Tank Level Probing Radar (TLPR)

1.3. Available configurations

Tab.1 ScanBrick® W configurations

Antenna configuration	W43
Antennas	4RX - 3TX
Azimuth resolution	16-32 degs
Elevation measurement capability (single target)	YES
Range resolution	0.05/0.15 m
Total range	200 m
Max pulses per second	200
Target displacement tracking accuracy	Appox. 20 micron (sigma) @ 50 m
Data interface	10/100/1000 Gbit
Power supply	12/24 V
Software	SurveyMate control SW / Application targeted APIs

1.4. Radar waveform

The ScanBrick® W system transmits a FMCW signal in automotive band. At receiver stage, matched filtering is performed via a mixing stage of received signal with a copy of the transmitted one. Such an operations, also known as “dechirping” provides an IF signal which frequency components are directly related to the targets distance. The signal is sampled and sent to host via Ethernet link.

The transmitted signal parameters are defined in Tab.2.

Tab.2 ScanBrick W – waveform parameters

Parameter	min	max
Start frequency [GHz]	77	
End frequency [GHz]		81
Pulse duration [µs]	20	5000
Frequency slope [MHz/µs]	-100	100
Pulse length [samples]	-	1 RX → 8192 2 RX → 4192 4 RX → 2048
ADC sampling frequency [Msps]	2	37.5

1.5. Radar Summary

1.5.1. Introduction to ScanBrick® W Radar

The ScanBrick® W system is a FMCW MIMO radar which transmit a frequency modulated signal continuously in order to measure range as well as angle and velocity. This differs from traditional pulsed-radar systems, which transmit short pulses periodically.

FMCW radars uses short (millimeter) wavelength signals, which enables detection of objects with sub-millimeter accuracy. It can also penetrate materials like plastic, drywall, and clothing while maintaining its high level of performance despite harsh environmental conditions such as rain, fog, dust and snow. The size of system components such as the antennas required to process mmWave signals is small. An mmWave system operating at 77–81 GHz (with a corresponding wavelength of about 4 mm), will have the ability to detect movements that are as small as a fraction of a millimeter.

An FMCW radar system transmits a chirp signal and captures the signals reflected by objects in its path. A chirp is a sinusoid whose frequency increases linearly with time as shown in the frequency vs time plot. A chirp is characterized by a start frequency fc, bandwidth (B), and duration (Tc). Slope of the chirp defines the rate at which the chirp ramps up. In the figure, chirp is sweeping a bandwidth of 4GHz in 40µs which corresponds to a slope of 100MHz/µs.

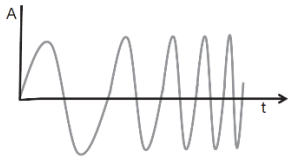


Figure 1: Chirp signal, with amplitude as a function of time

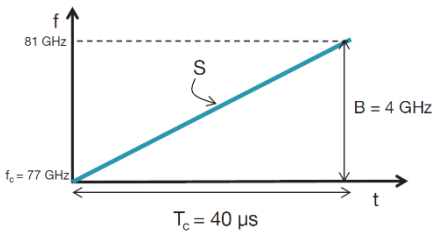


Figure 2: Chirp signal, with frequency as a function of time

1.5.2. RF specification

RF board consists of single-chip FMCW transceiver capable of operation in the 77- to 81-GHz band. It is an ideal solution for low power, self-monitored, ultra-accurate radar systems. It consists of 3TX, 4RX system with built-in PLL and ADC converters.

The RF subsystem includes synthesizer, PA, LNA, mixer, IF, and ADC. This subsystem also includes the crystal oscillator and temperature sensors. The three transmit channels can be operated simultaneously for transmit beamforming purpose as required; whereas the four receive channels can all be operated simultaneously.

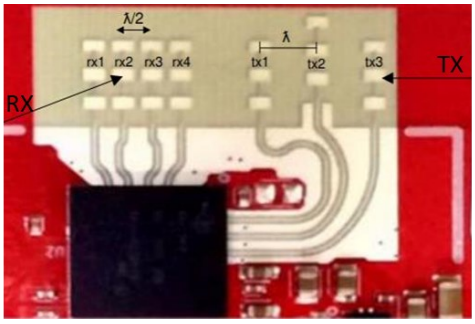


Figure 4: ScanbrickW43 antenna layout

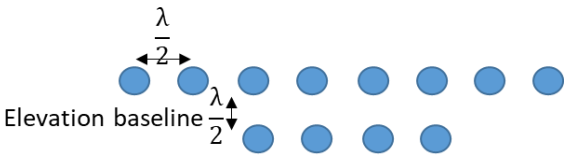


Figure 3: Virtual antennas position

The transmit subsystem consists of three parallel transmit chains, each with independent phase and amplitude control. A maximum of two transmit chains can be operational at the same time, however all three chains can be operated together in a time-multiplexed fashion. Each transmit chain can deliver a maximum of 13 dBm at the antenna port on the PCB.

The receive subsystem consists of four parallel channels. A single receive channel consists of an LNA, mixer, IF filtering, ADC conversion and decimation. All four receive channels can be operational at the same time.

ScanBrick® W support continuous acquisition mode with frequency modulation (FMCW modulation type).

1.5.3. Applications

ScanBrick® W radar is a Tank Level Probing Radar (TLPR) system.

2. Mechanical interface and installation

2.1. Mechanical drawings

Fig.1 and Fig.2 depict the lid and the base of the ScanBrick® W case, respectively. Linear dimensions are reported in units of mm.

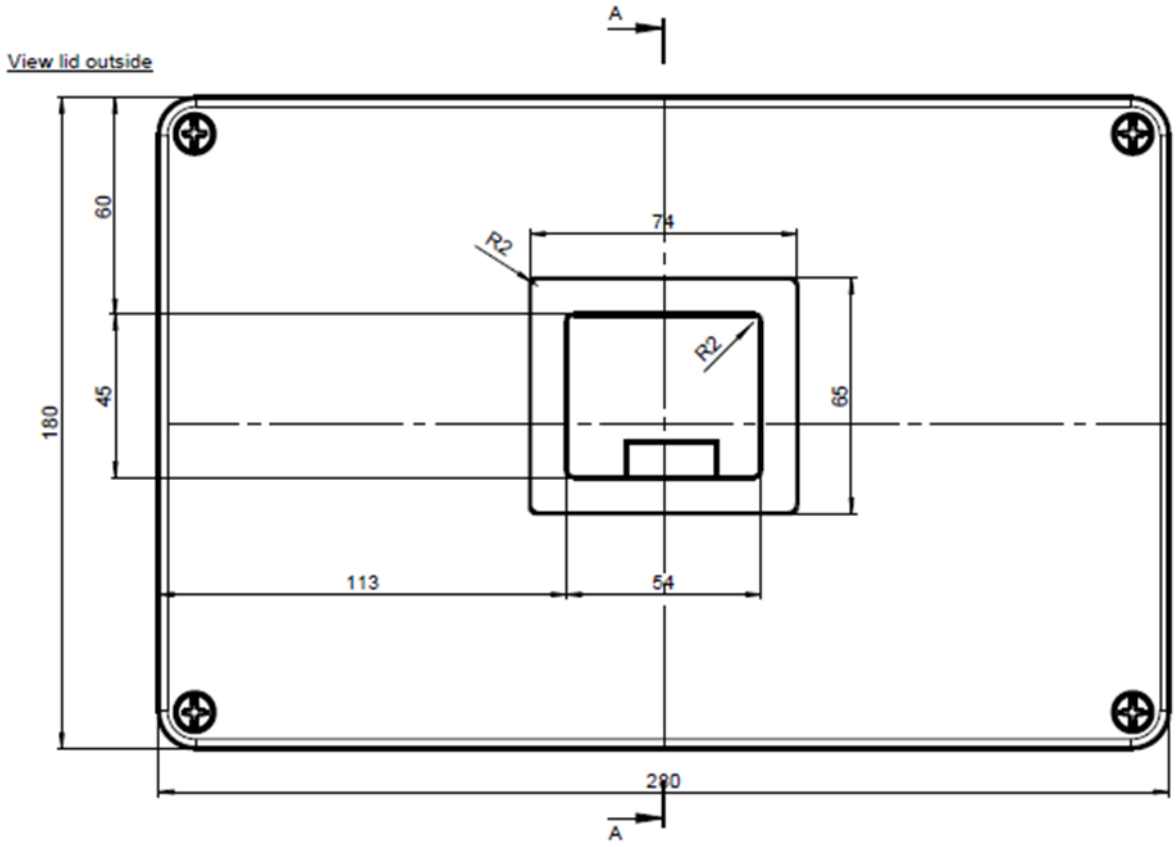


Fig.1 ScanBrick® W metallic case – Lid view from outside with radiating area sizes

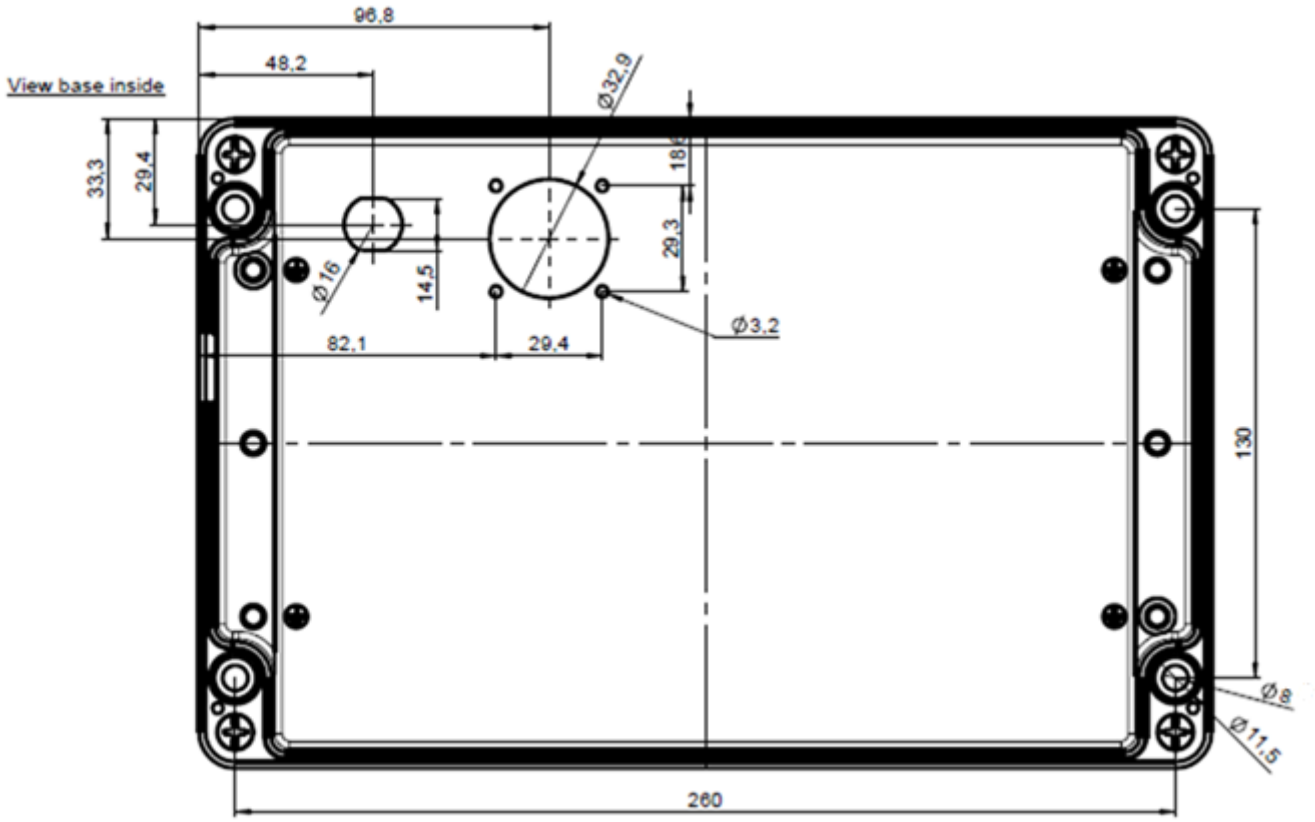


Fig.2 ScanBrick® W case – Base view from inside with holes sizes

The back panel also provides 4 skew holes for mounting purposes. The relative positions of the holes are provided. They are symmetrical in the case, and their position relative to the power supply and Ethernet should allow the design of the support structure.

The holes are threaded M8x1,25. The depth of the threaded hole is approximately 20 mm.

2.2. Connections and interfaces

Fig.3 shows the back side of the ScanBrick® W industrial case.

Fig.3 ScanBrick® W back view.

Tab.3 summarizes the ScanBrick® W connections specification.

Tab.3 ScanBrick® W connections specification

	Interface	Part number (host side)
	Power Supply, 12 V LEMO Serie	LEMO FGG.1K.302.CLAC50Z
	Ethernet Connector Amphenol RJF TV6 series	Amphenol RJFTV6MG

2.3. Installation

The system installation location is inside a covered metal tank.

Please be aware that the ScanBrick® system must be installed within a metallic closed tank which walls thickness shall not be below 2mm. The radiating area shall be mounted towards a dielectric lens to allow Radar measurement to be performed. However, metallic interfaces shall be foreseen to keep the Radar system within a closed metallic tank and avoid ejection of e.m. radiation.

2.4. Notices

- The installation of the Tank Level Probing Radar device shall be done by trained installers, in strict compliance with the manufacturer's instructions.
- The use of this device is on a "no-interference, no-protection basis. That is, the user shall accept operations of high-powered radar in the same frequency band which may interfere with or damage this device. However, devices found to interfere with primary licensing operations will be required to be removed at the user's expense.
- The installer/user of this device shall ensure that it is at least 10 km from the Dominion Astrophysical Radio Observatory (DRAO) near Penticton, British Columbia. The coordinates of the DRAO are lat 49°19'15''N and lon 119°37'12''W. For devices not meeting this 10 km separation (e.g., those in the Okanagan Valley, British Columbia,) the installer/user must coordinate with, and obtain the written concurrence of, the Director of the DRAO before the equipment can be installed or operated. The Director of the DRAO may be contacted at 250-497-2300 (tel.) or 250-497-2355 (fax). (Alternatively, the Manager, Regulatory Standards, Industry Canada, may be contacted.).

TÜVRheinland CERTIFIED
Management System ISO 9001:2015
www.tuv.com ID 9105081902

3. Host interface paradigma

3.1. Switching ON ScanBrick® W

Every time the ScanBrick® W must be switched ON the procedure described here shall be followed:

- Connect the Ethernet cable to ScanBrick® W using the connector as specified in Section 2.2;
- Connect the other head of the Ethernet cable to a PC network interface (notice that the connection might be either direct or through a LAN);
- Power ON the system by providing the required electrical interface (12V) to the power supply connector specified in Section 2.2.

3.2. ScanBrick® W startup sequence

Every time the ScanBrick® W is switched ON the startup steps sketched in Fig.4 are performed. Each step is described in detail in the following.

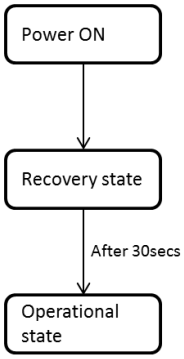


Fig.4 ScanBrick® W startup steps.

Power ON

This state immediately follows the feed of power supply to the system. The processing environment is initialized and just the Network task is activated. The Network task is launched with the default factory network settings. Typical example of factory network settings is reported in Tab.4.

Tab.4 ScanBrick® W – example of factory network settings

IP	192.168.1.40
Network Mask	255.255.255.0
Gateway	192.168.1.1

Recovery State

This state is used to guarantee the system to be always reachable at any stage of its life cycle. The Maintenance task is activated in this state and only maintenance commands (see Section 4.3) can be sent to the system while it is in this state.

After 30 seconds, in absence of a stable host connection, the system activates the user selected Ethernet interface (see Section 4.3) and goes to the Operational state.

Operational state

In this state both the Radar task and the on-board processing task are activated. The system is now ready to receive/send commands/data from/to a connected host (see Section 4.2).

Notice that in this state the system is still able to receive maintenance commands.

NOTE:

- Host/Server software libraries for communication are closed and not accessible to any user.
- In case of need of a firmware update, the new image is crypted and protected against unauthorized individuals.

4. Level Metering SW Application

Level Metering SW is released as a dynamic-link library, *LevelMeterCLI.dll*, developed in C++/CLI. The interface of such a library is detailed in ARE-011967.

In order to test this library, *LeverMeterGUI* application (C# developed) has been released. Here below a guide to this application is provided.

4.1. Installation

Requirements

The recommended minimum system requirements for a proper use of *LevelMeterGUI* software are:

- Intel® Core™ i5 5300U vPro™ Processor
- Microsoft Windows 7/ Windows 10
- Intel® HD 5500 graphics
- 8GB RAM

In order to connect to ScanBrick® W system for a new data acquiring session, a Network Ethernet cards (100Mbit/s) is necessary.

Procedure

To install *LevelMeterGUI*, it is first important to have no previous version of the software installed. If this is the case, make sure to remove it from the computer before installing the current version.

Open Explorer and go into the *LevelMeterGUI* setup folder. The content of the folder should be as shown in Fig.5.

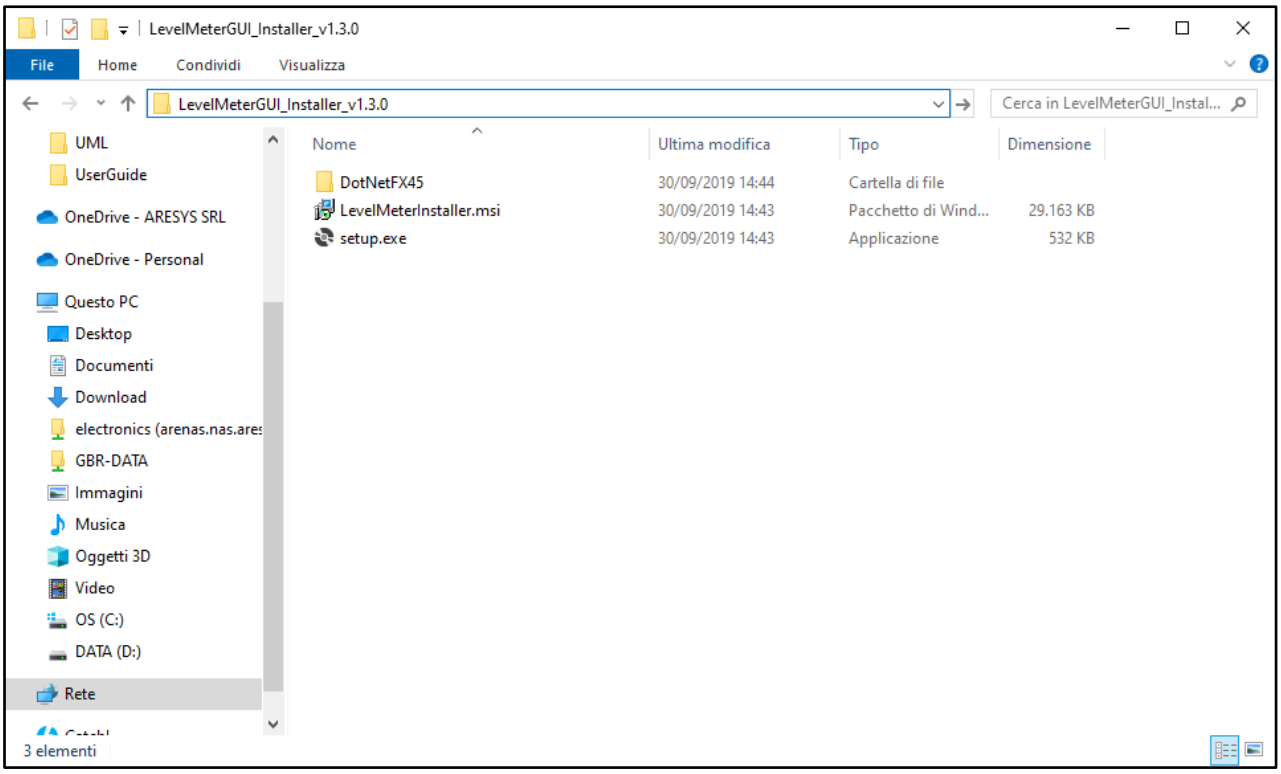


Fig.5 *LevelMeterGUI* Setup Folder

From the folder, click on *setup.exe* to start the setup procedure. A dialog will appear, asking to install the .Net Framework 4.5, if not already installed on your PC. Click *Install*.

Once the .Net Framework has been installed, the actual *LevelMeterGUI* installer will appear (see Fig.6). Click Next for the following three screens, selecting if needed a different destination folder for the software. Once the installation is complete, click on *Close*.

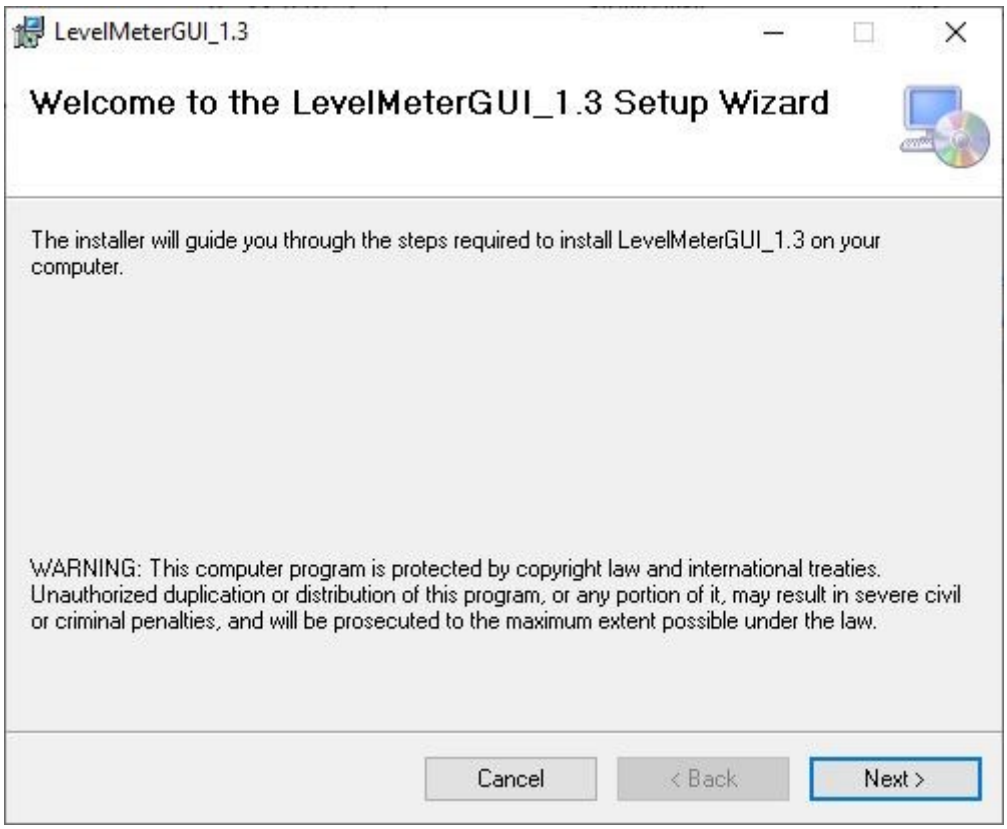


Fig.6 *LevelMeterGUI* Setup Wizard

4.2. Working Mode

When opening *LevelMeterGUI* (for example by clicking on the shortcut created on the Desktop by the installation procedure), the window in Fig.7 will appear.

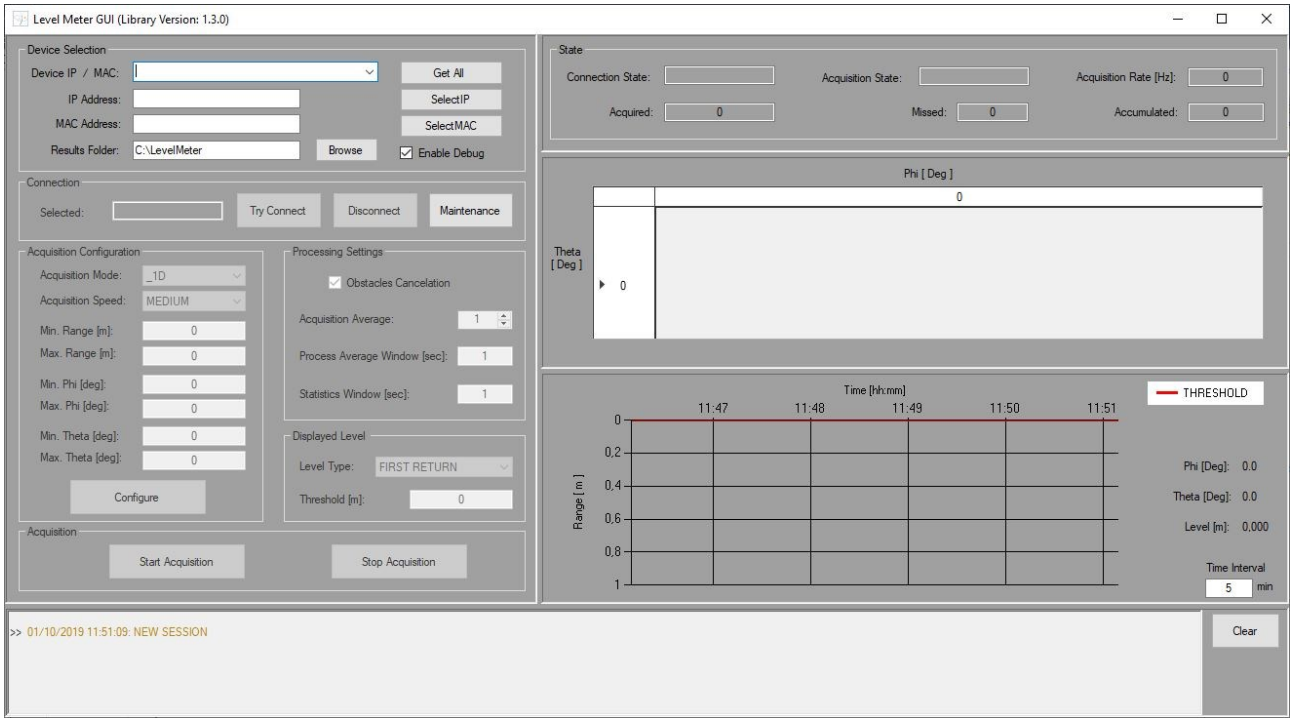


Fig.7 LevelMeterGUI Main Window

Device Selection

First thing to do to have the application working is to select a device using the panel in Fig.8.

By clicking *Get All* button, a list of all the radar system on the network will be provided in the drop-down menu labeled as *Device IP / MAC*. For each device, both the IP and the MAC addresses will be reported. Click on one of the devices in the menu to fill the text boxes *IP Address* and *MAC Address* (which can be also manually edited).

NOTE: if a device in the network is already connected to another host application instance (i.e. it is in a *busy* state), its address will appear red colored in the *Device IP / MAC* drop-down menu and it will be impossible to select it. Since the radar can be connected to one and only one application at a time, it is impossible to connect to a device already *busy*.

Once the addresses text boxes are filled, two alternative choices are available:

- Press *Select IP* button: in this case the Level Metering application will always work with the radar device owner of this IP address. If the connection with the device is lost during a working session (for example due to a network brake down), the Level Metering application will retry

to connect with this IP address. If this button is pressed, the Device Connection Panel is updated as in Fig.8.

- Press *Select MAC* button: in this case the Level Metering application will always work with the radar device identified by this MAC address. In case of connection break down, the application will try to reconnect with this MAC address, no matter of the IP which is currently assigned to the device. If this button is pressed, the Device Connection Panel is updated as in Fig.8.

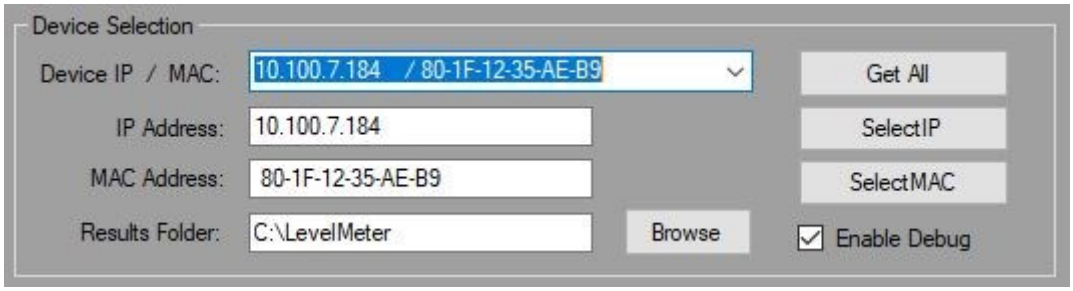


Fig.8 Device Selection Panel

The button *Browse* is useful to select the folder of the filesystem where to store all the data, logs and results of the application. *LevelMetetrGUI* application will set the content of the folder as shown in Fig.9. The results of the application processing are stored in separated folders, one for each working day (see the folder *2019.10.01* in Fig.9). In the *Debug* folder, for each working device, these data are stored:

- Last set radar configuration;
- Log files;
- Raw Data (i.e. data produced by the radar and not processed);
- Some processing results.

To reduce the amount of stored data, it is necessary to uncheck the *Enable Debug* check box: in such a way, the logs only will be saved in the *Debug* folder.

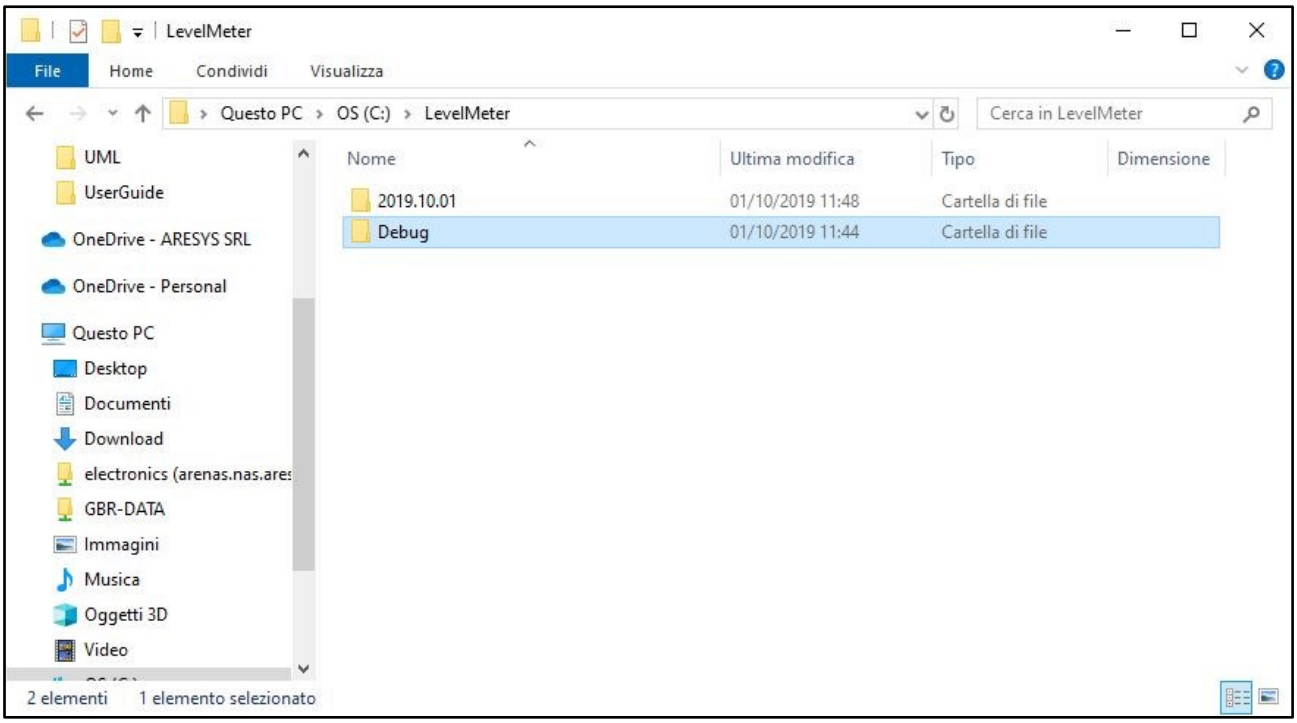


Fig.9 Data Folder

Device Connection

Depending on the selected device, the Connection management panel will appear as in Fig.10 (IP address has been selected) or in Fig.11 (MAC address has been selected).

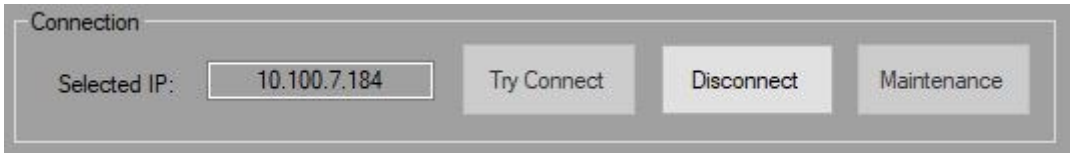


Fig.10 Connection to an IP Address

Fig.11 Connection to a MAC Address

To manage the connection with the device, three buttons are available:

- *TryConnect* button: by clicking this button, a cycle of period connection attempts is started. Each time the device disconnected, automatically the application will try to reconnect the system. When a connection attempt succeeds the *Connection State* of the Level Metering application (see Fig.14) becomes *CONNECTED*, elsewhere it is *DISCONNECTED*.

- *Disconnect* button: by clicking this button the periodic connection attempts are stopped and the application disconnects from the radar (the *Connection State* is forced to *DISCONNECTED* in Fig.14).

- *Maintenance* button: by clicking this button, the radar system maintenance window can be accessed (see Section 4.3). This button can be clicked only if *TryConnect* button has not been previously clicked (the system must be disconnected).

Configuration

Before starting a data acquisition session, it is necessary to configure both the acquisition and the data processing, using the panel in Fig.12.

Fig.12 Configuration Panels

To configure the acquisition, use the *Acquisition Configuration* panel:

- *Acquisition Mode*: this is a drop-down menu to select the measure type. Available options are: 1D (the system returns just one level measure), 2D (the system returns level measures on a 1D grid) or 3D (the system returns level measures on a 2D grid).

- *Acquisition Speed*: this is a drop-down menu allowing the selection of the rate of the radar acquisition and hence, the frequency of level meter results updates. Three speed levels are available: LOW (acquisition rate approximately of 13 Hz), MEDIUM (acquisition rate approximately of 103 Hz) and HIGH (acquisition rate approximately of 188 Hz).

- *Min. Range / Max. Range / Min. Phi / Max. Phi / Min. Theta / Max. Theta*: these are minimum and maximum values of distance, azimuth angle and elevation angle within which the level survey must be limited. If 1D *Acquisition Mode* has been selected, only the minimum and maximum range are used by the application; if 2D acquisition is set, both range and theta limits are used. Finally, all the limits are necessary if the 3D acquisition mode has been selected.

By clicking the *Configure* button, the acquisition is configured and the *Acquisition State* of the application goes from *READY* to *CONFIGURED* (see Fig.14). The acquisition configuration can be set as many time as required, provided that the system is not already acquiring (in such a case, stop the acquisition to update the configuration).

To configure the level meter processing, use the *Processing Settings* panel:

- *Obstacle Cancelation*: Enable or disable obstacles effect cancelation. When the obstacles cancelation is enabled, the effect of obstacles (for example, the contribution of the edge of the ladle) is removed by the level meter processing. **TIP:** uncheck this flag when performing level metering tests in an office environment, if you want to measure the distance of a not moving target (for example a wall).

- *Acquisition Average*: Set an average factor for the acquisition repetition frequency (i.e. the radar pulse repetition frequency). Measure update frequency (i.e. the frequency for the level measure refresh) will be given by the radar pulse repetition frequency (set by selecting an *Acquisition speed* value in the *Acquisition Configuration* panel), divided by this value.

- *Process Average Window*: Set temporal windows length (expressed in seconds) used by the level meter processing to carry out some internal averages. This factor does not affect measure update frequency (i.e. the frequency for the level measure refresh).

- *Statistics Window*: Set the width (expressed in seconds) of the window for statistics purpose. Statistics is used by level meter processing and its strictly related to the computation of the standard deviation of the measured level.

Finally, by accessing the *Displayed Level* panel some display configurations can be set:

- *Level Type*: this drop-down menu allows to select the type of returned level measure (both saved in the results file and displayed in the data visualization panel, Fig.15). It is possible to select FIRST RETURN (the level value corresponding to the 90% statistic percentile, computed from the maximum range distance), PEAK (the level value corresponding to the statistics mode) and MEAN (the level value corresponding to the statistics mean).

- *Threshold*: this is a constant target level value, drawn in Fig.15, to have a baseline against which to compare the real-time measured value.

Acquisition Management

Click the button *Start Acquisition* in the *Acquisition* Panel to start data acquisition and processing. This button can be clicked if and only if the *Acquisition State* of the application (see Fig.14) is *CONFIGURED*. If the starting operation succeeds, this state becomes *ACQUIRING* and new data and results will be saved in the folder set in the *Results Folder* text box (see Fig.8) and displayed in the *Data Visualization* panel (see Fig.15).

Fig.13 Acquisition Commands Panel

By clicking the *Stop Acquisition* button, the radar acquisition is stopped and the *Acquisition State* of the application (Fig.14) goes back to *CONFIGURED*.

State Visualization

The State Panel allows to have a complete description of the state of the application:

- *Connection State*: it can be *CONNECT* (radar is currently connected to the application) or *DISCONNECTED* (radar disconnected).
- *Acquisition State*: it can be *READY* (acquisition not configured yet), *CONFIGURED* (the acquisition has been configured at least one time) or *ACQUIRING* (the system is currently acquiring data and updating measure results).
- *Acquisition Rate*: is the frequency of the radar (expressed in Hertz) of acquisition of a new data. It depends on the selected *Acquisition Speed* (see Fig.12).
- *Acquired*: it is the number of acquired data from the start of the acquisition.
- *Missed*: it is the number of missed data from the start of the acquisition.
- *Accumulated*: it is the number of accumulated data, i.e. the number of data received and not processed yet to get a new level measure. If this value increases, this means that the selected data frequency is too high for the application processing (hence it is suggested to reduce the *Acquisition Speed* or to increase the *Acquisition Average,* see Fig.12).

Fig.14 State Panel

Data Visualization

When the *Acquisition State* of the application is in *ACQUIRING*, the measure results are displayed in the panel of Fig.15. In the upper panel, the grid of measure is displayed: for each point of the (Phi, Theta)-grid the instantaneous measure of distance is reported.

By clicking on one of the cells of the grid, it is possible to see in the lower panel the time series of the distance measure of the cells (i.e. how this measure change depending on time). Change the number in the *Time Interval* box to change the number of displayed minutes in the graph.

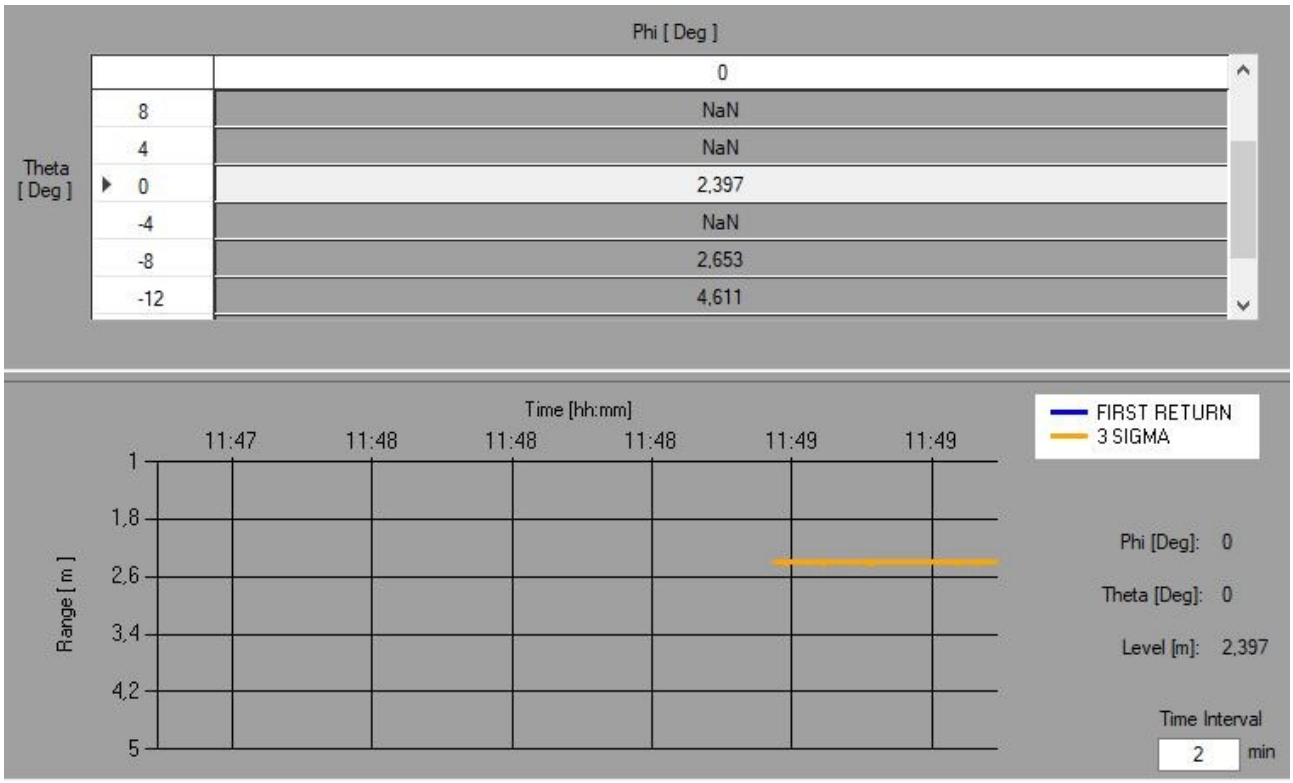


Fig.15 Data Visualization Panels

Log Visualization

At the bottom of the main window, it is possible to access to all the logs generated by the application, warning if a change in a state of the application or an error occurred.

Click *Clear* button to clear all the logs of the panel.

Fig.16 Log Panel

4.3. System Maintenance

Clicking the button *Maintenance* of the panel in Fig.10 or Fig.11, it is possible to access the System Maintenance windows of Fig.17. Using this window, it is possible to access to the radar maintenance operations, such as:

- to get a FW version and update the FW of the radar
- to get both the IP and MAC addresses of a radar;
- to get and update the network static settings of the radar;
- to get and update the radar connection mode;
- to get and update the Keep Alive period of the radar (i.e. the period of the messages the radar uses to check if the connection with a host application is still alive).

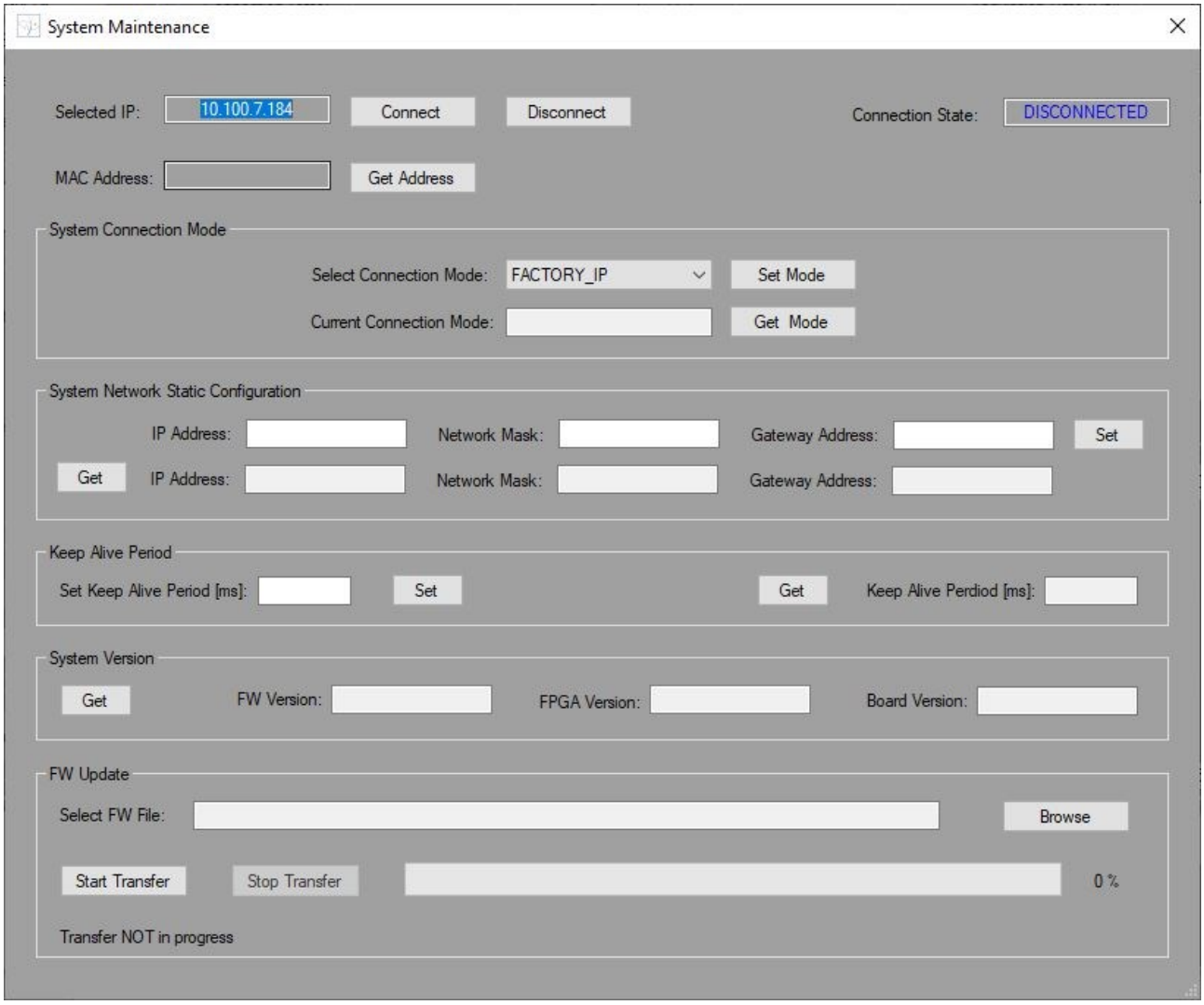


Fig.17 *LeverMeterGUI* Maintenance Window

System Connection

First thing to do to start a system maintenance session, is to connect the device using the *Connect* button in Fig.18. Note that in this case, just a single synchronous attempt of connection with the radar is performed. If this attempt fails, it is necessary to retry by clicking the button again. Press *Disconnect* button to disconnect the system.

The result of the connection/disconnection operations is displayed in the *Connection State* box. All the other operations in this maintenance windows can be successfully performed only if the system is connected.

NOTE: when the maintenance windows is closed, the system will be automatically disconnected.

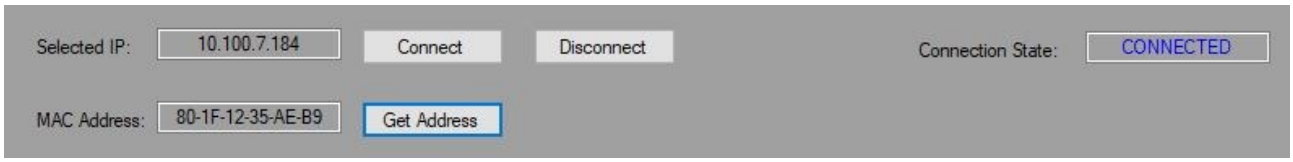


Fig.18 System Maintenance Connection Panel

Finally, clicking the *Get Address* button, it is possible to get the MAC address of the selected device (or the IP address if the device has been selected using the MACaddress).

Connection Mode

Using the panel in Fig.19 it is possible to get the current *Connection Mode* of the radar (i.e. the way by with the radar configure its network board, once it exits from the *Recovery State*, as explained in 3.2). It is also possible to update such a mode.

The possible connection modes are:

1. FACTORY_IP: when exiting the *Recovery State*, the radar will configure its network board using a static IP address, hard coded in its non-volatile memory. This static IP configuration is set by the producer when the radar is manufactured.

2. STATIC_IP: when exiting the *Recovery State*, the radar will configure its network board using a static IP address, configurable by the user (Fig.20).

3. DYNAMIC_IP: when exiting the *Recovery State*, the radar will configure its network board using an IP address gotten from a DHCP server.

NOTE: it is necessary to restart the device to have the *Connection Mode* changes to become effective.

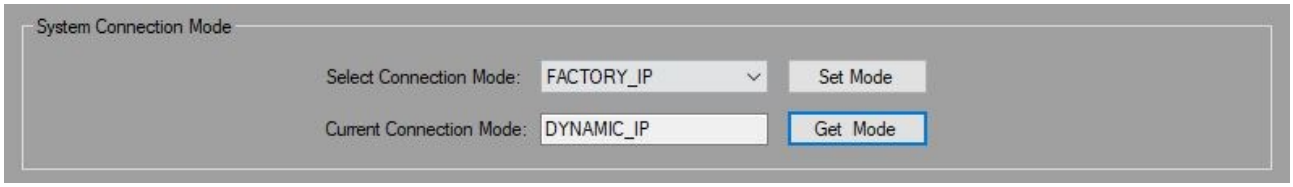


Fig.19 Connection Mode Panel

System Network Configuration

Using the panel in Fig.20 it is possible to read and update the network static configuration of the radar, i.e. IP address, Network mask and Gateway address. This network static configuration is the one used when STATIC_IP mode is set as *Connection Mode* for the radar.

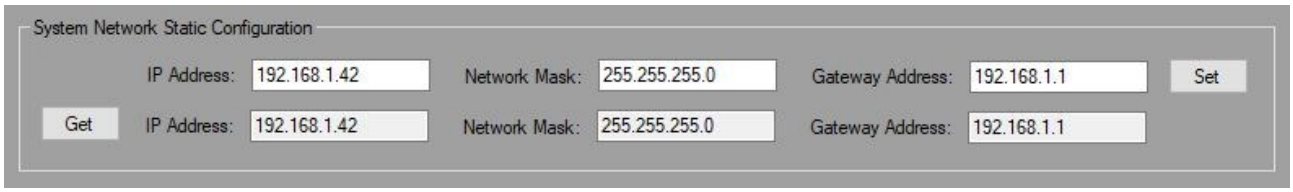


Fig.20 System Network Static Configuration Panel

NOTE: current IP address of the radar (shown in the panel of Fig.18), should not match the static IP address get from the radar in Fig.20. For example, if the currently set *Connection Mode* (Fig.19) is DYNAMIC_IP, the current IP address of the radar is obtained by a DHCP server and hence it almost certainly does not match the statically configured IP address.

NOTE: it is necessary to restart the device to have the *Network Static Settings* changes to become effective.

Keep Alive Period Management

Using the panel in Fig.21 it is possible to read and update the period of the keep alive message, expressed as millimeters. This is a message periodically sent from the radar to the host, to check if the connection is still alive. The period of the keep alive message is both the duration between two consecutive message transmissions and the time radar waits for an answer from the host.

Fig.21 Keep Alive Management Panel

NOTE: it is necessary to restart the device to have the *Keep Alive Period* changes to become effective.

System Version

Panel in Fig.22 allows to read the version (of the FW, FPGA and board) of the radar.

Fig.22 System Version Panel

System FW Update

To update the radar version, it is necessary to access the panel in Fig.23. First, select a FW file provided by the radar producer (a file with *'.bin'* extension) by browsing the file system (*Browse* button). Then click the button *Start Transfer* and the file transfer will start, as shown in Fig.24.

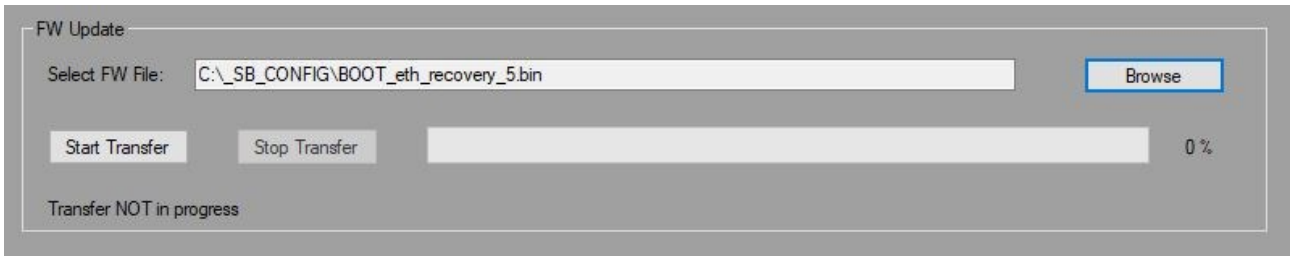


Fig.23 FW Update Panel (update NOT in progress)

To stop an in progress transfer, just click on the *Stop Transfer*. Otherwise, wait until the transfer ended; when this happens, the progress bar achieves the 100% of work done and a dialog box notifies the user.

Fig.24 FW Update Panel (update in progress)

NOTE: as stated by the red label in Fig.24, it is absolutely mandatory NOT to switch off the radar when a transfer operation is in progress. Stop the transfer or wait until it ends before turning off the radar.

NOTE: it is necessary to restart the device to have the new updated FW effectively working on the radar.

5. System certifications

5.1. CE Certification

The system ScanBrick® W is in conformity with the essential requirements of the Directive 2014/53/EU (RED) and of the Directive 2015/863/EU (RoHS).

5.2. UL Certification

The system ScanBrick® W is in conformity with the essential requirements of PROCESS CONTROL EQUIPMENT, ELECTRICAL

UL 61010-1:2010, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements

CSA C22.2 NO. 61010-1-12, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements

5.3. FCC Certification

NOTICE:

This device complies with Part 15 of the FCC Rules and contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada’s licence-exempt RSS standard(s).

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.

L’émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d’Innovation, Sciences et Développement économique 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'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

NOTICE:

Changes or modifications made to this equipment not expressly approved by ARESYS srl may void the FCC authorization to operate this equipment.

RADIOFREQUENCY RADIATION EXPOSURE INFORMATION

This equipment complies with FCC radiation exposure limits set both for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 1000cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitters