

POWERED BY

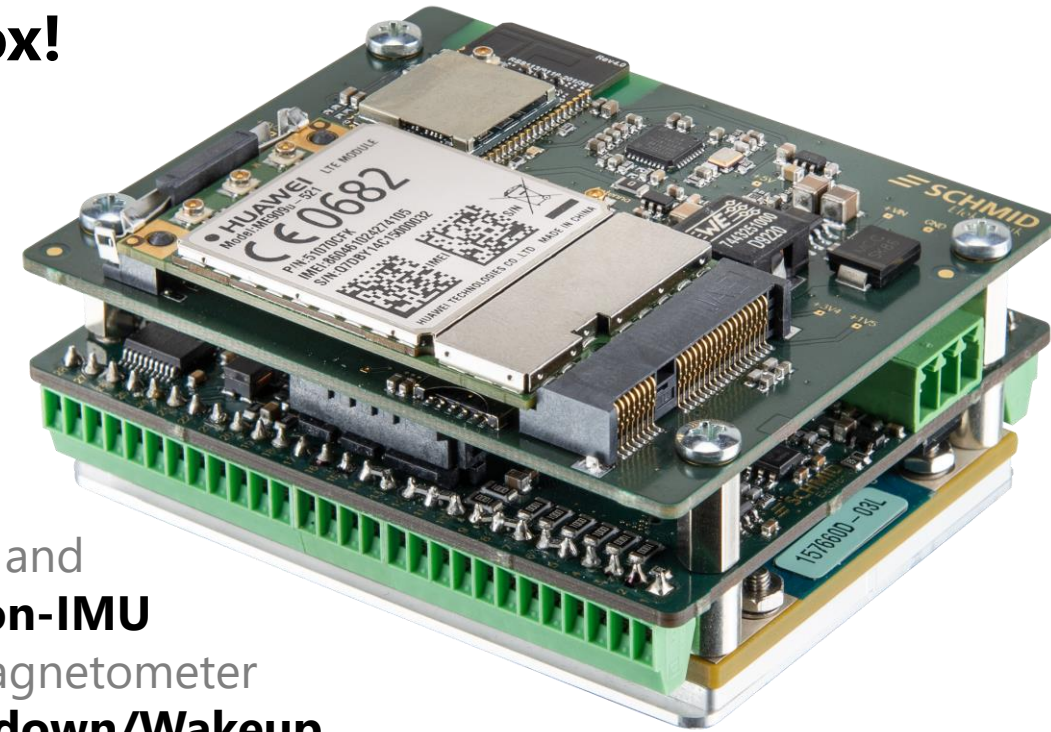
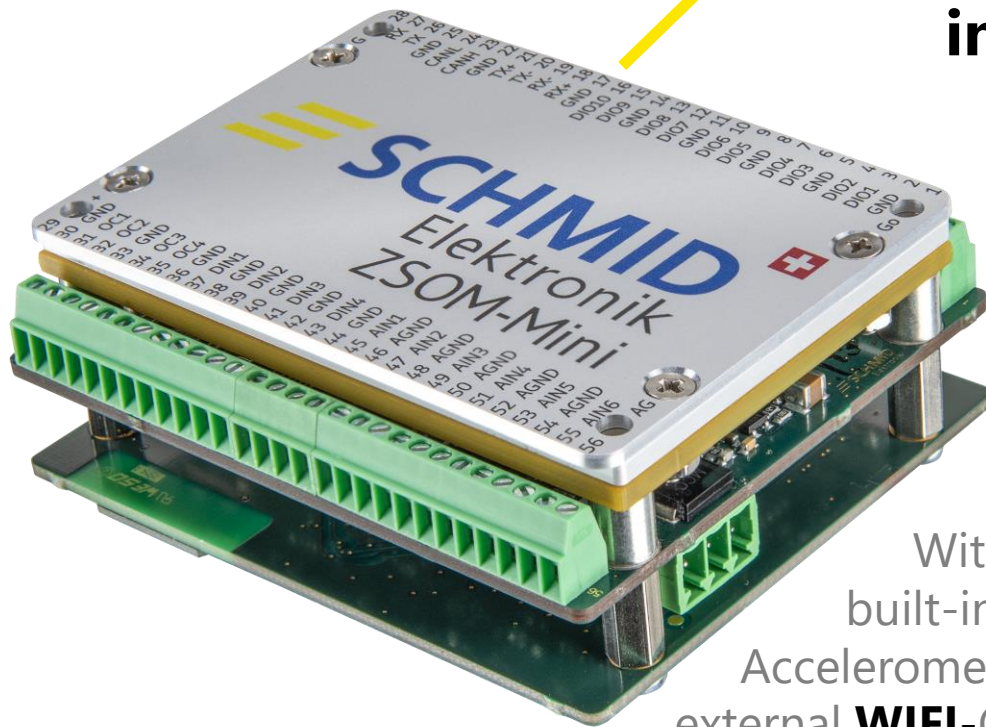


LabVIEW™

A **10**-Step-Guide to get Kickstarted with the

# ZSOM-Mini

**NI LabVIEW RT/FPGA-Power  
in a Cigarette Box!**



With **Analog/Digital-IO** and  
built-in **9DOF-Sensor-Fusion-IMU**  
Accelerometer • Gyroscope • Magnetometer  
external **WiFi**-Connection and **Shutdown/Wakeup**

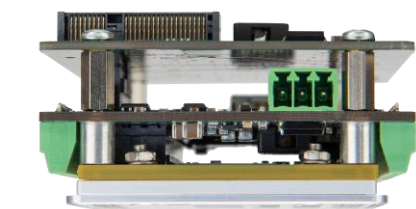
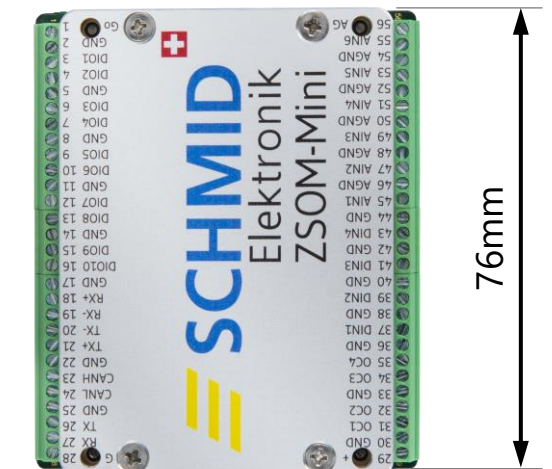
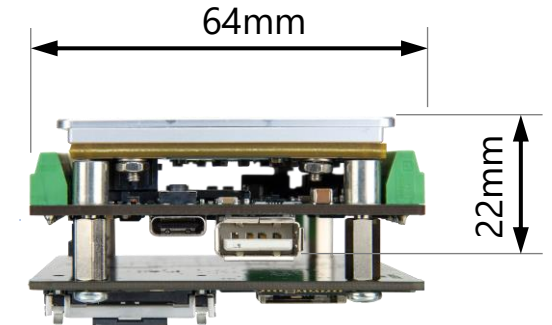
**Unleash your Creativity** and build **Tiny, Powerful, Connected Edge Devices** with NI **LabVIEW**-Embedded.  
With High-Performance Multicore-CPU & **FPGA, Mixed Signal** Support and **battery** friendly **Low-Power** Functionality

## Product Specification

- **6x analog in**, 16 bit,  $\pm 5V$  or  $\pm 10V$ , 450kHz simultaneous, 4<sup>th</sup> order anti aliasing with  $f_g=200kHz$ .
- **10x general purpose high speed I/O**, configurable as digital input or output, 3.3V or 5V operation, speed in the MHz range allows to integrate high performance SPI devices.
- **4x rugged digital input**, 3-30V, OVP
- **4x rugged open collector output**, max current: 200mA.
- **Communication**: 1x USB Host/TypeA, 1x USB-device/TypeC for TCP/IP-Connection, 1x CAN, 1x SD-Card, 1x RS232, 1x RS422/RS485
- **IMU**: 9x axes IMU (Accelerometer, Gyro, Magnetometer)
- **High-Precision RTC**: controllable target shut-down and configurable wake-up for battery operated applications.
- **Optional IoT-Functions** : generic connector to add mPCIe Board that adds WIFI, 4G and GPS to the system
- **Geometry** b/l/h: 64 x 76 x 22mm
- **Power**: wide input Range 9-30V. Power-On controlled by digital input signal (go) or RTC.
- **Battery Management System and IOT-Functions**: planned Q1/2022



IoT-Functions  
(Optional)



## A

- [Always-ON Jumper](#)
- [Analog Input](#)
- [Analog Output](#)

## B

- [Backup Battery](#)

## C

- [CAN](#)
- [CLIP](#)
- [Connect via USB](#)
- [Custom Specific Boards](#)

## D

- [Digital Input](#)
- [Digital IO](#)
- [Digital Output](#)

## F

- [Features](#)

## I

- [Installing Software on the ZSOM-Mini](#)

## K

- [Kernel Update Instruction](#)
- [Kill Signal](#)

## L

- [LEDs](#)

## P

- [Power-On Input \(Go\)](#)
- [Power Supply](#)
- [Precise RTC + Wakeup](#)

## Q

- [Quick Start Guide](#)

## R

- [Reset](#)
- [RS232 Interface](#)
- [RTC on sbRIO9651](#)

## S

- [SD-Card](#)
- [Systems requirements](#)

## T

- [Trouble Shooting Cheat Sheet](#)

## U

- [Upgrade SDK](#)
- [USB Host](#)

## W

- [WIFI](#)

## Z

- [ZSOM Mini Power & GPIOs](#)
- [ZSOM Starterkit](#)
- [ZSOM-Mini](#)
- [ZSOM-Mini Pinout-Description](#)

## Screw terminals

Pin	Signal	Pin	Signal
29	+Vin	28	GND
30	GND	27	RS232 Rx
31	OC1	26	RS232 Tx
32	OC2	25	GND
33	GND	24	CAN Low
34	OC3	23	CAN High
35	OC4	22	GND
36	GND	21	RS422/RS485 TX+
37	DIN	20	RS422/RS485 TX-
38	GND	19	RS422/RS485 RX-
39	DIN	18	RS422/RS485 RX+
40	GND	17	GND
41	DIN	16	DIO10
42	GND	15	DIO9
43	DIN	14	GND
44	GND	13	DIO8
45	AIN1	12	DIO7
46	AGND	11	GND
47	AIN2	10	DIO6
48	AGND	9	DIO5
49	AIN3	8	GND
40	AGND	7	DIO4
51	AIN4	6	DIO3
52	AGND	5	GND
53	AIN5	4	DIO2
54	AGND	3	DIO1
55	AIN6	2	GND
56	AGND	1	Go

## Extension Connector

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	GND	2	GND	3	+VIN	4	+VIN
5	+3V3	6	+3V3	7	+5V4	8	+5V4
9	GND	10	GND	11	GND	12	GND
13	FPGA DIO 1	14	FPGA DIO 2	15	FPGA DIO 3	16	FPGA DIO 4
17	FPGA DIO 5	18	FPGA DIO 6	19	GND	20	GND
21	FPGA DIO 7	22	FPGA DIO 8	23	FPGA DIO 9	24	FPGA DIO 10
25	FPGA DIO 11	26	FPGA DIO 12	27	GND	28	GND
29	FPGA DIO 13	30	FPGA DIO 14	31	FPGA DIO 15	32	FPGA DIO 16
33	FPGA DIO 17	34	FPGA DIO 18	35	FPGA DIO 19	36	POWER ON
37	GND	38	GND	39	USB N	40	USB P

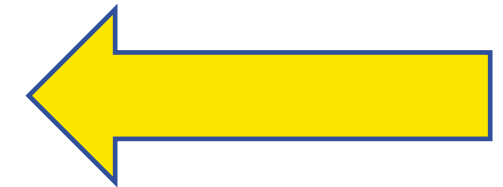
More information : [WIKI](#)

# Step 1 Choose Your Hardware Configuration

<http://wiki.schmid-elektronik.ch/zsom>

## Ordering Code

ZSOM-Mini-	xx	-	xx	-	xx	-	xx	
								Heat spreader
								<b>SE</b> Schmid Elektronik
								<b>NH</b> No Heat Spreader
								<b>SN</b> Schmid elektronik (No top sheet metal)
								Connection
								<b>ST</b> Screw Terminal
								<b>MP</b> Multi Pin Connector (Stiftleiste)
								<b>00</b> Solder Pads
								Power concept
								<b>3S</b> Multi cell battery or power supply (9...30V)
								<b>1S</b> Single cell battery (3.5..4.2V)
								Backup Voltage
								<b>BB</b> Backup Battery
								<b>NB</b> No Backup Battery
								<b>BH</b> Backup Battery for external RTC only



More information : [WIKI](#)

The following Versions are available:

**ZSOM-Mini-BB-3S-ST-SE**: Standard screw terminal version. Use this or ZSOM-Control to realize a prototype.

**ZSOM-Mini-BB-1S-MP-SN**: Embedded. Custom Base board and mechanical design needed.

go to [Start of ZSOM page](#)

#### Hardware Modules

[ZSOM-Control](#)  
[ZSOM-Mini](#)  
[Your board](#)  
[ZSOM-Control-Starterkit](#)

#### Documentation

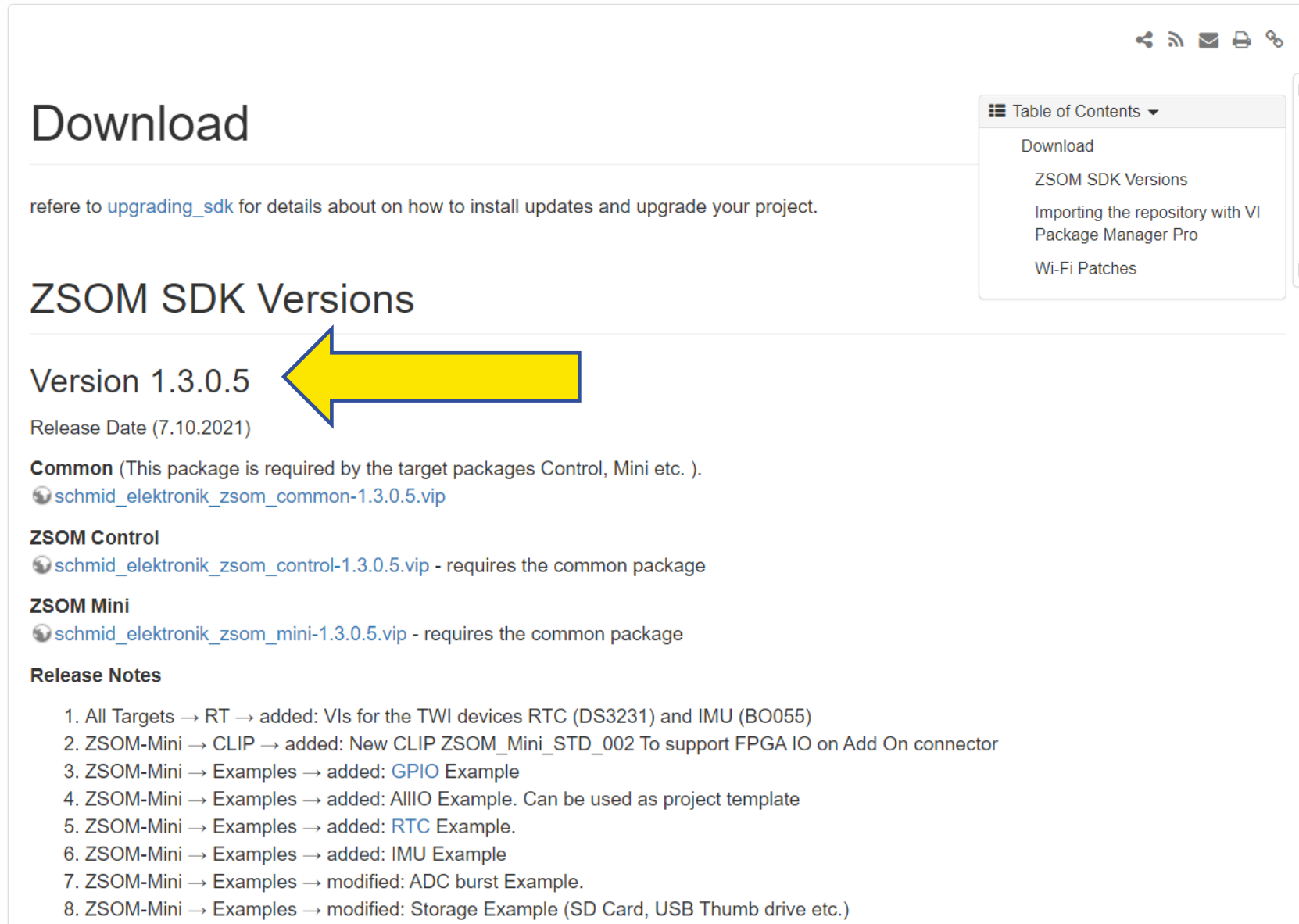
[quick start guide](#)  
[trouble\\_shooting](#)

#### Download

[download page](#) (login required)

#### other useful links

[Schmid Elektronik AG](#)  
[zBrain SDK](#)



The screenshot shows a web browser window displaying the 'Download' page for the ZSOM SDK. The page title is 'Download' and the main heading is 'ZSOM SDK Versions'. A yellow arrow points to the 'Version 1.3.0.5' section. The page includes a 'Table of Contents' sidebar with links to 'Download', 'ZSOM SDK Versions', 'Importing the repository with VI Package Manager Pro', and 'Wi-Fi Patches'. The 'Version 1.3.0.5' section lists the release date (7.10.2021) and provides links for 'Common', 'ZSOM Control', and 'ZSOM Mini' packages. A 'Release Notes' section follows, listing eight updates.

## Download

refere to [upgrading\\_sdk](#) for details about on how to install updates and upgrade your project.

## ZSOM SDK Versions

### Version 1.3.0.5

Release Date (7.10.2021)

**Common** (This package is required by the target packages Control, Mini etc. ).  
[schmid\\_elektronik\\_zsom\\_common-1.3.0.5.vip](#)

**ZSOM Control**  
[schmid\\_elektronik\\_zsom\\_control-1.3.0.5.vip](#) - requires the common package

**ZSOM Mini**  
[schmid\\_elektronik\\_zsom\\_mini-1.3.0.5.vip](#) - requires the common package

#### Release Notes

1. All Targets → RT → added: VIs for the TWI devices RTC (DS3231) and IMU (BO055)
2. ZSOM-Mini → CLIP → added: New CLIP ZSOM\_Mini\_STD\_002 To support FPGA IO on Add On connector
3. ZSOM-Mini → Examples → added: [GPIO](#) Example
4. ZSOM-Mini → Examples → added: AllIO Example. Can be used as project template
5. ZSOM-Mini → Examples → added: [RTC](#) Example.
6. ZSOM-Mini → Examples → added: IMU Example
7. ZSOM-Mini → Examples → modified: ADC burst Example.
8. ZSOM-Mini → Examples → modified: Storage Example (SD Card, USB Thumb drive etc.)

# Step 3 Check the GUI-Palette for the ZSOM-Mini

Functions

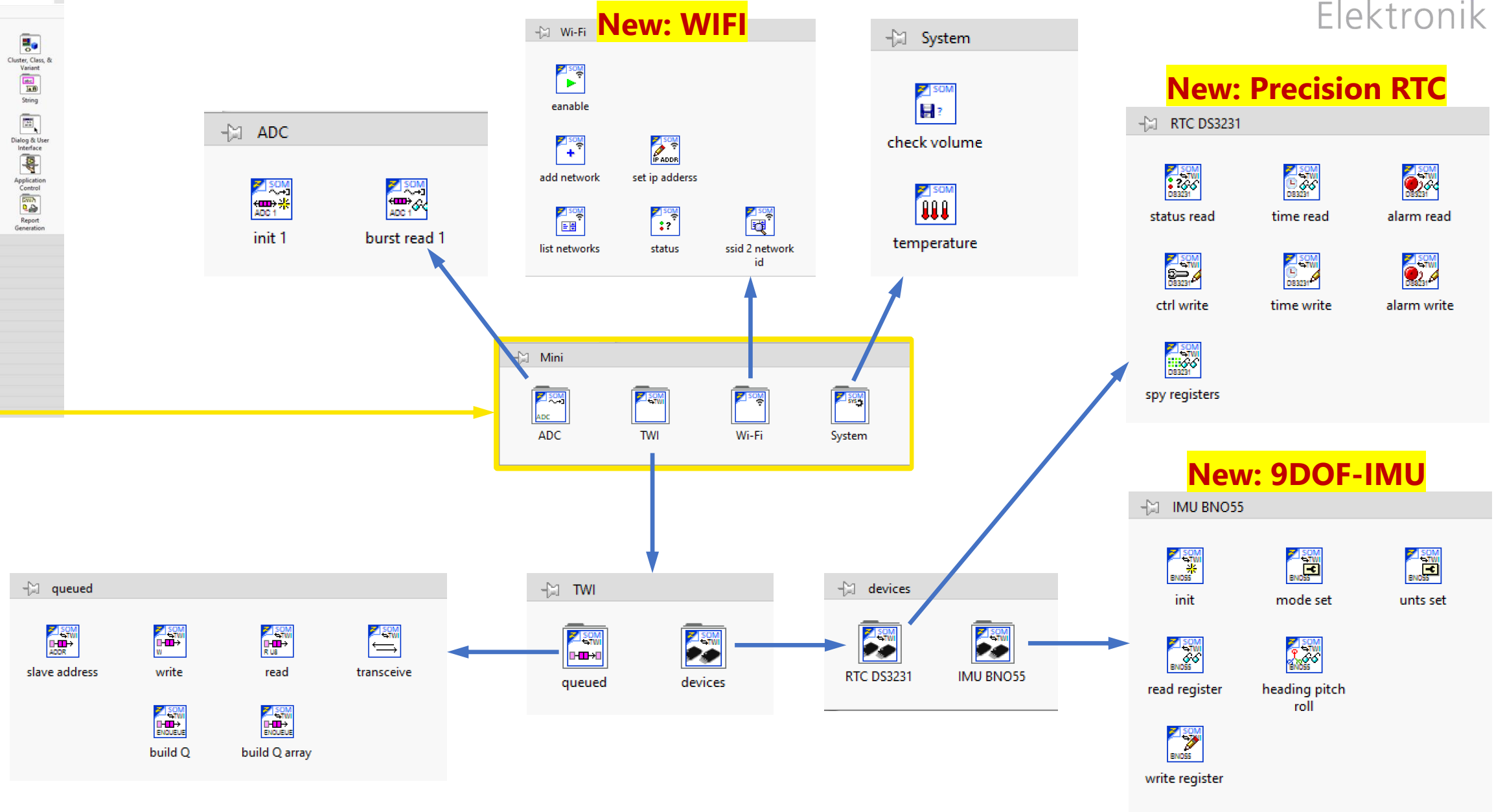
Search Customize

▼ Programming

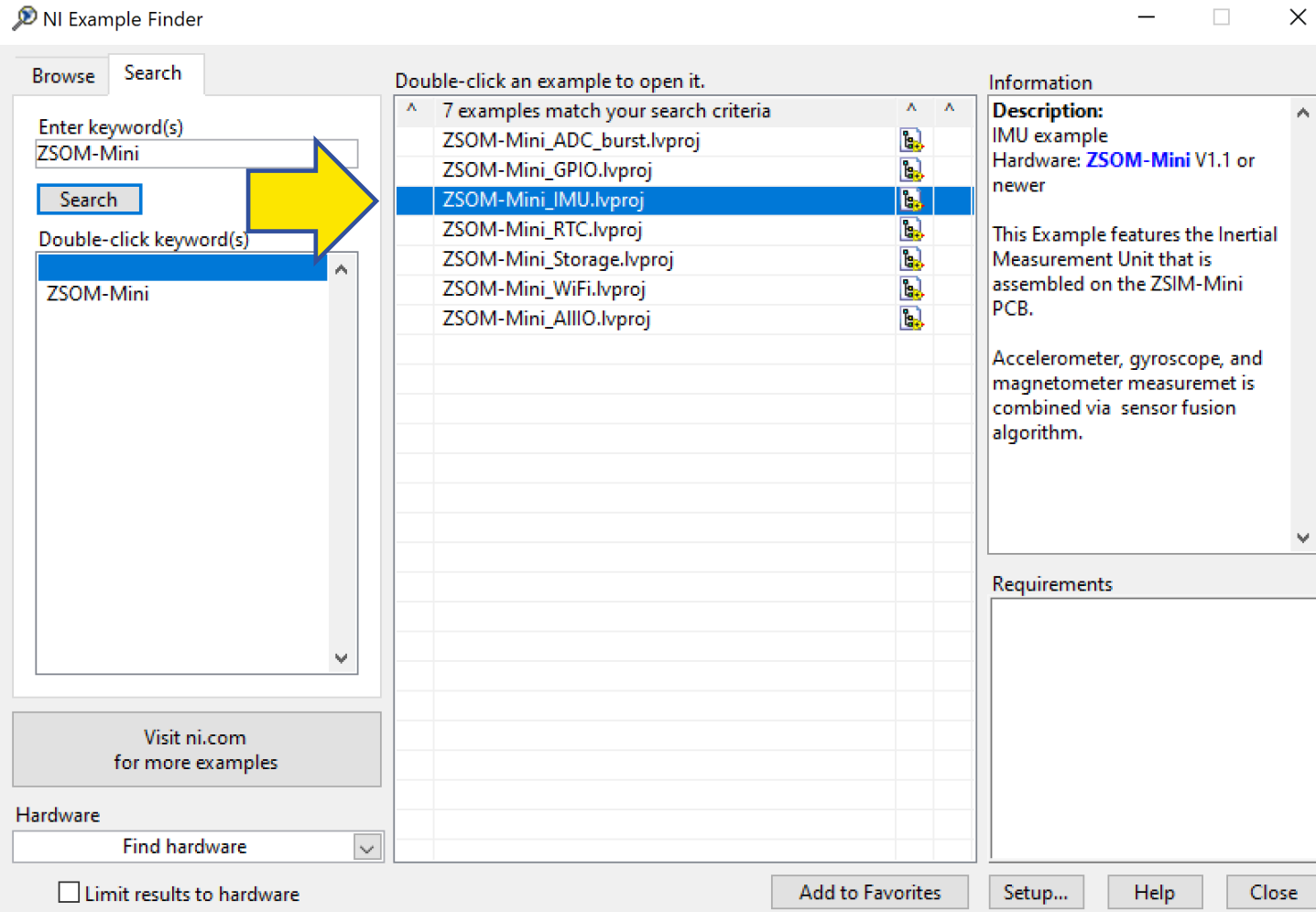
- Structures
- Array
- Cluster, Class, & Variant
- Numeric
- Boolean
- String
- Comparison
- Timing
- Dialog & User Interface
- File I/O
- Waveform
- Application Control
- Synchronization
- Graphics & Sound
- Report Generation

Measurement I/O

- Instrument I/O
- Vision and Motion
- Mathematics
- Signal Processing
- Data Communication
- Connectivity
- Control & Simulation
- Express
- Addons
- Favorites
- User Libraries
- Select a VI...
- Real-Time
- FPGA Interface
- Industrial Communications
- ZSOM\_SDK



# Step 4 Open the IMU-Example



The screenshot shows the NI Example Finder interface. On the left, the 'Search' tab is active. The search input field contains 'ZSOM-Mini', and a yellow arrow points to the search button. Below the search input, a list of search results shows 'ZSOM-Mini' selected. The main pane displays a list of 7 examples matching the search criteria, with 'ZSOM-Mini\_IMU.lvproj' highlighted. The right pane shows the 'Information' section for the selected example, including a description and requirements.

NI Example Finder

Browse Search

Enter keyword(s)  
ZSOM-Mini

Search

Double-click keyword(s)  
ZSOM-Mini

Visit ni.com for more examples

Hardware  
Find hardware

Limit results to hardware

Double-click an example to open it.

7 examples match your search criteria

- ZSOM-Mini\_ADC\_burst.lvproj
- ZSOM-Mini\_GPIO.lvproj
- ZSOM-Mini\_IMU.lvproj**
- ZSOM-Mini\_RTC.lvproj
- ZSOM-Mini\_Storage.lvproj
- ZSOM-Mini\_WiFi.lvproj
- ZSOM-Mini\_AllIO.lvproj

Information

**Description:**  
IMU example  
Hardware: **ZSOM-Mini** V1.1 or newer

This Example features the Inertial Measurement Unit that is assembled on the ZSIM-Mini PCB.

Accelerometer, gyroscope, and magnetometer measurement is combined via sensor fusion algorithm.

Requirements

Add to Favorites Setup... Help Close

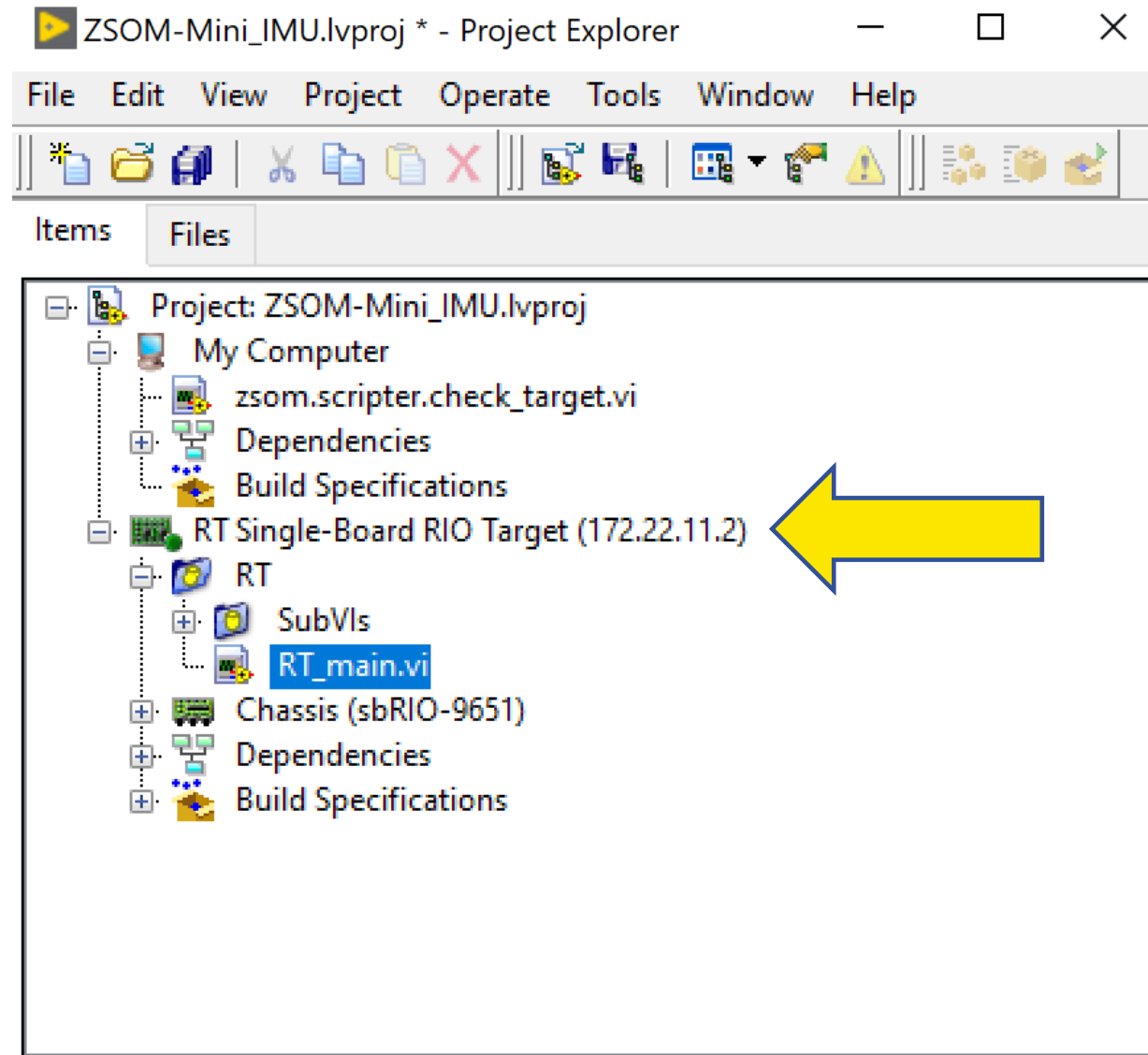
## Unleash your Creativity!

The ZSOM-Mini and the new SDK allows you a great start to create tiny mixed signal devices that include:

- **Analog** IO (up to 450 kHz)
- **Digital** IO
- **IMU** Functions (9 DOF)
- High-Precision **RTC** + **Wake-Up**
- **IOT** Functions (WIFI)



# Step 5 Connect to ZSOM-Mini Target



# Step 6 Run the IMU-Example (Check Video Clip)

RT\_main.vi on ZSOM-Mini\_IMU.lvproj/RT Single-Board RIO Target

File Edit View Project Operate Tools Window Help

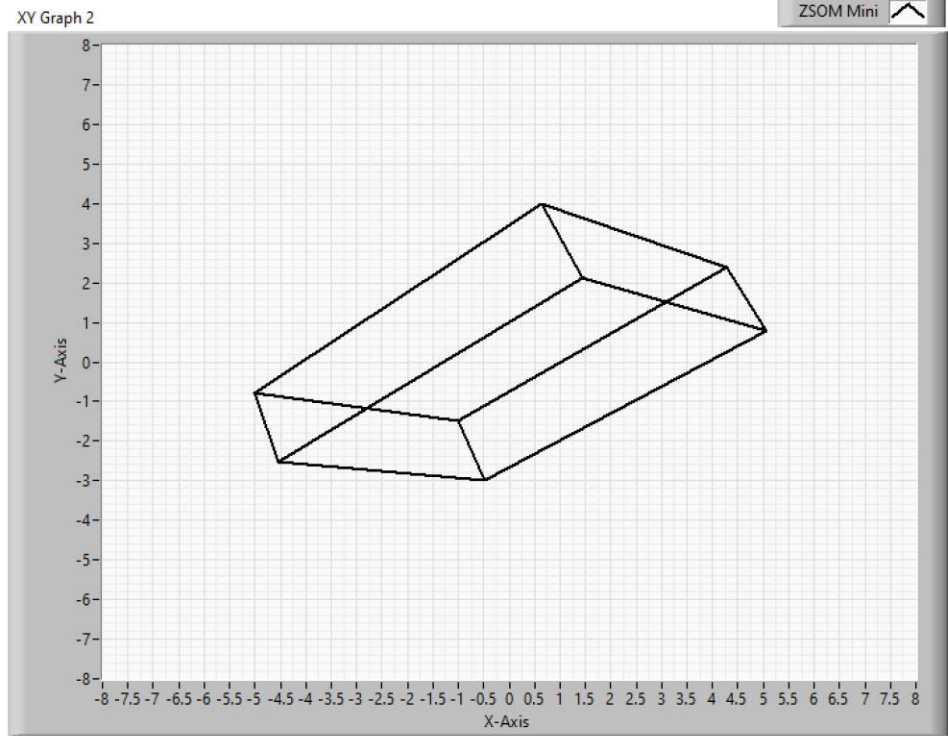

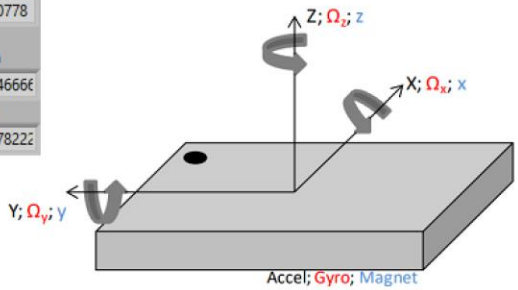
## IMU example

Hardware: ZSOM-Mini V1.1 or newer Version: 210917

ZSOM-Mini 1 | ZSOM-Mini 2 | ZSOM-Mini Application | ZSOM-Mini IMU

euler angles

heading	5.70778
pich	-0.46666
roll	-2.78222

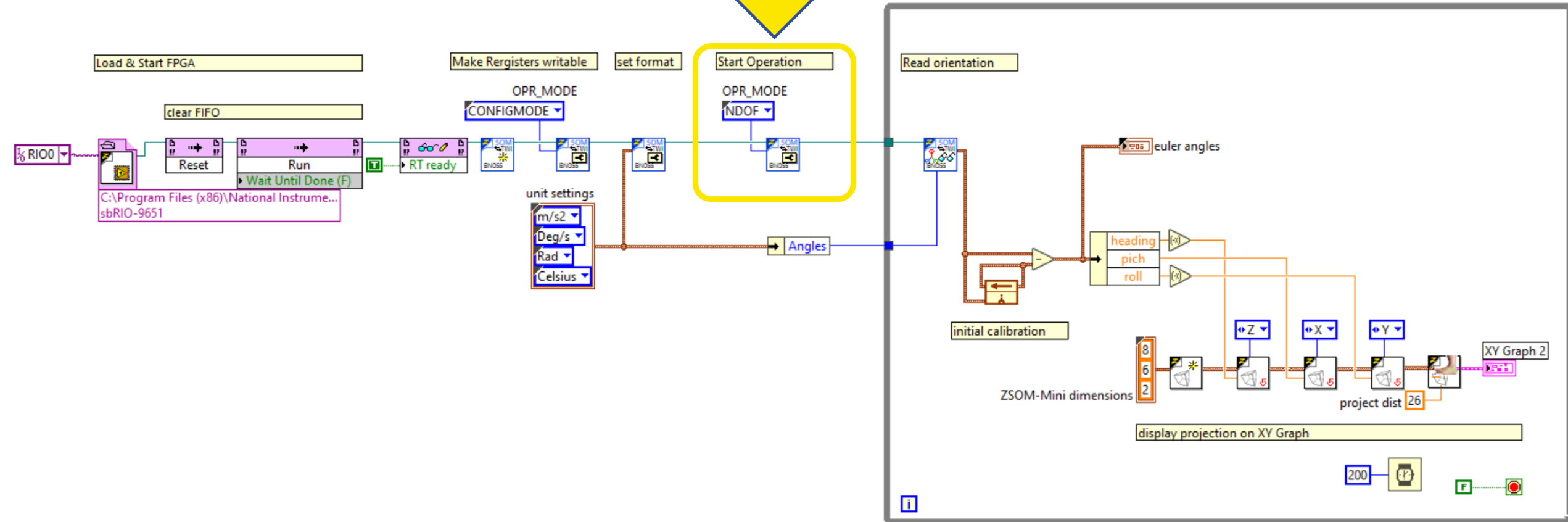
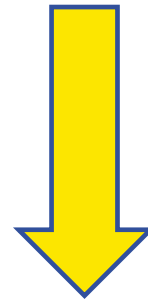


XY Graph 2

ZSOM Mini



# Step 7 Check out the LabVIEW Code and IMU Mode



From The Datasheet

### 3.3.1 Config Mode

This mode is used to configure BNO, wherein all output data is reset to zero and sensor fusion is halted. This is the only mode in which all the writable register map entries can be changed. (Exceptions from this rule are the interrupt registers (INT and INT\_MSK) and the operation mode register (OPR\_MODE), which can be modified in any operation mode.) As being said, this mode is the default operation mode after power-on or RESET. Any other mode must be chosen to be able to read any sensor data.

### 3.3.2 Non-Fusion Modes

**3.3.2.1 ACCONLY** If the application requires only raw accelerometer data, this mode can be chosen. In this mode the other sensors (magnetometer, gyro) are suspended to lower the power consumption. In this mode, the BNO055 behaves like a stand-alone acceleration sensor.

**3.3.2.1 MAGONLY** In MAGONLY mode, the BNO055 behaves like a stand-alone magnetometer, with acceleration sensor and gyroscope being suspended.

**3.3.2.2 GYROONLY** In GYROONLY mode, the BNO055 behaves like a stand-alone gyroscope, with acceleration sensor and magnetometer being suspended.

**3.3.2.3 ACCMAG** Both accelerometer and magnetometer are switched on, the user can read the data from these two sensors.

**3.3.2.4 ACCGYRO** Both accelerometer and gyroscope are switched on; the user can read the data from these two sensors.

**3.3.2.5 MAGGYRO** Both magnetometer and gyroscope are switched on, the user can read the data from these two sensors.

**3.3.2.6 AMG** (ACC-MAG-GYRO) All three sensors accelerometer, magnetometer and gyroscope are switched on.

### 3.3.3 Fusion modes

Sensor fusion modes are meant to calculate measures describing the orientation of the device in space. It can be distinguished between non-absolute or relative orientation and absolute orientation. Absolute orientation means orientation of the sensor with respect to the earth and its magnetic field. In other words, absolute orientation sensor fusion modes calculate the direction of the magnetic north pole. In non-absolute or relative orientation modes, the heading of the sensor can vary depending on how the sensor is placed initially. All fusion modes provide the heading of the sensor as quaternion data or in Euler angles (roll, pitch and yaw angle). The acceleration sensor is both exposed to the gravity force and to accelerations applied to the sensor due to movement. In fusion modes it is possible to separate the two acceleration sources, and thus the sensor fusion data provides separately linear acceleration (i.e. acceleration that is applied due to movement) and the gravity vector.

#### 3.3.3.1 IMU (Inertial Measurement Unit)

In the IMU mode the relative orientation of the BNO055 in space is calculated from the accelerometer and gyroscope data. The calculation is fast (i.e. high output data rate).

#### 3.3.3.2 COMPASS

The COMPASS mode is intended to measure the magnetic earth field and calculate the geographic direction. The earth magnetic field is a vector with the horizontal components x,y and the vertical z component. It depends on the position on the globe and natural iron occurrence. For heading calculation (direction of compass pointer) only the horizontal components x and y are used. Therefore the vector components of the earth magnetic field must be transformed in the horizontal plane, which requires the knowledge of the direction of the gravity vector. To summarize, the heading can only be calculated when considering gravity and magnetic field at the same time. However, the measurement accuracy depends on the stability of the surrounding magnetic field. Furthermore, since the earth magnetic field is usually much smaller than the magnetic fields that occur around and inside electronic devices, the compass mode requires calibration (see chapter 3.10)

#### 3.3.3.3 M4G (Magnet for Gyroscope)

The M4G mode is similar to the IMU mode, but instead of using the gyroscope signal to detect rotation, the changing orientation of the magnetometer in the magnetic field is used. Since the magnetometer has much lower power consumption than the gyroscope, this mode is less power consuming in comparison to the IMU mode. There are no drift effects in this mode which are inherent to the gyroscope. However, as for compass mode, the measurement accuracy depends on the stability of the surrounding magnetic field. For this mode no magnetometer calibration is required and also not available.

#### 3.3.3.4 NDOF\_FMC\_OFF

This fusion mode is same as NDOF mode, but with the Fast Magnetometer Calibration turned 'OFF'.

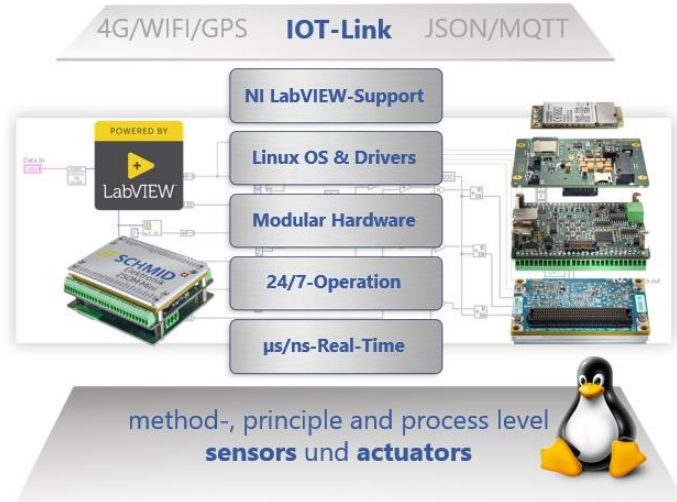
#### 3.3.3.5 NDOF

This is a fusion mode with 9 degrees of freedom where the fused absolute orientation data is calculated from accelerometer, gyroscope and the magnetometer. The advantages of combining all three sensors are a fast calculation, resulting in high output data rate, and high robustness from magnetic field distortions. In this mode the Fast Magnetometer calibration is turned ON and thereby resulting in quick calibration of the magnetometer and higher output data accuracy. The current consumption is slightly higher in comparison to the NDOF\_FMC\_OFF fusion mode.

# Step 9 Checkout the MVP-Paper

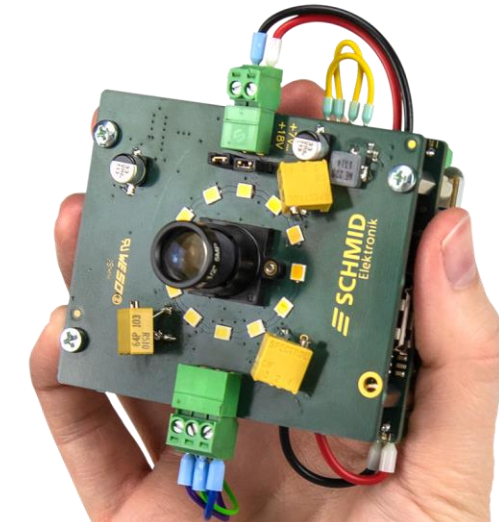


## Development Accelerator for Minimum Viable Products MVPs



For fast-moving Minimum Viable Products (MVPs), new methods for embedded software development can help, such as high abstraction without losing touch with hardware, signals, and real-time. NI LabVIEW does just that.

The graphical, data-flow-oriented programming language integrates C, Python and Matlab, runs in real time on embedded hardware, and connects effortlessly to the IoT.



MVP Paper: download from [WIKI](#)

# Step 10 Talk with us about your application ideas



Schmid Elektronik is a family-run, Swiss technology SME for embedded systems and industrial electronics. Customers are supplied with feasibility studies, prototypes, pilot series, minimum viable products (MVP), batch size 1 as well as small and medium series. Market services include hardware and software engineering, products for LabVIEW on customer-specific hardware and production services (EMS). One of Schmid Elektronik's specialties is Internet-of-Things things.



The ZBrain product family from Schmid Elektronik consists of hardware platforms for embedded systems that are graphically programmable with NI LabVIEW (RT, FPGA). With this Schmid Elektronik completes the NI platform (sbRIO, cRIO, PXI, SLSC) and enables its customers to run LabVIEW on their own hardware. Be it in prototypes, MVPs or products.



Silver  
Partner

CompactRIO AND CONTROL

Since 2007, Schmid Elektronik has been one of the NI Alliance Partners, achieved Silver status and holds the CompactRIO AND CONTROL Specialty certificate. Thus, the focus is on embedded sbRIO hardware, customized cRIO modules, specific FlexRIO and SLSC boards.



## Contact

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