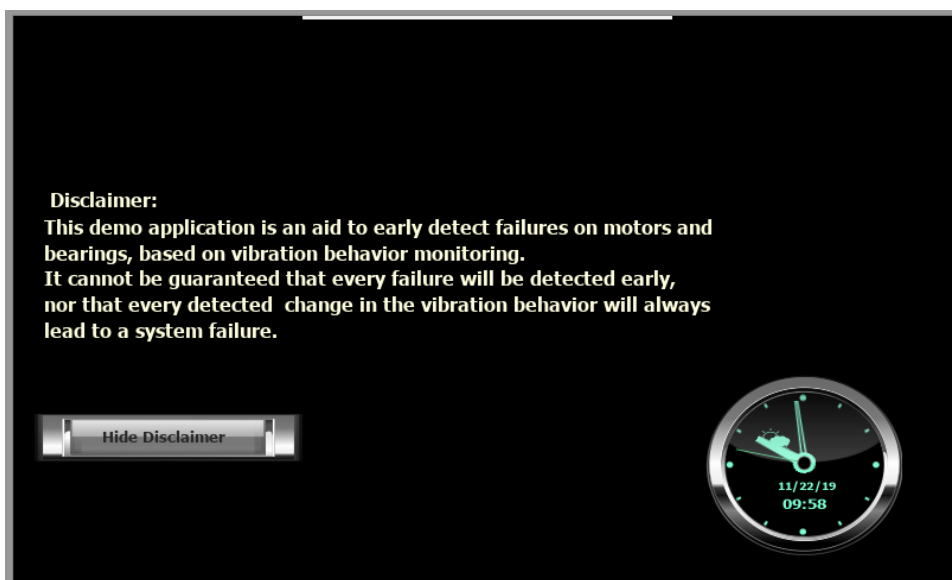


TURCK Vibration Monitoring Solution Box

Goal

Provide a ready to use solution for monitoring vibration based on Banner's vibration sensors.

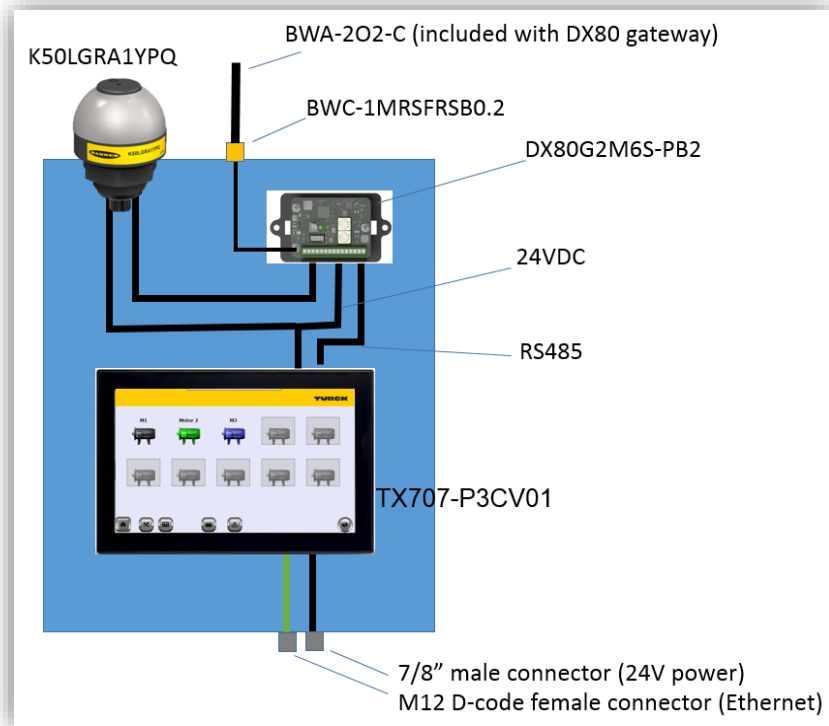
Disclaimer



Hardware



A metal enclosure (estimate 30 cm x 28 cm x 12 cm, ~4kg) with a TX707-P3CV01 HMI/PLC and DX80G2M6S-PB2 wireless gateway. (The image above shows a similar box with a TX107 HMI).



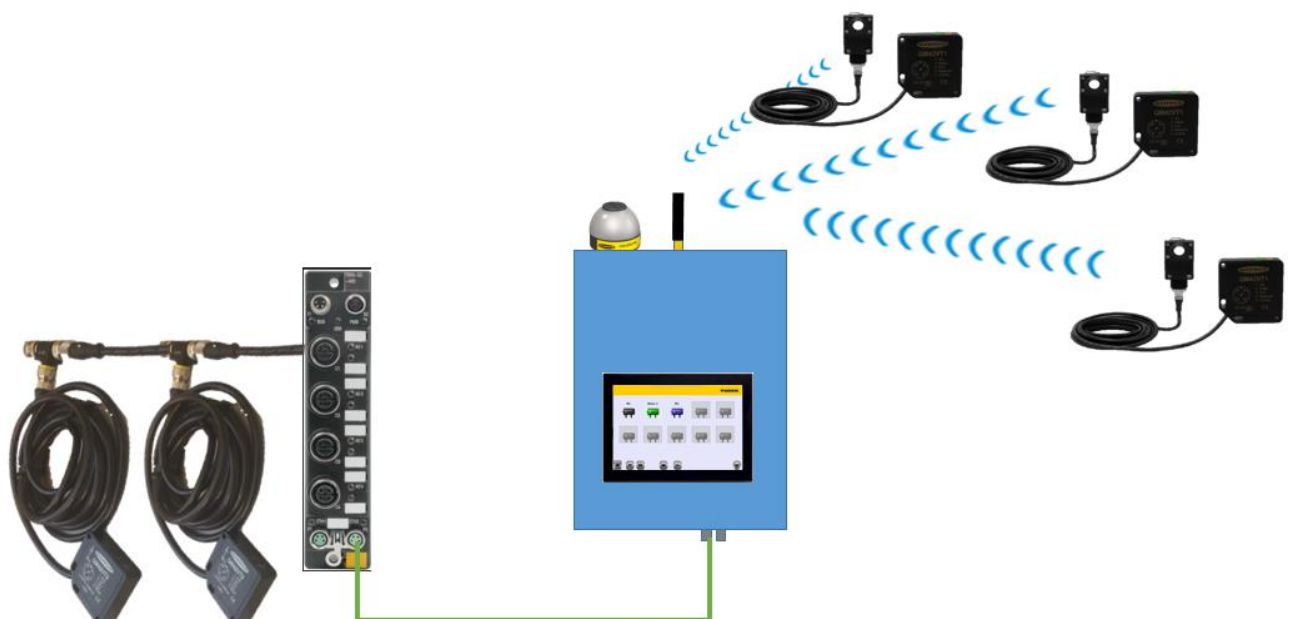
On the topside of the box will be mounted a K50LGRA1YPQ indicator light.

On the top is also a BWA-202C antenna for the Banner wireless, (connected to the gateway by a BWA-HW-016 antenna cable). On the bottom is an M12 connector for Ethernet and a 7/8" connector for power.

A second version could be created with, instead of an M12 connector for 24VDC, an 240VAC power plug and a 24VDC power supply in the box.

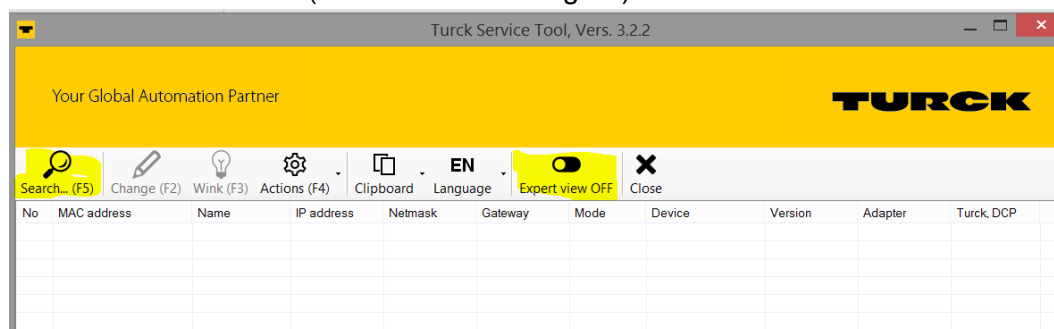
Sensor

To complete the demo, one or more vibration sensors are required. The maximum number of connected sensors is fifteen. Two connection options are possible.

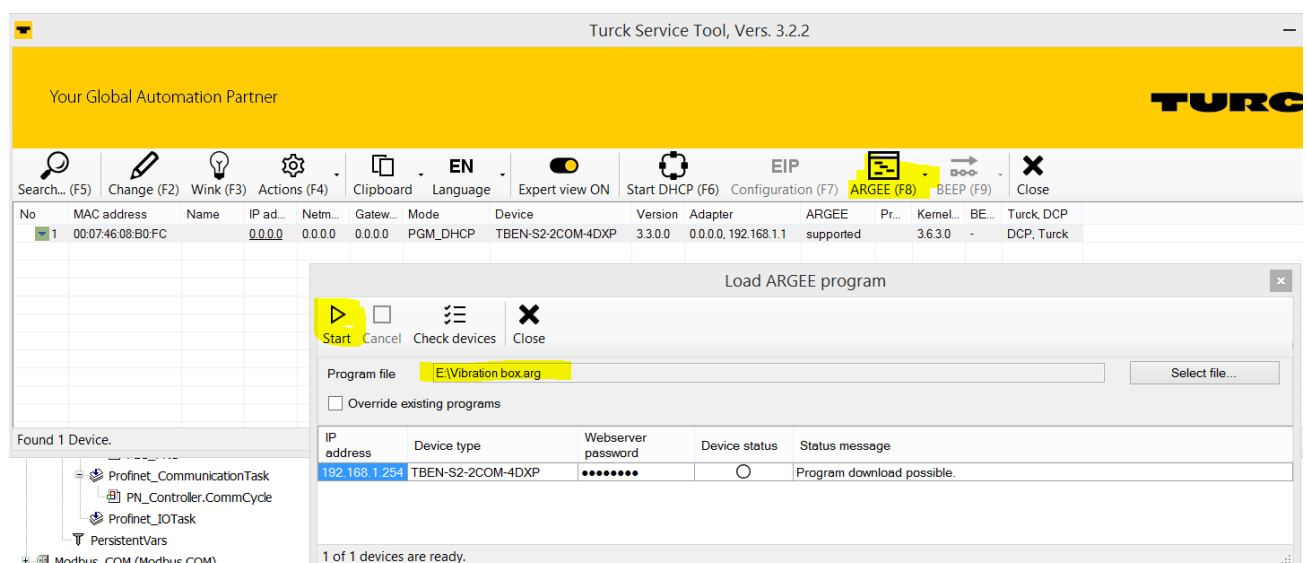


1. Wireless: QM42VT1 sensor and a DX80N2Q45VT battery powered node. The DX80 node is communicating the DX80 gateway that is connected on the TX707 COM port. In factory default condition, the values communicated by the sensor do not correspond to the monitoring program. An automatic configuration procedure can be triggered from the configuration screen.
2. Serial: QM42VT2 serial connected to a TBEN-S2-2COM-4DXP module. The sensor connect to COM0 on the TBEN module. Additional sensors can be daisy chained using RK4.5T-2-RS4.5T/S2503 shielded cables and VT2-FKM5-FKM5-FSM5 splitters.
A specific ARGEE program (to be provided with the demo software) communicates to the sensors. It contains the correct configuration setting for the TBEN and organizes the data in an efficient way.

To prepare the TBEN-S2-2COM-4DXP connect to a windows PC via Ethernet. On the PC start The Turck service tool (Version 3.2.2 or higher).



Set Expert view on and hit F5 to scan the Ethernet for TBEN devices.



Select the TBEN-S2-2COM-4DXP module, use the ARGEE (F8) button to pop up the Load ARGEE program window. Find the “Vibration box.arg” file and hit start to load the ARGEE program in the Module.

Use the module's webserver to set the Profinet station name to "tben-s2-2com-vib".

TURCK.COM For comments or questions, please email TURCK Support

TURCK

TBEN-S2-2COM-4DXP LOGOUT [ADMIN]

STATION >

- Station Information
- ! Station Diagnostics
- Event Log
- Ethernet Statistics
- EtherNet/IP™ Memory Map
- Modbus TCP Memory Map
- Links
- Station Configuration**
- Network Configuration
- Change Admin Password

COM 0 >

- Parameters
- Inputs
- Outputs

RS DATA/SCB 0.0 >

RS DATA/SCB 0.1 >

RS DATA/SCB 0.2 >

RS DATA/SCB 0.3 >

RS DATA/SCB 0.4 >

RS DATA/SCB 0.5 >

Station Configuration

Protocols

Deactivate EtherNet/IP™	<input type="checkbox"/>
Deactivate Modbus TCP	<input type="checkbox"/>
Deactivate PROFINET	<input type="checkbox"/>
Deactivate Web Server	<input type="checkbox"/>

EtherNet/IP™ Configuration

Activate GW Control Word	<input checked="" type="checkbox"/>
Activate GW Status Word	<input checked="" type="checkbox"/>
Activate Quick Connect	<input type="checkbox"/>

PROFINET Configuration

PROFINET Station Name	<input type="text" value="tben-s2-2com-vib"/>
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Modbus Configuration

NOTE: To disable the watchdog timer, enter 0. Also, the value is in millisecond (ms).

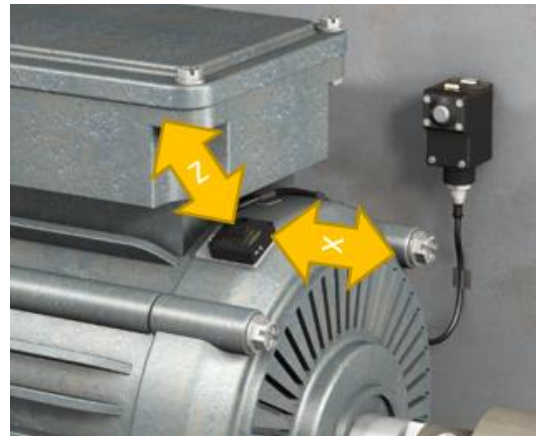
Now the TBEN can be connected to the Vibration monitor solution box.

Application description:

1. General

The Banner QM42VTx is an intelligent 2-dimensional vibration and temperature sensor. It samples the vibration at 8000 Hz during 2 seconds, then does a Fast Fourier Transform and makes the results of the calculation available in its internal registers. The QM42VT2 uses Modbus RTU protocol while the QM42VT1 uses a Banner propriety protocol to communicate to a DX80 wireless node.

The Vibration solution box monitors low frequency rms velocity in two dimensions (mm/s), high frequency rms acceleration in 2 dimensions (g) and temperature (°C). Increasing vibration energy in the low frequency (1st and 2nd harmonic to the motor frequency) usually indicate a problem with balance, alignment or fixation of the monitored machine. Increasing energy in the high frequency indicates a developing problem in the bearings. Increased temperature could indicate insufficient lubrication or already advanced damage to the bearings.



The vibration monitor box has a fixed sample rate. Based on that rate it collects real time values for very connected sensor. Each sensor gets a warning level and an alarm level for the five monitored parameters. The threshold levels can be set/modified by the authorized user. The authorized user can also start a baseline function that calculates the threshold based on average and Standard deviation. The thresholds are kept in persistent memory.

When new real-time values are available, the program calculates the status of the sensor:

- 0-No communication/grey:** All 5 parameters have exactly the same value as with the previous sample. Because of the resolution, this is statistically highly unlikely. When in Fast sample mode, communication status is not verified.
- 1-Good/green:** for all parameters that have a threshold configured, the actual values are lower than the threshold.
- 2-Warning/amber:** At least one actual value is above the warning threshold and none is above the alarm threshold.
- 3-Alarm/red:** At least one actual value is above the alarm threshold.
- 4-No threshold/blue:** No thresholds entered for any of the parameters.

The K50 on top of the Vibration monitoring show the status of the “worst” sensor. When any sensor goes in Alarm status the K50 sounds an alarm. The sound can be reset until a new alarm occurs or can be disabled permanently.

For every sensor, the thresholds for $V_{x_{rms}}$, $V_{z_{rms}}$, $A_{x_{rms}}$ and $A_{z_{rms}}$ can be calculated based on 100 consecutive samples. Warning levels are set to the Average value + 2 * St.Dev. The alarm levels are set to the Average value + 3 * St.Dev.

At the start and re-start of the threshold calculation, all concerned thresholds are reset to zero. After 10 samples, the thresholds are updated. After 100 samples the threshold calculation status is reset to zero.

All real-time values and thresholds are copied to a Network Variable List that is broadcast via UDP. The TCG20 has the possibility to write new values in the thresholds.

2. Overview/start screen

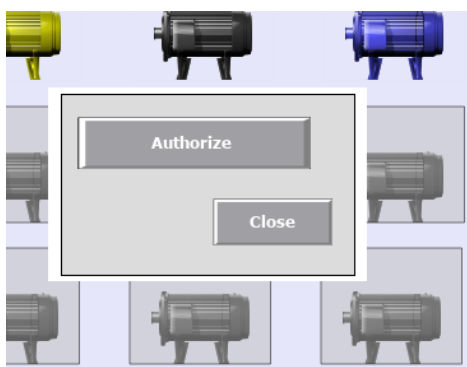


The “Show Disclaimer” has to be clicked once to show the disclaimer. Then, this button is no longer displayed.

The background template shows a Turck Logo. In the lower left corner is a *Home* button. In the lower right corner three buttons: *sound off*, *lock* and *language*.

Clicking the *Home* button in any screen brings back the overview screen.

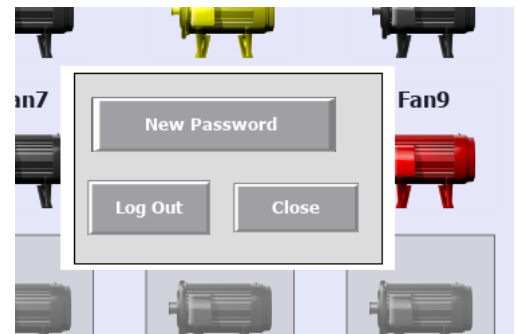
The *sound off* button switches the alarm sound off until another alarm threshold is passed.



Clicking *lock* button pops up a dialog that allows to login in as authorized user. The username is “admin” and the initial password is “admin”. When logged in as authorized user, an exclamation mark is shown next to the lock button.



Clicking the *lock* button as authorized user allows to change the password or to log-out. After 2 minutes of inactivity, the authorized user is logged out automatically.



Clicking the *language* button brings up a dialog to change the language. English, German and French language are supported. This can easily be changed in the TX Visu Pro project.

The overview screen shows 15 motors. A transparent square covers undefined motors. The defined motors have a color code that indicates the status. (grey, green, yellow, red or blue) Also the name given to the motor is shown.

Clicking on a motor leads to a corresponding trend screen showing two trends: low frequency velocity, high frequency acceleration. From the trend screen, it is possible to navigate to other trends.

From the overview screen, navigate to all other screens:

Setup, levels, monitoring, alarms and zoom.



There is also a button that gives access to some pdf files and a button that brings up a chrome web browser.

The overview also acts as screensver. After 5 minutes of inactivity, the overview screen is automatically selected.

3. Configuration



All values, except “Fast Sampling” are read-only for a non-authorized user. The authorize user can change any value, any time.

”Fast Sample” temporally sets the sample period to 2 seconds for demo purposes. If not reset manually, the sample rate will automatically return to the configured value after 15 minutes. Note that for QM42VT1 the reporting rate between the sensor and the node has a default of 15 seconds. This period can be made shorter, but that has a high impact on the battery lifetime.

The configuration screen shows the number of configured sensors (1 -15) and the sample period. A button shows if the sound is disabled.

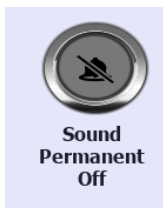


A slider allows to select one of the connected sensors.

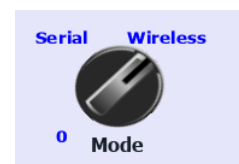
Every sensor has a name, a communication mode and an ID. For sensors with serial mode the ID is the Modbus slave ID, for wireless sensors it is the DX80 Node ID.



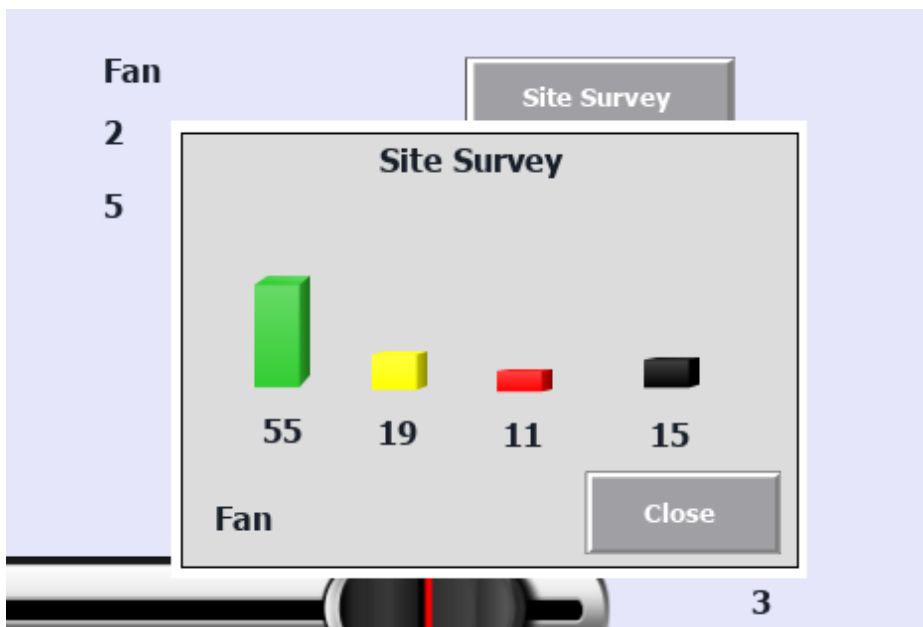
For the authorized user, Number of sensors, sample time, name and Node ID are read/write fields. Clicking pops up a keyboard.



The authorize user can also switch off the alarm sound permanently by clicking the button and set the communication mode for the selected sensor with the selector switch.



Site Survey



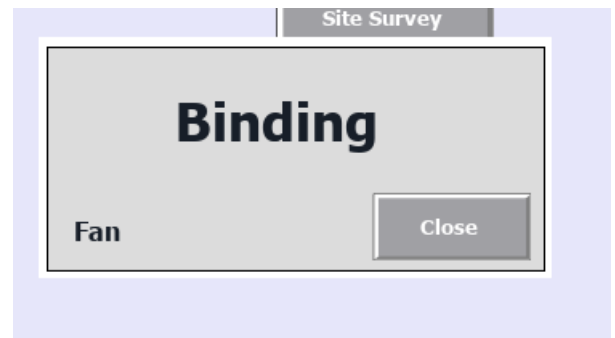
The *site survey* button is only visible when the selected sensor uses wireless communication. Clicking the button brings up dialog that gives information about the connection quality between that DX80 node and the DX80 gateway. Green indicates the percentage of transmissions with a good signal strength, yellow is average, red is poor and there is also a percentage for missed transmissions. Allow about 10 seconds for the first 100 test transmissions.

If the sum of poor and missed transmissions is higher than 20%, it will have a negative impact on the battery lifetime of the node.

Binding

When a wireless node is defined, it has to be “bound” to the DX80 gateway. Only the authorized user can initiate the binding process.

Clicking the *bind* button on the screen, puts the gateway in binding mode for the node ID currently selected on the slider bar. The node has to be brought in binding mode by triple click on the button (under the cover of the DX80 node). When the binding is successful, the yellow LED on the node will go on. The binding dialog on the HMI can then be closed.

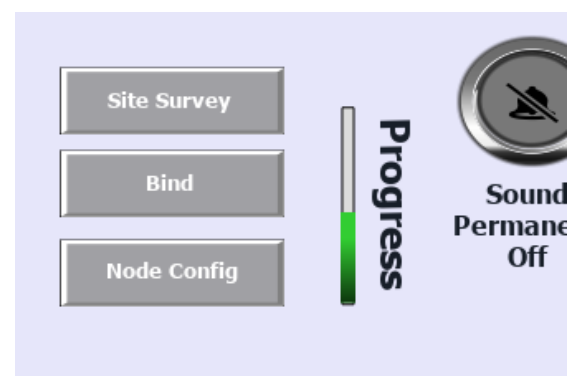


While the gateway is in survey mode or in binding mode communication to the other nodes is suspended.

Node Configuration

Once all wireless sensors are bound and on-line, the nodes need to be configured in order to provide the correct data. This procedure must be repeated after a new node is added.

Clicking the *node config* button starts the configuration sequence. That sequence takes several seconds and the progress is displayed on a green bar graph. On successful completion of the sequence, the button goes green for 3 seconds.

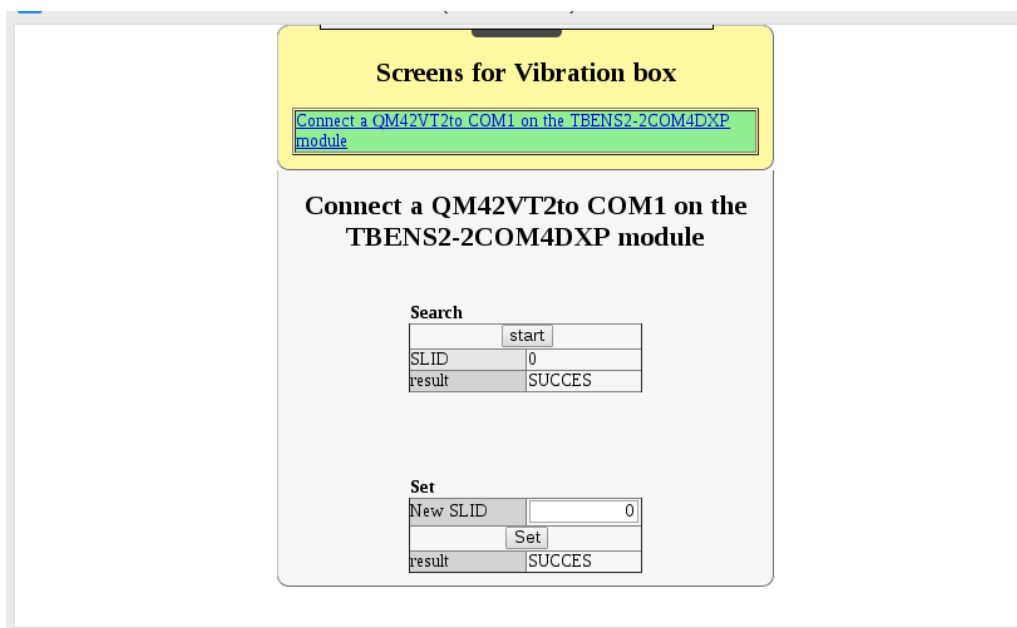


Serial connection

A new QM42VT2 sensor comes from the factory with Slave ID (SLID) set to 1. If more than one sensor is to be connected to the TBEN module, every sensor needs to have a unique SLID. On the TX707 click to *www* button to open the Chrome webbrowser.



The pre-configured homepage is the ARGEE HMI page of the 2COM module.



Screens for Vibration box

[Connect a QM42VT2to COM1 on the TBENS2-2COM4DXP module](#)

Connect a QM42VT2to COM1 on the TBENS2-2COM4DXP module

Search

start	
SLID	0
result	SUCCES

Set

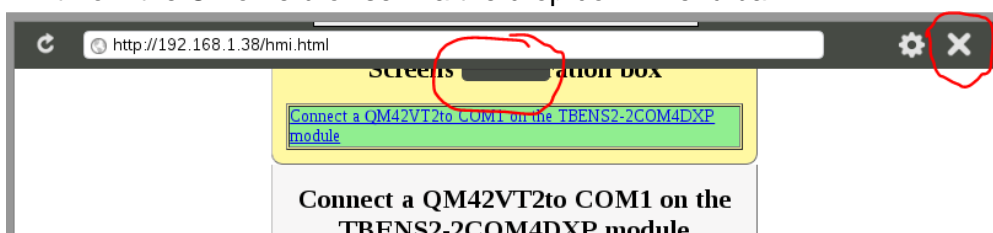
New SLID	0
Set	
result	SUCCES

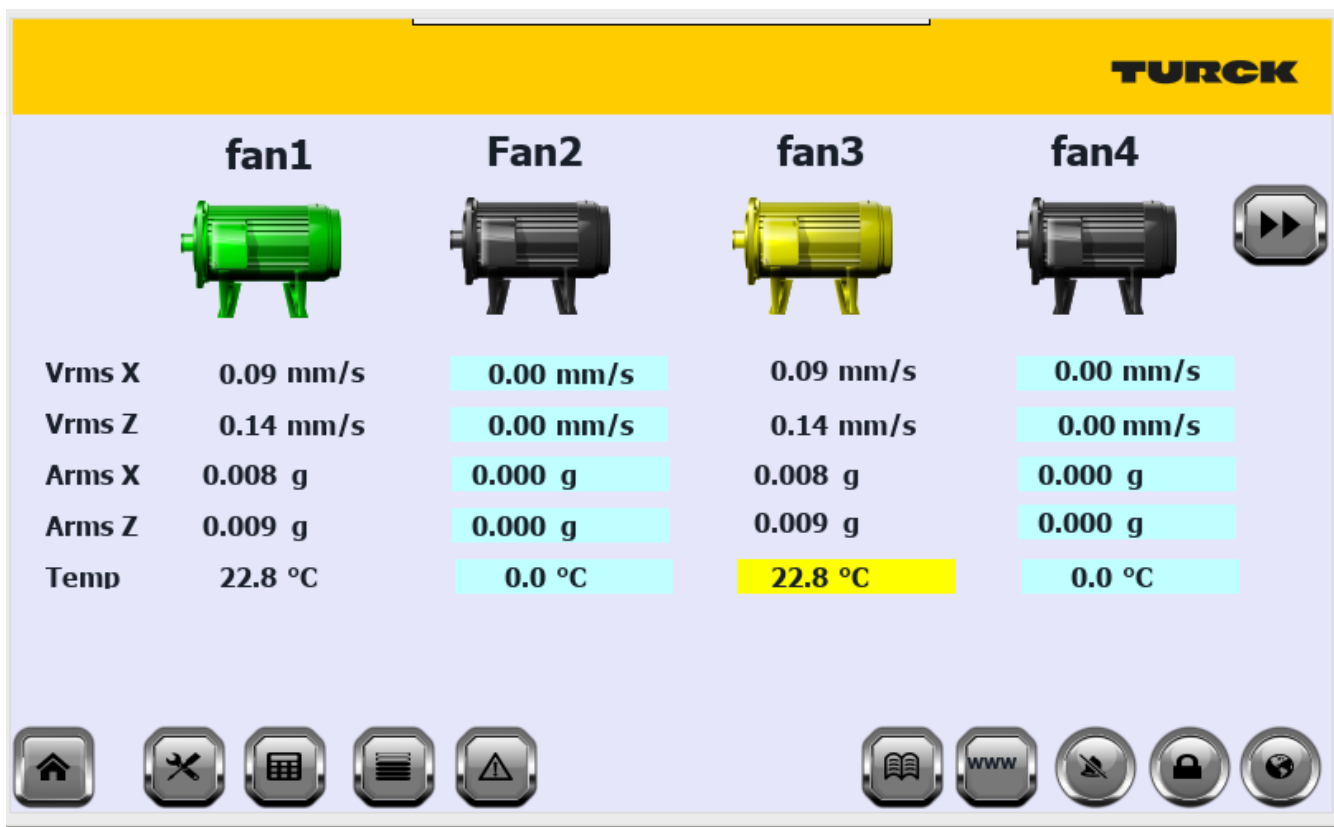
Connect to the new QM42VT2 sensor to COM1 on the 2COM module.

Click on the Start button to scan for the current SLID. Then, set the new SLID and click on the Set button.



Now you can connect the QM42VT2 sensor to COM0 and configure it in the vibration monitoring configuration screen.

Exit from the Chrome browser via the drop down menu bar.



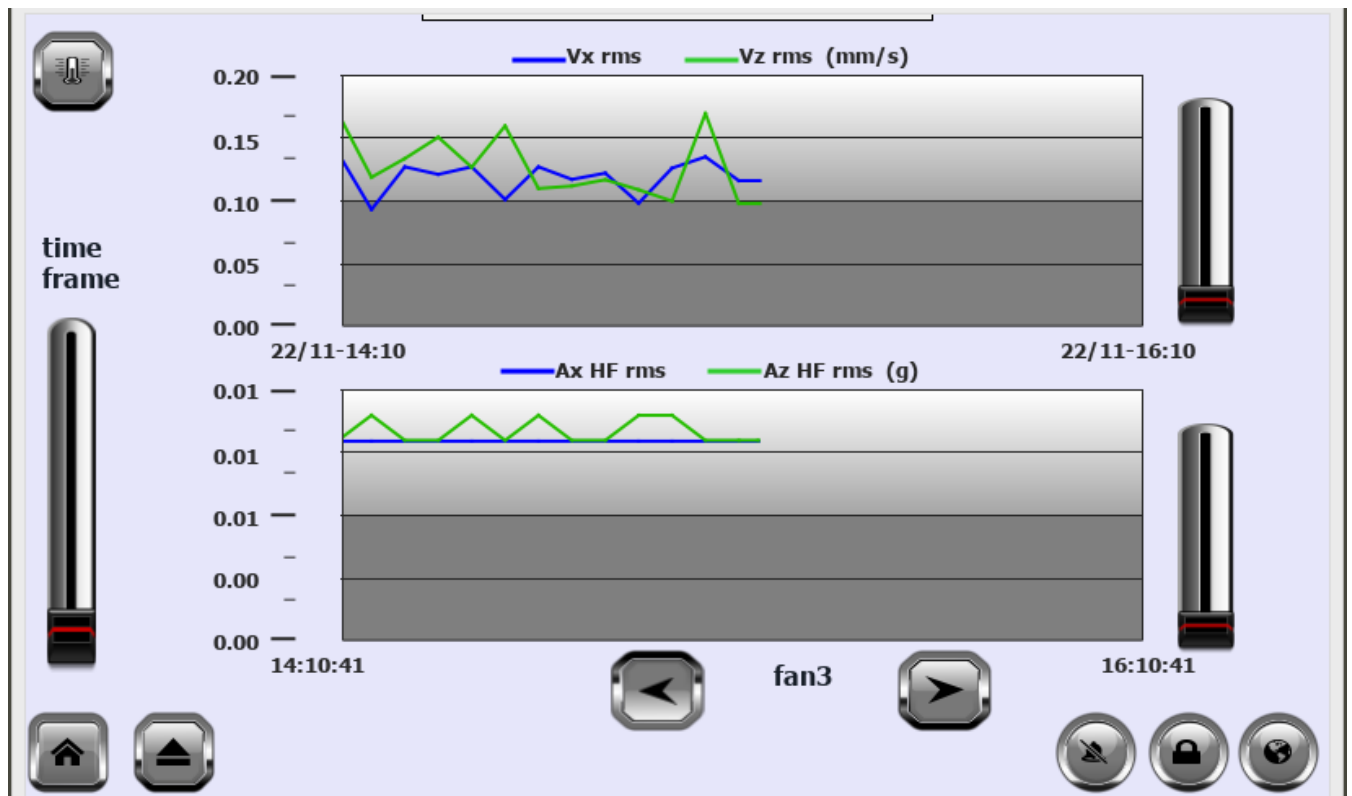
4. Zoom in

In the zoom view, the first four motors are shown. Below every motor are the actual values for Vrms, Arms and temperature. The values are shown against a background that corresponds to the status of that value: Blue if no thresholds are defined, yellow for warning and red for alarm.

If more sensors are defined  and  buttons allow to navigate between the other sensors.

5. Trend screen

To access the trend screen, click on a motor in the overview screen or a zoomed screen.

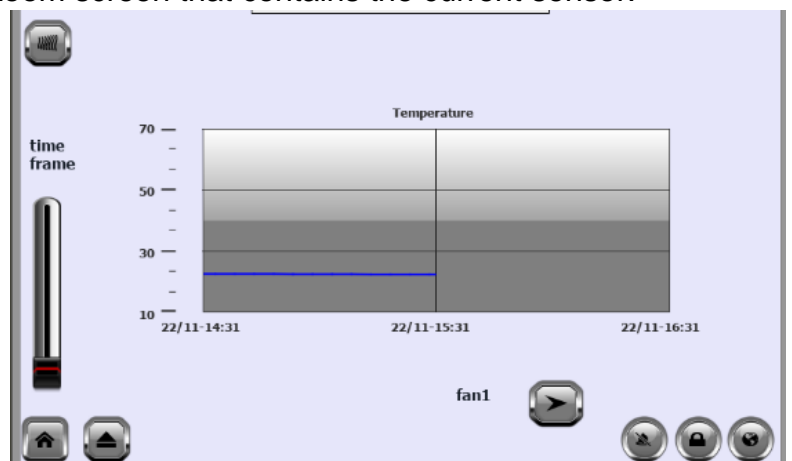


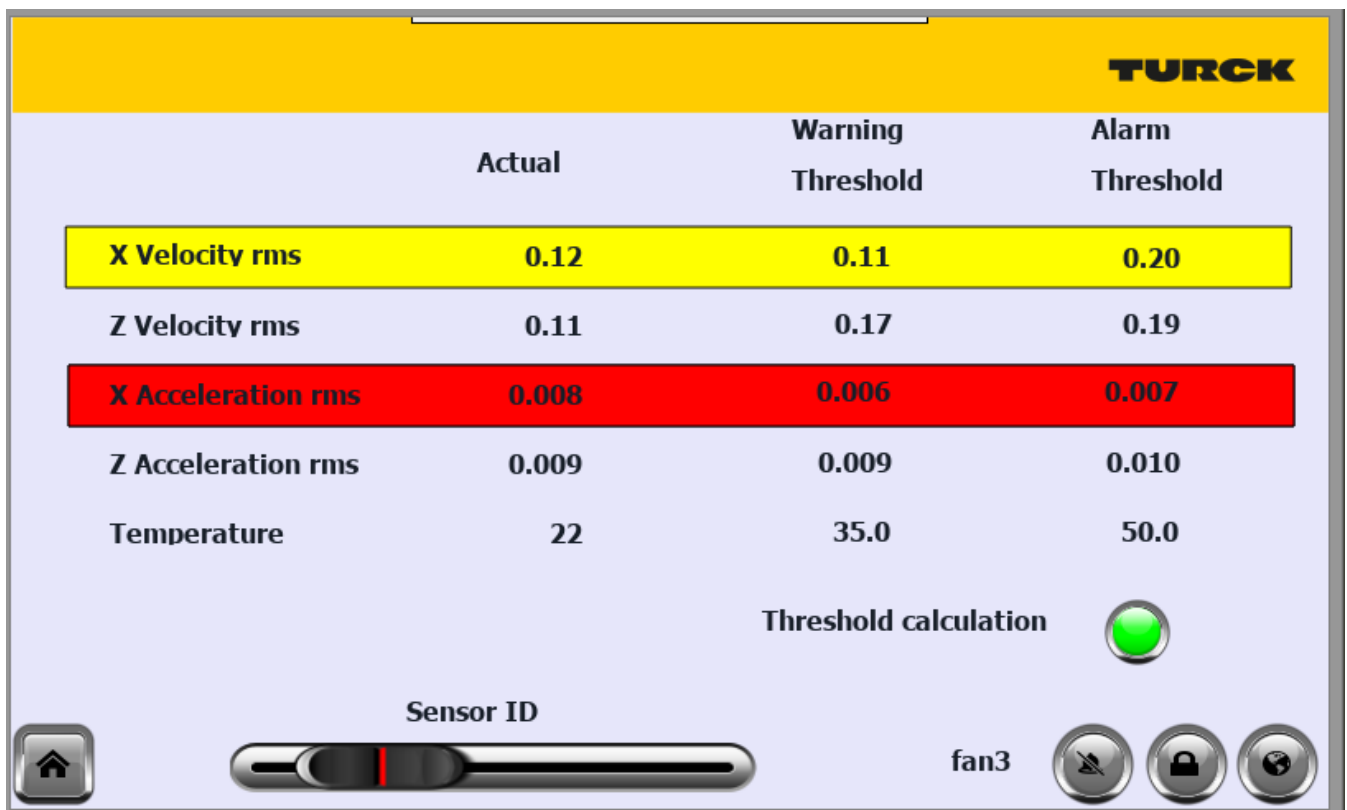
Two trends, each with two graphs show the evolution of Vrms and Arms in x and z dimensions. The graphs can be moved in x and y direction by simply dragging them. The slider bar on the right expands the time frame, those on the left expand the scale.

Navigate to other sensors' trends with the and buttons.

The button goes back back to the zoom screen that contains the current sensor.

The goes to the temperature trend of the same sensor. From the temperature trend, come back to the vibration trend with the button.



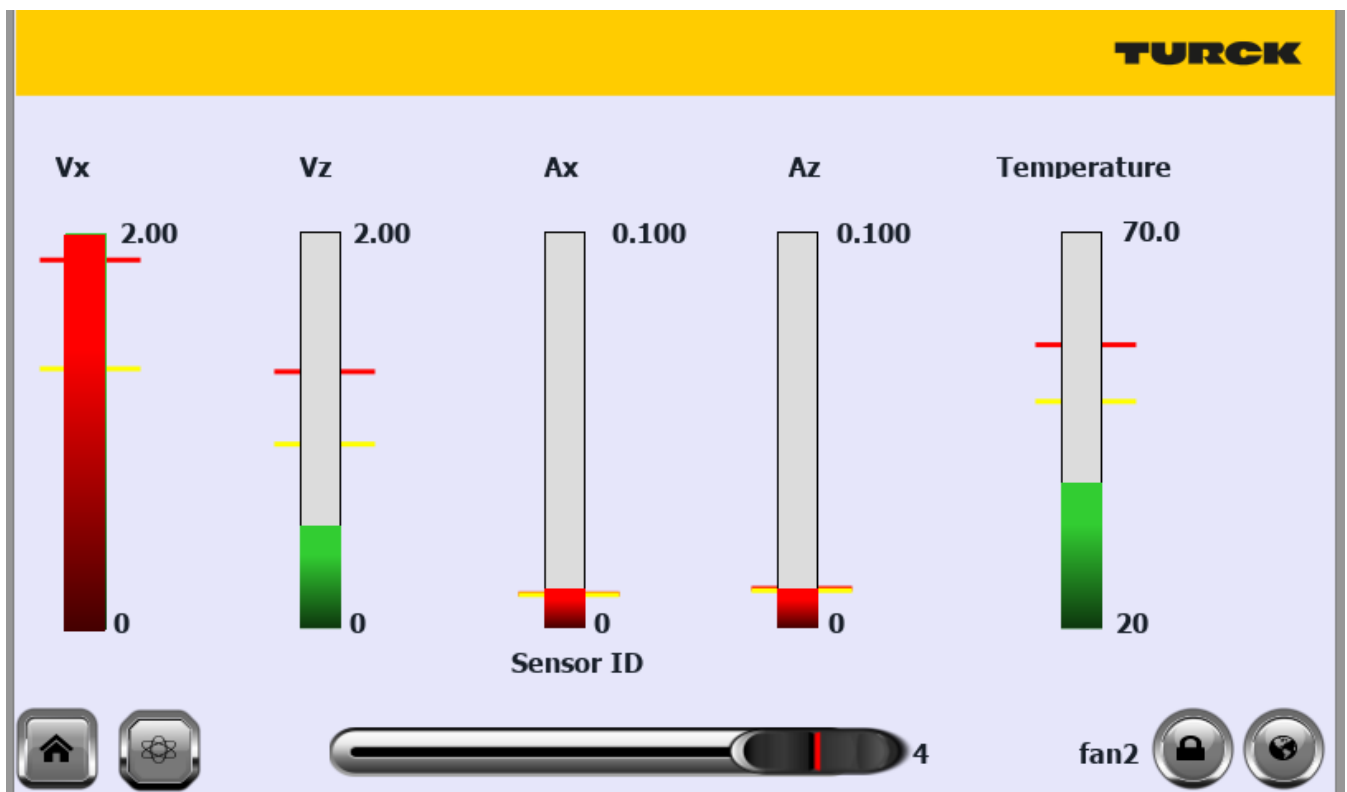
6. Levels

The level screen shows the actual values and the defined threshold levels. Use the slider to select the sensor.

The authorized user can enter new values for the warning and alarm thresholds.

The authorized user can also initiate an automatic threshold calculation. The button turns blue after it is clicked, goes yellow while calculating the samples and turns green after 100 samples have been processed. A number next to button shows how many samples are processed. At the start of the calculation, all thresholds (except temperature) are set to zero. Every 10 samples, the thresholds get a more accurate value, until the count is 100.

7. Monitoring



The monitor page shows the actual values for the different sensors as a bar graph. It also shows the alarm levels and the bar graph changes color depending on the status.



Brings up a dialog to adjust the maximum scale for the bar graph.



8. Alarm page

TURCK

Active Alarms - Acknowledge

Select	Time	State	Description	Severity
<input type="checkbox"/>	22 Nov 2019 16:05:24	Triggered	fan3 Warning Level	1-low
<input type="checkbox"/>	22 Nov 2019 16:05:24	Not Triggered Not Acked	Fan2 Alarm Level	5-high
<input type="checkbox"/>	22 Nov 2019 16:05:24	Triggered Not Acked	Fan9 Alarm Level	5-high

Check/Uncheck All Ack

Home Settings Calendar List Search Sound Off Lock Help

The Alarm page show abnormal conditions. Warnings show up against yellow background and disappear when the condition has returned to normal.

Alarms show up against a red background and need to be acknowledged by an operator. (tick the select mark and click on the “Ack” button). When a new alarm conditions occurs, the K50 on top of the box sounds an alarm. The sound is stopped by clicking on the *sound off* button. The sound also stops when the alarm condition disappeared.

If the condition is still present after it was acknowledged, it stays in the list against a white background.

TURCK

Active Alarms - Acknowledge

Select	Time	State	Description	Severity
<input type="checkbox"/>	16 Sep 2019 16:30:52	Triggered Not Acked	pump cooling Alarm Level	5-high
<input checked="" type="checkbox"/>	16 Sep 2019 16:31:04	Triggered Acked	fan2 Alarm Level	5-high

If the condition is back to normal but the alarm was not acknowledged, it stays in the list against a green background.

Active Alarms - Acknowledge				
Select	Time	State	Description	Severity
<input type="checkbox"/>	16 Sep 2019 16:31:22	Triggered	pump cooling Warning Level	1-low
<input type="checkbox"/>	16 Sep 2019 16:31:22	Not Triggered Not Acked	pump cooling Alarm Level	5-high