Remote Monitoring System Owner's Manual

toolmind™

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1. Introduction

Toolmind™ is a real-time monitoring system with visuals and signals that trigger when the system is operating outside the set parameters. This ensures quality parts are consistently produced while reducing scrap rates. Toolmind enables wireless monitoring of parameters (temperature, pressure, data output, relay) of multiple tools in one simple, easy to use package to increase user safety, with better process control.

How It Works: Sensor(s) are mounted into any G 1/8 BSPP port connecting to a pressure system. It sends a signal to the Base Station and/or Handheld(s) where the user can review if the monitored zone is operating within specified parameters.

Toolmind Security Features & Benefits:

- **Secure Information:** All data is safeguarded through self-contained wireless reducing risk of data breaches. No internet connection or cloud access required.
- **Interval Output:** Access to pressure system performance for quick reference and intervention at sensor intervals.
- **Local and Private Network:** Everything remains within a secure local network, exclusively accessible by the Toolmind system.
- **Multi-Tool Monitoring:** The Base Station can monitor up to 10 tools on the overview screen for a more complete image of how operations are functioning.

1.1. Intended Use

The Toolmind Remote Monitoring System, compliant with regulatory requirements, was developed to reduce the risk of scrap and make a safer working environment.

1.2. Disclaimer

Toolmind's ecosystem is an innovative Industry 4.0 solution designed to enhance efficiency and productivity. While every effort has been made to ensure the accuracy, reliability, and safety of the product, users should consider the following:

- **Use at your own risk:** The use of Toolmind products is at the discretion and responsibility of the user. Barnes Group Inc. does not guarantee any specific outcomes or results.
- **Consultation with experts:** Users are advised to consult with qualified professionals or experts in their respective industries before implementing Toolmind products into their application. Proper consultation can help tailor the product's integration to specific needs. Barnes Group Inc. does not guarantee that Toolmind products are appropriate for your application.
- **Limitations of liability:** Barnes Group Inc. and its affiliates shall not be liable for any direct, indirect, incidental, special, or consequential damages arising out of the use or inability to use Toolmind products, including but not limited to, damages for loss of profits, data, or other intangible losses. In no event shall Barnes Group Inc. or its affiliates be liable for any damages over the purchase price for the Toolmind products at issue.
- **Regulatory compliance:** Users are solely responsible for ensuring that their use of Toolmind products complies with all applicable laws, regulations, and industry standards governing their operations.

By purchasing and/or using Toolmind, the buyer and/or user acknowledges and agrees to these terms and assumes all risks associated with the purchase and use of Toolmind products. It is recommended to review this disclaimer periodically for any updates or changes.

1.3.   Regulatory Compliance

Compliance with the following standards is indicated by the corresponding mark on the product. The full text of declaration of conformities is available online. Scan the QR code to access.

Mark	Standard
CE UKCA	Barnes Group Inc declares that the Toolmind ecosystem products comply with directives (RED) 2014/53/EU and standards EN 61010-1:2010/A1:2016/C:2019, ETSI EN 301 489-1 V2.2.3 (2019-11), ETSI EN 301 489-17 V3.2.4 (2020-09).
RoHS COMPLIANT	This product complies with EU RoHS Directive 2011/65/EU and 2015/863/EU. Please dispose of this product in accordance with local regulations at the collecting point specified for electrical and electronic equipment.
FC	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.

Global Notice

Warning: In a domestic environment this product may cause radio interference, in which case, the user may be required to take adequate measures.

Canada Notice

The following Class A digital apparatus complies with Canadian ICES-003.

- PS1-BT-G18, PS2-BT-G18, PS3-BT-G18
- HHR-PS
- BASE-SENSE
- REPEATER-BT

FCC Notice

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 a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by Toolmind could void the user's authority to operate the equipment.

2. Safety

Training regarding these products can be requested by email to service@toolmind.com. The training can be requested at our location or yours and will cover precautions and best practices while working with Toolmind products.

⚠️   Before connecting the Toolmind to a pressure system, discharge the pressure.

⚠️   Position the Toolmind™ components where they will be protected from impact with machines in motion.

⚠️   Never exceed the maximum charging pressure marked on the pressure system.

3. Product Information

3.1. Sensor

Model Numbers: PS1-BT-G18, PS2-BT-G18, PS3-BT-G18

These sensors measure Pressure and temperature data then transmit via wireless communication. The sensors will not receive any information. Each sensor is programmed at the factory with a transmission interval, this interval defines the frequency between each transmission.

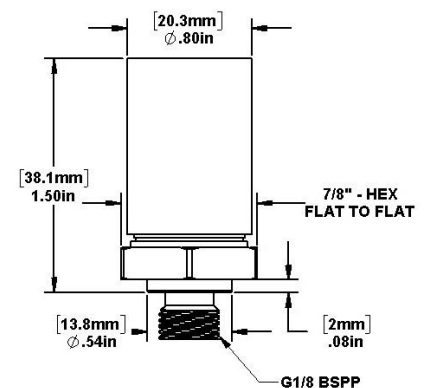**Wireless & Software Features:**

- Wireless Communication
- Compatible with all Toolmind's IoT system
- Normal, on-demand, and low power storage modes of operation
    - Normal mode transmits at transmission interval
    - On-demand mode transmits continuously for 10 seconds
    - Low-power sleep mode does not transmit
- Approximately 50-foot (15 meters) range pending obstructions

	PS1-BT-G18	PS2-BT-G18	PS3-BT-G18
Transmission Interval	20 sec.	40 sec.	0.5 sec.
Battery Life	Approx. 1.5 years	Approx. 3 years	Approx. 1 month

Mechanical Features:

- For use in liquid and gas mediums
- Reads 0 – 10,000 PSIG [0 – 690 bar]
    - (Full Scale =10000)
- Pressure accuracy ±1% FS @ FS
- Operating temperature: -4°F – 185°F; [-20°C – 85°C]
- Temperature accuracy ±5°F; [±3°C]
- G1/8 BSPP thread
- Internal Antenna
- Internal non-replaceable 3V Lithium Battery

3.2.   Handheld Reader

Model Number: HHR-PS

The Handheld Reader, when paired with a Toolmind Sensor, is designed to be an accompaniment to the Toolmind Base Station. The Handheld allows portable monitoring of sensors without the use of the Base Station. Using either on-demand mode or continuous scanning, you can pinpoint or let the data come to you. Featuring a rugged ABS housing, with a protective boot, the simple interface and user adjustable parameters allow you to check quickly and know that you have the correct pressure.
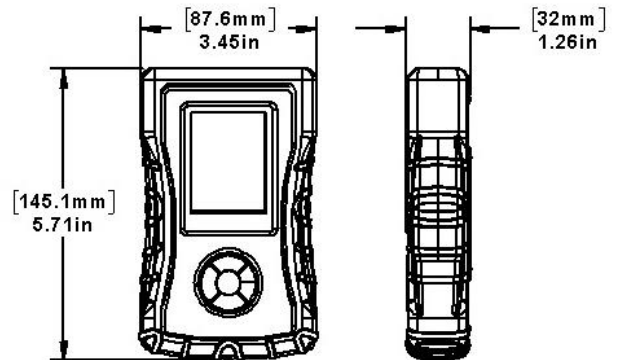
Wireless & Software Features:

- Wireless Communication
- Continuous, on demand, and storage modes of operation
- Basic Sensor naming capabilities
- Pressure and temperature monitoring
- Display units: F/PSI, C/BAR, or C/MPa

Mechanical Features:

- Rugged ABS enclosure
- Silicon protective boot
- USB-C rechargeable on-board battery
- Internal magnet
- Internal Antenna
- Internal Rechargeable 3.75V Lithium-ion Battery
- Charging accessories included,
    - o Specify region when ordering

3.3.   Base Station

Model Numbers: BASE-SENSE-01, BASE-SENSE-02

The Base Station allows you to remotely monitor your installed Toolmind Sensors. The Base Station can have up to 250 tools, with up to 12 Sensors monitored per tool, all on a 10-inch industrial touch screen display, with an easy-to-use HMI. Each Sensor can be renamed, and all monitored parameters have user adjustable limits (high and/or low). The Base Station also features an industry standard RS232 port so you can integrate to your PLC for decision-making or use the built-in relay to shut down operations if the system operates outside of the set parameters.
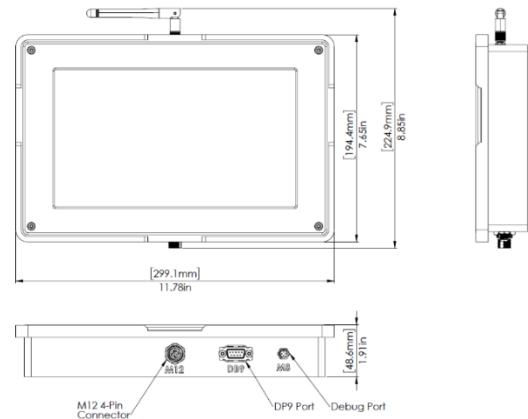
Wireless & Software Features:

- Wireless Communication
- Compatible with all of Toolmind's IoT system
- 250 tool library
- Capable of monitoring 12 Sensors per tool
- Sensor and tool naming functions
- Warning and fault options
- Adjustable high- & low-pressure limits
- Adjustable high temperature limit
- Fault options will trip relay
- Display units: F/PSI, C/BAR, or C/MPa
- Software Packages:
  - Standard Package, BASE-SENSE-01
    - Provided with an overview screen to monitor 10 tools at one time.
  - Storage Package, BASE-SENSE-02
    - Provided with a storage screen capable of monitoring the full ecosystem tools.

Mechanical Features:

- Rugged aluminum enclosure
- VESA 75 mounting pattern
- 10.1-inch touchscreen display
- M12 4-pin power/relay connector
- Built-in relay
- 24 VDC power requirement
- PNP and NPN adjustable in Settings
- DB9 RS232 connector for local data output
- External antenna for better range
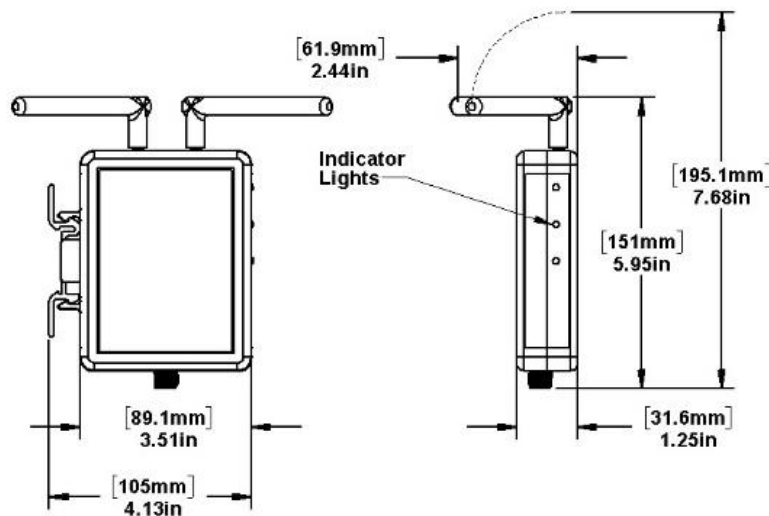- Access control (admin features)

3.4.   Repeater

In some instances, obstructions may impact the sensor's ability to reach the Base Station. The Repeater was developed to improve the connectivity of the Toolmind ecosystem.

Wireless Features:

- Wireless Communication
- Device that extends signal transmission distance; extended up to 300 ft. [91 m.]

Mechanical Features:

- Rugged ABS enclosure
- M12 4-pin power connector
- 24 VDC power requirement
- Dual external antenna for better range
- DIN rail mounting
- Optional wall mounting
- Led indicator lights

4. Installation

4.1. Sensor

Mounting the Sensor

Thread the Sensor into a B.S.P.P. G1/8 port. Using a 7/8-inch deep-well ½" drive socket, torque the Sensor to 6 ft.lbf +/- 0.5 ft.lbf (8.3 N.m. +/- 0.68 N.m.).

Powering the Sensor

Sensors are shipped in sleep mode to preserve the battery life. To activate the Sensor, place a magnet or the Toolmind Fob on the Sensor's end without threads shown in Figure 1. This will wake the Sensor from sleep mode.

Figure 1

4.2. Base Station

Mounting the Base Station

The Base Station has a 75 mm VESA mounting pattern on the back of the unit. Figure 2 provides information regarding the mounting pattern.
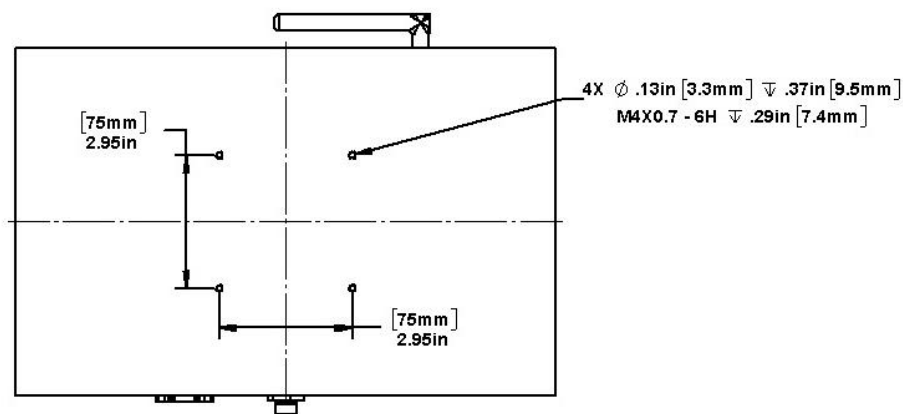

Figure 2

Powering the Base Station

The Base Station requires 24VDC to be powered through the M12 4-pin connection shown in Figure 3. Figure 4 shows the pin pattern for the power and the fault relay.
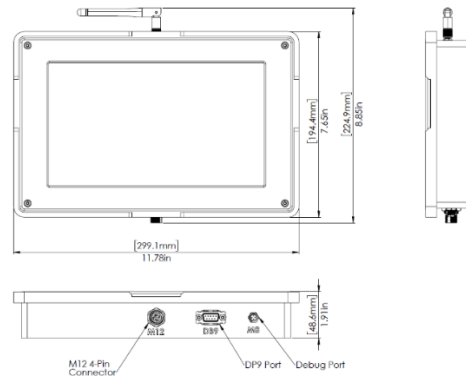

Figure 3

4-Pin Fault Relay

To wire the Base Station for relay functionality, the 4-pin connector supplying power should be wired to include either a normally open (NO) or normally closed (NC) pinout, see Figure 4 for pin designations.
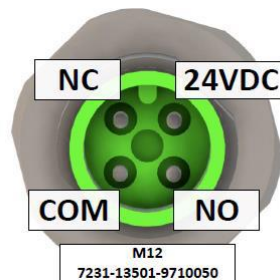

Figure 4

Connecting to a PLC

Connecting to a PLC, utilize the DB9 port shown in Figure 3 and connect to a communication protocol device (ie: ANYBus) via a DTE/DCE RS232 cable. See Figure 5 for pin out of the DP9 port. Follow the communication protocol device manufacturer's pinout documentation. **Note: If needed the data output uses LF+CR termination.**
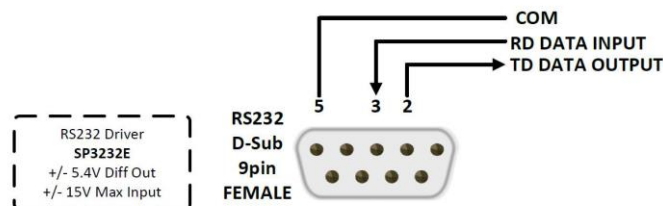

Figure 5

The example below references the setup for a ABC3007-A Anybus Communicator.

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Setting up an Anybus Communicator (ABC3007-A)

Once the Base Station is connected to the communicator, Connect a PC to the communicator through the "web config" port with an ethernet cable. On the PC, disconnect from all networks besides ethernet and set the ethernet network IP to Manual and set IPv4 address default as 192.168.0.10. Using HMSIPConfig software the communicator will be detected and should be listed. **Note: HMSIPConfig will not run if there is an OpenVPN on the PC.** Within the software click the web icon (looks like a sphere). The Serial Protocol is a Custom Produce / Consume using variable data lengths. Basic Settings should be adjusted to match the table below. Advanced settings are left as default.

Physical Standard:	Baud Rate:	Data Bits:	Parity:	Stop Bits:
RS-232	Select from list in "Settings"	8 data bits	None	1 stop bit

Setting up nodes is started by adding a node and naming it "Produce" and in the dropdown select the "add from new transaction template". This will open a new template which should also be named "Produce". Next you will drag the variable data block down into the field and set the settings as follows.

Fixed Field:	Length:	Delimeters:
Yes	8 bytes	None

Return to the Node and change update mode to "change on data" and offline option to "continue". Do these steps again to create a node called "Consume", then proceed to I/O Configuration. In I/O Configuration verify general area is disabled, that the Consume Node is placed on the right side with live list enabled, and the Produce Node is on the left side with enabled data exchange control enabled. The Communicator is now properly communicating with the base station. Navigate to diagnostics to see the results and verify the language is set to ASCII in order to read the data. Below is example format of the data you will see when heartbeat is enabled in the base station.

Example Format

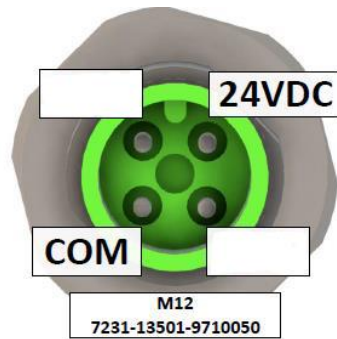$1

$2

$3

$4

{1,Tool #1,2,Sensor #2,32,69.44,3.00,OK}

$5

{1,Tool #1,2,Sensor #2,36,69.44,3.00,OK}

{1,Tool #1,1,Sensor #1,0,68.91,3.01,OK}

4.3.
Repeater

Powering the Repeater

The Repeater requires 24VDC to be powered through the M12 4-pin connection. In Figure 6, the pin pattern for the power can be seen.

Figure 2

Mounting the Repeater

The standard mounting for the Repeater is to snap it into a DIN rail. Another option is to use the provided clip to mount the Repeater to a wall. The clip is mounted to the wall using two screws. Next, the Repeater is snapped onto the clip.

5. Operations

5.1. Sensor

The Sensor system is a fully enclosed method of monitoring pressure and temperature inside of a pressure system. Data from the Sensor system can be viewed on a Handheld Reader or Base Station.

Usage

Mode	Activation	Function
Off / Sleep	Hold a magnet to the Sensor for 12 - 15 seconds.	While the unit is off, it will not send any data.
On Demand	Momentarily place a magnet on the Sensor.	The unit will send information in real time while the magnet is in contact until it enters sleep.
Normal	While Sensor is off- / sleep, hold a magnet to the Sensor for 2 seconds.	The unit will send the data at the Sensors transmit interval.

Preserving Battery Life

While the Sensor can be left on until the battery runs out, it is recommended that unless constant monitoring is needed, one should turn the Sensor off / put the sensor to sleep.

To do this, hold a magnet against the Sensor until either the Handheld or Base Station states power down. This should take roughly 12 - 15 seconds to occur. In off / sleep mode, the Sensor will not send data.

5.2.   Handheld Reader

Power-On

1. Press the OK button.
2. Wait for unit to power on.
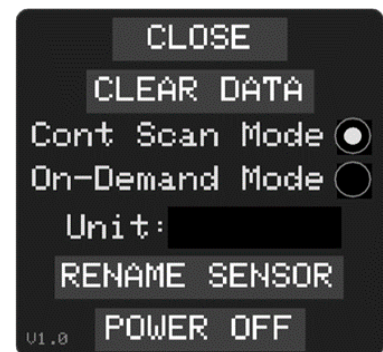   **Note:** If unit does not power, it may require charging.

Main Screen

The main screen will indicate the Handheld's battery level (lower left corner), the mode (lower right), the current pressure, battery voltage and temperature of the selected Sensor, when the unit last received data, Sensor MAC ID, and how many Sensors have been read (lower middle).
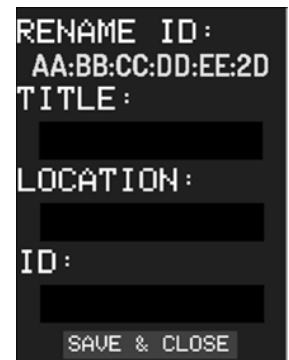
Settings Menu

1. Press the "Ok" button to enter the settings menu.
2. Use the up and down arrows to navigate the menu.
3. Clear Data: Select to clear all saved Sensor information.
4. Cont. Scan Mode: This mode continually scans for Sensors within range.
5. On-Demand Mode: Only updates when a magnet is placed on a Sensor. There is a magnet built into the end plate of the reader.
6. Unit: Change the unit of measurement pressure and temperature are displayed in.
7. Rename Sensor: Allows for simple naming of the Sensor.
8. Power Off: This will power the unit down.
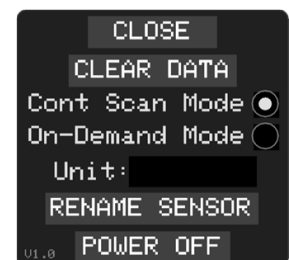
Renaming Sensors

1. Navigate to the settings menu.
2. Select "Rename Sensor" and press the "Ok" button.
3. Use the up and down buttons to select the desired Sensor and then press "Ok".
4. Use the up and down buttons to pick the desired label.
5. Press "Ok" to select the label and continue navigating the menu.
6. Once all labels are entered, navigate to "Save & Close" and press "Ok" to return to the settings menu.

* If in Mill mode there is a second page for naming and "NEXT" must be selected before "Save & Close" will appear.

Changing Units

1. Navigate to the settings menu.
2. Use the down arrow to navigate to the unit box.
3. Press the "Ok" button.
4. Use the up and down arrows to navigate through the unit options.
5. When the desired unit is shown, hit the "Ok" button. This will allow you to return to the settings menu.

Changing Handheld between Mill and Tool Mode

1. While the unit is powered down hold the down arrow.
2. While the down arrow is held press and release the ok while continuing to hold the down arrow.
3. The Screen will light up white before changing to a black background with and "Alias" option
4. Highlight the "Alias" field and press ok.
5. Use the up & down arrows to navigate to the desired mode.
6. Press "OK" to exit the "Alias" field.
7. Use the arrow to navigate to "DONE" and press "OK"

5.3.   Base Station

Power-On

The Base Station will automatically power-on when connected to 24VDC. It will default to the tool screen once admin mode is enabled. By default, the unit will remember the screen it was last on before powering down. If this is not desired navigate to settings and disable the remember screen setting.

Enable Admin Mode

Enable admin mode by holding the Toolmind access fob to the base station label. The words "Admin Enabled" will appear on screen.

Note: If the Base Station is left idle for 10 minutes, Admin Mode will be disabled, and you will need to use the access fob again.

The following actions can be completed with Admin Mode disabled:

- Select a tool from the tool selection screen.
- Assign tools to overview screen from tool selection screen.
- Dis/enable relay on overview screen.

Switching Units

1. From the tool selection screen, click the top right corner button labelled "Settings".
2. The unit settings are all available for selection:
    a. Pressure units available: PSI, BAR, and MPa
    b. Temperature units available: Fahrenheit (˚F), and Centigrade (˚C)

RS232 Communication

1. From the tool selection screen press the "Settings" button.
2. Select the checkbox for "Heartbeat." This is used for RS232 connections where the PLC requires constant communication to maintain an open channel. Heartbeat enables a 1 second pulse on the data output channel.
3. The right column has selectable baud rates for communications to the PLC. Ensure the unit baud rate is correct if data over the RS232 is required.

BASE-SENSE-01, Standard Package
      The standard package will transmit data of tools set on the overview screen (max of 10 tools) while the overview screen is being monitored, or a tool that has been selected to be monitored.

BASE-SENSE-02, Tool Storage Package
      The Tool Storage Package transmits data for all 250 tools while monitoring any page of the storage screen. When monitoring a specific tool the unit will only transmit data from that specific tool.
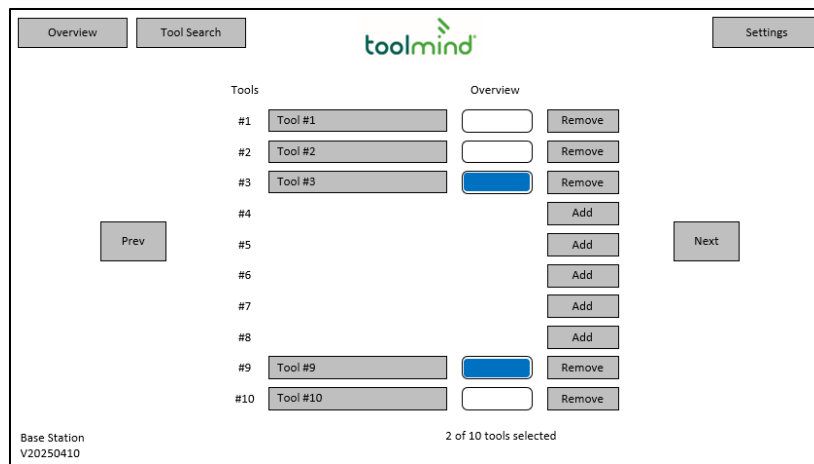
RS232 Commands

Commands that can be issued from over the RS-232 are in the table below:

Command:	Function Description:
$version	Specifies version
$,HBOFF	Disable heartbeat
$,HBON	Enable heartbeat
$B,"Baudrate"	Change Baud Rate – Baudrate Options: 9600, 14400, 19200, 38400, 57600, 115200
$T,"Tool number"	"Tool number" PLC control of active tool screen – Tools may be selected using either tool name string or numeric tool number, i.e. "01" or "02"
$OVT,"Tool Number"	Toggles the "Tool Number" onto the overview screen.
$OVC	Clear the overview screen.
$OVS	Go to overview screen.
$ECHO	Will inform what tools are and sensors are on the active screen, works on overview and tool screen.
$ALM,"Tool Number"	Toggles alarm for specified tool number.

Adding and Deleting a Tool

1. Navigate to the tool selection screen. On the right side of the list there will be buttons for adding, or removing tools.
2. Press the "Add" button across from the desired tool number to add a new tool.
3. To delete the tool and its data, press the "Remove" button, a pop-up will appear asking to confirm the decision.
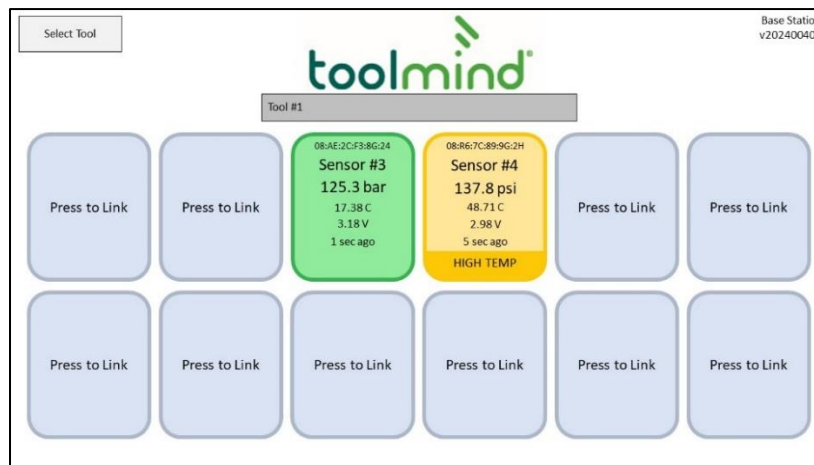
Selecting a Tool

1. Navigate to the tool selection screen.
2. To locate the desired tool, use the "Prev"(Previous) and "Next" buttons, or press the "Tool Search" button and type the number or name into the search box.
3. When you can see the desired tool on the tool selection screen, press the name of the tool to select the tool.

Naming a Tool

1. Navigate to the tool screen that is desired to be renamed.
2. Beneath the Toolmind logo, press on the tool name.
3. Using the keyboard that appears rename the tool and select "Save"

Linking and Unlinking a Sensor

1. From the tool's screen, select the desired sensor spot (1 – 12) on the tool dashboard, available spots are labeled with "Press to Link".
2. On the sensor setting screen, tap the "Press to Link" button, which will flash showing it is looking for a sensor and change to "Linking".
3. Hold a magnet or the Toolmind fob to the end of the sensor desired to be connected. After a few seconds the sensor will connect to that sensor spot. The sensor setting screen will now show the sensors MAC ID as well as its connection status.
4. To unlink a sensor simply press the button labeled "Press to Un-Link".

Naming Sensor

1. Navigate to the sensor screen that is desired to be renamed.
2. Beneath the Toolmind logo, press on the sensor name.
3. Using the keyboard that appears rename the tool and select "Save"

Configurating a Fault or Warning Condition

1. The fault and warning conditions can be set at the end of the sensor linking process or by selecting the desired sensor from the tool screen.
2. Horizontally from the desired limit, press the radio button next to the condition you want to activate (ie. High Temperature Limit - Warning).
   a. *Note: Off is the default condition.*
3. To set limits, select the value field and type the desired limit.
4. Once the desired conditions are configured, press the "Exit" button to return to the tool dashboard.
   a. *Note: Either fault or warning can be set per condition.*
   b. Multiple sensor spots can be created for the same Sensor.

Adding Tools to Overview Screen

1. Navigate to the tool selection screen.
2. Press the button between the Tool Name and Add/Remove button.
   a. *Note: In the bottom center there is a count of tools added to the overview screen. Max number of tools on overview screen is 10.*

Toggling Tool Relay (BASE-SENSE-01, Standard Package)

1. Tool Relays can only be enabled or disabled from the overview screen.
2. Navigate to the overview screen
   a. *Note: if the tool desired to toggle relay on is not on the overview screen review the above section on adding tools to the overview screen.*
3. Press the "Relay Disabled" button on the desired tool to toggle it to enabled, the button will change to "Relay Enabled".
4. Press the "Relay Enabled" button on the desired tool to toggle it to disabled, the button will change to "Relay Disabled".

Tool Relay (BASE-SENSE-02, Tool Storage Package)

- All 250 tools are monitored for faults and can trip the relay.

5.4.   Repeater

Power-On

The Repeater will automatically power on when connected to 24VDC. The indicator light will be visible if the unit has power.

6. Troubleshooting

6.1.   Sensor

Sensor Does Not Power-On or Show On-Demand

The Sensor battery may be drained to zero or may have bad connection. If this occurs upon receipt, contact service@toolmind.com.

Sensor Pressure Above 10,000 psi (690 bar)

The Sensor may have damaged internal components. If this occurs upon receipt, contact service@toolmind.com.

Sensor Pressure Floats Randomly

The Sensor may have damaged internal components. If this occurs upon receipt, contact service@toolmind.com.

6.2.   Base Station

RS232 Communication

When receiving data, if the information is not coming in the "Example Format" below, then several checks may be in order.

- Check that the DTE/DCE RS232 cable is not a null modem cable.
- Verify that the baud rate on the Base Station settings is set to the correct rate for your PLC.

Example Format: (Lines that start with "$" are the heartbeat counter, lines that start with "{"are Sensor data lines.) After "Sensor #" the data is included in the following order, Pressure, Temperature, Volts.

$1

$2

$3

$4

$5

{1,Tool #1,2,Sensor #2,32,69.44,3.00,OK}

$6

{1,Tool #1,2,Sensor #2,36,69.44,3.00,OK}

{1,Tool #1,1,Sensor #1,0,68.91,3.01,OK}

While setting up the RS-232 communicator, if connecting to the protocol converter for configuration isn't working, verify that network IP addresses are correctly configured and that any OPEN VPN ports are uninstalled/deactivated.

7. Disposal

This equipment must not be disposed of with unsorted waste. It is your responsibility to correctly dispose of the equipment at life-cycle-end by handing it over to an authorized facility for separate collection and recycling. It is also your responsibility to decontaminate the equipment in case of biological, chemical, and/or radiological contamination, so as to protect the persons involved in the disposal and recycling of the equipment from health hazards.

For more information about where you can drop off your waste of equipment, please contact your local waste management provider. By doing so, you will help to conserve natural and environmental resources and you will ensure that your equipment is recycled in a manner that protects human health.