

SMARTHUB Device Monitoring Unit



USER MANUAL



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1. GENERAL

1.1. Compliance and Certification

SMARTHUB is environmental and mechanical laboratory tested and certified.

FCC Compliance Statement:

This device 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 in residential installations. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio and television reception.

However, there is no guarantee that interference will not occur in a particular installation. If this device does cause such interference, which can be verified by turning the device off and on, the user is encouraged to eliminate the interference by one or more of the following measures:

- Re-orient or re-locate the receiving antenna.
- Increase the distance between the device and the receiver.
- Connect the device to an outlet on a circuit different from the one that supplies power to the receiver.

	WARNING! Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
	WARNING! Tablet, RF device, lithium battery, electric device 24V (AC/DC).
<p>This device complies with FCC Rules Part 15: Operation is subject to two conditions:</p> <ol style="list-style-type: none"> 1. This device may not cause harmful interference, and 2. This device must accept any interference that may be received or that may cause undesired operation. 	

To comply with FCC Section 1.310 for human exposure to radio frequency electromagnetic fields, implement the following instruction: A distance of at least 20 cm between the equipment and all persons should be maintained during operation of the equipment.

1.2 Statement of Conformity

The SMARTHUB unit and spindle speed sensor are IP67 compliant.

The SMARTHUB device meets the following standards:

European Standards (CE)

- EMC: EN 301489-1/17
- Radio: EN 300328 V 1.8.1
- Safety: EN 61010-1:2010




American Standards (UL)

- EMC: FCC Part 15 B
- Radio: FCC Part 15 C
- Safety: UL 61010-1

Japan / Singapore Standards

- Radio: Law No. 31
- ARIB STD T-66

1.3 Safety Warnings

	<p>Read the Manual:</p> <p>Safety of the operator is a main concern. Avoid accidents by reading the safety alerts and taking a careful approach to handling the equipment. The operator can avoid many accidents by observing the following precautions. Review the safety instructions of the manufacturer and all organizations responsible for the prevention of accidents.</p>
	<p>Ensure the Following:</p> <p>The work area and area around the CNC machine are free of obstacles. The work area is properly lit. The equipment is operated only by a responsible adult trained in its operation. The equipment is not operated by a person under the influence of drugs or alcohol. The equipment is not operated by a person with any illness or physical condition that might reduce reflexes or awareness and increase exposure to risk. Before beginning operation, install all of the safety devices prescribed by the manufacturer.</p>
	<p>Warning:</p> <p>Always use safety glasses or protective screens to protect your eyes.</p>

1.4 General Overview

The SMARTHUB is an innovative real time data monitoring, processing, and switching unit for safe, efficient operating of the HSM Jet Spindle (SPINJET/Typhoon/TR speed increasers) installed on CNC milling or turning centers.

1.5 SMARTHUB Ecosystem

SMARTHUB receives a wireless 2.4 GHz signal from the Spindle's on-board speed sensor RPMs and other data (battery, RSSI, hours, etc.), process it and relays it to the machine PLC. The SMARTHUB communicates directly with the machine PLC via protected electric wire/cable. SMARTHUB communicates directly with the machine PLC via protected electric cable.



The SMARTHUB relays data, signals, warnings and alarms to the Tablet Display/APP. RPM status of the spindle (rotating or stationary), enables or disables the door lock mechanism as a safety measure. Additional functions include stopping the work cycle if speed is too low. Extra device monitoring sensors may be added, such as heat, vibration, strain, pressure, etc.

Data is displayed and managed via the user-friendly Tablet/ Mobile APP. Operators can view a real time speed graph screen, along with short-term speed history, sensor battery levels and RF signal strength.

1.6 Main Features

- SMARTHUB monitors up to 4 devices working simultaneously and can store another 128 devices in stand-by mode.
- SMARTHUB continuously monitors real-time RPMs, battery level, RSSI, speed alerts, device ID, working hours, and also displays tools installed and machine ID.
- Four colored LEDs indicate operating modes.
- SMARTHUB casing is compact, streamlined, robust, and IP67 sealed.

1.7 Basic Configuration — 5 PLC I/O SIGNALS:

- Low RSSI
- Low Battery
- High / Low Speed Limit Exceeded
- Spindle Speed \neq 0
- Power ON

1.8 SMARTHUB Case Contents

- One SMARTHUB Unit
- UL Cable (one meter), male Amphenol connector at the SMARTHUB end, stripped for wiring at the other end. Longer cable or additional connectors are available upon request
- User Manual and Installation Guide



1.9 Display Tablet

The Display Tablet is a sealed, IP68 rugged model, featuring a slim, light-weight casing and convenient holding strap. It comes in a protective carry case, and includes, a charger, USB cable and manufacturer's instructions booklet.

NOTE: The Display Tablet is ordered and packaged separately.



1.10 SMARTHUB APP

The user-friendly APP has been preinstalled on the Display Tablet.

The software provides:

- Operating status and position of Jet Spindles in the ATC magazine
- Monitor and display of spindle status (running or fully stopped), real-time RPMs, short-term RPM history screen, spindle transmitter battery levels, signal strength and spindle working hours
- Up to 4 spindles operating simultaneously
- Warnings and alarms: Low/high RPM limits
- Manual programming:
 - Adjustable low/high speed limits
 - Cutting tool information:
 - Work station data
 - Spindle I/D number
 - Machine identification data



1.11 HSM Jet Spindle

Colibri's coolant-driven HSM Jet Spindle, tradenames (SPINJET/Typhoon) are packaged and sold separately.

Please refer to the HSM Jet Spindle User Manual for installation and operating instructions.



2. INSTALLATION

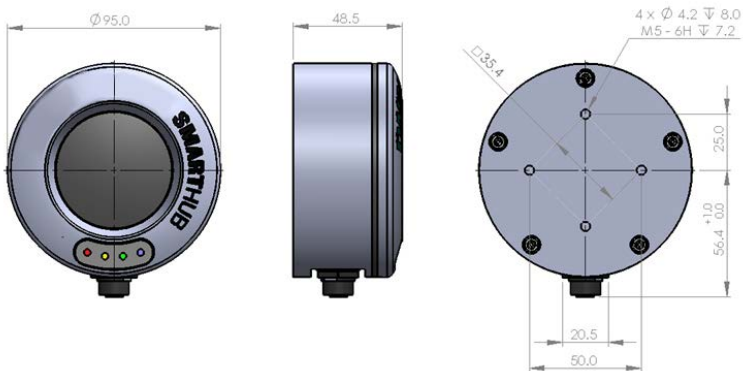
The SMARTHUB unit connects with all common PLC I/O ports and takes up only a small area for mounting in the CNC machine. It requires minimal mechanical installation.

2.1. System Requirements

- 24V (AC/DC) xxx [mA] max power feed line
- 5 x I/O port types
- Mounting placement: Stationary position with direct, unobstructed Wi-Fi access to the machine spindle sensor
- Mounting holes according to mechanical mounting layout schematic
- Display Tablet charging: Standard 220/110 50Hz socket

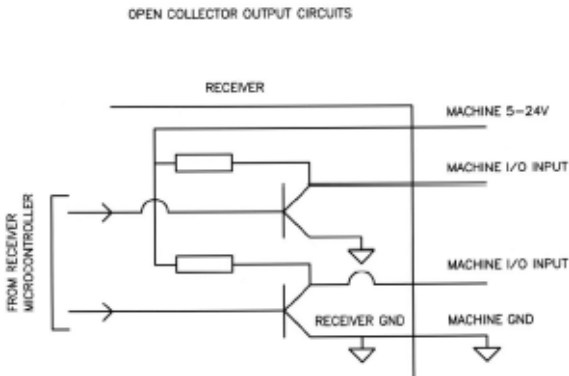
2.2. Mechanical Installation

- SmartHUB should be mounted inside the machine workpiece processing cabinet.
- The back side of SMARTHUB unit has 4 standard M5 threads to interface with a mounting bracket (not supplied), or cabinet wall.
- For the maximum RF performance, it is recommended to install the SMARTHUB on the back wall of the processing cabinet, with logo facing outwards.
- SMARTHUB should be installed in a vertical position with connector facing downwards.
- Although designed to flush excessive coolant in a 90° vertical position, it is recommended to install at a slight tilt (5-25 degrees) facing downwards, to rush coolant and chip evacuation when needed.
- SMARTHUB unit includes a 1 meter cable with male connectors at both ends: Amphenol 12-08PMMS-SF8001.



2.3. Electrical Installation (wiring)

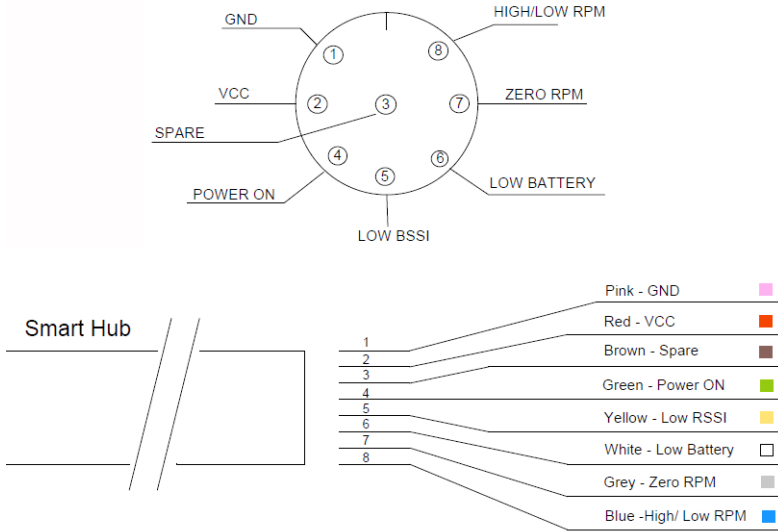
Principal Signals Electrical Circuit Diagram



2.4. Signals Control

Sealed (IP certified), the SMARTHUB Unit is powered by a 24VDC from the CNC machine electric cabinet, providing signals in discrete control mode (connected to PLC I/O's), or optionally send data packs via RS232 serial communication.

2.4.1. Signals Wiring

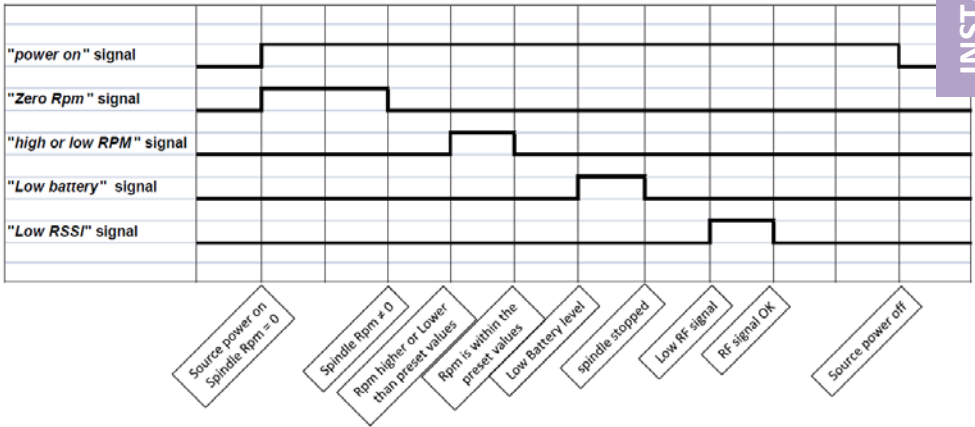


- **POWER ON:** System is ON. 1 when system is on 0 when no power feed.
- **LOW RSSI:** Weak signal strength. Signal is high when RSSI is weak; signal is low when RSSI OK.
- **LOW BAT:** Low battery in spindle transmitter. Signal is high when battery level is low; signal is low when the spindle stops.
- **ZERO RPM:** Spindle is stopped – may be used to control machine door latch (safety). 1 when power is on and spindle speed = 0.
- **HIGH/LOW RPM:** Speed either lower or higher than the preset limit. Signal is high when high or low limit preset values are exceeded, Signal low when speed returns to normal.

NOTE: Additional signals available upon customer request.

2.4.2. Signals Time Chart

High/Low RPM limits can be selected by using default values for each spindle type, or by manually programming the desired



limits.

2.5. LED Panel Indicators

The SMARTHUB has a 4 colored LED panel indicators that signify functionality modes or possible fault. After powering up, LEDs will turn on for 3 seconds while performing a self-test procedure.

- **GREEN LED** stays lit permanently, as long as the device is powered.
- **BLUE LED** lights up when the Bluetooth module is ON and functioning properly.
- **YELLOW LED** lights up when SMARTHUB is receiving data from a revolving spindle.
- **RED LED** will blink if there is an alert or warning status from a revolving spindle.

	Blue	Green	Yellow	Red
Power up - 3 seconds	ON	ON	ON	ON
No Active Spindle	ON	ON		
Active Spindle	ON	ON	ON	
Active Spindle with alert/warning	ON	ON	ON	BLINK

2.6. Validation Test Procedures

2.6.1.Validation Test 1 (using external power supply)

a.Connect the device to the external power supply

- Connect the AC adapter to the electric socket
- Connect the BLACK alligator clip to the device PINK wire (ground)
- Connect the RED alligator clip to the device RED wire (power)
- The unit should power on, with all LED lights flashing for 3 seconds

b.Test default signals (default values)

- Remove all batteries from simulation tags
- Connect the multi-meter (fluke) BLACK line to the PINK wire (ground)
- Do not disconnect the adaptor line
- Turn on the multi-meter and set dial to DC detection

Power-on (GREEN wire)	Default state is HIGH	Touch GREEN wire with multi-meter RED point	Reading should show 22.5V ~ 23.9V
Low-RSSI (YELLOW wire)	Default state is LOW	Touch YELLOW wire with multi-meter RED point	Reading should show ~ 0V
Low-battery (WHITE wire)	Default state is LOW	Touch WHITE wire with multi-meter RED point	Reading should show ~ 0V
Zero RPM (GREY wire)	Default state is HIGH	Touch GREY wire with multi-meter RED point	Reading should show 22.5V ~ 23.9V
High/low RPM (BLUE wire)	Default state is LOW	Touch BLUE wire with multi-meter RED point	Reading should show ~ 0V

c.Test live signals (during spindle operation)

- Make sure SmartHUB power is on (BLUE and GREEN lights should be lit)
- Turn on Tablet display
- Tap "Devices" to see the list of connected devices
- Remove all devices by tapping the "X" button
- Insert battery into one simulation tag (note ID on the side)
- Connect the simulation tag to the SmartHUB by tapping "Add Device" on the application and entering simulation tag ID (1003 / 1004)
- Check the tag is connected by returning to the main screen. If no information is displayed on the main screen, reboot Tablet and reconnect
- When simulated graphs appear, check the signals to see if the state (High/Low) changes as follows:

1. Zero RPM (GREY wire) - default state is HIGH - touch the GREY wire with the multi-meter RED point - reading should show $\sim 0V$
2. High/low RPM (BLUE wire) - default state is LOW - touch the BLUE wire with the multi-meter RED point - reading should show $22.5V \sim 23.9V$ if spindle speed is out of limits

NOTE: The SmarthUB should be in proper working order if the above tests have been performed correctly.

2.6.2. Validation Test 2 (using the machine power supply)

- Disconnect the external power supply
- With machine maker employee, connect the PINK wire to the machine ground
- With machine maker employee, connect the RED wire to the machine power
- Perform both DEFAULT and LIVE SIGNAL tests again

2.7. Post Installation Procedures

SMARTHUB is designed to operate automatically in the presence of an RF transmission signal from a paired device (spindle).

2.8. Operating in Multiple Machines

Multiple SMARTHUB units may be installed (one per machine) in different machines located in close proximity, however certain limitations may apply. The Tablet APP recognizes more than one active SMARTHUB and will automatically change the main page display from the 'single machine view' to the 'multiple machine view'.

3. MOBILE APP

The Application (APP) is a proprietary, closed software program that has been preinstalled on the Display Tablet. It is specially designed for operation with the SMARTHUB ecosystem to monitor and display all existing functions. It also allows the operator to input and alter data such as connections, presets, alerts, updated working conditions, etc.

3.1. APP Screens

To enter information where needed in any screen, tap the field and a keyboard will pop up.

- **Welcome Screen**

Upon powering up the Tablet, a welcome screen is displayed for 5 seconds, until the application is loaded.



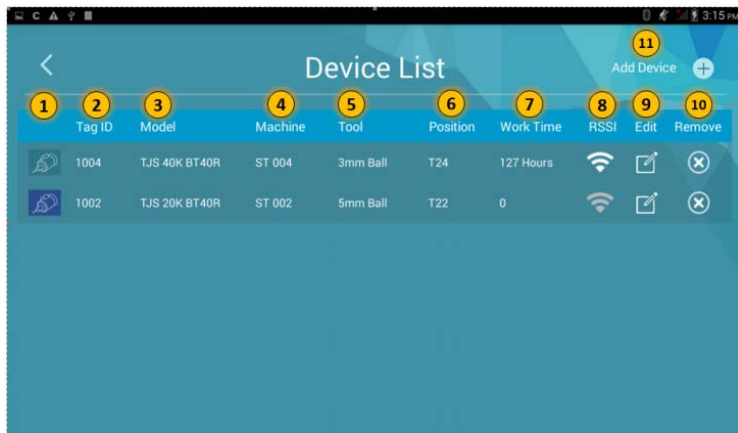
- **Add New Device Screen**

1. **Sensor ID:** Tool ID printed on the side of the Sensor (4 characters), mandatory.
2. **Tool Position:** Tool's position in the tool magazine.
3. **Cutting Tool:** Description of cutting tool.
4. **Device SN:** Serial number of the spindle.
5. **Model:** Spindle model selected from drop down list.
6. **Machine:** Name of the machine operating the spindle.
7. **Speed Limit:** This field sets the default speed limits. If the spindle rotates outside the allowed speed limits an alert will be generated. The 'Automatic Setting' uses system default limits, while the 'Manual Setting' allows the user to enter custom speed limits.
8. **Low Limit:** Custom speed limit low range.
9. **High Limit:** Custom speed limit high range.
10. **Cancel:** Cancel adding new device.

11. **Store Device:** Save new device settings to the system.

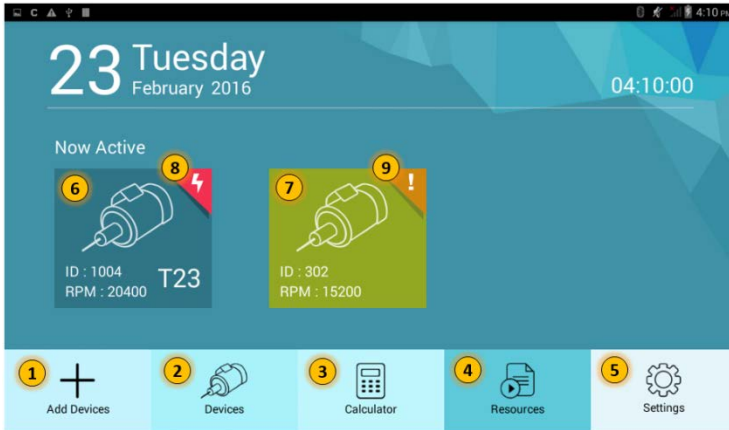
- **Device List Screen**

After spindle is stored, the Device List screen will appear, listing all connected spindles.



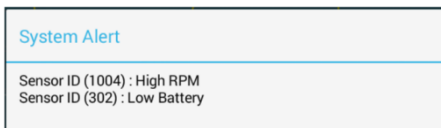
1. **Spindle Icon:** Represents the type of spindle used.
2. **Tag ID:** Sensor ID, printed on the side of the Tag.
3. **Model:** Sensor model.
4. **Machine:** Name of the machine.
5. **Tool:** Type of tool.
6. **Position:** Position of the spindle (sensor) in the tool magazine.
7. **Work Time:** Total spindle work time (hours).
8. **RSSI:** Signal Strength Indicator. Grey when sensor is not active or transmitting.
9. **Edit:** Press icon on any line to edit spindle properties.
10. **Remove:** Tap icon on any line to disconnect the spindle.
11. **Add Device:** Tap icon to connect another spindle.

- **Active Tags Screen**



1. **Add Device:** Tap to enter spindle properties and connect a new device.
2. **Device List:** Tap to view list of devices currently connected.
3. **Calculator:** Not functional in this version.
4. **Resources:** Tap to view support documents and help videos.
5. **Settings:** Tap to view or update system settings.
6. **Active Spindle:** Tap to display active spindle rotation speed charts.
7. **Active Spindle:** Displays additional active spindle.
8. **Alert:** Indication of High/Low RPM.
9. **Warning:** Indication of Low Battery or Low RSSI.

Note: Tap the Warning/Alert sign to view more detailed status information.



- Graphs Screen



1. **Minimized Graph:** RPM graph of an active spindle/sensor, tap to enlarge.
2. **Minimized Graph:** RPM graph of an additional active spindle/sensor.
3. **Main Graph:** RPM Graph of selected spindle/sensor. Press and drag to zoom.
4. **Upper Speed Limit:** Dashed line represents the upper speed limit.
5. **Lower Speed Limit:** Dashed line represents the lower speed limit.
6. **Warning / Alert:** Icon appears to indicate an active warning or alert.
7. **Battery Status:** Battery value. Less than 10% activates a warning.
8. **Signal Strength:** Icon indicates sign strength from all bands filled white (strong signal) to all bands grey, (weak or no signal).
9. **RPM Reading:** Most recently measured RPM value from selected spindle.
10. **Station:** Machine name.
11. **Cutting Tool:** Cutting tool type.

4. MAINTENANCE

The SMARTHUB unit is free from maintenance. It is however recommended to periodically wipe the face of the unit with a clean cloth, to ensure colored LED indicators are unobstructed by cutting fluid residue and easily visible.

- **Recommended Operating Environment:** Temperature Range: 0 - 50° C
- **Storage Conditions:** The SMARTHUB unit must be stored in conditions meeting the following requirements.
 - Sheltered from possible adverse weather conditions
 - Ideal storage temperature range: 15 °C to 27 °C
 - Humidity range: 30% to 60% relative humidity (RH)



Warning:

It is strictly prohibited immerse the SMARTHUB in a fluid bath.

5. FAQs

Review the section MOBILE APP for information about display screen alerts and management. Answers to common questions appear below.

When is the High/Low Speed Warning Signal activated?

This signal will activate when spindle RPMs are either higher or lower than the pre-set value programmed by user or automatically set by the program when selecting one of the spindle models preprogrammed into the system.

What do the Speed Signal Indications actually mean?

- Low pressure (low speed)
- Over pressure (high speed)
- Heavy load on the spindle or incorrect machining conditions, spindle malfunction (low rpm's)

What are the High/Low Speed Warning Signal Options?

- Option 1: Stays as visual warning on screen, until the operator acknowledges it.
- Option 2: Stop cycle until machine operator checks what is wrong.

Why is the Low Battery Signal warning always lit?

- The "low battery signal" timing is triggered by the battery condition, but goes back to zero level when spindle stops transmitting (stops)
- If battery was not replaced when spindle operation resumes; (rotational speed + spindle data transmission) a "low battery" warning will appear, and remain on until spindle stops again and so on, or until battery is replaced.
- Therefore the trigger for that signal is the low battery level and the terminator is "spindle stop"
- The battery life is long, at least ~750 hr.
- It is highly recommended to replace battery when necessary, otherwise no data will be transmitted and the SmartHUB will no longer "recognize" the spindle. This can pose safety problems

Can the SmartHUB system be used to configure other devices?
The SmartHUB and APP are designed to support auxiliary equipment not usually monitored by the machine controller, such as lathe live tooling, other auxiliary spindles (mechanical, pneumatic, electric), etc. This requires a sensor installed on the target device.
Will the SmartHUB work without the tablet?
The SmartHUB continues monitoring and sending warning alerts to machine PLC, regardless of the presence of the tablet. The tablet is a must for binding the spindles to the SmartHUB and viewing the real-time data.
What will happen if two SmartHUB units operate close to one another?
Nothing happens as long as the spindle/device isn't paired to both of them.
Will the SmartHUB immediately receive the spindle (device) transmissions?
As long as the device is paired with the SmartHUB, it immediately and automatically starts monitoring.
How many more signals can be added in the future?
More signals may be added as needed; the main limitation in discrete I/O mode is the cable size and free ports in the PLC.

6. WARRANTY

SMARTHUB Unit Warranty Frame: The manufacturer warrants the unit is to be free from defects in material, design and workmanship under normal use. Maintenance and service, for a period commencing from the date of invoice referenced by the SMARTHUB serial no. imprinted on the back of the housing, is valid until: 12 months from the date of invoice.

Within the frame of warranty, the following conditions are in effect:

- Warranty does not apply a SMARTHUB unit that has been subject to operator/programmer error (i.e. crashed or installation errors, and/or contamination).
- Warranty does not apply to a SMARTHUB unit that has been repaired, or has attempted to be repaired by anyone other than a manufacturer authorized representative.
- Claim of defect must be issued by returning the SMARTHUB in its original packaging accompanied by a written claim form; with an explanation of the malfunction, inclusion of the unit serial no. and a copy of the product invoice.
- The manufacturer's liability under this warranty shall be limited to the repair of, or replacement of, at the manufacturer's discretion, any part determined to the manufacturer's satisfaction to be defective, and which has not been found to have been misused, abused, abnormally used, or damaged by accident or improper maintenance, altered, or carelessly handled.
- Upon determination by the manufacturer that a warranty claim is valid, a refurbished or new SMARTHUB unit will be shipped as a replacement, on a no charge bases. All SMARTHUB units repaired under warranty will remain under the initial warranty timeframe for the balance of the valid warranty period.
- Customer shall pay shipping and handling costs for the SMARTHUB unit's return to the manufacturer's premises. Return of the repaired or replacement SMARTHUB unit under warranty shall be sent to the customer's premises only, at the expense of the manufacturer.

- The manufacturer reserves the right to choose the method of shipment on all replacement parts supplied under warranty.
- The customer shall bear all shipping costs related to SMARTHUB units which are not under warranty.

Repair and Refurbishment: SMARTHUB Unit Warranty Frame

- A SMARTHUB unit that has undergone repair by the manufacturer not within the warranty cover terms and/or valid time frame shall be entitled to a limited warranty period of 6 months from the invoice date; all warranted repairs must be performed by the manufacturer as the sole certified entity. Using any repair service other than a manufacturer authorized rep, will immediately terminate the warranty; validity, scope and terms.
- The repaired SMARTHUB unit warranty is subject to the above-mentioned restriction terms as equally applied and specified for the “SMARTHUB Unit Warranty Frame”.
- This warranty document supersedes all and any previous warrant policy information published by the manufacturer.
- The manufacturer reserves the right to make changes in products or specifications at any time, without prior notice.

This warranty shall not apply to:

- Claims or damage resulting from customer or third party repairs or modifications to the product, or other circumstances beyond the manufacturer’s control.
- Claims or damage due to non-compliance with recommended installation, operation and maintenance procedures, as specified by the manufacturer, including, without limitation; abuse, neglect, misuse of the product by the customer, its agents, employees or contractor.
- Damage resulting from operation of product not within the working parameters and working environment it was designed for.
- Claims or damage resulting from the use of third party replacement parts.

- Any direct or indirect loss, consequential loss, personal injury or damage to property, loss arising from interruptions or delays in production.
- Claims or damage resulting from buyer's non-compliance with applicable laws, regulations, codes or by-laws, and standard industry practices.

Transfer of Warranty

The SMARTHUB unit is only covered under warranty to the original buyer of the SMARTHUB and this warranty is non-transferable to, and may not be enforced by, any third parties, including, but not limited to; subsequent buyers, users or assignees of the unit.

SMARTHUB Device Monitoring Unit



USER MANUAL

