

## Operations Manual EZDP-2058 Rev U Brush Condition Monitoring



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## Legal Information

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## Patents

Please send patent information requests to [patents@cutsforth.com](mailto:patents@cutsforth.com).

## Federal Communications Commission Requirements

### Brush Condition Monitoring - Primary Controller

**Primary Controller:** Utilizes Intel RF module 8265NG

FCC ID: PD98265NG

IC ID: 1000M-8265NG

### Brush Health Sensor

**Part #:** EBHS001

FCC ID: 2ARPJ-EBHS001

IC ID: 24545-EBHS001

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.



**Caution:** User changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



**Note:** 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.

## ISED Canada Regulatory Compliance Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

# Safety Information

## Safety Information [English]

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

### Safety Conventions



#### NOTE:

Additional information.



#### ELECTRICAL DANGER

Indicates an action or specific equipment area that can result in personal injury or death from an electrical hazard if proper precautions are not taken.



#### CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury or equipment damage.



#### WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.



#### ROTATING PART CAUTION

Indicates possible injury from rotating parts.



#### DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

### General Safety Instructions



#### ELECTRICAL DANGER

Only qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid injury should work with Cutsforth products. Among the many considerations are the following:

- Avoid contact with energized circuits.
- Avoid contact with rotating parts.
- Never install any component that appears not to be functioning in a normal manner.
- Always ensure proper installation of the holder assembly and shaft grounding rope.



## ELECTRICAL DANGER

Before working on the generator, de-energize, lock out, and tag out all power sources to the generator, shaft, and accessory devices. Electric shock and death may result due to failure to heed this warning.



## ROTATING PART CAUTION

High-voltage and rotating parts can cause serious or fatal injury. Installation, operation, and maintenance of this product must be performed only by qualified personnel, in accordance with all applicable safety regulations and guidelines.



## WARNING

Never mix different carbon brush grades or brushes from different manufacturers on the same unit.



## LIFTING EQUIPMENT

For configurations that weigh more than 18 kg (40 lbs.), please utilize team lifting techniques to lift and move the equipment, including lifting with the legs, and avoid twisting while moving the equipment.

## Consignes de Sécurité [Français]

Les informations qui suivent sont essentielles afin d'assurer la sécurité de l'utilisateur lors de l'installation et de l'opération de l'équipement. Assurez-vous de bien lire et de comprendre tous les avertissements et mises en garde qui suivent.

### Conventions de Sécurité



#### NOTE:

Informations supplémentaires.



#### RISQUES DE CHOC ÉLECTRIQUE

Indique que l'action ou la partie de l'équipement concernée peut mener à des blessures par électrisation ou à la mort par électrocution si les précautions adéquates ne sont pas prises.



#### MISE EN GARDE

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures mineures à modérées ou à des dommages matériels.



#### AVERTISSEMENT

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures sévères ou à la mort.



#### MISE EN GARDE : PIÈCE ROTATIVE

Indique la présence de pièces d'équipement rotatives pouvant causer des blessures.



#### DANGER

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures sévères ou à la mort.

### Consignes de Sécurité Générales



#### RISQUES DE CHOC ÉLECTRIQUE

L'utilisation des produits Cutsforth n'est recommandée qu'aux professionnels qualifiés qui savent comment reconnaître la présence de risques de choc électrique ainsi que les consignes de sécurité à suivre pour éviter les blessures liées à ces risques. Lesdites consignes de sécurité incluent, sans s'y limiter :

- Éviter tout contact avec des circuits alimentés;
- Éviter tout contact avec des pièces d'équipement rotatives;
- Ne jamais installer de composante ne paraissant pas fonctionner normalement;
- Toujours s'assurer que la structure de soutien et le câble de terre de l'arbre de la génératrice sont correctement installés.



## RISQUES DE CHOC ÉLECTRIQUE

Avant de travailler sur la génératrice, désalimentez, cadenassez et étiquetez toutes les sources d'énergies liées à la génératrice, à l'arbre et aux appareils accessoires. L'opérateur s'expose à des risques de chocs électriques pouvant causer la mort s'il ne tient pas compte de cet avertissement.



## MISE EN GARDE : PIÈCE ROTATIVE

Les pièces d'équipement rotatives et sous haute tension peuvent causer des blessures sévères ou fatales. L'installation, l'opération et la manutention de ce produit ne doivent être faites que par des professionnels qualifiés et en respectant toutes les règles et consignes de sécurité applicables.



## AVERTISSEMENT

Ne jamais utiliser de frotteurs de différentes qualités ou venant de différents fabricants sur le même appareil.



## ÉQUIPEMENT DE LEVAGE

Pour les configurations pesant plus de 18 kg (40 lb), veuillez recourir à des techniques de levage en équipe pour soulever et déplacer l'équipement — notamment en sollicitant les jambes — et évitez toute torsion du corps lors du déplacement.

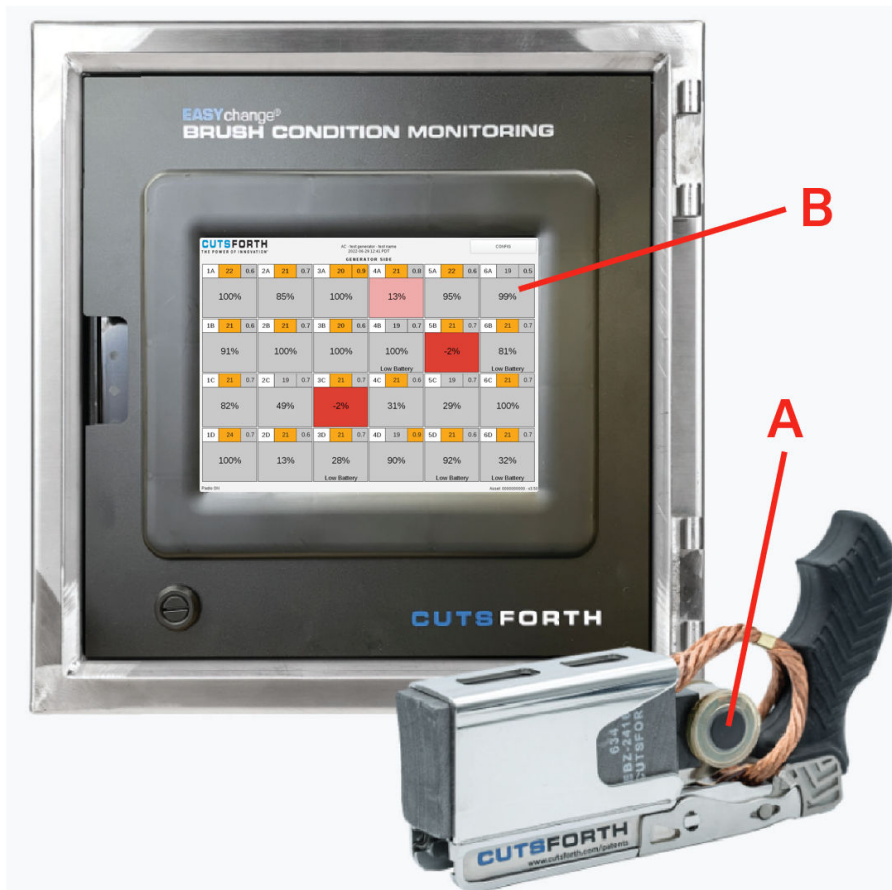
# 1. EASYchange® Brush Condition Monitoring

For over 30 years, Cutsforth has installed over 35,000 of the best-in-class brush holders on turbine generators worldwide. Now, with our exclusive EASYchange® Brush Condition Monitoring, Cutsforth offers an even better way to operate your generator's brush-type excitation. Brush performance metrics can now be delivered to the control room system and maintenance can be performed based on brush condition, rather than a calendar.

Automated measurements and brush health analytics allow plant operators to improve the efficiency of technicians' daily and weekly tasks by dispatching them to the collector when maintenance is actually needed.

The Brush Condition Monitoring System is composed of:

- a Cutsforth-developed industrial data logger product known as the Brush Health Sensor (BHS) (A) shown installed on the EASYchange® brush holder, and
- a Sensor Controller touch-screen interface (B) that compiles the data collected from several BHS units installed with the EASYchange® brush holders.



Cutsforth's patented hardware and technology processes and transmits the following data points over a 2.4 GHz wireless link to local displays as well as via Modbus protocol into a plant's DCS, Historian, or InsightCM™.

## 2. Brush Condition Monitoring (BCM) Technical Specifications

### 2.1. Brush Condition Monitor Technical Specifications

#### 2.1.1. Product Certifications

Table 1. EU Directive Information – CE Compliance

|                                                              |                                                                                 |
|--------------------------------------------------------------|---------------------------------------------------------------------------------|
| Electro Magnetic Compatibility<br>(EMC) Directive 2014/30/EU | EN 61326-1:2013<br>EN IEC 61000-3-2: 2019+A1: 2021<br>EN 61000-3-3:2013+A2:2021 |
| Safety Low Voltage Directive (LVD) 2014/35/EU                | EN 61010-1:2010+A1:2019                                                         |
| RoHS Directive 2011/65/EU                                    | Large Scale Fixed Installation Exclusion                                        |

Table 2. North America

|                                     |                                                                                                      |
|-------------------------------------|------------------------------------------------------------------------------------------------------|
| Electromagnetic Compatibility (EMC) | Conforms to FCC 47 CFR Part 15 Subpart B (05/2024)<br>Certified to CSA Std ICES-003 Issue 7 Oct 2020 |
| Safety                              | CSA C22.2 #61010-1-12:2012 Ed. 3 + U1;U2;A1<br>UL 61010-1:2012 Ed.3 + R:19Jul2019                    |

Table 3. UK Conformity Assessment – UKCA

|                                                       |                                          |
|-------------------------------------------------------|------------------------------------------|
| Electro Magnetic Compatibility<br>(EMC) 2016          | EN 61326-1:2013                          |
| Electrical Equipment Safety Regulation 2016           | EN 61010-1:2010                          |
| Regulation Restriction of Hazardous Substances (RoHS) | Large Scale Fixed Installation Exclusion |

Markings for EBMA-001:



Marking for EBMA-002:



## 2.1.2. Environmental Specifications

|                       |                                     |
|-----------------------|-------------------------------------|
| Operating Temperature | -20 °C to 70 °C (-4 °F to 158 °F)   |
| Operating Humidity    | 10% RH to 90% RH, non-condensing    |
| Enclosure Ratings     | NEMA Type 3R, 4, 4X, 12, 13<br>IP66 |

## 2.1.3. AC Power Supply Requirements

|                                 |                                 |
|---------------------------------|---------------------------------|
| Plant-supplied power source     | 120 V, 60 Hz or 240 V, 50 Hz AC |
| Circuit breaker                 | Internal 120V, 5 A              |
| Current draw under normal usage | Approximately 0.6 A             |

## 2.1.4. AC Power Specifications

|                            |                                                                   |
|----------------------------|-------------------------------------------------------------------|
| Input Voltage Range        | 85 – 264 VAC                                                      |
| Input Frequency Range      | 47 – 63 Hz                                                        |
| Input Power Rating         | 150 W                                                             |
| Over Voltage Category      | III; According to EN62368, EN61558, EN50178, EN60664-1, EN62477-1 |
| Input Wire Connection Type | Screw Terminal                                                    |
| Input Wire Size            | 30 - 10 AWG                                                       |

## 2.2. Brush Health Sensor Technical Specifications

### 2.2.1. Product Certifications

Table 4. EU Directive Information – CE Compliance

|                                                           |                                                                                                               |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Electro Magnetic Compatibility (EMC) Directive 2014/30/EU | EN 50663: 2017<br>EN 62479: 2010                                                                              |
| Safety Low Voltage Directive (LVD) 2014/35/EU             | EN 61010-1:2010+A1:2019                                                                                       |
| RoHS Directive 2011/65/EU                                 | Large Scale Fixed Installation Exclusion                                                                      |
| Radio Equipment Directive (RED) 2014/53/EU                | ETSI EN 300 328 V2.2.2 (2019-07)<br>ETSI EN 301 489-1 V2.2.3 (2019-11)<br>ETSI EN 301 489-17 V3.2.4 (2020-09) |

Table 5. North America

|                                     |                                                                                                      |
|-------------------------------------|------------------------------------------------------------------------------------------------------|
| Electromagnetic Compatibility (EMC) | Conforms to FCC 47 CFR Part 15 Subpart B (05/2024)<br>Certified to CSA Std ICES-003 Issue 7 Oct 2020 |
| Safety                              | Out of scope, 9VDC device                                                                            |

|       |                                                                                                                                                                                                                                                                     |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radio | CFR47 FCC Part 15.247 Subpart C: 04/201<br>CFR47 FCC Part 15 Subpart B: 04/2019<br>RSS-247 Issue 2 02/2017<br>ICES-003 Issue 6: 01/2016 Updated: 04/2019<br>RSS-Gen Issue 5 04/2018<br>RSS-102 Issue 5 03/2015<br>KDB 558074 D01 15.247 Measurement Guidance v05r02 |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Table 6. UK Conformity Assessment – UKCA

|                                                              |                                                                                                               |
|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Electro Magnetic Compatibility<br>(EMC) Directive 2014/30/EU | EN 50663: 2017<br>EN 62479: 2010                                                                              |
| Safety Low Voltage Directive (LVD) 2014/35/EU                | EN 61010-1:2010+A1:2019                                                                                       |
| RoHS Directive 2011/65/EU                                    | Large Scale Fixed Installation Exclusion                                                                      |
| Radio Equipment Directive (RED) 2014/53/EU                   | ETSI EN 300 328 V2.2.2 (2019-07)<br>ETSI EN 301 489-1 V2.2.3 (2019-11)<br>ETSI EN 301 489-17 V3.2.4 (2020-09) |

Markings for EBHS-001:



R-R-7CF-EBHS001

## 2.2.2. Environmental and Power Specifications

|                       |                                     |
|-----------------------|-------------------------------------|
| Operating Temperature | -35 °C to 105 °C (-31 °F to 221 °F) |
| Enclosure Ratings     | IP6X dustproof                      |
| Power                 | Battery                             |
| Battery Type          | Lithium metal (non-replaceable)     |
| User Interface        | Push-button activation              |
| Feedback mode         | LED indication                      |

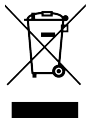
## 2.3. Waste Electrical and Electronic Equipment (WEEE) Directive

### WEEE Directive Statement

In accordance with Article 14 of Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), the following marking requirements apply:

- The directive applies to electrical and electronic equipment falling under Annex I, Category 9 of Directive 2012/19/EU.
- Products must include markings that clearly identify the producer and indicate that the equipment was placed on the market after 13 August 2005.
- The crossed-out wheeled bin symbol signifies that the equipment must not be disposed of with unsorted municipal waste. End users are required to follow applicable local recycling and disposal procedures for electrical and electronic equipment.
- The marking affixed to the product confirms that it falls within the scope of this directive.

Marking for the WEEE Directive; Appears on all products sold into the EU:



## 2.4. Data from Primary Controller

| Most Recent Recorded Values (Local)                                                                                                                         | Configurable Brush Health Alerts (Local)                                                                                   | Historical Data Trending (Output to Historian)                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>▪ Usable Brush Length (%)</li> <li>▪ Brush Vibration (Mils Displacement, Pk-to-Pk)</li> <li>▪ Temperature</li> </ul> | <ul style="list-style-type: none"> <li>▪ Brush Length Warnings</li> <li>▪ High Vibration</li> <li>▪ Temperature</li> </ul> | <ul style="list-style-type: none"> <li>▪ Usable Brush Length</li> <li>▪ Vibration</li> <li>▪ Ambient Temperature at Brush Health Sensor (BHS)</li> <li>▪ BHS Battery Life</li> <li>▪ System Status</li> <li>▪ System Date/Time</li> <li>▪ Temperature</li> </ul> <p>See <a href="#">Modbus Interface (page 47)</a> for a complete list.</p> |

## 2.5. Integration and Infrastructure

The Brush Condition Monitoring (BCM) System is equipped with an integrated touchscreen user interface that provides local configuration, visualization, and system status monitoring. An optional secondary display may be installed to support additional viewing locations. The BCM System communicates wirelessly with the Brush Health Sensors using a 2.4 GHz RF Bluetooth® Low Energy (BLE) connection, enabling reliable data transmission in industrial environments. For integration with plant DCS or historian systems, the BCM System supports multiple data output interfaces, including Modbus TCP/IP over Ethernet, Modbus RS-232, and Modbus RS-485.

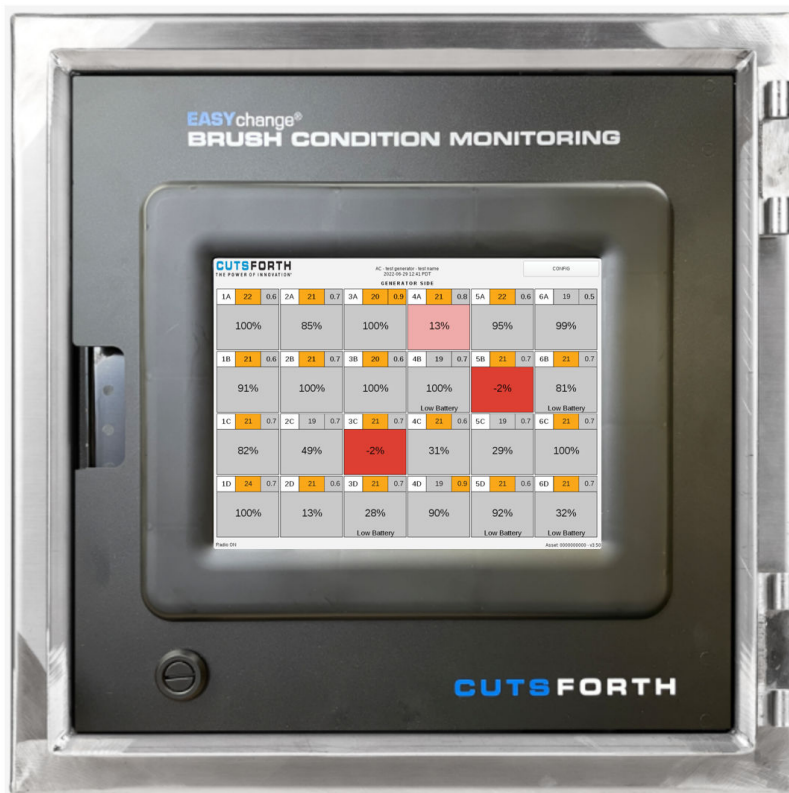
If desired, the Modbus data from the BCM System can be inputted into Cutsforth's InsightCM™ software. For more information on InsightCM™, including specific server requirements, visit the InsightCM™ README on the Cutsforth Support webpage at <https://support.cutsforth.com>.

### 3. Primary Controller Overview

The Primary Controller receives data from the Brush Health Sensors (BHS) at regular intervals. It presents information based on the received data to users locally using up to two industrial displays, and to remote users over Modbus TCP, Modbus RTU, or over Ethernet into InsightCM™ software.

At the generator, the Primary Controller user interface visually alerts users of short brushes and high vibrations based on plant-defined thresholds. This same critical data and more can also be relayed to the control room, reducing unnecessary physical inspections. Some installation may make use of an Auxiliary Display, which is a fully-functioning duplication of the primary display that can be placed at a secondary location near the brush rigging if desired.

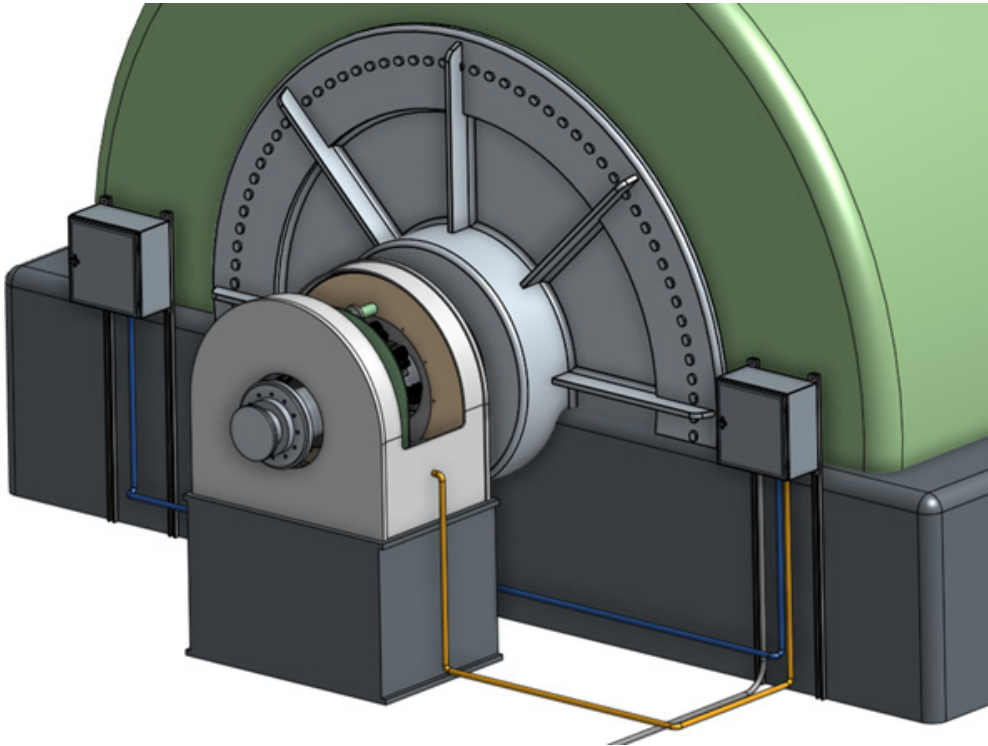
Brush health historical analytics are logged by the system and available on the Brush Detail screen for each brush holder location. Ultimately, the combination of recent and historical brush health analytics will improve operator efficiencies and optimize a plant's staff utilization.



## 4. Brush Condition Monitoring System Installation

This section covers the installation process of the Brush Condition Monitoring System and the routing of the antenna signal wire. Before beginning the installation, thoroughly review the Brush Condition Monitoring System Installation Planning Guide (EZDP-2061). The major installation steps consist of:

1. [Mounting the Brush Condition Monitoring System Enclosure \(page 17\)](#)
2. [Running Power to the Brush Conditioning Monitoring System \(page 18\)](#)
3. [Route the Antenna Cabling \(page 19\)](#)
4. [Install Brush Holder Label Clips \(page 20\)](#)

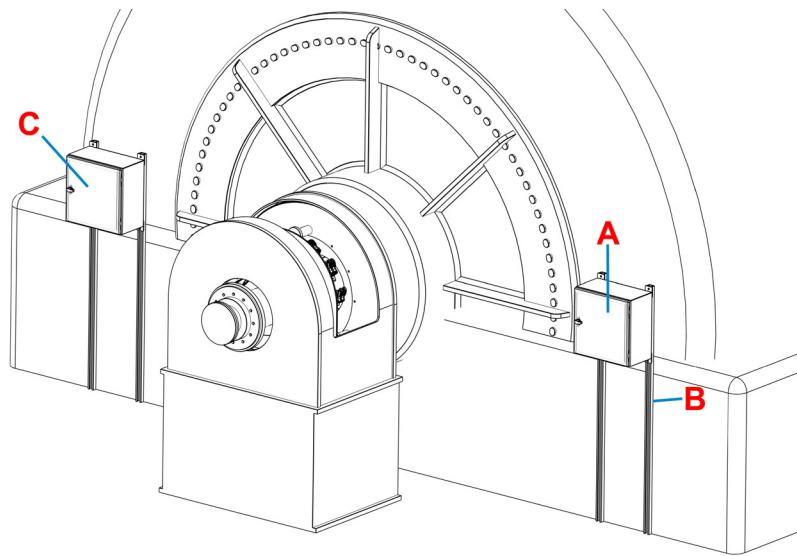


## 4.1. Mounting the Brush Condition Monitoring System Enclosure

This section covers the placement and mounting requirements for the Brush Condition Monitoring System enclosure.

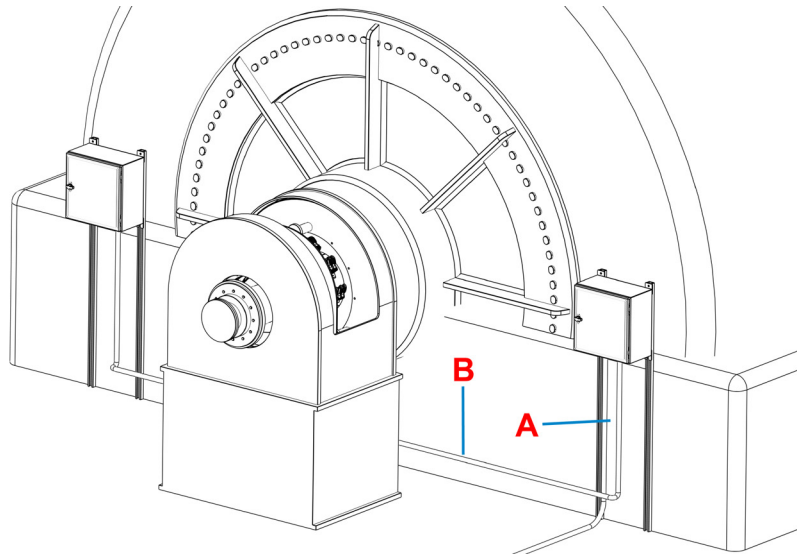
### 4.1.1. Brush Condition Monitoring System Mounting Requirements

The Brush Condition Monitoring System **(A)** requires a minimum of two Unistrut rails **(B)** for mounting. Mount the enclosure as close to the exciter brushes as possible, while maintaining operator safety, to optimize the user experience. If desired, an optional auxiliary display **(C)** can be installed on the opposite side of the shaft from the primary enclosure. The auxiliary display uses the same enclosure and has the same mounting requirements as the primary enclosure.



## 4.2. Running Power to the Brush Conditioning Monitoring System

The Brush Condition Monitoring System has an internal enclosed AC/DC converter which requires power input of 85–264 VAC at 47–63 Hz. The power output of the internal power supply is 24V, 6.25A DC (150W max). The power input cabling should be run to the Brush Condition Monitoring System in liquid-tight conduit (A). If installing the auxiliary display, liquid-tight conduit should be run between the enclosures to run power, display, and serial cables (B).

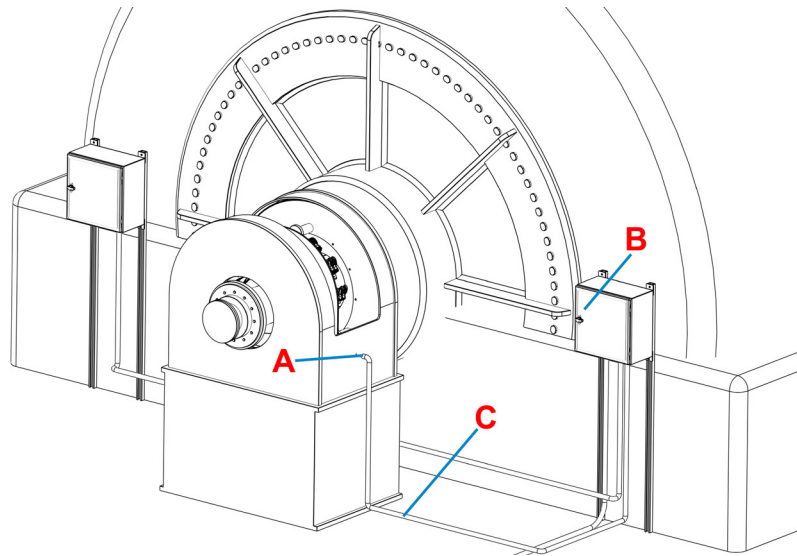


## 4.3. Route the Antenna Cabling

The Brush Condition Monitoring System requires the use of an antenna to enable ideal communication to and from the Brush Health Sensors. The ideal antenna mounting location may vary between installations. If you are unsure about the placement of the antenna, refer to the [Antenna Placement Mode \(page 45\)](#) section of this manual.

In most cases, the ideal antenna location will be inside the exciter housing. If this is the case:

1. Drill a hole through the lower portion of the exciter housing **(A)**.
2. Mount the antenna to the inside of the exciter housing with its connector extending through the newly drilled hole.
3. On the outside of the exciter housing, route liquid-tight conduit from the antenna to the Brush Condition Monitoring System **(B)** to run the antenna cable **(C)**.

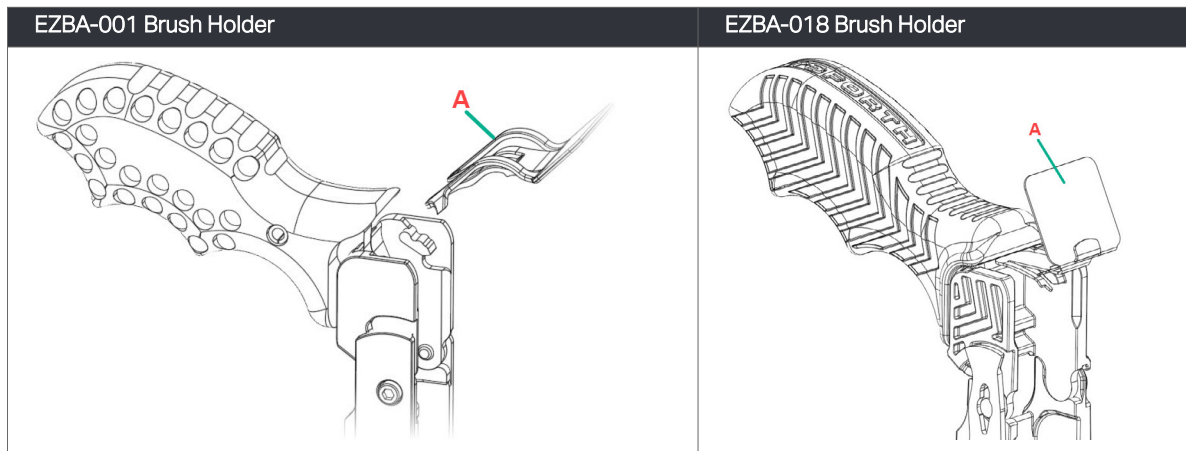


## 4.4. Install Brush Holder Label Clips

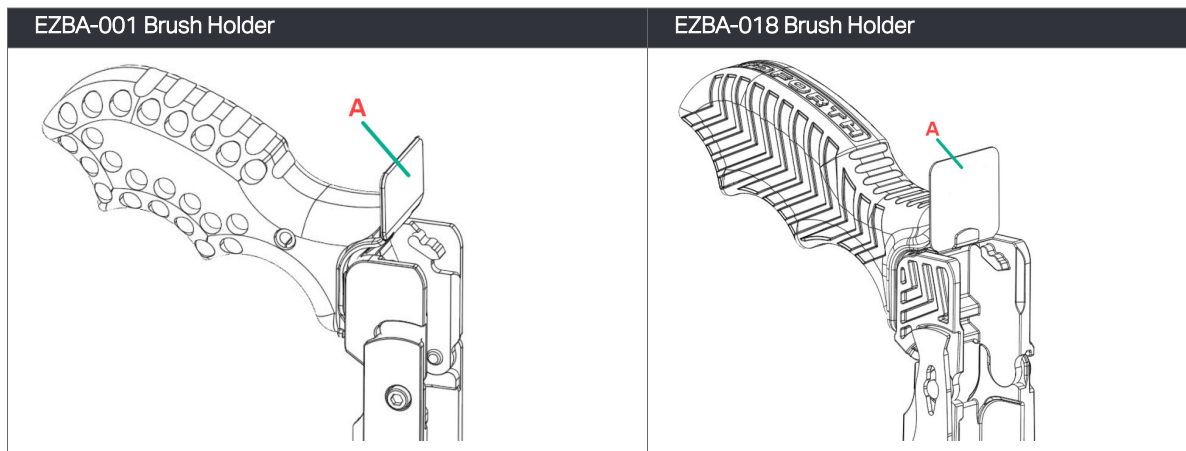
Installing brush holder label clips can assist in easily identifying brush positions as they relate to the Brush Condition Monitoring System display. The label clips often use an alphanumeric nomenclature to identify the row and path of each brush. For example, brush '2B' would refer to the brush located in row '2' and path 'B'.

To install the label clips:

1. Orient the label clips **(A)** as shown.



2. Guide the label clip **(A)** under the brush holder handle until you feel the label clip lock into place. The final resting position is shown here:



## 5. Brush Health Sensors

The Brush Health Sensor (BHS) is a data logging device that processes sensor data and reports it back to the Sensor Controller at a regular interval over a 2.4 GHz wireless link. Up to 216 Brush Health Sensors may be connected to a single monitoring system. The 2.4 GHz antenna is a PCB trace style antenna.



### 5.1. Pair a New Sensor

To pair a new sensor:

1. From the home screen, select the brush holder location where you want to place the new sensor.
2. When that brush holder location's menu appears, push **Press to Pair New Sensor**.

**Brush Details**

**Location: 3D**

☐ Disable  
  
☐ Alternate Color

**90%**

Brush Life Remaining

**0.6**

Mils Pk-Pk

**19**

Celsius

Press to Pair New Sensor

Clear Brush Length Warnings

**Sensor Pairing Date** 2022-08-17 10:06:41 PDT

**Sensor Pairing Age (days)** 0

**Measurement Count** 3

**Brush Install Date** UNKNOWN

**Brush Age (days)** UNKNOWN

|                             |     |     |     |   |   |   |
|-----------------------------|-----|-----|-----|---|---|---|
| <b>Recent Displacements</b> | 1.0 | 1.0 | 1.1 | - | - | - |
| <b>Recent Temperatures</b>  | 19  | 18  | 18  | - | - | - |

3. Press the button on the sensor you wish to pair.
4. Wait until a "pairing successful" message is returned.
5. Once pairing has successfully completed, install the brush and sensor in the proper position on the collector ring.

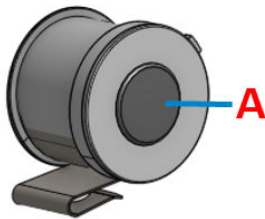


#### SENSOR NOT PAIRING? FOLLOW THESE STEPS:

- If a confirmation message does not appear, that sensor could be paired to another location.
- You can check if the sensor is paired somewhere else by following the instructions under first FAQ question.
- If you want to relocate the sensor to a different holder or location, or have confirmed the sensor is not paired with another location, simply unpair the sensor and repeat the pairing process.
- Still unable to pair the sensor? Submit a support request at [Cutsforth.com/Support](https://Cutsforth.com/Support).

## 5.2. Frequency of Sensor Updates

Sensors are factory programmed to update data and communicate with the Primary Controller once every hour. However, the operator can manually wake up the sensor at any time by pressing the button **(A)** on the sensor. This forces the Primary Controller to collect data from that sensor at that time. The frequency of the automatic sensor data updates can be adjusted from the Advanced Configuration screen.



## 5.3. Unpair a Sensor

To unpair a sensor, press and hold the button on the sensor for three seconds until the two LEDs on the sensor flash three times.

This indicates that the sensor has been unpaired. The data for that sensor/location will remain visible on the Primary Controller home page until the next regular data collection interval passes. At that point, the Primary Controller home screen will update accordingly.

### 5.3.1. Replacing a Brush

Follow the standard EASYchange® process to change the brush. Provided that the Brush Health Sensor (BHS) still has battery life, the existing sensor-spring assembly can be reinstalled with the new brush.

Visit [Cutsforth.com/BrushChange](https://Cutsforth.com/BrushChange) for video instructions.



REMINDER:

After the replacement brush is installed into the holder; short-press the BHS button one time, to reset the brush length data.

## 5.4. Brush Health Sensor Battery Life

The power source for the device is three Panasonic BR1632A lithium metal primary batteries soldered into the device. In the case of a low battery in a Brush Health Sensor, the Brush Condition Monitoring System will display a low battery warning. At that point, the sensor will have roughly 30 days of battery life remaining.

**Operational Battery Life:** 2 Years (Will vary depending on user-defined measurement interval as well as operating environment)

## 5.5. Button-On Self Test

The Brush Health Sensor contains self-test logic that allows the user to perform a single button press on the sensor and receive a status code in the form of number of LED flashes.

| LED Flashes | Status Code                 |
|-------------|-----------------------------|
| 1           | Success                     |
| 2           | Battery voltage error       |
| 3           | Accel comm error            |
| 4           | Accel functional error      |
| 5           | Magnetic encoder comm error |
| 6           | Temperature error           |
| 7           | Application error           |

## 6. Using the Primary Controller System User Interface

Before powering the Primary Controller on, first inspect the system to ensure that there are no foreign materials inside the enclosure, no damaged components, or loose wire connections.

### 6.1. Power On the Primary Controller

To power on the Primary Controller

1. Swing open the faceplate panel of the Primary Controller.
2. Locate the switch towards the bottom of the panel and flip it to the "ON" position.
3. Close the faceplate panel and wait for the system to boot and automatically load the monitoring application.

### 6.2. Primary Controller System Screen Layout

The diagrams in this section illustrate how the Primary Controller screen layout correlates to the brushes on your generator. The Advanced Configuration screen contains an option to select the generator reference label location. This allows the user to arrange the home screen in a way that makes the most sense for their unit configuration and the Primary Controller mounting location.

This is the Primary Controller screen layout. The below example shows the generator reference label location at the top of the screen.

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example plant

Siemens - example generator - example name

2022-08-17 12:51 PDT

CONFIG

GENERATOR SIDE

|      |    |     |      |    |     |      |    |     |      |    |     |      |    |     |      |    |     |
|------|----|-----|------|----|-----|------|----|-----|------|----|-----|------|----|-----|------|----|-----|
| 1A   | 24 | 0.7 | 2A   | 22 | 0.7 | 3A   | 21 | 0.6 | 4A   | 21 | 0.7 | 5A   | 21 | 0.8 | 6A   | 21 | 0.7 |
| 100% |    |     | 100% |    |     | 82%  |    |     | 97%  |    |     | 100% |    |     | 100% |    |     |
| 1B   | 20 | 0.6 | 2B   | 21 | 0.7 | 3B   | 20 | 0.6 | 4B   | 21 | 0.7 | 5B   | 20 | 0.8 | 6B   | 22 | 0.7 |
| 100% |    |     | 89%  |    |     | 100% |    |     | 100% |    |     | 90%  |    |     | 92%  |    |     |
| 1C   | 23 | 0.8 | 2C   | 19 | 0.7 | 3C   | 19 | 1.0 | 4C   | 21 | 0.7 | 5C   | 22 | 0.9 | 6C   | 21 | 0.7 |
| 85%  |    |     | 100% |    |     | 84%  |    |     | 100% |    |     | 100% |    |     | 91%  |    |     |
| 1D   | 23 | 0.7 | 2D   | 25 | 0.8 | 3D   | 19 | 0.6 | 4D   | 25 | 0.9 | 5D   | 21 | 0.9 | 6D   | 20 | 0.6 |
| 84%  |    |     | 98%  |    |     | 90%  |    |     | 100% |    |     | 81%  |    |     | 84%  |    |     |

Radio ON

LEFT

RIGHT

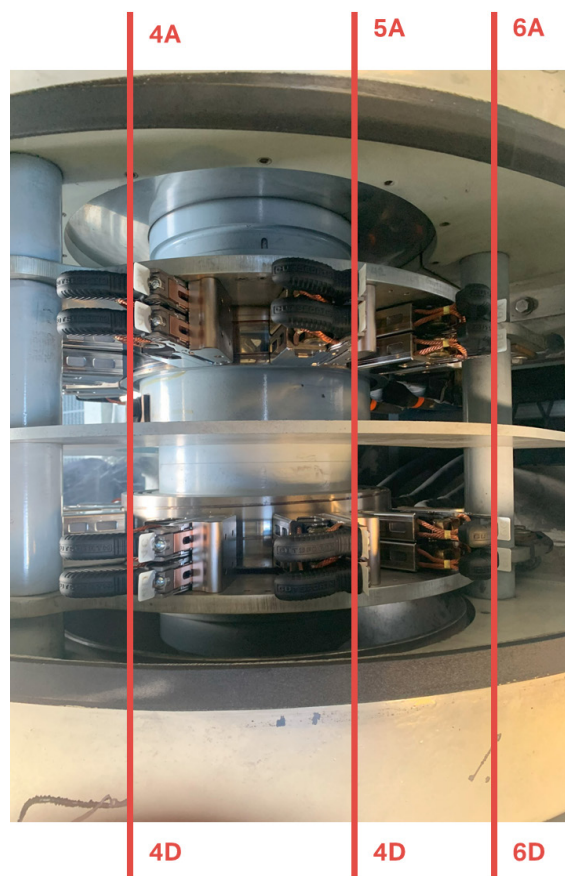
Asset: 0000000000 - v3.50

The following diagrams show the brushes with the left (blue) and right (red) rows highlighted.

**Generator Side**



**Generator Side**



## 6.3. Navigating the Primary Controller Screen

Once the Primary Controller has been powered on, the top level view of the user interface screen appears:

- The **Config** button (A) opens the primary configuration window.
- Information in the top center of the user interface screen (B) shows plant name, generator manufacturer, name and type, and current time; all of which can be modified within Advanced Configuration.
- Asset tag and Brush Condition Monitoring Application version are shown in the bottom right corner (C).

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B

example plant  
Siemens - example generator - example name  
2022-08-17 12:51 PDT

A

CONFIG

GENERATOR SIDE

|      |    |     |      |    |     |      |    |     |      |    |     |      |    |     |      |    |     |
|------|----|-----|------|----|-----|------|----|-----|------|----|-----|------|----|-----|------|----|-----|
| 1A   | 24 | 0.7 | 2A   | 22 | 0.7 | 3A   | 21 | 0.6 | 4A   | 21 | 0.7 | 5A   | 21 | 0.8 | 6A   | 21 | 0.7 |
| 100% |    |     | 100% |    |     | 82%  |    |     | 97%  |    |     | 100% |    |     | 100% |    |     |
| 1B   | 20 | 0.6 | 2B   | 21 | 0.7 | 3B   | 20 | 0.6 | 4B   | 21 | 0.7 | 5B   | 20 | 0.8 | 6B   | 22 | 0.7 |
| 100% |    |     | 89%  |    |     | 100% |    |     | 100% |    |     | 90%  |    |     | 92%  |    |     |
| 1C   | 23 | 0.8 | 2C   | 19 | 0.7 | 3C   | 19 | 1.0 | 4C   | 21 | 0.7 | 5C   | 22 | 0.9 | 6C   | 21 | 0.7 |
| 85%  |    |     | 100% |    |     | 84%  |    |     | 100% |    |     | 100% |    |     | 91%  |    |     |
| 1D   | 23 | 0.7 | 2D   | 25 | 0.8 | 3D   | 19 | 0.6 | 4D   | 25 | 0.9 | 5D   | 21 | 0.9 | 6D   | 20 | 0.6 |
| 84%  |    |     | 98%  |    |     | 90%  |    |     | 100% |    |     | 81%  |    |     | 84%  |    |     |

Radio ON

C

Asset 0000000000 - v3.50

Radio ON

C Asset: 0000000000 - v3.50

## 6.4. Power Off the Primary Controller

To power off, repeat the power on sequence in reverse order.

Another option for power off is to:

1. Plug in an external USB keyboard.
2. Press **ALT+F4** to close out of the application.
3. Press **ALT+F4** again to bring up the Power menu.
4. Select your desired option (shut down, restart, etc.).
5. If shutting down, wait for the system to fully shut down, then open the faceplate panel and flip the switch to the OFF position.

## 7. Connecting an Auxiliary Display

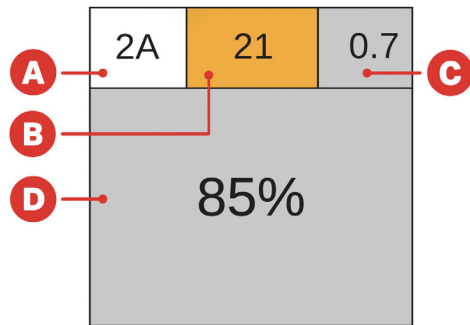
Some installations may make use of an auxiliary display, which is a fully-functioning duplication of the primary display that can be placed at a secondary location near the brush rigging if desired.

Three connections are required for the auxiliary display:

- 24V DC Power
- Touchscreen Signal over Ethernet
- Video over Ethernet

## 8. Brush Status Indication

The individual brush status indicators provide the following information:



- A Location**
- B Temperature** (Peak Average in Degrees Celsius)
- C Brush Vibration/Displacement** (Mils Peak-to-Peak)
- D Usable Brush Life Remaining**

## 8.1. Color Definitions

The background color of the brush status indicator area changes depending on the remaining brush length:

- Red indicates the remaining brush length is less than or equal to 0%
- Pink indicates that the remaining brush length is less than or equal to the threshold set in the Configuration window

The background color of the displacement or temperature areas will be orange if the brush displacement or temperature value is greater than or equal to the associated threshold set in the Configuration window.

This figure shows possible background colors for different areas of the brush status indicator:

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AC - test generator - test name

2022-06-29 12:41 PDT

CONFIG

GENERATOR SIDE

|      |    |     |      |    |     |             |    |     |             |    |     |             |    |     |             |    |     |
|------|----|-----|------|----|-----|-------------|----|-----|-------------|----|-----|-------------|----|-----|-------------|----|-----|
| 1A   | 22 | 0.6 | 2A   | 21 | 0.7 | 3A          | 20 | 0.9 | 4A          | 21 | 0.8 | 5A          | 22 | 0.6 | 6A          | 19 | 0.5 |
| 100% |    |     | 85%  |    |     | 100%        |    |     | 13%         |    |     | 95%         |    |     | 99%         |    |     |
| 1B   | 21 | 0.6 | 2B   | 21 | 0.7 | 3B          | 20 | 0.6 | 4B          | 19 | 0.7 | 5B          | 21 | 0.7 | 6B          | 21 | 0.7 |
| 91%  |    |     | 100% |    |     | 100%        |    |     | 100%        |    |     | -2%         |    |     | 81%         |    |     |
|      |    |     |      |    |     |             |    |     | Low Battery |    |     |             |    |     | Low Battery |    |     |
| 1C   | 21 | 0.7 | 2C   | 19 | 0.7 | 3C          | 21 | 0.7 | 4C          | 21 | 0.6 | 5C          | 19 | 0.7 | 6C          | 21 | 0.7 |
| 82%  |    |     | 49%  |    |     | -2%         |    |     | 31%         |    |     | 29%         |    |     | 100%        |    |     |
| 1D   | 24 | 0.7 | 2D   | 21 | 0.6 | 3D          | 21 | 0.7 | 4D          | 19 | 0.9 | 5D          | 21 | 0.6 | 6D          | 21 | 0.7 |
| 100% |    |     | 13%  |    |     | 28%         |    |     | 90%         |    |     | 92%         |    |     | 32%         |    |     |
|      |    |     |      |    |     | Low Battery |    |     |             |    |     | Low Battery |    |     | Low Battery |    |     |

Radio ON

Asset 0000000000 - v3.5.0

Radio ON

Asset: 0000000000 - v3.50

## 9. Configure the Brush Condition Monitoring System Settings

The following settings can be changed in the Configuration window:

- Brush Alert Length



At this level the location background color will change to pink.

- Displacement Fault Maximum



At this level the displacement background color will change to orange.

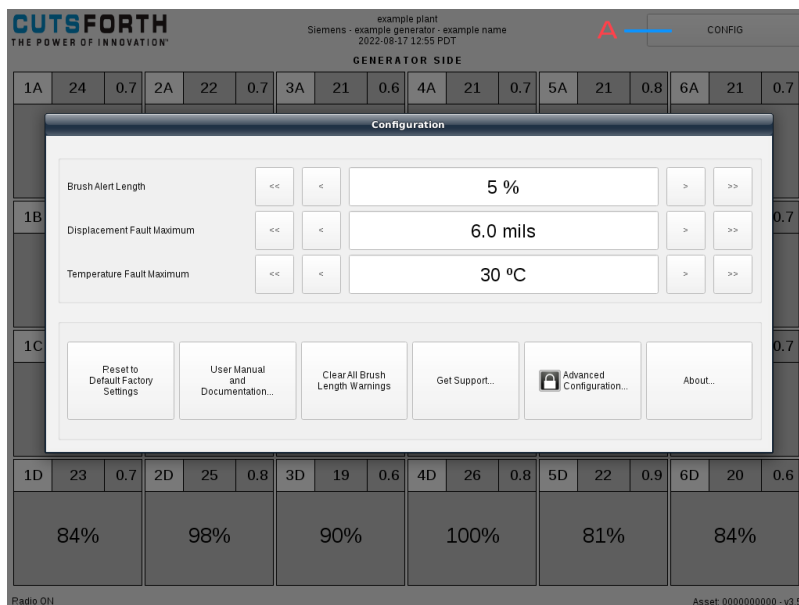
- Temperature Fault Maximum



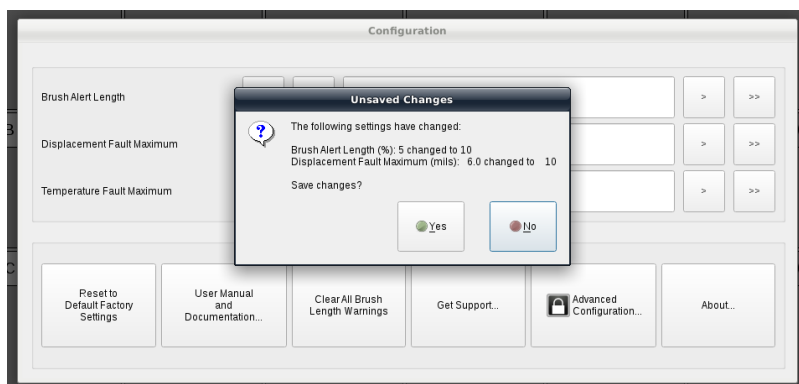
At this level the temperature background color will change to orange.

To configure the Brush Condition Monitoring System settings:

1. Press **Config (A)** to open the Configuration window.



2. Click anywhere on the shaded area outside of the Configuration window to close it. If any settings have changed, a Save changes dialog appears.



## 10. Advanced Configuration Settings



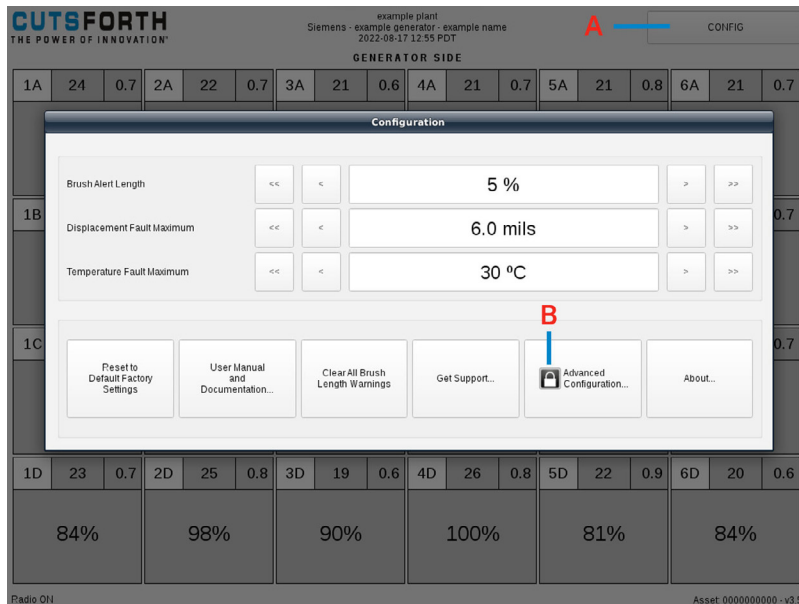
Some of the steps in these sections will require the use of a USB keyboard, USB mouse, and/or a USB storage drive. The use of a USB hub or splitter is often beneficial.

The Advanced Configuration window provides an option for the operator to:

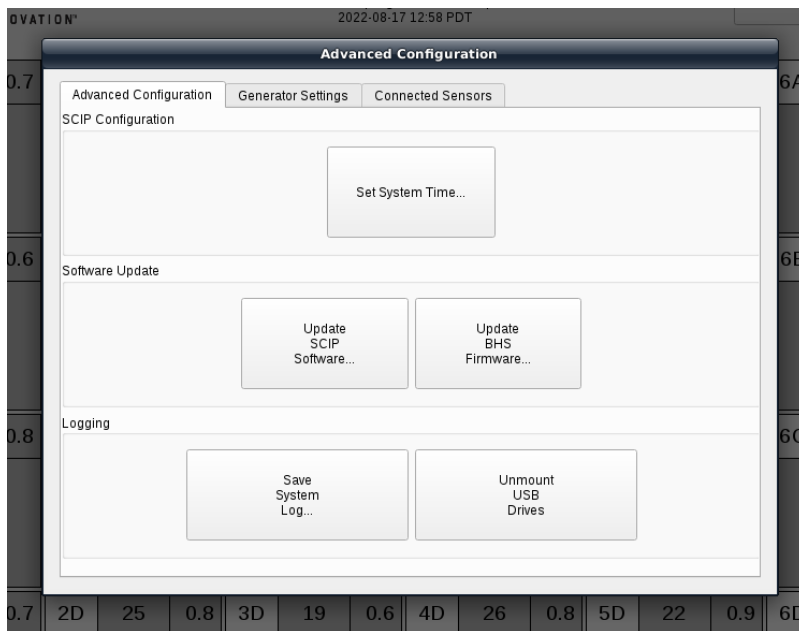
- [Export Data and Event Logs \(page 37\)](#)
- [Update the Brush Condition Monitoring Application \(page 38\)](#)
- [Update the Brush Health Sensor Firmware \(page 39\)](#)
- [Set the Brush Condition Monitoring System Time \(page 40\)](#)

## 10.1. Access the Advanced Configuration Window

1. Press Config **(A)**.
2. Press Advanced Configuration **(B)**.

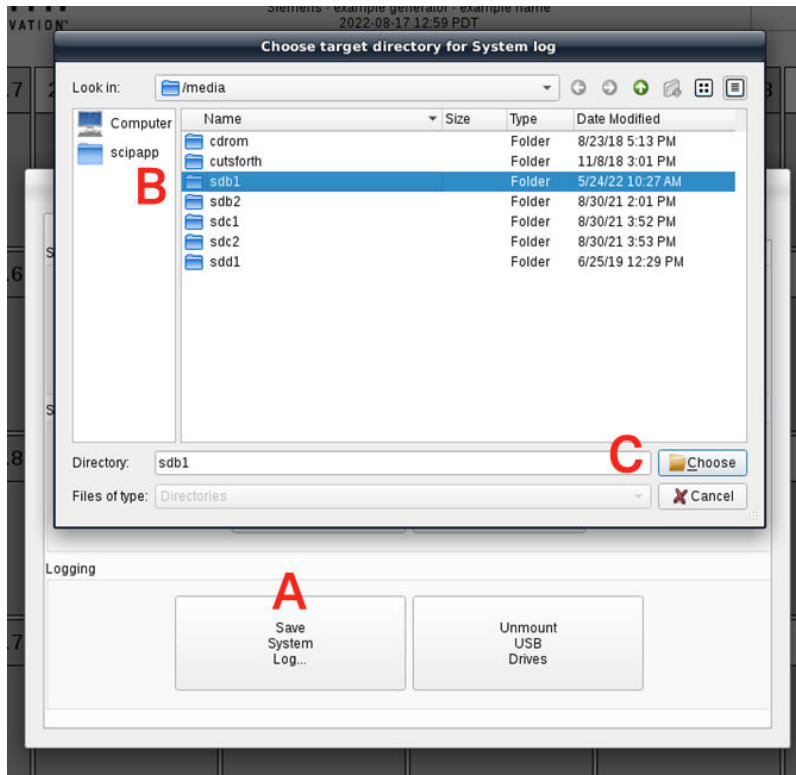


3. Enter the administrative password to open the Advanced Configuration window. Contact [support@cutsforth.com](mailto:support@cutsforth.com) for access information.



## 10.2. Export Data and Event Logs

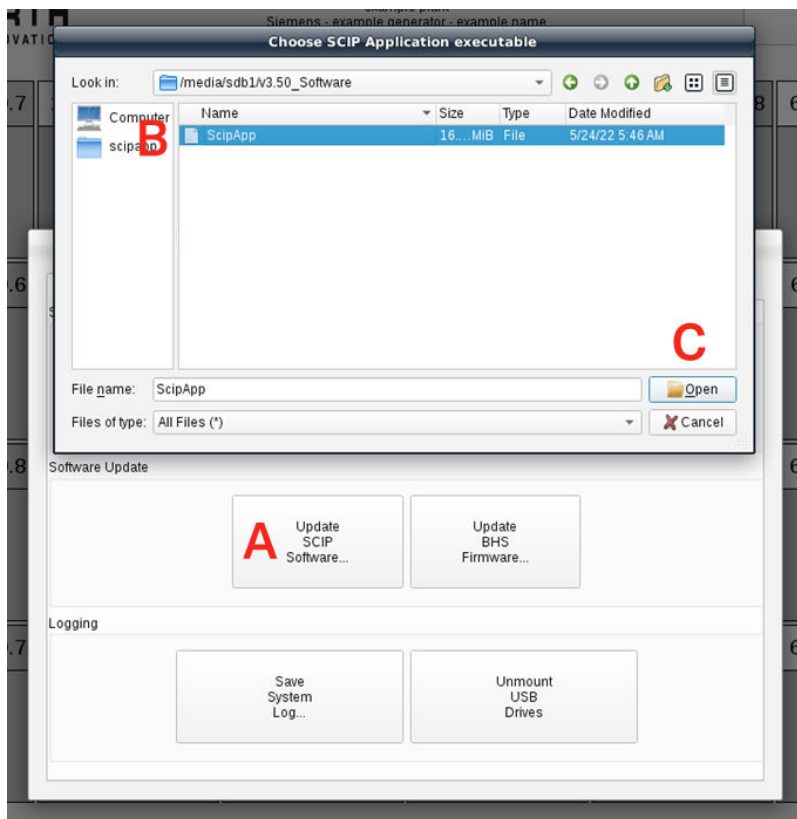
1. Plug in a USB drive.
2. Press **Save System Log (A)**
3. Select the sdb1 folder **(B)**.
4. Press **Choose (C)**. This exports historical data logs to a .csv file and system event logs in the form of .txt files.



## 10.3. Update the Brush Condition Monitoring Application

To update the Brush Condition Monitoring Application utilizing an external USB device loaded with new software:

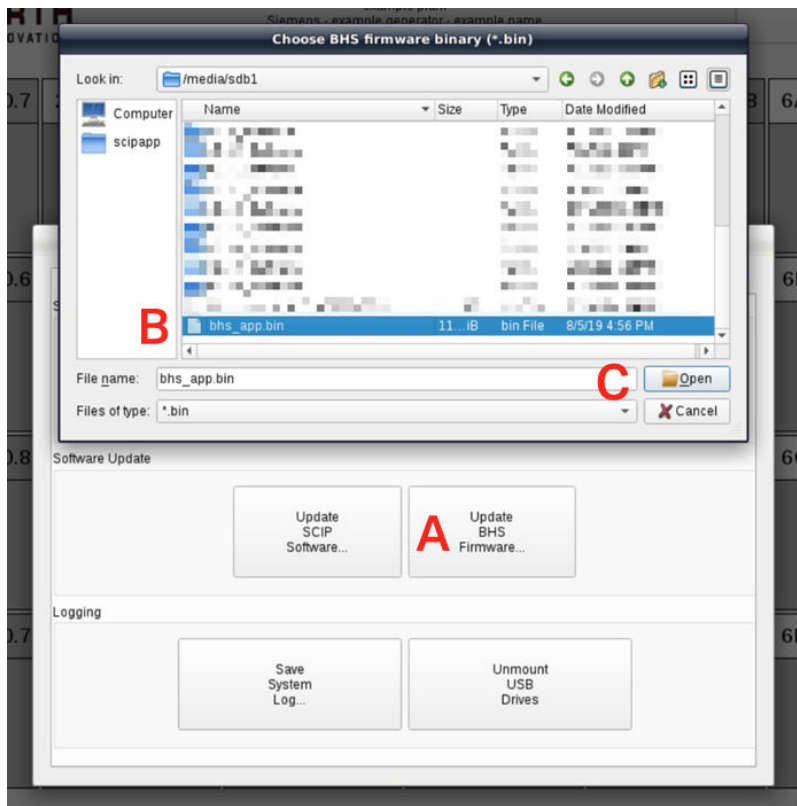
1. Plug in a USB drive with the new Brush Condition Monitoring Application.
2. Press **Update SCIP Software (A)**.
3. Open the sdb1 folder and navigate to ScipApp binary.
4. Select **ScipApp binary (B)** and press **Open (C)**.
5. The Brush Condition Monitoring Application will restart.



## 10.4. Update the Brush Health Sensor Firmware

To update the sensor firmware:

1. Plug in a USB drive with the new firmware.
2. Press **Update BHS Firmware (A)**.
3. Open the sdb1 folder and navigate to the latest firmware binary.
4. Select the firmware binary **(B)** and press **(C)**.
5. The application imports the new firmware and stages it for update.



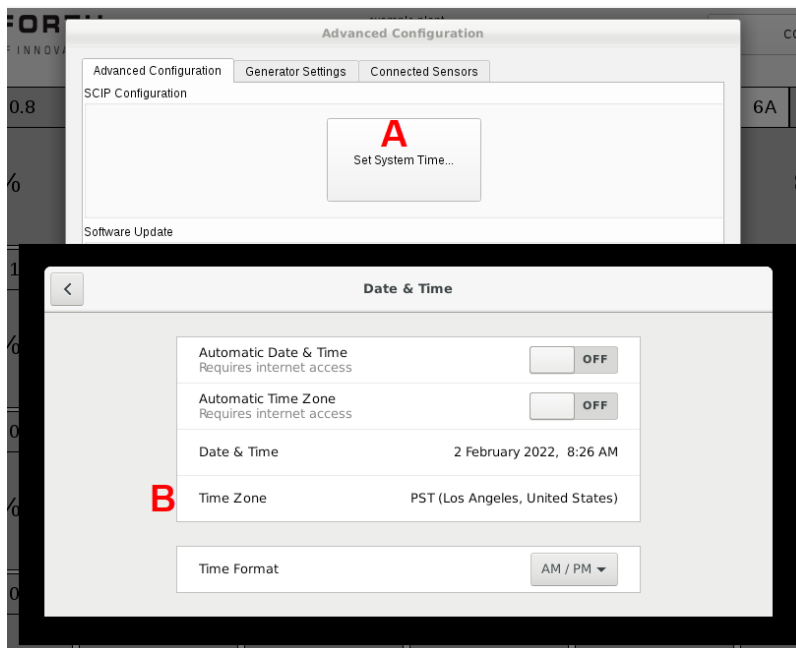
## 10.5. Set the Brush Condition Monitoring System Time

To set the Brush Condition Monitoring System time:

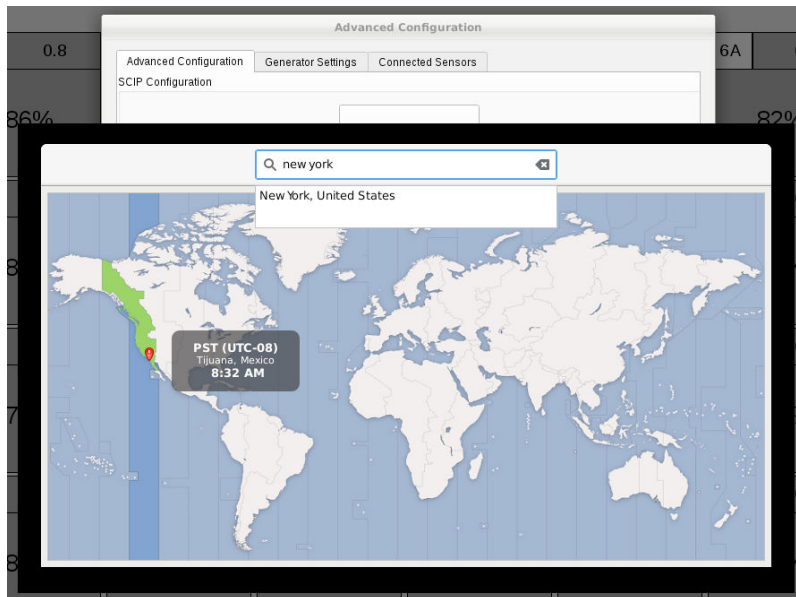
1. Press **Set System Time (A)**.
2. Press **Time Zone (B)**.



Automatic Time Zone must be turned off in order to manually set the time zone.



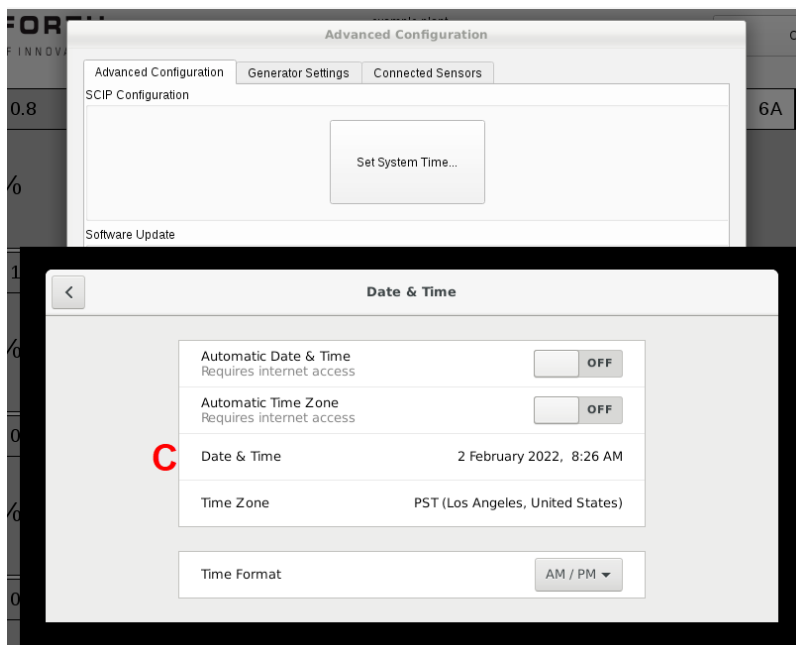
3. Select a time zone by pressing on the map or by entering a city name in the search bar and selecting from the drop-down list.



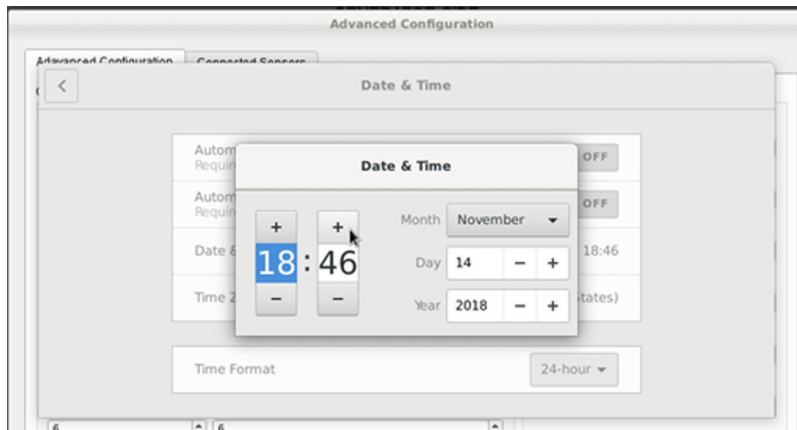
4. Press **Alt + F4** to close the Time Zone Selection window.
5. Press **Date and Time (C)**.



**Automatic Date and Time** must be turned off in order to manually set the date and time.



- Set the date and time and press the **Esc** key to close the date and time editor.



- Press **Alt + F4** to close the Date and Time window and return to the Advanced Configuration Window.
- Click anywhere on the shaded area outside of the Advanced Configuration window to close it.

## 11. Generator Settings

To access the Generator Settings page, enter the Advanced Configuration screen and navigate to the Generator Settings tab. The following settings can be changed from this page:

- Plant name
- Generator manufacturer, type, and name
- Location of on-screen generator reference label
- Measurement interval (how often sensors will report data)
- Number of brushes (number of rows and number of columns)
- Brush numbering label display type (alphanumeric vs. numeric)
- Modbus TCP port
- Modbus RTU serial interface settings



Some of the steps in these sections will require the use of a USB keyboard, USB mouse, and/or a USB storage drive. The use of a USB hub or splitter is often beneficial.

**Advanced Configuration**

Advanced Configuration | **Generator Settings** | Connected Sensors

**Generator Information**

Plant: example plant

Generator Manufacturer: Siemens

Generator Type: example generator

Generator Name: example name

Generator Location: Top

Measurement Interval: 1 hour

Num. Brush Rows: 4

Num. Brush Columns: 6

Label Display Type: Alphanumeric

Asset Tag: 0000000000

**Modbus - ttyS2 and ttyS3**

TCP Port: 501

Server Address: 1

Baud Rate: 19200

Data Bits: 8

Parity Bits: Even

Stop Bits: 1

Re-Initialize Modbus Ports

## 11.1. Measurement Interval

The Brush Condition Monitoring System collects data sets from the Brush Health Sensors (BHS) during regular measurement intervals. This measurement interval is a user-configurable setting from the Generator Settings page with options of 1, 3, 6, or 12 hours. Please note that battery life of the BHS is directly impacted with the frequency of data collection.

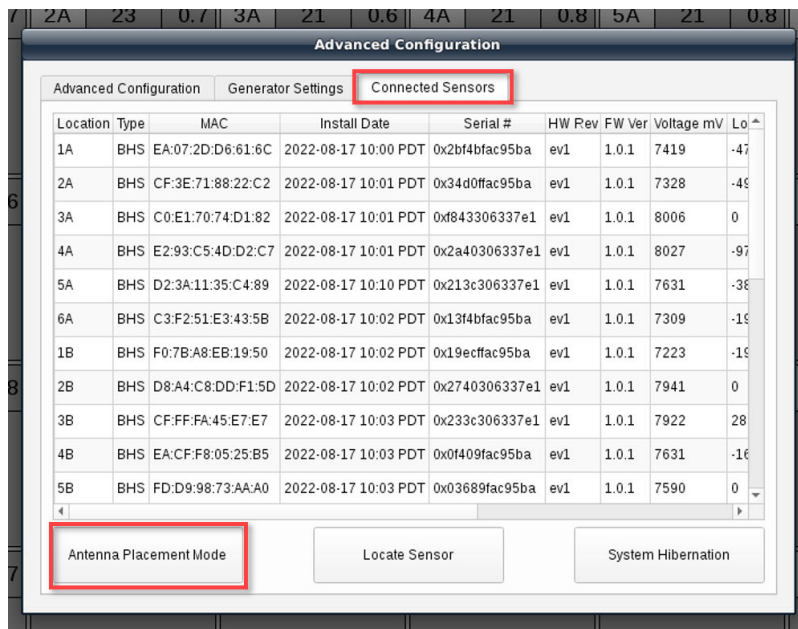
The screenshot shows the 'Advanced Configuration' window with the 'Generator Settings' tab selected. The 'Generator Information' section contains fields for Plant, Generator Manufacturer, Generator Type, Generator Name, and Generator Location. The 'Modbus - ttyS2 and ttyS3' section contains fields for TCP Port, Server Address, Baud Rate, Data Bits, Parity Bits, and Stop Bits. The 'Measurement Interval' dropdown menu is highlighted with a red box, showing options: 1 hour, 3 hours, 6 hours, and 12 hours. The 'Num. Brush Rows' and 'Num. Brush Columns' fields are also visible. The 'Label Display Type' is set to 'Alphanumeric' and the 'Asset Tag' is '0000000000'. A 'Re-Initialize Modbus Ports' button is located at the bottom right.

## 12. Antenna Placement Mode



Sensor batteries will drain at a faster than normal rate during antenna placement mode.

To enter antenna placement mode, navigate to the Connected Sensors tab in the Advanced Configuration window and press **Antenna Placement Mode**.



In antenna placement mode, brush status indicators show radio signal strength instead of sensor data. Background color changes depending on the strength of the radio signal:

- **Red:** Weak or unknown signal strength
- **Pink:** Moderate signal strength
- **Gray:** Strong signal strength

Two numbers are shown for every location:

- The left number is the signal strength on the Primary Controller side (quality of the radio link from sensor to the Primary Controller).
- The right number is the signal strength on the sensor side (quality of the radio link from Primary Controller to sensor).

Please allow around one hour for all sensors to report signal strength. To exit antenna placement mode, navigate back to the Connected Sensors tab in the Advanced Configuration window, and press **Antenna**

**Placement Mode.** To prevent excessive battery drainage, the BCM system will automatically quit antenna placement mode after two hours.

example plant  
Siemens - example generator - example name  
2022-08-17 14:45 PDT

**WARNING:**  
**ANTENNA**  
**PLACEMENT**

CONFIG

GENERATOR SIDE

|               |               |               |               |               |               |
|---------------|---------------|---------------|---------------|---------------|---------------|
| 1A<br>-54/-51 | 2A<br>-52/-48 | 3A<br>-53/-51 | 4A<br>-53/-59 | 5A<br>-50/-46 | 6A<br>-60/-57 |
| 1B<br>-53/-49 | 2B<br>-53/-48 | 3B<br>-50/-49 | 4B<br>-47/-43 | 5B<br>-53/-47 | 6B<br>-58/-50 |
| 1C<br>-59/-59 | 2C<br>-54/-56 | 3C<br>-57/-55 | 4C<br>-54/-49 | 5C<br>-50/-43 | 6C<br>-49/-45 |
| 1D<br>-50/-44 | 2D<br>-49/-44 | 3D<br>-57/-55 | 4D<br>-54/-55 | 5D<br>-54/-55 | 6D<br>-50/-43 |

Radio ON Asset: 0000000000 - v3.50

## 13. Modbus Interface

To convert the alphanumeric brush location tags to a numeric value that corresponds to the Modbus outputs, use the following schema: From smallest to largest: 1A, 2A, 3A,..., 1B, 2B, 3B,..., 1C, 2C, 3C, etc.



The Brush Condition Monitoring System should be configured as a slave device.

Refer to this table when programming the Modbus output on your BCM System:

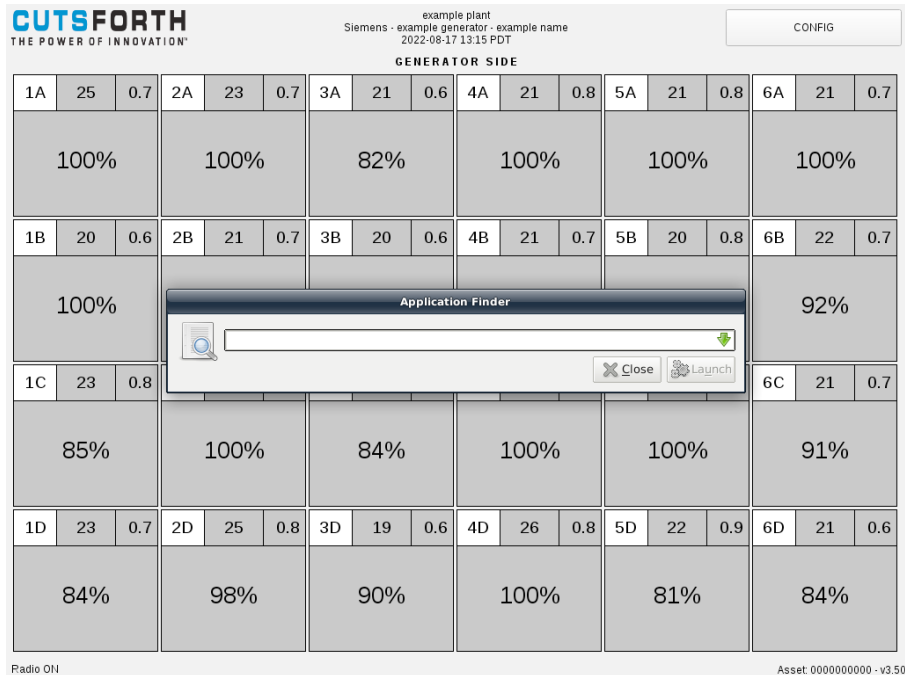
| Brush | Name                         | Value Type | Value Unit                                                                | Register Type  | Address (Base 0) | Physical Address (Base 0) | Supported Functions         |
|-------|------------------------------|------------|---------------------------------------------------------------------------|----------------|------------------|---------------------------|-----------------------------|
| 0–229 | Sensor Low Batt              | Boolean    | Flag                                                                      | Discrete Input | 10000–10229      | 0x000–0x0E5               | 0x02 Read<br>Discrete Input |
| 0–229 | Sensor Malfunction           | Boolean    | Flag                                                                      | Discrete Input | 10230–10459      | 0x0E6–0x1CB               | 0x02 Read<br>Discrete Input |
| 0–229 | Replace Brush Now (Critical) | Boolean    | Flag                                                                      | Discrete Input | 10460–10659      | 0x1CC–0x2B1               | 0x02 Read<br>Discrete Input |
| 0–229 | Replace Brush Soon (Alert)   | Boolean    | Flag                                                                      | Discrete Input | 10690–10919      | 0x2B2–0x397               | 0x02 Read<br>Discrete Input |
| 0–229 | High Vibration Warning       | Boolean    | Flag                                                                      | Discrete Input | 10920–11149      | 0x398–0x47D               | 0x02 Read<br>Discrete Input |
| 0–229 | Sensor Sample Old            | Boolean    | Flag                                                                      | Discrete Input | 11150–11379      | 0x47E–0x563               | 0x02 Read<br>Discrete Input |
| 0–229 | Temperature Critical         | Boolean    | Flag                                                                      | Discrete Input | 11380–11609      | 0x564–0x649               | 0x02 Read<br>Discrete Input |
| 0–229 | Length Error                 | Boolean    | Flag                                                                      | Discrete Input | 11610–11839      | 0x64A–0x72F               | 0x02 Read<br>Discrete Input |
| 0–229 | Brush Length                 | Short      | % Remaining                                                               | Input Register | 30000–30229      | 0x000–0x0E5               | 0x04 Read<br>Input Register |
| 0–229 | Pk-to-Pk Displacement        | Word       | 0.001 mils                                                                | Input Register | 30230–30459      | 0x0E6–0x1CB               | 0x04 Read<br>Input Register |
| 0–229 | Temperature                  | Short      | Degrees C                                                                 | Input Register | 30460–30689      | 0x1CC–0x2B1               | 0x04 Read<br>Input Register |
| N/A   | System Status                | Word       | Bitfield: b0 : Hibernation Mode (1 - Enabled, 0 - Disabled)<br>b1-15: RFU | Input Register | 30920            | 0x398                     | 0x04 Read<br>Input Register |
| N/A   | System Time                  | Word       | POSIX time (LSB - MSB)                                                    | Input Register | 30921–30922      | 0x399–0x39A               | 0x04 Read<br>Input Register |
| N/A   | Short Brush Count            | Word       | Number of brushes that must be replaced immediately                       | Input Register | 30923            | 0x39B                     | 0x04 Read<br>Input Register |

| Brush | Name                                         | Value Type | Value Unit                                        | Register Type  | Address (Base 0) | Physical Address (Base 0) | Supported Functions         |
|-------|----------------------------------------------|------------|---------------------------------------------------|----------------|------------------|---------------------------|-----------------------------|
| N/A   | Near-Short Brush Count                       | Word       | Number of brushes that will need replacement soon | Input Register | 30924            | 0x39C                     | 0x04 Read<br>Input Register |
| N/A   | High Vibration Brush Count                   | Word       | Number of sensors reporting high vibration        | Input Register | 30925            | 0x39D                     | 0x04 Read<br>Input Register |
| N/A   | Sensor Error Count                           | Word       | Number of sensors reporting errors                | Input Register | 30926            | 0x39E                     | 0x04 Read<br>Input Register |
| N/A   | Low Battery Total                            | Word       | Number of sensors reporting low battery           | Input Register | 30927            | 0x39F                     | 0x04 Read<br>Input Register |
| 0–229 | Battery Voltage                              | Word       | Millivolts (mV)                                   | Input Register | 30928–31157      | 0x3A0–0x485               | 0x04 Read<br>Input Register |
| 0–229 | RSSI Value                                   | Word       | Decibel milliwatts (dBm)                          | Input Register | 31158–31387      | 0x486–0x56B               | 0x04 Read<br>Input Register |
| 0–229 | BHS MAC address (lo byte, little-endian)     | Word       | N/A                                               | Input Register | 31388–31617      | 0x56C–0x651               | 0x04 Read<br>Input Register |
| 0–229 | BHS MAC address (mid byte, little endian)    | Word       | N/A                                               | Input Register | 31618–31847      | 0x652–0x737               | 0x04 Read<br>Input Register |
| 0–229 | BHS MAC address (hi byte, little-endian)     | Word       | N/A                                               | Input Register | 31848–32077      | 0x738–0x81D               | 0x04 Read<br>Input Register |
| 0–229 | SensorError Register with Sensor Error Flags | Word       | N/A                                               | Input Register | 32078–32307      | 0x81E–0x903               | 0x04 Read<br>Input Register |
| N/A   | Old Samples Count                            | Word       | Number of sensors reporting old samples           | Input Register | 32308            | 0x904                     | 0x04 Read<br>Input Register |
| N/A   | Temperature Critical Count                   | Word       | Number of sensors reporting critical temperature  | Input Register | 32309            | 0x905                     | 0x04 Read<br>Input Register |

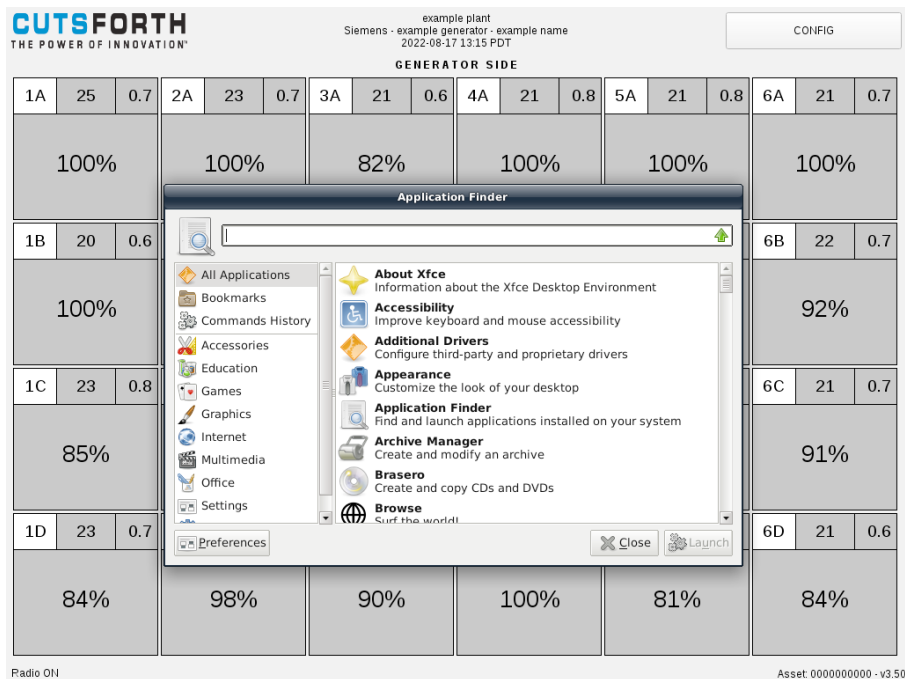
| Brush | Name               | Value Type | Value Unit                                      | Register Type  | Address (Base 0) | Physical Address (Base 0) | Supported Functions      |
|-------|--------------------|------------|-------------------------------------------------|----------------|------------------|---------------------------|--------------------------|
| N/A   | Length Error Count | Word       | Number of sensors reporting brush length errors | Input Register | 32310            | 0x906                     | 0x04 Read Input Register |

## 13.1. Entering a Static IP Address

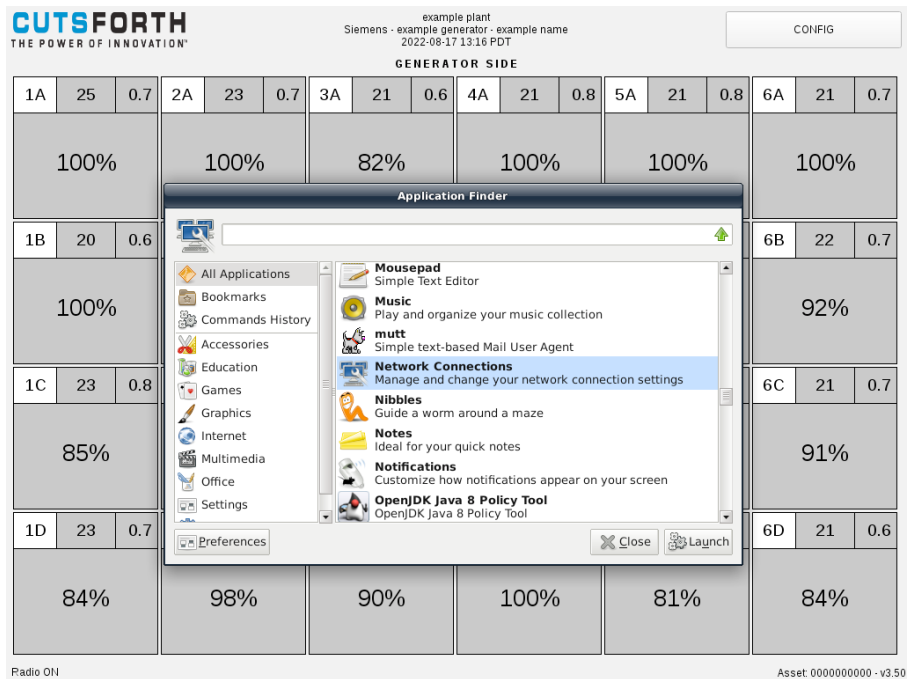
1. Plug the USB keyboard into the BCM system.
2. Press **Alt+F2** to pull up the Application Finder.



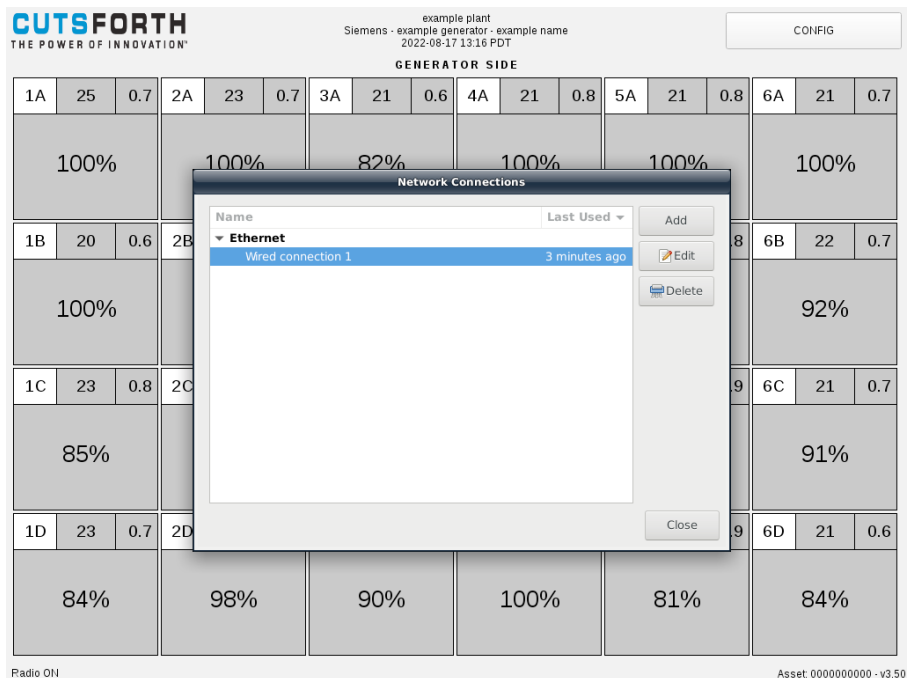
3. Click on the green arrow that is pointed down to display the window of options.



4. Scroll down, select **Network Connections**, and click **Launch**.



5. Double-click **Wired Connection 1**.



6. Select the **IPv4 Settings** tab.

The screenshot shows the Cutsforth web interface with a 'GENERATOR SIDE' table in the background. The 'Editing Wired connection 1' dialog box is open, displaying the 'IPv4 Settings' tab. The 'Method' is set to 'Automatic (DHCP)'. The 'Additional static addresses' section has empty fields for Address, Netmask, and Gateway. The 'Additional DNS servers' and 'Additional search domains' fields are also empty. The 'DHCP client ID' field is empty. A checkbox for 'Require IPv4 addressing for this connection to complete' is unchecked. The 'Routes...' button is visible at the bottom right of the dialog. The background table shows various generator parameters and their percentages.

| 1A   |     |  | 2A   |     |  | 3A  |     |  | 4A  |     |  | 5A  |     |  | 6A  |     |  |
|------|-----|--|------|-----|--|-----|-----|--|-----|-----|--|-----|-----|--|-----|-----|--|
| 25   | 0.7 |  | 23   | 0.7 |  | 21  | 0.6 |  | 21  | 0.8 |  | 21  | 0.8 |  | 21  | 0.7 |  |
| 100% |     |  | 100% |     |  | 92% |     |  | 91% |     |  | 84% |     |  | 84% |     |  |

7. Under the Method drop-down, select **Manual** to change IP configuration settings to **static**.

The screenshot shows the Cutsforth web interface with the 'Editing Wired connection 1' dialog box open, displaying the 'IPv4 Settings' tab. The 'Method' is now set to 'Manual'. The 'Addresses' section has empty fields for Address, Netmask, and Gateway. The 'DNS servers' and 'Search domains' fields are also empty. The 'DHCP client ID' field is empty. A checkbox for 'Require IPv4 addressing for this connection to complete' is unchecked. The 'Routes...' button is visible at the bottom right of the dialog. The background table shows various generator parameters and their percentages.

| 1A   |     |  | 2A   |     |  | 3A  |     |  | 4A  |     |  | 5A  |     |  | 6A  |     |  |
|------|-----|--|------|-----|--|-----|-----|--|-----|-----|--|-----|-----|--|-----|-----|--|
| 25   | 0.7 |  | 23   | 0.7 |  | 21  | 0.6 |  | 21  | 0.8 |  | 21  | 0.8 |  | 21  | 0.7 |  |
| 100% |     |  | 100% |     |  | 92% |     |  | 91% |     |  | 84% |     |  | 84% |     |  |

- Click **Add**.

example plant  
Siemens - example generator - example name  
2022-08-17 13:22 PDT

CONFIG

GENERATOR SIDE

|    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |
|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|
| 1A | 25 | 0.7 | 2A | 23 | 0.7 | 3A | 21 | 0.6 | 4A | 21 | 0.8 | 5A | 21 | 0.8 | 6A | 21 | 0.7 |
|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|

100%

100%

92%

21

0.7

85%

21

0.7

84%

21

0.6

84%

98%

90%

100%

81%

Radio ON

Asset: 0000000000 - v3.50

Editing Wired connection 1

Connection name: Wired connection 1

General Ethernet 802.1X Security DCB Proxy IPv4 Settings IPv6 Settings

Method: Manual

Addresses

| Address | Netmask | Gateway |
|---------|---------|---------|
|         |         |         |

Add

Delete

DNS servers:

Search domains:

DHCP client ID:

☐ Require IPv4 addressing for this connection to complete

Routes...

Cancel Save

- Enter the desired addressing information, and click **Save** when you are finished.

example plant  
Siemens - example generator - example name  
2022-08-17 13:25 PDT

CONFIG

GENERATOR SIDE

|    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |
|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|
| 1A | 25 | 0.7 | 2A | 23 | 0.7 | 3A | 21 | 0.6 | 4A | 21 | 0.8 | 5A | 21 | 0.8 | 6A | 21 | 0.7 |
|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|

100%

100%

92%

21

0.7

85%

21

0.7

84%

21

0.6

84%

98%

90%

100%

81%

Radio ON

Asset: 0000000000 - v3.50

Editing Wired connection 1

Connection name: Wired connection 1

General Ethernet 802.1X Security DCB Proxy IPv4 Settings IPv6 Settings

Method: Manual

Addresses

| Address         | Netmask         | Gateway |
|-----------------|-----------------|---------|
| 111.111.111.111 | 111.111.111.111 |         |

Add

Delete

DNS servers:

Search domains:

DHCP client ID:

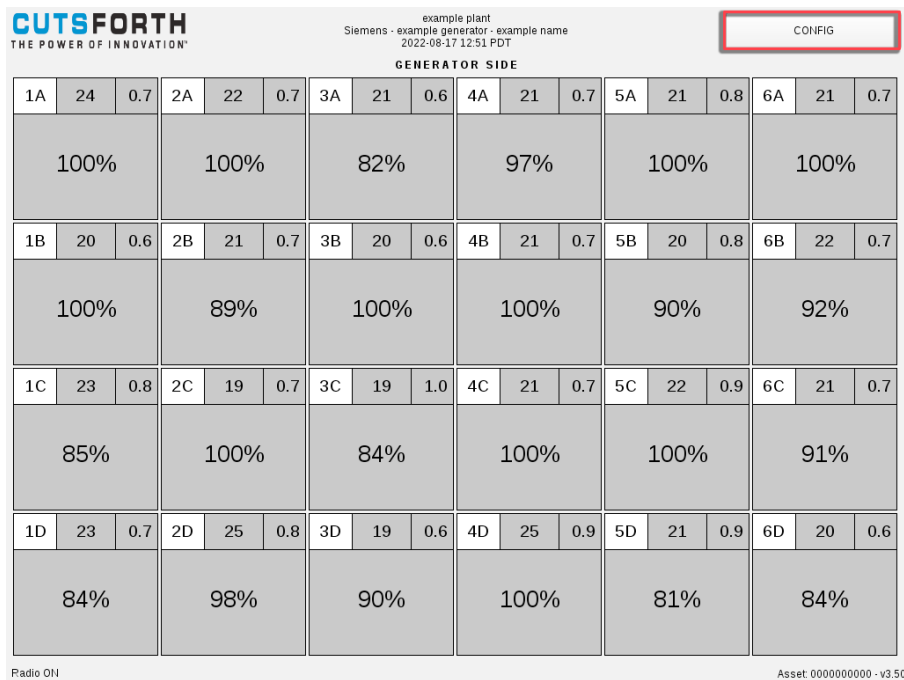
☒ Require IPv4 addressing for this connection to complete

Routes...

Cancel Save

## 13.2. Locating the MAC Addresses

1. Connect a USB keyboard to the BCM system.
2. From the BCM Application Home Screen, press **CONFIG** in the upper-right corner.



**CUTSFORTH**  
THE POWER OF INNOVATION™

example plant  
Siemens - example generator - example name  
2022-08-17 12:51 PDT

**CONFIG**

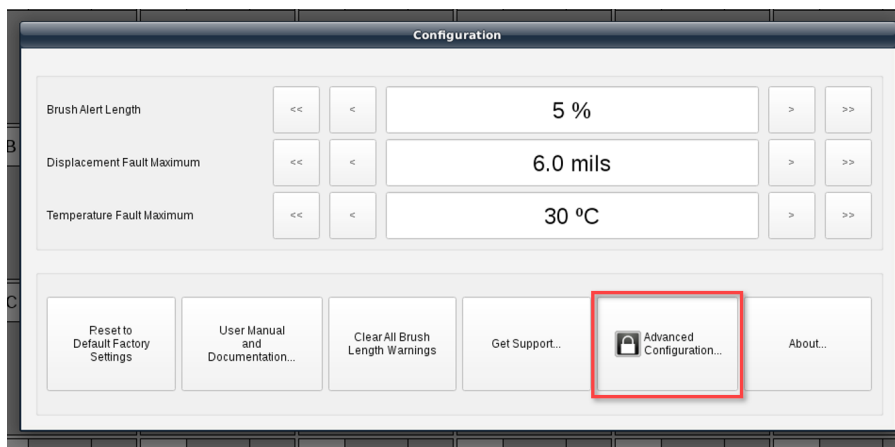
**GENERATOR SIDE**

| 1A   | 24 | 0.7 | 2A   | 22 | 0.7 | 3A   | 21 | 0.6 | 4A   | 21 | 0.7 | 5A   | 21 | 0.8 | 6A   | 21 | 0.7 |
|------|----|-----|------|----|-----|------|----|-----|------|----|-----|------|----|-----|------|----|-----|
| 100% |    |     | 100% |    |     | 82%  |    |     | 97%  |    |     | 100% |    |     | 100% |    |     |
| 1B   | 20 | 0.6 | 2B   | 21 | 0.7 | 3B   | 20 | 0.6 | 4B   | 21 | 0.7 | 5B   | 20 | 0.8 | 6B   | 22 | 0.7 |
| 100% |    |     | 89%  |    |     | 100% |    |     | 100% |    |     | 90%  |    |     | 92%  |    |     |
| 1C   | 23 | 0.8 | 2C   | 19 | 0.7 | 3C   | 19 | 1.0 | 4C   | 21 | 0.7 | 5C   | 22 | 0.9 | 6C   | 21 | 0.7 |
| 85%  |    |     | 100% |    |     | 84%  |    |     | 100% |    |     | 100% |    |     | 91%  |    |     |
| 1D   | 23 | 0.7 | 2D   | 25 | 0.8 | 3D   | 19 | 0.6 | 4D   | 25 | 0.9 | 5D   | 21 | 0.9 | 6D   | 20 | 0.6 |
| 84%  |    |     | 98%  |    |     | 90%  |    |     | 100% |    |     | 81%  |    |     | 84%  |    |     |

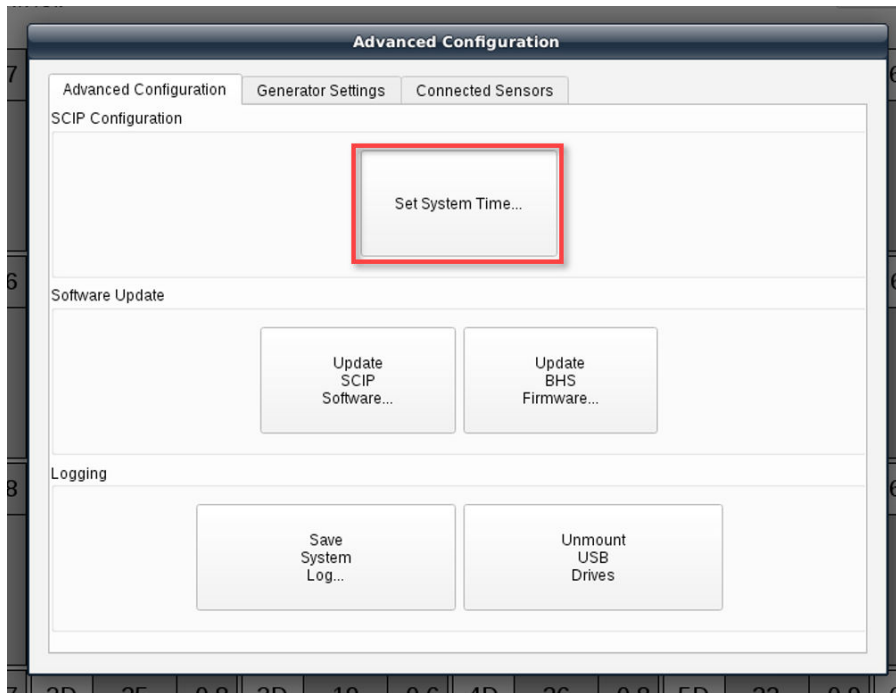
Radio ON

Asset: 0000000000 - v3.50

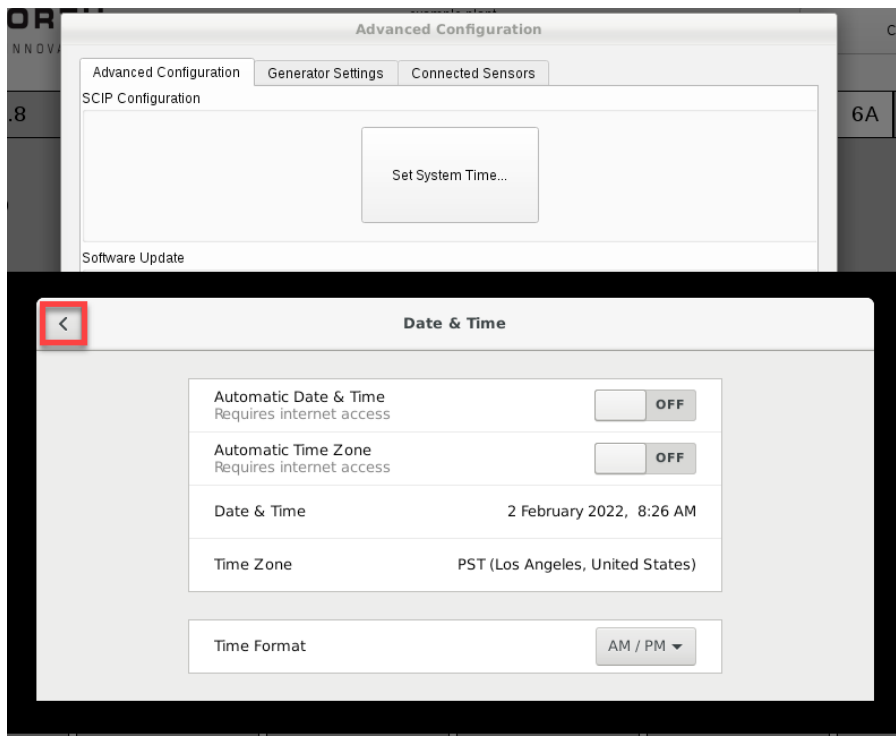
3. At the bottom of the Configuration screen, press **Advanced Configuration**. When prompted, enter the administrative password.



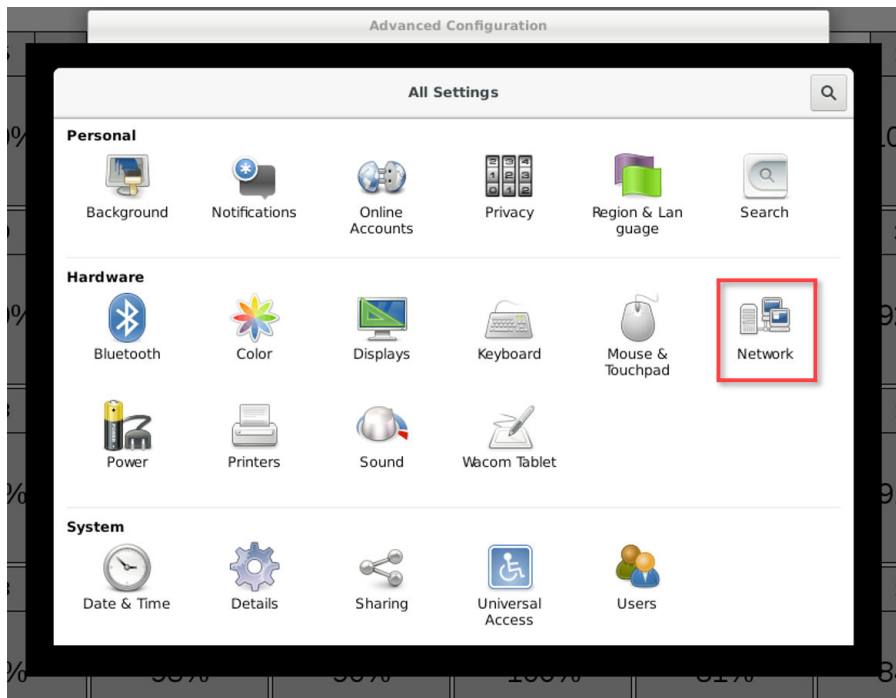
4. In the lower-right corner of the Advanced Configuration screen, press **Set System Time**.



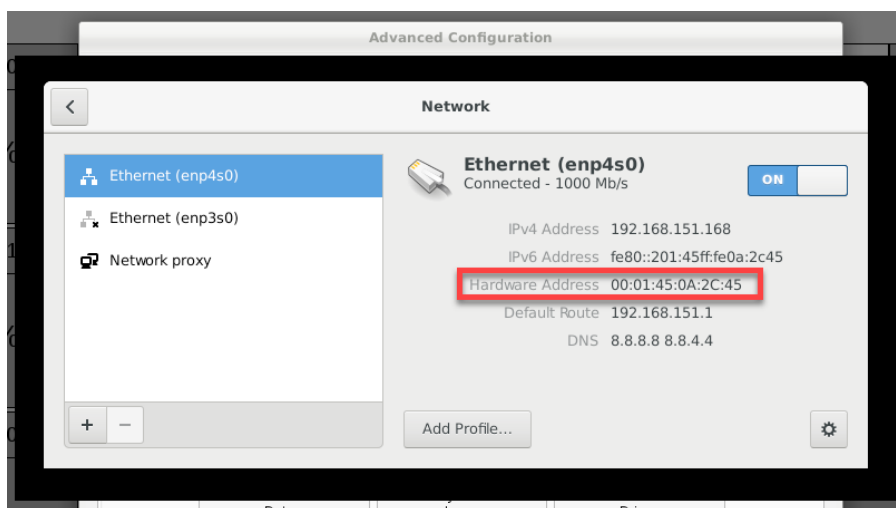
5. From the Data & Time screen, press the back button in the upper-left corner.



6. From the All Settings menu, select **Network**.



7. The MAC addresses will be listed as "Hardware Address" under each "Ethernet" option in the list on the left hand side.



## 13.3. Modbus RTU Configuration

In addition to Modbus TCP/IP, the BCM System also supports Modbus RTU communication via either RS-232 or RS-485. If using Modbus RTU, confirm the serial ports are configured appropriately for either RS-232 or RS-485. This can be managed in the SIO Configuration settings within the BIOS menu. The BIOS menu can be accessed by pressing F2 during the bootup process.

A null modem cable is required if using RS-232.

The BCM System provides an RJ45 connection point for the Modbus RTU communications. The following table outlines the wiring pinouts for RS-232 and RS-485.

| RJ45 Pin | RS-232 | RS-485  |
|----------|--------|---------|
| 1        | DSR    | Tx/Rx - |
| 2        | RTS    | N/A     |
| 3        | Shield | N/A     |
| 4        | Tx     | N/A     |
| 5        | Rx     | Tx/Rx + |
| 6        | GND    | GND     |
| 7        | CTR    | N/A     |
| 8        | DTR    | N/A     |

## 14. Frequently Asked Questions (FAQ)

*How can I confirm if a sensor is already paired and where it is paired to?*

Return to the main screen of the controller, single-press the button on the BHS sensor in question and that sensor's brush location icon will flash with a blue border for a few seconds. If none of the brush location icons flash, that sensor is not paired to any of the brush location icons.

*Can a new BHS be installed on a used brush?*

Yes, both a new BHS and a used BHS with battery life remaining can be installed on new and partially used brushes alike. Remember, in both cases, to single-press the sensor button after the sensor and brush are installed in the holder, but before it is installed onto the generator, to reset the brush length data.

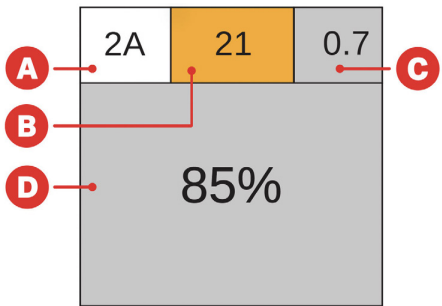
*How long does a BHS battery last?*

The expected battery life of the sensors is 2 years or longer and may vary depending on environmental conditions and the user-set measurement intervals. The brush location icon will show a low battery warning roughly 30 days prior to the end of the BHS battery life.

*What is the "Clear Brush Length Warnings" button on the brush detail screen for?*

When a brush length falls below the threshold set in the CONFIG screen, that brush data icon will turn pink, and then red if it falls below 0%. If the brush length is no longer below the user-set threshold, but the pink/red condition still persists, pressing this button will reset the icon back to gray.

*What do the different color warnings mean in the Brush Data Icon?*

|                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>A Location</b><br/><b>B Temperature</b> (Peak Average in Degrees Celsius)<br/><b>C Brush Vibration/Displacement</b> (Mils Peak-to-Peak)<br/><b>D Usable Brush Life Remaining</b></p> | <p>Section <b>C</b> will turn orange when the vibration/displacement threshold is exceeded, which is set in the CONFIG screen under "Displacement Fault."</p> <p>Section <b>D</b> will turn pink when the usable brush life goes below the "Brush Alert Length" threshold, also set in the CONFIG screen. Then this section will turn red once the brush exceeds its usable life (0%).</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## *What do I do if I see "No Data" on a brush location icon?*

Attempt the following troubleshooting steps in this order:

1. Press the button on the associated sensor once, and watch the BCM screen to see if the location in question updates with data within a few seconds.
2. Unpair and re-pair the BHS following the instructions under Pairing a Brush Health Sensor, then wait for the measurement interval to pass (default is three hours) to see if the location begins showing data.

If steps 1-2 are not successful, please submit a support request at [Cutsforth.com/Support](https://Cutsforth.com/Support).

## *What does the symbol on the brush location icon mean?*

The  symbol indicates that attention is needed on that brush location, though it can mean a number of different things, from an abnormal brush length reading to a sensor not being connected to the BCM System. Clicking on the brush location icon can yield some information about this alert in some cases, but for the most detailed information, you can export the system logs (see section 13.2). If the alert is associated with a condition that is no longer present, pressing the "Clear Brush Length Warnings" button on the brush details screen will clear this alert.

## 15. Glossary

|                                   |                                                                                                                                                                                                                                                                                 |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| antenna                           | A device, typically mounted inside the exciter enclosure, which helps facilitate wireless communications between the Brush Condition Monitoring System and the Brush Health Sensors.                                                                                            |
| antenna placement mode            | An optional mode included in the Brush Condition Monitoring System which displays the wireless signal strength of each sensor in or order to assist in successful placement of the antenna.                                                                                     |
| attenuation                       | The reduction of the amplitude of a signal due to excessive cable length.                                                                                                                                                                                                       |
| auxiliary display                 | An optional, secondary enclosure of the Brush Condition Monitoring System which consists of a fully-functioning duplicate display of the primary controller.                                                                                                                    |
| AWG                               | American Wire Gauge                                                                                                                                                                                                                                                             |
| Brush Condition Monitoring System | A Cutsforth EASYchange® monitoring system that performs automated measurements and brush health analytics that allow plant operators to improve the efficiency of technicians' daily and weekly tasks by dispatching them to the collector when maintenance is actually needed. |
| Brush Health Sensor (BHS)         | A wireless sensor integrated into the brush spring which communicates with the Brush Condition Monitoring System.                                                                                                                                                               |
| DCS                               | Distributed Control System                                                                                                                                                                                                                                                      |
| LOTO                              | Lockout/Tagout                                                                                                                                                                                                                                                                  |
| Modbus RTU                        | Modbus Remote Terminal Unit                                                                                                                                                                                                                                                     |
| Modbus TCP                        | Modbus Transmission Control Protocol                                                                                                                                                                                                                                            |
| primary controller                | The main enclosure of the Brush Condition Monitoring System, which contains the computer and power supply as well as the main touchscreen interface.                                                                                                                            |