

Operations Manual EZDP-2058 Rev J

Brush Condition Monitoring



THE INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND PROPRIETARY TO CUTSFORTH INC. AND SHALL NOT BE REPRODUCED OR DISCLOSED IN WHOLE OR PART FOR ANY DESIGN OR MANUFACTURE WITHOUT THE WRITTEN AUTHORIZATION OF CUTSFORTH INC.

CUTSFORTH THE POWER OF INNOVATION"

Table of Contents

1 About Cutsforth	Δ
1.1 Cutsforth Products	. 4
1.2. Cutsforth Field Services	. 4
1.3 Cutsforth Automation and Control Services	. -
2 Legal Information	
2. Legal III of Manophy	. J 5
2. 1. LITTILEU VValtality	. U
2.2. CUPYI19116	. 0
2.0. Falterillo	. U
2.4. Federal Communications Commission Requirements	. 0
2.4.1. Drush Conduction Monitoring - Primary Condroller	. 0
2.4.2. Brush Health Sensor	. 0
2.0. ISED Ganada Regulatory Compliance Statement	. /
3. Safety Information	. 8
	. 8
3.1.1. Safety Conventions	. 8
3.1.2. General Safety Instructions	. 8
3.2. Consignes de Securite [Français]	. 9
3.2.1. Conventions de Sécurité	. 9
3.2.2. Consignes de Sécurité Générales	10
4. EASYchange Brush Condition Monitoring	11
5. Brush Condition Monitoring (BCM) Technical Specifications	12
5.1. Primary Controller Technical Specifications	12
5.2. BHS Technical Specifications	12
5.3. Data from Primary Controller	13
6. Primary Controller Overview	14
7. Brush Condition Monitoring System Installation	15
7.1. Mounting the Brush Condition Monitoring System Enclosure	16
7.1.1. Brush Condition Monitoring System Mounting Requirements	16
7.2. Running Power to the Brush Conditioning Monitoring System	17
7.3. Route the Antenna Cabling	18
7.4. Install Brush Holder Label Clips	19
8. Brush Health Sensors	20
8.1. Pair a New Sensor	20
8.2. Frequency of Sensor Updates	21
8.3. Unpair a Sensor	21
8.3.1. Replacing a Brush	21
8.4. Brush Health Sensor Battery Life	22
8.5. Button-On Self Test	23
9. Using the Primary Controller User Interface	24
9.1. Power On the Primary Controller	24
9.2. Primary Controller Screen Layout	24
9.3. Navigating the Primary Controller Screen	26
9.4. Power Off the Primary Controller	27
10. Connecting an Auxiliary Display	28
11. Brush Status Indication	29
11.1. Color Definitions	30
12. Configure the Brush Condition Monitoring System Settings	31

CUTSFORTH THE POWER OF INNOVATION"

13. Advanced Configuration Settings	33
13.1. Access the Advanced Configuration Window	34
13.2. Export Data and Event Logs	35
13.3. Update the Brush Condition Monitoring Application	36
13.4. Update the Brush Health Sensor Firmware	37
13.5. Set the Brush Condition Monitoring System Time	38
14. Generator Settings	41
14.1. Measurement Interval	42
15. Antenna Placement Mode	43
16. Modbus Interface	45
16.1. Entering a Static IP Address	48
16.2. Locating the MAC Addresses	52
17. Frequently Asked Questions (FAQ)	55
18. Glossary	57



1. About Cutsforth

Cutsforth specializes in developing innovative new technologies and services to support the power generation industry. Cutsforth's patented EASYchange® brush holder design, online truing service, InsightCM[™] condition monitoring software, and patented shaft grounding and monitoring systems have been installed across the globe in generators of all sizes and in nearly every industry application, including nuclear, natural gas, coal, wind, and hydroelectric.

Cutsforth's knowledge and commitment to excellence drives our innovative solutions for the changing needs of the power industry. Whether it is a quick response to a critical situation or a new way of solving an old problem, our commitment to quality ensures that our customers receive best-in-class products and services—Cutsforth is the Power of Innovation.

Cutsforth, Inc. started back in 1991 as a small company focused primarily on making replacement brush holders for generators and exciters. Today, after 30+ years in business, Cutsforth's experience and innovative designs have brought its best-in-class excitation brush holder and shaft grounding replacements and collector ring services to some of the world's largest power companies.

1.1. Cutsforth Products

- EASYchange[®] Removable Brush Holders
- EASYchange[®] Brush Condition Monitoring
- Cutsforth Shaft Grounding Systems
- Rotor Flux Monitoring
- Electro-Magnetic Interference Monitoring
- InsightCM[™] Condition Monitoring Software

1.2. Cutsforth Field Services

Cutsforth provides comprehensive product installations for all product offerings as well as on-site training after the installation. We work efficiently during your outage to ensure a smooth upgrade to our innovative solutions such as Product Installations, Online Collector Ring and Commutator Truing, Spiral Groove Restoration, and Consulting and Emergency Services.

1.3. Cutsforth Automation and Control Services

Cutsforth provides comprehensive Automation and Control services which include data historian integration, InsightCM[™] integration, DCS logic, engineered drawings and much more. This further complements our turnkey monitoring system installations.



2. Legal Information

2.1. Limited Warranty

This document is provided 'as is' and is subject to being changed, without notice, in future editions. Cutsforth reviews this document carefully for technical accuracy; however, CUTSFORTH MAKES NO EXPRESS OR IMPLIED WARRANTY AS TO THE ACCURACY OF THE INFORMATION WITHIN THIS MANUAL AS IT RELATES TO SPECIFIC INSTALLATION. THE CUSTOMER IS RESPONSIBLE FOR VERIFYING INSTALLATION AND OPERATING CONDITIONS AT EACH INSTALLATION LOCATION AND FOR EACH GENERATOR TYPE. Cutsforth warrants that its hardware products will be free of defects in materials and workmanship that cause the product to fail to substantially conform to the applicable Cutsforth published specifications for one (1) year from the date of invoice.

For a period of ninety (90) days from the date of invoice, Cutsforth warrants that (i) its software products will perform substantially in accordance with the applicable documentation provided with the software, and (ii) the software media will be free from defects in materials and workmanship. If Cutsforth receives notice of a defect or non-conformance during the applicable warranty period, Cutsforth will, in its discretion: (i) repair or replace the affected product, or (ii) refund the fees paid for the affected product. Repaired or replaced hardware will be warranted for the remainder of the original warranty period or ninety (90) days, whichever is longer. If Cutsforth elects to repair or replace the product, Cutsforth may use new or refurbished parts or products that are equivalent to new in performance and reliability and are at least functionally equivalent to the original part or product. You must obtain an RMA number from Cutsforth before returning any product to Cutsforth. Cutsforth reserves the right to charge a fee for examining and testing hardware not covered by the Limited Warranty.

This Limited Warranty does not apply if the defect of the product resulted from improper or inadequate maintenance, installation, repair, or calibration performed by a party other than Cutsforth; unauthorized modification; improper environment; use of an improper hardware or software key; improper use or operation outside of the specification for the product; improper voltages; accident, abuse, or neglect; or a hazard such as lightning, flood, or other act of nature.

THE REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND THE CUSTOMER'S SOLE REMEDIES, AND SHALL APPLY EVEN IF SUCH REMEDIES FAIL OF THEIR ESSENTIAL PURPOSE.

WARNING REGARDING USE OF CUTSFORTH SHAFT MONITORING EQUIPMENT: CUSTOMER IS ULTIMATELY RESPONSIBLE FOR VERIFYING AND VALIDATING THE SUITABILITY AND RELIABILITY OF THE PRODUCTS WHENEVER THE PRODUCTS ARE INCORPORATED IN THEIR SYSTEM OR APPLICATION, INCLUDING THE APPROPRIATE DESIGN, PROCESS, AND SAFETY LEVEL OF SUCH SYSTEM OR APPLICATION. PRODUCTS ARE NOT DESIGNED, MANUFACTURED, OR TESTED FOR USE IN LIFE OR SAFETY CRITICAL SYSTEMS, OR ANY OTHER APPLICATION IN WHICH THE FAILURE OF THE PRODUCT OR SERVICE COULD LEAD TO DEATH, PERSONAL INJURY, SEVERE PROPERTY DAMAGE OR ENVIRONMENTAL HARM (COLLECTIVELY, "HIGH-RISK USES"). FURTHER, PRUDENT STEPS MUST BE TAKEN TO PROTECT AGAINST FAILURES, INCLUDING PROVIDING BACK-UP AND SHUT-DOWN MECHANISMS. CUTSFORTH EXPRESSLY DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY OF FITNESS OF THE PRODUCTS OR SERVICES FOR HIGH-RISK USES. CUTSFORTH DOES NOT WARRANT, GUARANTEE, OR MAKE ANY REPRESENTATIONS REGARDING THE USE OF OR THE RESULTS OF THE USE OF THE PRODUCTS IN TERMS OF CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. CUTSFORTH DOES NOT WARRANT THAT THE OPERATION OF THE PRODUCTS WILL BE UNINTERRUPTED OR ERROR FREE. INCIDENTAL AND CONSEQUENTIAL DAMAGES, INCLUDING LOSS OF USE, ARE SPECIFICALLY EXCLUDED FROM THIS WARRANTY; THE MAXIMUM VALUE OF A WARRANTY CLAIM CANNOT EXCEED THE ORIGINAL VALUE OF THE ASSEMBLY OR COMPONENT.

2.2. Copyright

Under copyright law, this publication may not be reproduced or transmitted in any form, electronic or mechanical, including photocopying, recording, storing in an information retrieval system, or translating, in whole or in part, without the prior written consent of Cutsforth. Cutsforth respects the intellectual property of others, and we ask our users to do the same. Cutsforth software is protected by copyright and other intellectual property laws. Cutsforth software is only licensed to be run on the intended hardware for which it was purchased. Reproduction of software or written materials is prohibited unless Cutsform has obtained a license for that express purpose.

2.3. Patents

Please send patent information requests to patents@cutsforth.com.

2.4. Federal Communications Commission Requirements

2.4.1. Brush Condition Monitoring - Primary Controller

Primary Controller: Utilizes Intel RF module 8265NG

FCC ID: PD98265NG

IC ID: 1000M-8265NG

2.4.2. 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.

2.5. 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.



3. Safety Information

3.1. 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.

3.1.1. Safety Conventions



3.1.2. 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.

3.2. 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.

3.2.1. Conventions de Sécurité



NOTE:

Informations supplémentaires.



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.



MISE EN GARDE : PIÈCE ROTATIVE

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



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.



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.



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.

Document #: EZDP-2058 Rev J 2025-03-11



3.2.2. 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 avertissment.



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 manufacturiers sur le même appareil.



4. 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 InsightCMTM.



5. Brush Condition Monitoring (BCM) Technical Specifications

5.1. Primary Controller Technical Specifications

- USB 3.0
- Touchscreen interface
- Optional secondary display
- 2.4 GHz RF interface
- Operating Temperature -20 to 70°C (-4 to 158°F)
- Communication to plant control room has three interface options:
 - Modbus TCP over Ethernet
 - Modbus RTU over RS-232
 - InsightCMTM over Ethernet
- AC Main Power in:
 - Input voltage: 100–240 Vac, 47–63Hz
 - Input power: 250W Max
- Enclosure is NEMA 4X rated when closed

5.2. BHS Technical Specifications

- Operating Temperature: 0 to 105 °C (32 to 221 °F)
- Battery powered from lithium metal primary cells
- LED lights on sensors to provide visual feedback for operators
- Push button activation on each sensor
- 2.4 GHz RF transceiver
- IP6X dustproof

5.3. Data from Primary Controller

Most Recent Recorded Values (Local)	Configurable Brush Health Alerts (Local)	Historical Data Trending (Output to Historian)
 Usable Brush Length (%) Brush Vibration (Mils Displacement, Pk-to-Pk) Temperature 	 Brush Length Warnings High Vibration Temperature 	 Usable Brush Length Vibration Ambient Temperature at Brush Health Sensor (BHS) BHS Battery Life System Status System Date/Time Temperature See Modbus Interface (page 45) for a complete list.



6. 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 InsightCMTM 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.





7. 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. Mount the Brush Condition Monitoring System Enclosure (page 16)
- 2. Run Power to the Brush Conditioning Monitoring System (page 17)
- 3. Route the Antenna Cabling (page 18)
- 4. Install Brush Holder Label Clips (page 19)





7.1. Mounting the Brush Condition Monitoring System Enclosure

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

7.1.1. 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.





7.2. 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 100–240V AC at 60 Hz (250W max). The power output of the internal power supply is 24V, 10.4A DC (250W max). The power input cabling should be run to the Brush Condition Monitoring System in ³/₄ in. trade-size, liquid-tight conduit (A). If installing the auxiliary display, a ³/₄ in. trade-size liquid-tight conduit should be run power, display, and serial cables (B).





7.3. 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 43) 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 a ³/₄ in. trade size liquid-tight conduit from the antenna to the Brush Condition Monitoring System (**B**) to run the antenna cable (**C**).





7.4. 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:

8. 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 Brush Condition Monitoring System. The 2.4 GHz antenna is a PCB trace style antenna.

8.1. 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%	6	0.6	19		
Press to Pair New Sensor	Brush L Remain	ife ing	Mils Pk-Pk	Celsius		
Clear Brush Length Warnings						
Sensor Pairing Date			2022-08-1	7 10:06:41 PC	т	
Sensor Pairing Age (days)				0		
Measurement Count				3		
Brush Install Date			UN	KNOWN		
Brush Age (days)			UN	KNOWN		
Recent Displacements	1.0	1.0	1.1			
Recent Temperatures	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.

8.2. 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.

8.3. 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.

8.3.1. 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 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.

8.4. 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)

8.5. 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 a 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

9. Using the Primary Controller 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.

9.1. 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.

9.2. Primary Controller 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 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.

CU'	TSF(Si	iemens - exa 2(examp ample ger)22-08-17	le plant herator - e ' 12:51 PC	xample nan)T	ne				(CONFIG		
							G E	NERAT	OR SI	DE								
1A	24	0.7	2A	22	0.7	ЗA	21	0.6	4A	21	0.7	5A	21	0.8	6A	21	0.7	
	100%	J		100%)0% 82%					97%			100%	1	100%			
1B	20	0.6	2B	21	0.7	ЗB	20	0.6	4B	21	0.7	5B	20	0.8	6B	22	0.7	
	100%	J	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 Of	1		1	_EFT								R	IGH ¹	Г	Ass	et: 0000000	000 · v3.5	

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

Generator Side

Generator Side

9.3. 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).

CU THE PO	TSF(H			B s	iemens - exa 2(examp ample ge 022-08-17	le plant nerator - e 7 12:51 Pl	example nan OT	ne						
							G E	NERA	IOR SI	DE							
1A	24	0.7	2A	22	0.7	ЗA	21	0.6	4A	21	0.7	5A	21	0.8	6A	21	0.7
	100%			100% 2B 21 0.7			82%			97%			100%	1	100%		
1B	20	0.6	2В	21	0.7	ЗB	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	ЗD	19	0.6	4D	25	0.9	5D	21	0.9	6D	20	0.6
Padio O	84%		98% 90% 100% 81%										84%	000 425			

9.4. 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.

10. 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

CUTSFORTH

11. Brush Status Indication

The individual brush status indicators provide the following information:

11.1. 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:

CU'	TSFC WER OF IN		H				AC - te 20	est gener 022-06-29	ator · test) 12:41 PE	name DT					CONFIG			
							GE	NERAT	FOR SI	DE								
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%	35% 100%					13%			95%		99%			
1B	21	0.6	2B	21	0.7	ЗB	20	0.6	4B	19	0.7	5B	21	0.7	6B	21	0.7	
	91%			100%			100%			100% ow Batte	ry		-2%		81% 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% Low Battery Low Battery								ry	Lo	32% ow Batte	ry				
Radio ON	1														Ass	et 0000000	000 - v3.50	

CUTSFORTH

12. 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.

						s	iemens - ex 2	examp ample ger 022-08-17	le plant herator - e 12:55 PC	example nan OT	ne		A	E	•	CONFIG	
							GI	INERAT	OR SI	DE							
1A	24	0.7	2A	22	0.7	ЗA	21	0.6	4A	21	0.7	5A	21	0.8	6A	21	0.7
	_			_			_	Config	uration	_	_		_	_		_	
	Brush Al	ert Lengti	n		<	<	<			5	%				>	>>	
1B	Displace	ement Fai	ult Maximu	ım	<	<	<			6.0	mils				>	>>	0.7
	Tempera	ature Faul	t Maximur	n	<	<	<			30) ºC				>	>>	
1C																	0.7
	De	Reset to fault Facto	ory	Useri a	Manual nd		Clear All E	Irush	Ge	et Support		Ad Ad	anced		About		
		Settings		Docume	entation		Length Wa	rnings					ntiguration				
1D	23	0.7	2D	25	0.8	3D	19	0.6	4D	26	0.8	5D	22	0.9	6D	20	0.6
	84%			98%			90%			100%			81%			84%	
	0470			0070			0070			10070			01/0			0470	
Radio Ol	4														Ass	set: 0000000	0000 - v3.5

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.

Brush Alert Length		Unsaved	Changes		> >>
Displacement Fault Maxin Femperature Fault Maxim	num	The following settings ha Brush Alert Length (%); 5 Displacement Fault Maxir Save changes?	ve changed: changed to 10 num (mils): 6.0 changed • <u>Y</u> es	to 10	> >>
Reset to Default Factory Softings	User Manual and	Clear All Brush Length Warnings	Get Support	Advanced Configuration	About

13. 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 35)
- Update the Brush Condition Monitoring Application (page 36)
- Update the Brush Health Sensor Firmware (page 37)
- Set the Brush Condition Monitoring System Time (page 38)

13.1. Access the Advanced Configuration Window

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

CU THE PO	JTSFORTH Siemen-seample generator-example name POWER OF INNOVATION:												CONFIG				
							G	ENERA	ORSI	DE							
1A	24	0.7	2A	22	0.7	ЗA	21	0.6	4A	21	0.7	5A	21	0.8	6A	21	0.7
	_	_		_			_	Config	uration	_	_		_			_	
	BrushAlerLength << < 5 %												>	>>			
18	Displace	ement Fa	ult Maxim	um	<	<	<			6.0	mils				>	>>	0.7
	Tempera	ature Faul	t Maximui	m	<	<	<	30 °C > >>									
												B					
10	De	Reset to fault Facto Settings	ory	Useri a Docume	Manual nd entation		Clear All Length Wa	Brush arnings	Ge	et Support		Adv Co	ranced nfiguration		About		0.7
1D	23	0.7	2D	25	0.8	3D	19	0.6	4D	26	0.8	5D	22	0.9	6D	20	0.6
	84%			98%			90%)		100%)		81%			84%	
Radio Of	1														Ass	et 000000	0000 · v3.5

3. Enter the administrative password to open the Advanced Configuration window. Contact support@cutsforth.com for access information.

OVAT	10 N"	202	22-08-17 12:58 PDT	
		Advar	nced Configuration	
0.7	Advanced Configuration SCIP Configuration	Generator Settings	Connected Sensors	6A
		s	Set System Time	
0.6	Software Update			6B
		Update SCIP Software	Update BHS Firmware	
0.8	Logging			6C
		Save System Log	Unmount USB Drives	
0.7	2D 25 0.8	3D 19	0.6 4D 26 0.8 5D 22 0.9	6D

CUTSFORTH

13.2. 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.

	2022	08-17 12:59 PDT	ipre name	
-	Choose target	directory for Sy	stem log	
2 Look in:	/media		•	0 0 0 6 = =
Computer scipapp B	Name Cdrom Cutsforth Sdb1 Sdb2 Sdc1 Sdc2 Sdd1	▼ Size	Type Folder Folder Folder Folder Folder Folder	Date Modified 8/23/18 5:13 PM 11/8/18 3:01 PM 5/24/22 10:27 AM 8/30/21 2:01 PM 8/30/21 3:52 PM 8/30/21 3:53 PM 6/25/19 12:29 PM
s				
Directory: sd	b1			

13.3. 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.

	/media/sdb1/v3.50_Software	- 0 0	o 🙈 🎞 🔳
Computer scipato	Name ScipApp	▼ Size Type Date k 16MiB File 5/24/2	lodified 2 5:46 AM
File <u>n</u> ame: S	:IpApp		C jen
Files of type: A	I Files (*)		✓ Cancel
tware opuate	A Update SCIP Software	Update BHS Firmware	
iging			

13.4. 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.

	Chasses BUC Fr	nenerator . eyam	nie name		_
	Choose BHS fir	mware binary	(*.bin)		
Look in: 📄 /n	nedia/sdb1		•	0000	
Computer	Name	▼ Size	Type	Date Modified	*
scipapp	and the second			1 10 10 10 10 10 10 10 10 10 10 10 10 10	
	A Contract of Cont		200	76/10 BT1	
	ALC: NOTE: N			1.00	
	Add Children		Setting.	11,000,000	
	and the second se		-		
	10. C 10. C 1		100	1000	
	and the product of		-	a contract second	
D.	A CONTRACTOR OF A CONTRACT OF		1000	Contraction (Section)	_
B	bhs_app.bin	11IB	bin File	8/5/19 4:56 PM	•
					•
File name: bhs_a	app.bin				<u>Open</u>
Files of type: *.bin				•][.	🗶 Cancel
ware Update					
	Update	∪p	date		
	Update SCIP Software		date HS ware		
	Update SCIP Software	A B Firm	date HS ware		
aina	Update SCIP Software	A B Firm	date HS ware		
iging	Update SCIP Software	A ^{Up} B Firm	date HS ware		
iging	Update SCIP Software	A Up B Firm	date HS ware		
iging	Update SCIP Software Save System	A Up B Firm	date HS ware Unmount USB		
iging	Update SCIP Software Save System Log	A ^{Up} B	date HS ware Unmount USB Drives		
ging	Update SCIP Software Save System Log		date HS ware Unmount USB Drives		

13.5. 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).

Ø

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

OR		Adva	nced Configuration		 COM
TNROV	Advanced Configuration	Generator Settings	Connected Sensors		
0.0	SCIP Configuration				64
6 6			A Set System Time		8
	Software Update				
1			Date & Time		
∕₀	Auto Requ	matic Date & Time lires internet access		OFF	7
0	Auto Requ	matic Time Zone lires internet access		OFF	H
	Date	e & Time	2 February	2022, 8:26 AM	
6	B Time	Zone	PST (Los Angeles,	United States)	_(
0	Time	Format		AM / PM 👻	

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.

		and a set of the set of the set		
JR		Advanced Configuration		co
N U V J	Advanced Configuration Generator Se	ettings Connected Sensors		
	SCIP Configuration			6A
		Set System Time		
				5
	Software Update			
<		Date & Time		
	·			
	Automatic Date & Requires internet a	Time access	OFF	
	Automatic Time Z Requires internet a	one access	OFF	
	C Date & Time	2 Feb	ruary 2022, 8:26 AM	
	Time Zone	PST (Los Anç	geles, United States)	
	Two Format			
	Time Format			

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

Isvanced Confin	ration Connected Concern					
<		Date & Time	,			
	Autom	Date & Time	,			OFF
	Autom Requir +	+ Month	Novem	nber	•	OFF
	Date 8 18 :	46 Day	14	-	+	18:46
	Time 2 📃	- Year	2018	-	+	tates)
	Time Format		-	[24-h	our 👻

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

CUTSFORTH

14. 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.

dvanced Configuration	Generator Settings	Connected Sensors		
enerator Information			Modbus - ttyS2 an	d ttyS3
Plant	example plant		TCP Port	501
Generator Manufacturer	Siemens		Server Address	1 ;
Generator Type	example generator		Baud Rate	19200 -
Generator Name	example name			
Generator Location	Тор		Data Bits	8 -
Measurement Interval	1 hour		Parity Bits	Even -
Num. Brush Rows	4		Stop Bits	1 -
Num. Brush Columns	6		•	
Label Display Type	Alphanumeric		Re-Initialize N	lodbus Ports
Asset Tag	000000000			

14.1. Measurement Interval

The Brush Condition Monitoring (BCM) 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.

Advanced Configuration	Generator Settings	Connected Sensors		
Generator Information			Modbus - ttyS2 an	d ttyS3
Plant	example plant		TCP Port	501
Generator Manufacturer	Siemens	•	ServerAddress	1
Generator Type	example generator		Baud Rate	19200 -
Generator Name	example name		Data Bits	8 -
Generator Location	Top	•	Parity Bits	Even 👻
Num. Brush Rows	3 hours		Stop Bits	1 -
Num. Brush Columns	6 hours 12 hours			
Label Display Type	Alphanumeric	•	Re-Initialize M	lodbus Ports
Asset Tag	000000000			

15. Antenna Placement Mode

	Ν.
/ •	
/ •	

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**.

Advanced	Confi	iguration	Generat	or Settings	Connecte	d Sensors	1			
Location	Туре	MA	٩C	Instal	Date	Serial #	HW Rev	FW Ver	Voltage mV	Lo ^
1A	BHS	EA:07:2D:	D6:61:6C	2022-08-17	10:00 PDT	0x2bf4bfac95	ba ev1	1.0.1	7419	-47
2A	BHS	CF:3E:71:	88:22:C2	2022-08-17	10:01 PDT	0x34d0ffac95	ba ev1	1.0.1	7328	-49
ЗA	BHS	C0:E1:70:	74:D1:82	2022-08-17	10:01 PDT	0xf84330633	7el evl	1.0.1	8006	0
4A	BHS	E2:93:C5:	4D:D2:C7	2022-08-17	10:01 PDT	0x2a4030633	37e1 ev1	1.0.1	8027	-97
5A	BHS	D2:3A:11:	35:C4:89	2022-08-17	10:10 PDT	0x213c30633	7e1 ev1	1.0.1	7631	-38
6A	внз	C3:F2:51:	E3:43:5B	2022-08-17	10:02 PDT	0x13f4bfac95	ba ev1	1.0.1	7309	·19
1B	внз	F0:7B:A8:	EB:19:50	2022-08-17	10:02 PDT	0x19ecffac95	ba ev1	1.0.1	7223	-19
2B	BHS	D8:A4:C8:	DD:F1:5D	2022-08-17	10:02 PDT	0x274030633	37e1 ev1	1.0.1	7941	0
3B	BHS	CF:FF:FA:4	45:E7:E7	2022-08-17	10:03 PDT	0x233c30633	7e1 ev1	1.0.1	7922	28
4B	внѕ	EA:CF:F8:	05:25:B5	2022-08-17	10:03 PDT	0x0f409fac95	ba ev1	1.0.1	7631	-16
5B	BHS	FD:D9:98:	73:AA:A0	2022-08-17	10:03 PDT	0x03689fac95	5ba ev1	1.0.1	7590	0 🛫
4										F
Antenn	a Plac	ement Mod	ie		Locate Se	nsor		Systen	n Hibernatior	1

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.

CUTSFORT THE POWER OF INNOVAT		example plant Siemens - example generator 2022-08-17 14:45	· example name PDT	WARNING: ANTENNA PLACEMENT	CONFIG				
GENERATOR SIDE									
1A	2A	3A	4A	5A	6A				
-54/-51	-52/-48	-53/-51	-53/-59	-50/-46	-60/-57				
1B	2B	ЗВ	4B	5B	6B				
-53/-49	-53/-48	-50/-49	-47/-43	-53/-47	-58/-50				
1C	2C	3C	4C	5C	6C				
-59/-59	-54/-56	-57/-55	-54/-49	-50/-43	-49/-45				
1D	2D	3D	4D	5D	6D				
-50/-44	-49/-44	-57/-55	-54/-55	-54/-55	-50/-43				

Radio ON

Asset: 000000000 - v3.50

CUTSFORTH

16. 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 Brush Condition Monitoring 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 Discrete Input
0– 229	Sensor Malfunction	Boolean	Flag	Discrete Input	10230– 10459	0x0E6– 0x1CB	0x02 Read Discrete Input
0– 229	Replace Brush Now (Critical)	Boolean	Flag	Discrete Input	10460– 10659	0x1CC- 0x2B1	0x02 Read Discrete Input
0– 229	Replace Brush Soon (Alert)	Boolean	Flag	Discrete Input	10690– 10919	0x2B2- 0x397	0x02 Read Discrete Input
0- 229	High Vibration Warning	Boolean	Flag	Discrete Input	10920– 11149	0x398- 0x47D	0x02 Read Discrete Input
0– 229	Sensor Sample Old	Boolean	Flag	Discrete Input	11150– 11379	0x47E– 0x563	0x02 Read Discrete Input
0- 229	Temperature Critical	Boolean	Flag	Discrete Input	11380– 11609	0x564– 0x649	0x02 Read Discrete Input
0- 229	Length Error	Boolean	Flag	Discrete Input	11610– 11839	0x64A- 0x72F	0x02 Read Discrete Input
0– 229	Brush Length	Short	% Remaining	Input Register	30000– 30229	0x000- 0x0E5	0x04 Read Input Register
0- 229	Pk-to-Pk Displacement	Word	0.001 mils	Input Register	30230– 30459	0x0E6– 0x1CB	0x04 Read Input Register
0- 229	Temperature	Short	Degrees C	Input Register	30460– 30689	0x1CC- 0x2B1	0x04 Read Input Register

CUTSFORTH THE POWER OF INNOVATION"

Brush	Name	Value Type	Value Unit	Register Type	Address (Base 0)	Physical Address (Base 0)	Supported Functions
N/A	System Status	Word	Bitfield: b0 : Hibernation Mode (1 - Enabled, 0 - Disabled) b1-15: RFU	Input Register	30920	0x398	0x04 Read Input Register
N/A	System Time	Word	POSIX time (LSB - MSB)	Input Register	30921– 30922	0x399– 0x39A	0x04 Read Input Register
N/A	Short Brush Count	Word	Number of brushes that must be replaced immediately	Input Register	30923	0x39B	0x04 Read Input Register
N/A	Near-Short Brush Count	Word	Number of brushes that will need replacement soon	Input Register	30924	0x39C	0x04 Read Input Register
N/A	High Vibration Brush Count	Word	Number of sensors reporting high vibration	Input Register	30925	0x39D	0x04 Read Input Register
N/A	Sensor Error Count	Word	Number of sensors reporting errors	Input Register	30926	0x39E	0x04 Read Input Register
N/A	Low Battery Total	Word	Number of sensors reporting low battery	Input Register	30927	0x39F	0x04 Read Input Register
0- 229	Battery Voltage	Word	Millivolts (mV)	Input Register	30928– 31157	0x3A0– 0x485	0x04 Read Input Register
0– 229	RSSI Value	Word	Decibel milliwatts (dBm)	Input Register	31158– 31387	0x486– 0x56B	0x04 Read Input Register
0– 229	BHS MAC address (lo byte, little- endian)	Word	N/A	Input Register	31388– 31617	0x56C- 0x651	0x04 Read Input Register
0– 229	BHS MAC address (mid byte, little endian)	Word	N/A	Input Register	31618– 31847	0x652- 0x737	0x04 Read Input Register
0– 229	BHS MAC address (hi byte, little- endian)	Word	N/A	Input Register	31848– 32077	0x738- 0x81D	0x04 Read Input Register

CUTSFORTH THE POWER OF INNOVATION[™]

Brush	Name	Value Type	Value Unit	Register Type	Address (Base 0)	Physical Address (Base 0)	Supported Functions
0– 229	SensorError Register with Sensor Error Flags	Word	N/A	Input Register	32078– 32307	0x81E- 0x903	0x04 Read Input Register
N/A	Old Samples Count	Word	Number of sensors reporting old samples	Input Register	32308	0x904	0x04 Read Input Register
N/A	Temperature Critical Count	Word	Number of sensors reporting critical temperature	Input Register	32309	0x905	0x04 Read Input Register
N/A	Length Error Count	Word	Number of sensors reporting brush length errors	Input Register	32310	0x906	0x04 Read Input Register

16.1. Entering a Static IP Address

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

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

CU' THE PO	TSF(I D N"			Si	emens - ex 21 G E	examp ample ge)22-08-11	le plant nerator - e 7 13:15 PI	xample nan)T D F	1e					CONFIG	
1A	25	0.7	2A	23	0.7	ЗA	21	0.6	4A	21	0.8	5A	21	0.8	6A	21	0.7
	100%			100%			82%			100%	,		100%			100%	,
							Aj	oplicatio	on Finde	r							
1B	20	0.6													6B	22	0.7
	100%	23 0.8 All Applications About Xfce Information about the Xfce Desktop Environment Machine States (Information about the Xfce Desktop Environment) Machine States (Informent) Machine Sta														92%	
1C	23	0.8	Games Games Games Games Games												6C	21	0.7
	85%			Games Image: Appearance Games Customize the look of your desktop Graphics Image: Application Finder Internet Find and launch applications installed on your system Multimedia Create and modify an archive Office Find and copy CDs and DVDs												91%	
1D	23	0.7	Settings Strowse Surf the world! Set Close Strowse												6D	21	0.6
	84%			98%			90%			100%			81%			84%	
Radio ON	4														Ass	et: 0000000	000 - v3.50

Radio ON

EZDP-2058 Rev J 2025-03-11

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

5. Double-click Wired Connection 1.

6. Select the IPv4 Settings tab.

CU THE PO			10 N"			S	iemens - exa 20	exampl emple ger 22-08-17	le plant herator - e 13:20 PD	kample nan T	ne					CONFIG	
							GE	NERAT	ORSI) E							
1A	25	0.7	2A	23	0.7	ЗA	21	0.6	4A	21	0.8	5A	21	0.8	6A	21	0.7
				_			Editin	ng Wired	d conne	tion 1			_			1	
	100%	Con	nection	name:	Wired co	nnectior	1									100%	
		0	General	l Ethe	ernet	802.1	.X Securit	y D	СВ	Proxy	IPv4 S	Settings	IPv6	Settin	gs		
1B	20	м	ethod:	Automa	itic (DHC	P)									•	22	0.7
			dition	al static	addres	505									_		
	100%		Addre	ss	uuures.	N	etmask			Gatev	vay			Add		92%	
														Delete	2		
1C	23		Addition	al DNS se	ervers:											21	0.7
		1	Addition	al search	domains												
	85%		DHCP cl	ient ID:												91%	
			🗌 Requ	uire IPv4 a	ddressin	g for this	s connectio	on to cor	nplete								
														Routes.			
1D	23															21	0.6
													Cancel	🦪 s	ave		
	84%			98%			90%			100%)		81%			84%	
Radio ON	1														As	set: 0000000	000 · v3.50

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

CUTSFORTH THE POWER OF INNOVATION" COLORIZED EXAMPLE DEAL Siemens - example generator - example name 2022-08-17 13:22 PDT CENERATOR SIDE														CONFIG			
							G E	NERA	TOR SI	DE							
1A	25	0.7	2A	23	0.7	ЗA	21	0.6	4A	21	0.8	5A	21	0.8	6A	21	0.7
				_			Editir	ng Wire	d conne	tion 1			_				
	100%	Con	nection	name:	Wired co	nnectior	1									100%	
		(Genera	l Ethe	ernet	802.1	LX Securit	ty D	DCB	Proxy	IPv4 9	Setting	s IPvé	Settin	gs		
1B	20	м	ethod:	Manual											•	22	0.7
	100%	A	ddress Addre	es ss		N	etmask			Gatev	vay			Add	2	92%	
1C	23		DNS sei	rvers:												21	0.7
			Search	domains:													
	85%		DHCP cl	ient ID:												91%	
			Requ	uire IPv4 a	ddressin	g for thi	s connectio	on to co	mplete								
1D	23													Routes.	·· [21	0.6
	84%			98%			90%			100%)		Cancel	Si Si	ave	84%	
Radio Ol	4														Ass	et: 0000000	000 - v3.5

8. Click Add.

CU THE PO	EUTSFORTH HE POWER OF INNOVATION* example plant Siemen - example generator - example name 2022-08-17 13:22 PDT CO													CONFIG			
							G E	NERAT	OR SI	DE							
1A	25	0.7	2A	23	0.7	ЗA	21	0.6	4A	21	0.8	5A	21	0.8	6A	21	0.7
				_			Editir	ng Wire	d conne	ction 1			_				
	100%	Con	nection	name:	Wired co	nnectior	1									100%	
		0	Genera	l Ethe	ernet	802.1	X Securit	ty D	СВ	Proxy	IPv4 S	Settings	s IPvé	5 Settin	gs		
1B	20	Me	ethod:	Manual											•	22	0.7
		Ad	dress	es													
	100%		Addre	SS		N	etmask			Gatev	way			Add		92%	
														Delete	2		
1C	23	1	DNS sei	rvers:												21	0.7
			Search	domains:													
	85%	Ŀ	DHCP cl	lient ID:												91%	
			Requ	uire IPv4 a	ddressin	g for this	s connectio	on to co	mplete						_		
10	22													Routes.		21	0.6
	2.5															21	0.0
													Cancel	√ si	ave	-	
	84%			98%			90%			100%)		81%			84%	
Radio Of	4														Ass	et: 0000000	000 · v3.5

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

CU THE PO	CUTSFORTH example plant HE POWER OF INNOVATION* Siemens example querator example name													CONFIG			
							G E	NERA	FOR SI	DE							
1A	25	0.7	2A	23	0.7	ЗA	21	0.6	4A	21	0.8	5A	21	0.8	6A	21	0.7
				_			Editir	na Wire	d conne	ction 1			_				
	100%	Con	nection	name:	Wired co	nnection	n 1	by P	ACB.	Provv	IDv4.9	Sotting	= IDv6	Sottin		100%	
1B	20	м	ethod:	Manual	ine.	002.1	LA Securi	Ly L		FIOXy	11 0.4	Jetting		Jettin	▼	22	0.7
	100%	A	ddress Addre 111.11	es :ss 1.111.111			Netmask 111 111 1	¢ 11.111		Ga	ateway			Add		92%	
1C	23		DNS se	rvers:												21	0.7
	050/		Search	domains:												010/	
	85%	Ŀ	DHCP cl	lient ID: uire IPv4 a	ddressin	ig for thi	s connectio	on to co	mplete							91%	
1D	23	-												Routes.		21	0.6
	84%			98%			90%			100%)		Cancel	√ si	ave	84%	
Radio Of	V														Ass	et: 0000000	000 · v3.5

16.2. 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.

CU'	TSF(S	iemens - exa 2(examp ample ge)22-08-11	le plant nerator - e 7 12:51 Pl	xample nan)T	ne				(CONFIG	
							GE	NERAI	FOR SI	DE							
1A	24	0.7	2A	22	0.7	ЗA	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	ЗB	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	1														Ass	et: 0000000	000 · v3.5

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

Brush Alert Length		<<	<		5 %	Ď	>	>>
Displacement Fault Maxin	num	<<	<		6.0 m	ills	>	>>
Temperature Fault Maxim	um	<<	<		30 %	С	>	>>
Peset to User Ma Default Factory and Settings Document		al n	Clear Length	All Brush Warnings	Get Support	Advanced Configuration	About	L

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

Advanced Configura	tion Generator Settings Con	nected Sensors	
CIP Configuration			
	Set Sys	tem Time	
oftware Update			
	Update	Undate	
	SCIP Software	BHS Firmware	
ogging			
	Save System Log	Unmount USB Drives	

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

Advanced Configuration Generator Settings Connect SCIP Configuration Set System Software Update C Date & Automatic Date & Time Requires internet access Date & Time Time Zone	ad Sensors 6A Time Time OFF
Advanced Configuration SCIP Configuration Software Update Software Update Automatic Date & Time Requires internet access Automatic Time Zone Requires internet access	Time OFF
SCIP Configuration Set System Software Update C Date & Dat	Time OFF
Software Update Software Update C Software Updat	Time
Set System Software Update C Date & C D	Time Time OFF
Set System Software Update Control Date & Time Requires internet access Automatic Time Zone Requires internet access Date & Time Time Zone	Time OFF
Software Update Date & Automatic Date & Time Requires internet access Automatic Time Zone Requires internet access Date & Time Time Zone	Time
Software Update Software Update Automatic Date & Time Requires internet access Automatic Time Zone Requires internet access Date & Time Time Zone	Time
Software Update	Time
Date & Date & Date & Date & Date & Date & Time Requires internet access Automatic Time Zone Requires internet access Date & Time Time Zone	Time
Automatic Date & Time Requires internet access Automatic Time Zone Requires internet access Date & Time Time Zone	Time
Automatic Date & Time Requires internet access Automatic Time Zone Requires internet access Date & Time Time Zone	OFF
Automatic Date & Time Requires internet access Automatic Time Zone Requires internet access Date & Time Time Zone	OFF
Automatic Date & Time Requires internet access Automatic Time Zone Requires internet access Date & Time Time Zone	OFF
Automatic Time Zone Requires internet access Date & Time Time Zone	
Automatic Time Zone Requires internet access Date & Time Time Zone	
Date & Time	OFF
Date & Time	
Time Zone	2 February 2022, 8:26 AM
Time Zone	
	ST (Los Angeles, United States)
Time Format	AM / PM 👻

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

			Advanced	Configuration			
			All S	ettings			٩ 2
9/	Personal						.00
	A state	۲				Q	- 84
,	Background	Notifications	Online Accounts	Privacy	Region & Lan guage	Search	2:
	Hardware						
9/	*	*					92
	Bluetooth	Color	Displays	Keyboard	Mouse & Touchpad	Network	
							2
	Power	Printers	Sound	Wacom Tablet			21
20	System						5T
_	(r)	505		E	<u>&</u>		
;	Date & Time	Details	Sharing	Universal Access	Users		2
%			5070	1 100 /		01/0	84

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

E	Ad	dvanced (Configuration		
<	Network				
٨	Ethernet (enp4s0)	\bigcirc	Ethernet (enp Connected - 1000 M	4s0) Nb/s	
÷	Ethernet (enp3s0)		IPv4 Address	192.168.151.168	
Q2	Network proxy		IPv6 Address	fe80::201:45ff:fe0a:2c45	
			Hardware Address	00:01:45:0A:2C:45	
			Default Route	192.168.151.1	
			DNS	8.8.8.8 8.8.4.4	
+	_	Add	Profile		\$
	Data	Í	00	Drives	

17. 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. The storage battery life is roughly 10 years.

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?

Section 😉 will turn orange when the vibration/ displacement threshold is exceeded, which is set in the CONFIG screen under "Displacement Fault."

Section Owill 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%).

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.

What does the \mathbf{A} 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.

18. 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.	