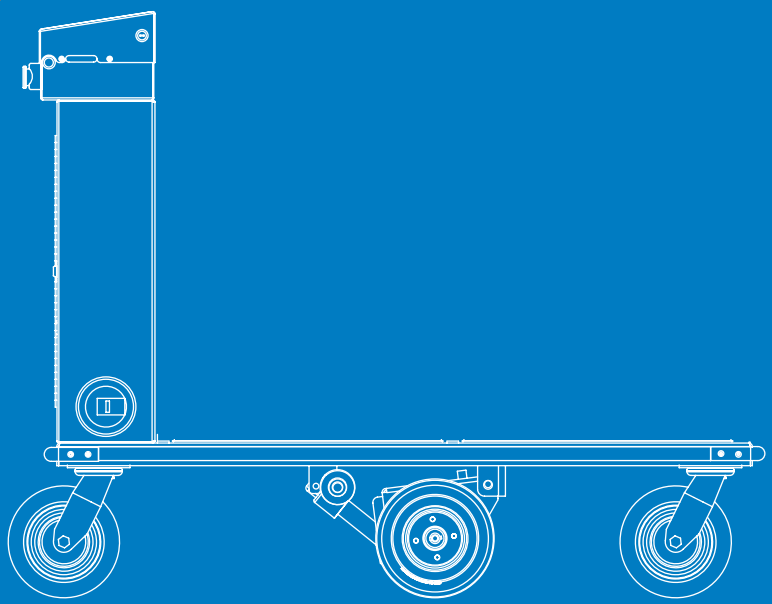
ERGO-EXPRESS®

Motorized Cart

User Manual: Operation and Service

SERIAL NUMBER



WEBSITE
www.phswest.com

24/7 PHONE NUMBER
+1.763.498.7576

ADDRESS
6704 Bleck Drive
Rockford, MN 55373

54572-400_Rev_B

Liability Statement

This product, the Ergo-Express® Motorized Cart, has been built to the highest standards of PHS West. Please do not attempt to operate or repair this equipment without adequate training. Any use, operation, or repair in contravention of this document is at your own risk. By acceptance of this system, you hereby assume all liability consequent to your use or misuse of this equipment. PHS West assumes no liability for incidental, special, or consequential damage of any kind. PHS West reserves the right to make equipment or product specification changes at any time. This manual, and all information contained within it, are subject to revision at a future date.

End of Life Statement

Your PHS West Motorized Cart has been designed to provide years of reliable and trouble free service, but at some point in time, it may be necessary to retire the system from service. To protect the environment, the following requirements should be considered and followed:

- This PHS West Motorized Cart is primarily constructed from steel and contains no hazardous materials (with the exception of the batteries). This equipment has an electrical control panel that must be removed from the system and disposed of according to country, regional and local requirements.
- The PHS West Motorized Cart is considered mobile industrial equipment as stated in Category 6 in Annex 1A of the European Waste of Electrical and Electronic Equipment (EU WEEE) Directive 2012/19/EU. As of 2014, this directive could change in the future and the directive should be reviewed for any future changes.
- Included in the PHS West Motorized Cart are components manufactured by others. Their retirement and disposal are covered in the individual equipment technical manuals listed in the PHS West manual if applicable.

Proprietary Notice

Trademark Acknowledgments

Revision Log

Revision Level	Date	Affected Pages	Description of Change
A	April 24, 2023	All	Branding
B	October 22, 2025	All	Branding

Introduction

For an understanding of efficient and safe operation of your Ergo-Express® Motorized Cart, it is important to read this manual.

The Ergo-Express® Motorized Cart uses a microprocessor-based controller to operate all functions including: drive speed, drive direction, a motor speed governor, a battery charge meter and an automatic brake. Additionally, the microprocessor controls many functions not readily apparent to the user such as load compensation, acceleration control, emergency stop behavior, and motor current limiting.

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Related Documents

These documents are included in the manual package that shipped with your equipment. All information contained in these documents pertains to devices not manufactured by PHS West. Each manufacturer assumes responsibility for the contents of the accompanying literature.

Equipment Type	Functional Data	Document Numbers and Manufacturer
Battery Charger	24 VDC 2A Fully Automatic Battery Charger	Document Number 2403 SRL Soneil

Safety

Document Symbol Conventions

It is important that you read and understand this manual. The information contained within relates to protecting your safety and preventing problems. The symbols below are used to help you recognize this information.

Symbol	Description
⚠	**DANGER!** Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury
⚠	**WARNING!** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury
⚠	**CAUTION!** Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury
!	**NOTICE:** Indicates a potential situation which, if not avoided, can result in property damage or damage to the equipment
⚠	**Note:** Indicates information, notes, or tips for improving your success using the equipment

⚠ CAUTION!

The following instructions are vital to preventing hazardous situations that could result in an injury.

- Before servicing, disconnect the power at the batteries and unplug the chargers.
- All batteries are sealed and maintenance free.
- Never operate the Motorized Tug if your visibility is obstructed.
- Always use safety straps while towing other equipment.
- Use caution when operating the tug on steep inclines.
- Never carry riders on the tug.
- Never leave the tug unattended while the parking brake is disengaged.
- Turn the power off when leaving the tug unattended.

Built-In Features

The User Interface is equipped with several internal features to enhance the operation of the system.

- **Throttle Engaged During Power Up:** To prevent abrupt startups, the equipment will not operate if the throttle is engaged while the power switch is turned on. The throttle must be in the neutral position when the power switch is turned on.
- **Sleep Mode:** The equipment utilizes a power saving mode designed to conserve battery life. If the system does not detect user input for several minutes, the equipment will power itself off. To exit sleep mode, turn the power switch to the off position, and then back to the on position.
- **Electromechanical Brake:** the cart automatically engages a motor brake when the drive wheels are not being powered, even while the system is off. See Manually Moving for instructions on disengaging the brake.
- **Throttle Lock-Out During Charging (Interlock):** If the system is charging, the throttle levers will be disabled. If the throttles are engaged while charging, the cart will not operate and a fault code will be displayed on the user interface.
- **Anti-Runaway:** If, for any reason, the brake lever is released and the cart rolls away, the controller will automatically limit the speed of the cart. This function operates even if the cart is powered "off."
- **Start Compensation:** The controller will sense when the cart is stopped on an inclined surface and will provide additional power when started to prevent roll back.
- **Daily Inspection:** Always inspect your cart before using it. If any of the components are found to be damaged, nonfunctional, or missing, remove the cart from service and replace immediately. Refer to the Maintenance section.

User Interface

The user interface (**UI**) is the control system for the cart's power drive and safety features. It is located at the front of the cart at the top of the steering column.

Figure 1: User Interface Location

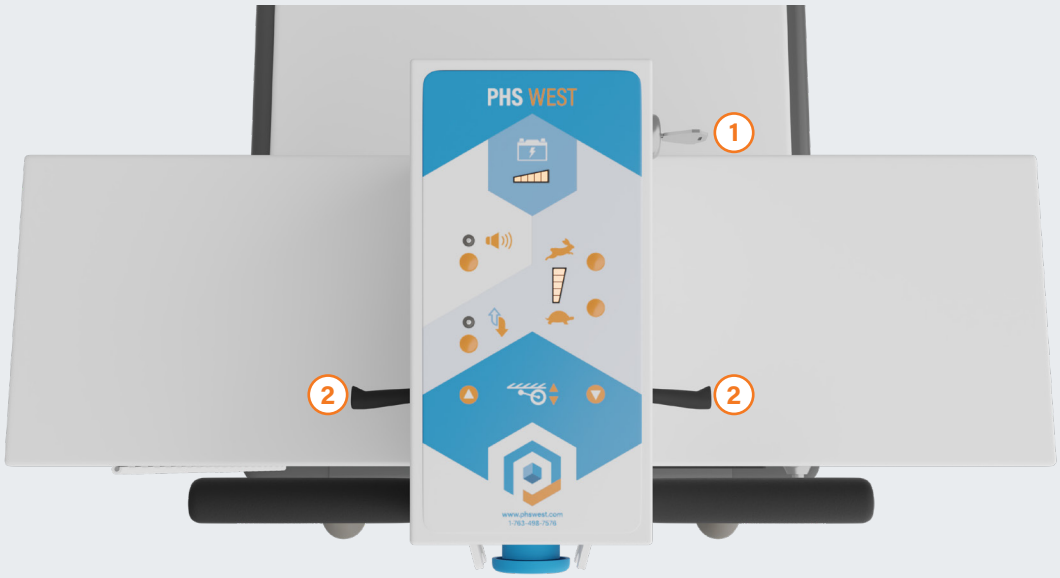


Figure 2: User Interface Components

1 On/Off Key Switch

The key switch is located on the side of the user interface. To power the cart on, insert the key at a horizontal orientation and rotate it counterclockwise. With the key at a vertical orientation, the cart will perform a boot up cycle lasting approximately 10-20 seconds before the cart is ready to operate. To turn the cart off, rotate the key clockwise to it's original position.

2 Throttle

It is critical to understand all of the user interface functions prior to engaging the throttle.

The two throttle levers on the user interface are used to control the speed of the drive motor. When either throttle is engaged the cart will move in the direction indicated by the reverse indicator (see Reverse Button). Releasing the throttle will disengage the power drive and bring the cart to a stop. The speed of the cart is proportionate to amount the throttle is engaged. For example, engaging the throttle halfway will activate the power drive at half of the maximum speed. Engaging the throttle fully will activate the power drive at the maximum speed. Both levers perform the same function.

Stop Switch

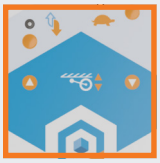
The stop switch is used to bring the cart to an immediate stop when needed and should not be used for routine stops. To engage the stop switch, press the large blue button. The cart will come to an immediate stop and the throttle will not function while the stop switch is depressed. Upon releasing the stop switch, the cart's throttle will function normally.

Reverse Button
The reverse button acts as a directional toggle. If the reverse light is illuminated, the cart will travel in the reverse direction.

Speed Control
The speed setting determines the maximum speed of the cart when the throttle is fully engaged. To raise the maximum speed, press the button nearest to the rabbit symbol. To lower the maximum speed, press the button nearest to the turtle symbol.

Motion Alarm
The motion alarm sounds to alert that the cart is in motion. To activate or deactivate, press the motion alarm button. When the motion alarm light is illuminated, the motion alarm is activated. The default startup setting has the motion alarm set to active.

Battery Charge Level Indicator
The battery charge level is displayed at the top of the UI. If all bars are illuminated, the battery is fully charged. If a single bar is illuminated, the battery is significantly drained and needs to be charged immediately See Battery Charging



Retractable Drive *(If Applicable)*
The retractable drive buttons lift and lower the drivewheel. To raise the drivewheel for manual movement, press the up button. To lower the drivewheel and engage power drive, press the down button.

Horn *(If Applicable)*
The horn is used to project a clear signal when approaching blind corner, high traffic zones, etc. To engage the horn, press the small black button on the front of the UI.

Operation

⚠ CAUTION!

- Turn the power off when leaving the cart unattended.

- **Power on the cart:** Turn the on/off key switch counter-clockwise to the 'On' position. Check the battery level indicator to verify the batteries have an adequate charge.
- **Engage throttle:** Slowly engage either throttle lever until the cart begins to move. Both levers perform the same, functioning as a proportional speed control. Engaging the throttle fully results in the cart traveling at the full maximum speed. Engaging the throttle half way results in half of the maximum speed, and so on.
- **Coming to a stop:** Releasing the throttle disengages the power drive and brings the cart to a stop. In cases where an immediate stop is necessary, engage the stop switch.

- **Maintain spatial awareness:** Anytime the equipment is in motion, the operator should be facing the direction of travel, announcing their presence, and managing their speed at a level appropriate for the environment.
- **Positioning:** When traveling in **forward**, position yourself directly in front of the user interface with both hands on the handlebars. When traveling **reverse**, keep to the side of the cart and slightly ahead of the user interface. Use the hand closest to the truck to operate the throttle and steer. Make sure to stay out of the path of the cart.

Figure 3: Directional Positioning

Battery Charging

⚠ CAUTION! Please read instructions completely before charging.

- Charge batteries fully in a dry, well ventilated, fire retardant location.
- Inspect batteries for bulging, swelling, and cracking before charging.
- Ensure that the batteries are replaced every 12 months.
- Never change a frozen battery.
- If you suspect a problem with the your cart batteries, contact the PHS West technical support team.

Proper charging practices will ensure the cart operates at peak performance. It is recommended to charge the cart at the end of each shift and between workloads when possible. This will prevent unforeseen downtimes and maximize the cycle life of the batteries.

Charging the Batteries

1. Position the cart near a standard 110-Volt outlet. Pull the cord out from the electrical cabinet and plug it into the outlet.
2. The battery level indicator will show the battery level while charging. When the batteries are fully charged, the indicator will flash on and off.

Charging Guidelines:

- The batteries should be charged whenever the cart is parked and not in use. The system has a smart charger so the batteries will not overcharge.
  - There is no need to cycle the batteries. There is no risk of the batteries developing a memory if charged too frequently. They should be charged at any time, regardless of discharge level.
- In the event the batteries do become fully discharged, a full charge will take approximately three to eight hours, depending on the battery equipment options.
- Battery life will, in part, depend on proper charging practices.
  - Avoid operating the cart when the battery charge indicator is low.
  - As batteries wear out, their ability to hold a charge decreases. If the batteries are losing a charge more quickly than in the past, replace them.
  - If stored for an extended period of time, leave the charger plugged in to an outlet or disconnect the batteries.

Manually Moving

If the cart must be moved manually, the motor brake must be physically disengaged. Reference the figure below for the override lever location. While the brake is physically disengaged, the cart will not operate and a 1-2 fault code will flash on the user interface.

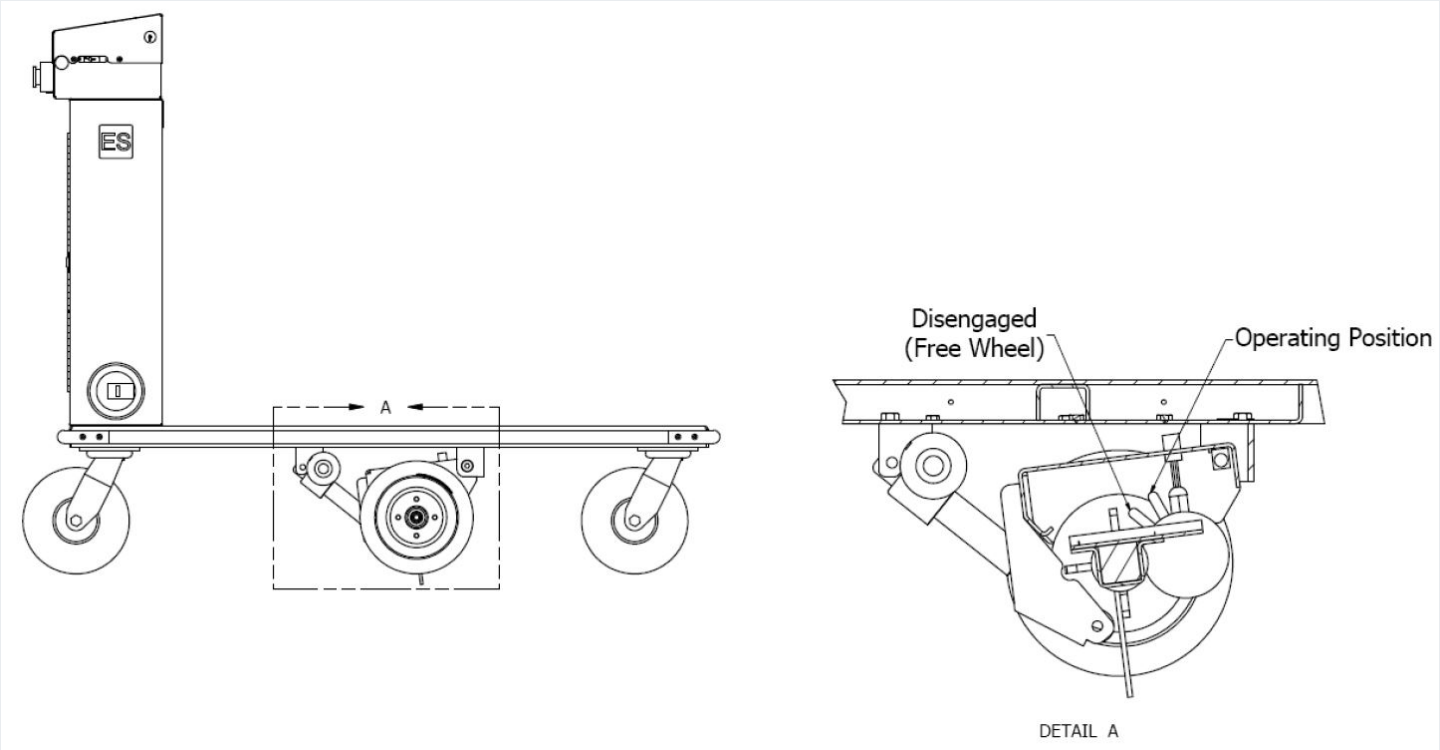


Figure 4: Brake Lever

Maintenance

⚠ CAUTION!

Only minimum maintenance is required to maintain the service and dependability of the cart. Failure to follow these instructions may result in personal injury or property damage.

Daily

- Always inspect your cart before using it. If any of the following are found to be damaged, nonfunctional, or missing, remove the cart from service and replace immediately.
- Check the battery charge level indicator. Operating the equipment with a low charge can damage the battery and void your warranty.
- Keep the charger plugged in when not in use.
- Visually check the load wheels and drive wheel for damage.
- Ensure that the power cord is in good condition and secured.
- Check that the stop switch is operating properly.
- Check the grounding chain located under the cart. Ensure the chain is present and touches the ground.
- Visually check the cart for any other external damage.

Monthly

- Check and tighten any exposed fasteners.
- Inspect load wheels for roughness during rotation. Replace if necessary.
- Inspect the charge cord and AC charging receptacle.

Three Months

- Check all bolts and connections for tightness and wear.

Six Months

- Check all electrical connections for clean contact.
- Check all tires for wear and replace if necessary.

Yearly

- Replace the batteries.

General Cleaning

These manufacturer recommended practices for cleaning products are not intended to disinfect product. Periodic cleaning to remove the buildup of dirt and residue is highly recommended to extend the life of your powder coating finish.

Use a mild detergent with warm water on a soft cloth. Use of a CaviWipe™ type of cleaner is also acceptable. Do not use wire brushes, abrasives, or similar cleaning tools that will abrade the powder coated surface. Always test the solution in an inconspicuous area before using on a large scale.

⚠ WARNING!

Do not expose the cart to spray-on cleaning solutions or excessive moisture.

Troubleshooting

The power on sequence may take up to 30 seconds as the controller performs diagnostic tests and ensures the cart is ready for use. The battery charge display indicates three states:

- **Steady On** indicating normal operational status
- **Steady Off** indicating the power is off
- **Flashing** indicates an error code
  - The UI display will briefly flash when the power is turned on. This does not indicate a fault.
  - The UI display will flash when charging to indicate a full charge. This does not indicate a fault.

If there is a fault detected, use *Table 1* to interpret. Count the flashes to determine the fault code. The display will flash the first number of the code, pause for approximately one second, then flash the second number of the code.

Code	Problem	Possible Causes
1-1	Brake Short	▪ Shorted brake ▪ Loose/broken connection to brake ▪ Faulty UI module
1-2	Brake Open	▪ Brake manually released ▪ Brake shorted to case ▪ Missing/open brake ▪ Loose/broken connection to brake ▪ Faulty UI module
2-1	Motor Short	▪ Defective motor ▪ Loose/broken connection to motor ▪ Faulty UI module
2-2	Motor Open	▪ Defective motor ▪ Loose/broken connection to motor ▪ Brake manually released ▪ Faulty UI module
2-3	Power Relay Short	▪ Defective batteries ▪ Faulty UI module
2-4	Actuator Motor Short	▪ Actuator motor ▪ Loose/broken connection to actuator motor ▪ Faulty UI module
4-2	Charge Mode Time Out	▪ Bad charger cable ▪ Bad batteries ▪ Bad charger
5-3	Throttle Fail Band	▪ Throttle control pot is off center/open ▪ Loose/broken connection cable ▪ Faulty UI module.

Warranty

Prior to servicing your equipment, please call our 24/7 technical and operational support hot-line at 1-888-639-5438. PHS West warrants this product to be free of defects in material and workmanship during the warranty period. Our warranty obligation is to provide a replacement for a defective original part, if the part is covered by the warranty, after we receive a proper request.

- ***Who may request service?*** The purchaser is the warrantee. Only the warrantee can request service.
- ***What is an "original part?"*** The part used to make the product as shipped.
- ***What is a "proper request?"*** A request for warranty service is proper if PHS West receives both:
  - A photocopy of the customer invoice displaying shipping date.
  - A written request for warranty service that includes the warrantee's name and phone number.
- **Requests may be sent using:**
  - Email: info@phswest.com
  - Mail: PHS West, 6704 Bleck Drive, Rockford, MN 55373
  - Fax: +1 763-498-8128
- ***What is covered under the warranty?*** After PHS West receives a request for warranty service, an authorized representative will contact the warrantee to determine whether the claim is covered by the warranty. Before providing warranty service, PHS West may require the warrantee to send the entire product or the defective part(s) to PHS West.
- ***How long is the warranty period?*** The warranty period for original, dynamic components is one year. For batteries, the warranty period is 30 days. The warranty period begins the date the product is shipped to the warrantee from PHS West.
- **Warranty Evaluation:** All parts sent back (freight paid by warrantee) to PHS West for warranty replacement or repair will be evaluated. PHS West will determine if the part is a warranty issue or if it has been damaged due to misuse or negligence. A written report will be issued detailing the investigation of the part and whether or not the part is classified as warranty.
- ***What is not covered by warranty?***
  - Labor
  - Freight
  - Occurrence of any of the following:
    - Product misuse
    - Negligent operation or repair
    - Corrosion or use in corrosive environments
    - Inadequate or improper maintenance
    - Damage sustained during shipping
    - Collisions or other incidental contact causing damage to the product
    - Unauthorized modifications: Do not modify the product in any way without first receiving written authorization from PHS West. Modifications may make the product unsafe or cause excessive or abnormal wear.
- ***If a defective part is warranteed, how will PHS West correct the issue?*** PHS West will provide an appropriate replacement for any covered part. An authorized representative of PHS West will contact the warrantee to discuss the claim.
- **Warranty Procedure:** In the event that a part is damaged or broken, please contact PHS West via phone or email to establish dialogue to identify and diagnose the issue. Please have your cart's serial number available when you call or email.

Declaration of Conformity

Manufacturer's Name: PHS West
Manufacturer's Address: 6704 Bleck Drive
Rockford, MN 55373 USA

PHS West declares under sole responsibility for issuing this declaration of conformity in relation to the following product(s):

Product Description: Battery-Powered, Walk-Behind Modular Cart
Model Number: 2000 Series, Ergo-Express®Cart V1.0, V1.5 and V2.0

The above product(s) is hereby declared to conform to the essential requirements set out in community harmonization legislation mentioned below:

Machinery Directive: 2006/42/EC
EMC Directive: 2014/30/EU
RoHS Directive: 2011/65/EU

The following standards have either been referred to or have been compiled with in part or in full as relevant:

EN ISO 12100:2010	Machinery Safety	Safety of Machinery - General Principles for Design - Risk Assessment & Reduction, includes EN 14121:2007
IEC 60335-1:2010/AMD2:2016	Safety	Household and similar Electrical Appliances - General Safety
EN 55014-1:2006+A1:2009+A2:2011	EMC	Safety Electromagnetic Compatibility - For Household Appliances
EN 55014-2:+A1:2008	EMC	Electromagnetic Compatibility - For Household Appliances
CENELEC 61000-3-2	EMC	Electromagnetic Compatibility - Limits for Harmonic Emissions
ENELEC 61000-3-3	EMC	Electromagnetic Compatibility - Limitation for Voltage Changes
EN 12895:2015	EMC	Industrial Trucks Electromagnetic Compatibility
EN 62233:2008+C1	EMC	Measurement Methods for EMC Fields of Household Appliances
CENELEC 61000 -6-2	EMC	Electromagnetic Compatibility - Limits for Harmonic Emissions
CENELEC 610 00-6-4	EMC	Electromagnetic Compatibility- Limitation for Voltage Changes
EN 62233:2008 +C1	EMC	Measurement Methods for EMC Fields of Household Appliances

Full Name, Position of Responsible Person and Place of Signing
Michael Lindsay, President, Rockford, MN 55373 USA

Signature: Date:

A technical file has been compiled and is available to European national authorities upon written request.

Addendum A

Regulatory Reference - 60335-1 © IEC:2010+A1:2013 (Clause 7.12 and 7.12 of Annex B)

⚠ CAUTION! Possible Harm to persons and equipment

This equipment is not intended for use by:

- Persons with reduced physical, sensory, or mental capabilities, including children, or that lack experience and knowledge of said equipment, unless they have been trained and supervised in the instruction of use of this equipment by a person responsible for their safety.
- Children (if applicable) should be supervised to ensure they do not play with the equipment.

⚠ CAUTION! Follow all instructions regarding battery handling

- Batteries are intended to be replaced by the user. See sections for **Replacing the Batteries.**
- Disable the equipment before performing any maintenance.
- Disconnect the equipment from the charging system before servicing the batteries.
- This equipment utilizes three sealed 12VDC rechargeable AGM batteries.
- Remove batteries as per the **Replacing the Batteries** instructions in this manual.
- Replace batteries as per the **Replacing the Batteries** instructions in this manual.
- For installation, be sure to understand the correct battery polarity.
- The batteries must be removed from the equipment before scrapping the device.
- Follow country and local environmental laws and regulations for proper and safe disposal of used batteries.
- Do not use non-rechargeable batteries.

⚠ CAUTION! In the event of a leaking battery, follow the instructions below

- Immediately stop use of the equipment.
- Follow the **Replacing the Batteries** instructions to remove the leaking battery. Wear gloves and eye protection during removal.
- Properly dispose of the leaking battery according to local environmental laws and regulations.
- Replace the battery with an identical 12VDC rechargeable AGM battery.

⚠ WARNING! Crushing Risk! Heavy Weight!

Addendum B

Ascent Battery Supply, LLC
1325 Walnut Ridge Drive
Hartland, WI 53029

SAFETY DATA SHEET (SDS) — SEALED LEAD ACID: AGM

The information and recommendations below are believed to be accurate at the date of document preparation. Ascent Battery Supply, LLC makes no warranty or merchantability or any other warranty, express or implied, with respect to this information and assumes no liability resulting from its use. This SDS provides guidelines for safe use and handling of product. It does not, and cannot, advise all possible situations. All specific uses of this product must be evaluated by the end user to determine if additional safety precautions should be taken.

The following information is provided as a courtesy to Ascent customers.

SECTION 1 – IDENTIFICATION

Product Name	AGM Battery: Stand-By, UPS, High-Rate, Telecomm
Common Name(s)	Absorbed Glass Mat(AGM) - Battery
Synonyms	SLA, VRLA, AGM, Absorbed Glass Mat, Sealed Recombinant
DOT Description	Wet Battery, non-spillable
Chemical Name	Sealed Lead Acid Battery, Secondary Battery
Distributed By	Ascent Battery Supply, LLC
Address	1325 Walnut Ridge Drive, Hartland, WI 53029
Emergency number	CHEMTREC 1-800-424-9300
International Emergency Number	CHEMTREC +1 703-741-5970 (Collect)

SECTION 2 – HAZARD(S)

Hazard Statements	
Normal Conditions	Under normal operating conditions, this product poses no health hazard.
Unusual Fire and Explosion Hazards	Hydrogen and oxygen gases are produced in the cells during normal battery operation and may increase fire risk in poorly ventilated areas (hydrogen is flammable and oxygen supports combustion). These gases enter the air through the vent caps. To avoid the chance of fire or explosion, keep sparks and other sources of ignition away from the battery.
Electrical Safety	Battery terminals can be short circuited.
Health Hazards	Lead and Lead Compounds: Isolated exposure to dust or fumes can cause respiratory and eye irritation. Chronic exposure can cause kidney and nervous system damage; anemia and damage to the reproductive system. Ingestion may cause abdominal pain, nausea, vomiting, diarrhea, and severe cramping.

Additional Information – No health effects are expected related to normal use of this product as sold.

SECTION 3 – COMPOSITION

Chemical Name	CAS No.	Percentage %
Lead/Lead Compounds	7439-92-1	50-75
Sulfuric Acid	7664-93-9	5-20
Tin	7440-31-5	0-1
Antimony	7440-36-0	0-0.1
Calcium	7440-70-2	0-0.15
Arsenic	7440-38-2	0-0.1

ABS/Polypropylene	9003-56-9/9003-07-0	2-10
AGM Separator	n/a	3-4

SECTION 4 – FIRST AID MEASURES

Inhalation	**Electrolyte:** Remove from exposure, move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Consult a physician immediately. **Lead:** Remove from exposure, gargle, wash nose and lips. Consult physician immediately.
Eyes Contact	**Electrolyte and Lead:** Flush eyes immediately with large amounts of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Consult a physician immediately.
Skin Contact	**Electrolyte:** Flush affected area(s) with large amounts of water using deluge emergency shower, if available, shower for at least 15 minutes. Remove contaminated clothing, including shoes. Consult a physician if skin irritation appears. Wash contaminated clothing before reuse. Discard contaminated shoes. **Lead:** Wash immediately with soap and water.
Ingestion	Do NOT induce vomiting or aspiration into the lungs may occur and can cause permanent injury or death. Give large quantities of water. Never give anything by mouth to an unconscious person. Consult a physician immediately.

SECTION 5 – FIRE-FIGHTING MEASURES

Flash Point – N/A

Auto Ingestion – No Data Available

Extinguisher Media - Dry chemical type extinguishers or water.

Special Fire-Fighting Procedures - Full protective clothing and NIOSH-approved self-contained breathing apparatus with full face shield. Extinguish fire with agent suitable for surrounding combustible materials. Cool exterior of battery if exposed to fire to prevent or stop release of lead chemicals and fumes. Firefighting runoff and dilution water may be toxic and corrosive. Do not use carbon dioxide directly on cells.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Lead dust should be vacuumed or wet swept into a DOT approved container. Use controls that minimize escaping or fugitive emissions. Do not use compressed air.

SECTION 7 – HANDLING AND STORAGE

Store batteries in a cool, dry, well-ventilated area: separate from incompatible materials and any activities that can generate flames, sparks, or heat. Use an insulating material, such as cardboard, between stacked layers of

batteries. Keep all metallic articles that could short the terminals away from batteries. Use insulated tools only. Follow all installation instructions and diagrams when installing or maintaining battery systems.

Handle cautiously; avoid contact with eyes and skin.

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection (NIOSH/MSHA approved) - None required under normal handling conditions. During battery formation (high-rate charge condition), acid mist can be generated which may cause respiratory irritation. Also, if acid spillage occurs in a confined space, exposure may occur. If irritation occurs, wear a respirator suitable for protection against acid mist.

Eye Protection - If battery case is damaged, use chemical goggles or face shield worn over safety glasses.

Skin Protection - If battery case is damaged, use rubber or plastic acid-resistant gloves with elbow-length gauntlet, acid-resistant apron, clothing and boots. Safety shoes are recommended when handling batteries. All footwear must meet requirements of ANSI Z41.1 -Rev.1972

SECTION 9 – PHYSICAL/CHEMICAL PROPERTIES

Boiling Point	Electrolyte: 110°C (230°F)	**Melting Point**	Lead: 327°C (621°F)
Vapor Pressure	Electrolyte: 10 mmHg	**Vapor Density**	>1
Specific Gravity (H2O=1)	Electrolyte: 1.27-1.33	**Solubility in Water**	Electrolyte: 100%
Evaporation Rate	Acid: <1 (n-BuAc=1)		
Reactivity in Water	NA	**Auto-Ignition Temperature**	580°C (Hydrogen)
Odor Threshold	Not Applicable	**Viscosity (poise @ 25° C)**	Not Available
Partition Coefficient	NA	**Decomposition Temperature**	Not Available
Flash Point	259°C (Hydrogen)		
Appearance and Odor	Electrolyte: clear liquid; acidic odor Case: case with terminals, odorless		

SECTION 10 – STABILITY & REACTIVITY

Stability - This product is stable under normal conditions at ambient temperature. Avoid sparks, other sources of ignition, and electrical shorting.

INCOMPATIBILITY (MATERIALS TO AVOID) –

Lead/Lead Compounds: potassium (K), carbides, sulfides, peroxides, phosphorus (P), and sulfur
Battery Electrolyte (Acid): combustible materials, strong reducing agents, most metals, carbides, organic materials, chlorates, nitrates, picrate and fulminates.

SECTION 11 – TOXICOLOGICAL INFORMATION

Threshold Limit Value: OSHA Air Exposure Limits (ug/ m^3)
Lead/Lead Compound: 50
Tin: 2000
Dilute Sulfuric Acid: 1000

ROUTES AND METHODS OF ENTRY -

Inhalation -
Acid mist from formation process may cause respiratory irritation.

Skin Contact –
Acid may cause irritation, burns and/or ulceration.

Eye Contact -
Acid may cause severe irritation, burns, cornea damage and/or blindness.

Ingestion -
Acid may cause irritation of mouth, throat, esophagus, and stomach.

SIGNS AND SYMPTOMS OF OVEREXPOSURE –

Acute Effects -
Over exposure to lead may lead to loss of appetite, constipation, sleeplessness and fatigue. Over exposure to acid may lead to skin irritation, corneal damage of the eyes and upper respiratory system.

Chronic Effects -
Lead and its components may cause damage to kidneys and nervous system. Acid and its components may cause lung damage and pulmonary conditions.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

Potential to Cause Cancer: The International Agency for Research on Cancer has classified "strong inorganic acid mist containing sulfuric acid" as a Category1 carcinogen, a substance that is carcinogenic to humans. This classification does not apply to liquid forms of sulfuric acid or sulfuric acid solutions contained within a battery. Inorganic acid mist is not generated under normal use of this product. Misuse of the product, such as overcharging, may however result in the generation of sulfuric acid mist.

SECTION 12 – ECOLOGICAL INFORMATION

Hazardous Decomposition Products

Lead/Lead Compounds: Oxides of lead and sulfur.

Battery Electrolyte (Acid): Hydrogen, sulfur dioxide, and sulfur trioxide.

SECTION 13 – DISPOSAL

Waste Disposal Method –

Battery electrolyte (acid): Neutralize as above for a spill, collect residue, and place in a drum or suitable container. Dispose of as hazardous waste.

Spent batteries: Send to lead smelter for reclamation following applicable Federal, State and local regulations. Product can be recycled along with automotive (SLI) lead acid batteries.

Do not flush lead contaminated acid to sewer.

SECTION 14 – TRANSPORT

U.S. DOT: Lead Acid batteries that are classified as non-spillable have been tested and meet the non-spillable criteria listed in CFR 49, 173.159 (f) and 173.159a (d) (1).

Non-spillable batteries are excluded from CFR 49, Subchapter C requirements, provided that the following criteria are met:

(1) The batteries must be securely packed in strong outer packaging and meet the requirements of CFR 49 173.159a;
(2) The batteries' terminals must be protected against short circuit; and
(3) Each battery and their outer packaging must be plainly and durably marked "NONSPILLABLE" or "NONSPILLABLE BATTERY"

The exception from CFR 49, Subchapter C means shipping papers need not show proper shipping name, hazard class, UN number, and packing group. Hazardous warning labels are not required when transporting a non-spillable battery.

IATA: Lead Acid batteries that are classified as non-spillable have been tested and meet the non-spillable criteria listed in IATA Packing Instruction 872 and Special Provision A67. Non-spillable batteries must be packed according to IATA Packing Instruction 872. This means shipping papers need not show proper shipping name, hazard class, UN number, and packing group. Hazardous warning labels are not required when transporting a non-spillable battery. These batteries are excluded from all IATA regulations provided that battery terminals are protected against short circuits.

IMDG: Lead Acid batteries that are classified as non-spillable have been tested and meet the non-spillable criteria listed in Special Provision 238. Non-spillable batteries must be packed according to IMDG Packing Instruction P003. This means shipping papers need not show proper shipping name, hazard class, UN number, and packing group. No hazardous warning labels are required when transporting a non-spillable battery. These batteries are excluded from all IMDG code provided that the batteries' terminals are protected against short circuits per PP16.

SECTION 15 – REGULATORY INFORMATION

Batteries in this category may be listed with UL in the 'recognized component' class.

SECTION 16 – OTHER INFORMATION

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Notes

PHS West
6704 Bleck Drive
Rockford, MN 55373 USA
(ph) +1 763-498-7576
www.phswest.com