
BDx Module Documentation

Release 1

Magna-Power Electronics, Inc.

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PREFACE

Thank you for choosing a Magna-Power Electronics product. This document provides user, service, and programming information the BDx Module Fully integrated blocking diode accessory. If you have any suggestions or feedback for this document, please contact Magna-Power at feedback@magna-power.com.

1.1 Contact Magna-Power

Magna-Power support can be contacted for service, technical support, or spare parts:

- By Phone: +1-908-237-2200
- By Email: support@magna-power.com

Visit magna-power.com/support for more support resources and information about contacting Magna-Power worldwide.

1.2 Safety Notice

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Neither Magna-Power Electronics nor any of the associated sales organizations accept responsibility for personal injury, consequential injury, loss, or damage resulting from improper use of the equipment and accessories.

Installation and service must be performed only by properly trained and qualified personnel who are aware of dealing with electrical hazards. Ensure that the AC power line ground is properly connected to the Accessory chassis. Furthermore, other power grounds, including those connected to application maintenance equipment, must be grounded for both personnel and equipment safety.

This product is a Safety Class 1 instrument, provided with a protective earth terminal. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

<p>Warning: Residual voltage. Lethal voltages may be present inside the Accessory even when the AC input voltage is disconnected. Only properly trained and qualified personnel should remove covers and access the inside of the Accessory.</p>

During normal operation, the operator does not have access to hazardous voltages within the product's chassis. Depending on the application, high voltages hazardous to human safety may be present on the DC power terminals. Ensure that the DC power cables are properly labeled as to the safety hazards and that any inadvertent contact with hazardous voltages is eliminated.

Do not install substitute parts or perform unauthorized maintenance on the product.

These operating instructions form an integral part of the equipment and must be available to the operating personnel at all times. All the safety instructions and advice notes are to be followed.

Warning: General. Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operating instructions.

Warning: Environmental Conditions. Never use the instrument outside of the specified environmental conditions described in the Environmental Characteristics of the specifications.

Warning: Ground the Instrument. This product is provided with protective earth terminals. To minimize shock hazard, the instrument must be connected to the AC mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in injury or death.

Warning: Before Applying Power. Verify that all safety precautions are taken. All connections must be made with the unit turned off, and must be performed by qualified personnel who are aware of the hazards involved. Improper actions can cause fatal injury as well as equipment damage. Note the instrument's external markings described under "Safety Symbols".

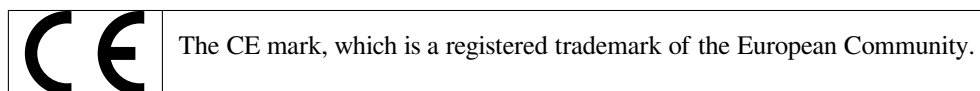
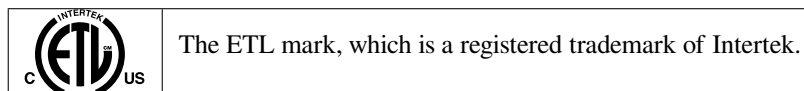
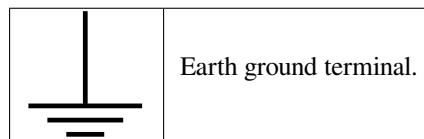
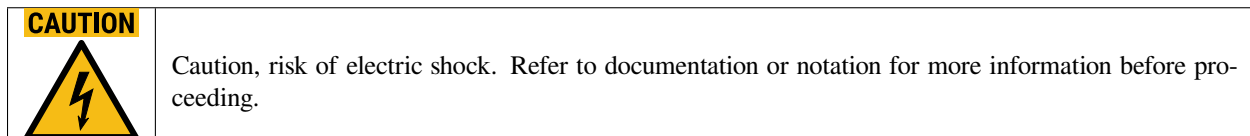
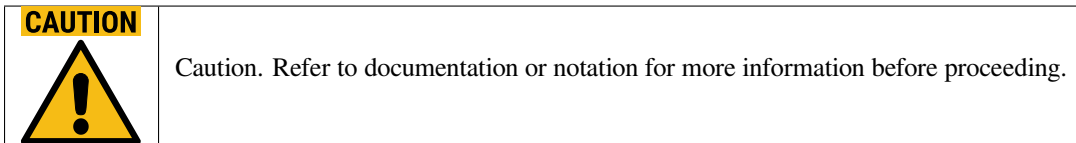
Warning: Do Not Operate in an Explosive Atmosphere. Do not operate the instrument in the presence of flammable gases or fumes.

Warning: Do Not Remove the Instrument Cover. Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Disconnect the power cable and any external circuits before removing instrument covers.

Warning: Do Not Modify the Instrument. Do not install substitute parts or perform any unauthorized modification to the product, except with the direction of Magna-Power support personnel. Return the product to a Magna-Power authorized service center for repair.

Warning: In Case of Damage. Instruments that are not functioning correctly, appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

1.3 Safety Symbols



1.4 Limited Warranty

The following is made in lieu of all warranties expressed or implied.

Magna-Power Electronics, Inc. warrants its products to be free of manufacturing defects for a period of two years from date of original shipment from its factory. Magna-Power Electronics, Inc. will repair, replace, or refund the purchase price at its discretion, which upon examination by Magna-Power Electronics, Inc., is determined to be defective in material or workmanship, providing such claimed defective material is returned upon written authorization of Magna-Power Electronics, Inc., freight and duties prepaid.

For products failing within the first 30 days of the warranty period, Magna-Power Electronics, Inc. will return the repaired product at its expense using a standard ground shipping method; after 30 days of the warranty period, the repaired product will be returned at the customer's expense using the customer's requested shipping method.

Damage due to corrosion, customer alterations, excessive dust, extreme environmental or electrical conditions, and/or misuse will be evaluated upon inspection. If inspection reveals that the cause of damage is not due to materials or workmanship, repair of the product will be treated on a non-warranty basis.

All electrical, commercial supply parts, and items not manufactured by Magna-Power Electronics, Inc. shall carry the warranty of the original manufacturer and no more, but under no circumstances to exceed the warranty period. Replacement parts shall be warranted for a period of 90 days. Warranty labor shall only apply if the product, assembly, or part is returned to the factory freight prepaid and insured. Damage or breakage while in transit is not covered by this warranty.

Magna-Power Electronics, Inc. assumes no responsibility to Buyer for labor to diagnose and remove defective product and installation of replacement product. Furthermore, Magna-Power Electronics, Inc. is not liable to Buyer or to any third party for consequential or incidental damages under any circumstances, whether due to defect in the product, due to delay or failure of delivery, due to a failure of the product to perform as specified, or for any other reason or cause. Buyer and Magna-Power Electronics, Inc. agree that Buyer's sole remedy and Magna-Power Electronics, Inc.'s sole liability to Buyer is limited to repair, replacement, or refund of the purchase price of the product as described herein, whether Buyer's claim arises out of contract or in tort.

All claims against the warranty shall be the final determination of Magna-Power Electronics, Inc.

1.5 User Manual Warranty

The material contained in this document is provided "as is," and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Magna-Power disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Magna-Power shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Magna-Power and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

1.6 U.S. Government Rights

The Software is "commercial computer software," as defined by Federal Acquisition Regulation ("FAR") 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement ("DFARS") 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Magna-Power provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA). The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Magna-Power: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Magna-Power shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S.

government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data

1.7 WEEE Directive 2002/96/EC

This product complies with the Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC marking requirement. The affixed product label (see below) indicates that you must not discard this electrical/electronic product in domestic household waste.



Product Category: With reference to the equipment types in the WEEE directive Annex 1, this product is classified as “Monitoring and Control instrumentation” product.

Do not dispose products in domestic household waste.

To return unwanted products, [contact Magna-Power Electronics](#).

1.8 Declaration of Conformity

Magna-Power Electronics declares on its sole responsibility that the BDx Module Fully integrated blocking diode accessory complies with the essential requirement of the relevant European Directives, and is eligible to carry the CE mark.

1.9 Document Conventions

This user’s manual uses several conventions to highlight certain words and phrases and draw attention to specific pieces of information.

Note: Notes are tips, shortcuts or alternative approaches to the task at hand. Ignoring a note should have no negative consequences, but you might miss out on a time saving procedure.

Warning: The warning sign denotes a hazard, calling attention to a procedure or practice. If a warning is not correctly performed or adhered to, it could result in personal injury. Do not proceed beyond a warning sign until the conditions are fully understood or met.

Caution: The caution sign denotes a hazard, calling attention to a procedure or practice. If a caution is not correctly performed or adhered to, it could result in damage to the product. Do not proceed beyond a caution sign until the conditions are fully understood or met.

Source-code listings are also set in mono-spaced roman but add syntax highlighting as follows:

```
#!/usr/bin/python
# -*- coding: utf-8 -*-

from serial import Serial

class Magna(Serial):
def __init__(self, port, expected_serial_number=None, log=None):
    super(Magna, self).__init__(port, baudrate=19200, timeout=2.0)
    self.log = log if log else self.magna_log
    self.write('*CLS\r\n')
```

1.10 Additional Help and Feedback

For additional help or to provide feedback about the product's design and features, please contact: support@magna-power.com.

QUICKSTART GUIDE

2.1 Quickstart Guide

1. Unpackage the product and perform a visual inspection for any damage. ([Read More](#))
2. Mount the BDx Module in a rack. ([Read More](#))
3. Connect the provided BDx Module interface cable between the BDx Module's 15-pin D-Sub user I/O connector and the MagnaDC power supply's 37-pin D-Sub JS1 user I/O connector. ([Read More](#))
4. Enable Interlock feature on the MagnaDC power supply. (See [MagnaDC power supply user manual](#))
5. Connect the BDx Module to AC power using the provided provided IEC 60320 C13 AC power cord. ([Read More](#))
6. Connect the positive bus bar on the MagnaDC power supply to the DC input connection on the BDx Module. ([Read More](#))
7. Connect the DC output connection on the BDx Module to your load. ([Read More](#))
8. Switch the control power switch on the BDx Module to the on position.

PRODUCT INFORMATION

3.1 Key Features

The BDx Module offers a turn-key rack-mount blocking diode solution, including:

- Fully integrated and enclosed heatsinking and fan cooling
- User I/O status feedback including a temperature alarm state
- Front panel status indicator
- Heavy-duty tin-plated copper bus bars
- Remote sensing terminal for voltage feedback compensation
- Universal single phase active-PFC AC input connection

Internally, semiconductors are secured to Magna-Power manufactured heatsinks with fans and integrated thermocouples. An internal microprocessor monitors the internal temperature and provides +5V digital output signal when the system is powered and in a normal operating state. This +5V signal can be easily integrated into interlock systems, to ensure power is only driven through the BDx Module when its powered on and cooling is functional. Additionally, a +5V digital input allows control of when the BDx Module is turned off and on, providing complete integration with a connected power supply.

A quick summary of the BDx Module key features:

- Add-on module for MagnaDC power supplies
- 4 models addressing broad range of applications
- Protection up to 1,200 Vdc
- Forward current up to 1,200 Adc
- Fully integrated cooling with status indicator
- Power supply user I/O controls interface
- Included fixed rail rack-mount kit

3.2 Models

The following tables list the available models in the BDx Module.

3.2.1 Model Ordering Guide

The following ordering guide defines how an BDx Module is defined:

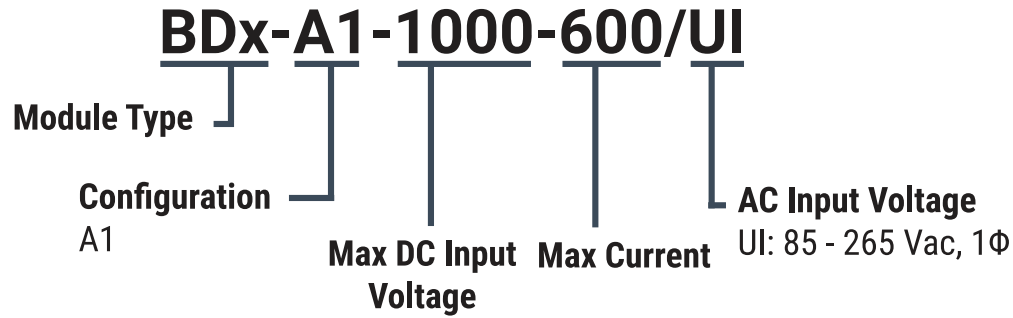


Fig. 3.1: BDx Module Model Ordering Guide

3.2.2 BDx Module Models

Model	Config	Max DC Input Voltage	Max Current	Reverse Voltage Rating	Typical Losses
BDx-A1-1000-300/UI	A1	1000 Vdc	300 Adc	1200 Vdc	Up to 1.4%
BDx-A1-150-600/UI	A1	150 Vdc	600 Adc	200 Vdc	Up to 2.5%
BDx-A1-1000-600/UI	A1	1000 Vdc	600 Adc	1200 Vdc	Up to 1.4%
BDx-A1-150-1200/UI	A1	150 Vdc	1200 Adc	200 Vdc	Up to 2.5%

3.3 Specifications

3.3.1 AC Input Specifications

1Φ AC Input Voltage <i>1Φ, 2-wire + ground</i>	85 to 265 Vac
AC Input Connector	IEC 60320 C13 receptacle
AC Input Frequency	50-60 Hz
AC Input Isolation	±1500 Vac, maximum input voltage to ground

3.3.2 External User I/O Specifications

External User I/O Port	15-pin D-Sub DB-15, female
Digital Output Voltage <i>System Status</i>	+5V when systems normal. 0V when off or faulted state. Connected to MagnaDC interlock input via provided cable.
Digital Input Voltage <i>Enable</i>	+5V to engage cooling fans. 0V to disable product. Connected to MagnaDC power status output via provided cable.
Remote Sense	6-32 screw connection for positive terminal

For more details about the External User I/O, see: *BDx Module D-Sub 15-pin BDx Interface user I/O connector (female) pin numbering*.

3.3.3 Physical Specifications

Racking Standard	EIA-310
Rear Support Rails	Included
Size and Weight <i>Configuration A1, All Models</i>	1U 1.75" H x 19" W x 24" D (4.4 x 48.3 x 61.0 cm) 20 lbs (9.07 kg)

3.3.4 Environmental Specifications

Ambient Operating Temperature	0°C to 50°C
Storage Temperature	-25°C to +85°C
Humidity	Relative humidity up to 95% non-condensing
Air Flow	Side air inlet, rear exhaust

3.3.5 Regulatory Compliance

EMC	Complies with 2014/30/EU (EMC Directive) CISPR 22 / EN 55022 Class A
Safety	Complies with EN61010-1 Complies with 2014/35/EU (Low Voltage Directive)
CE Mark	Yes
RoHS Compliant	Yes

3.4 Dimensional Diagrams

The following are vectorized dimensional diagrams for the BDx Module. Click the respective image for a larger view. 3D STEP models can be downloaded from Magna-Power's downloads page.

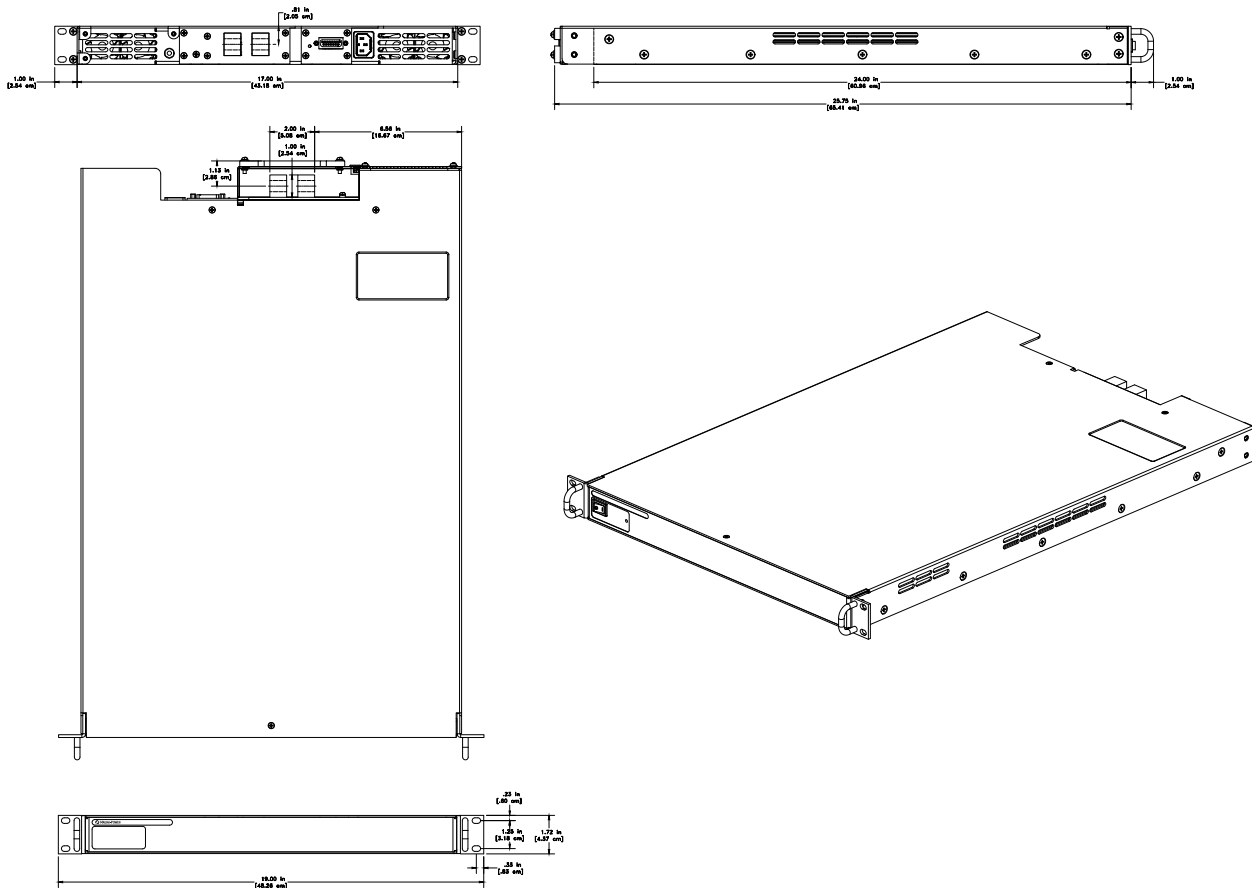


Fig. 3.2: BDx Module dimensional diagrams

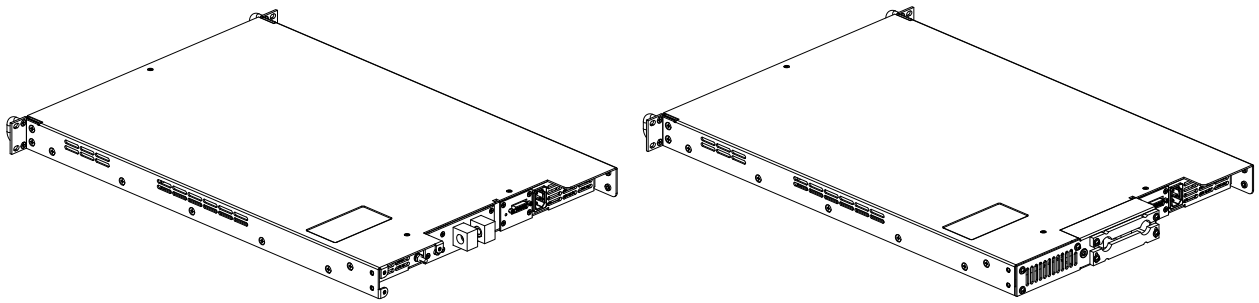


Fig. 3.3: BDx Module rear view without the protective cover (left) and with the protective cover (right)

INSTALLATION

4.1 Inspection

Carefully unpack the BDx Module and accessories saving all packing materials and included enclosures. Inspect product for possible shipping damage. Check that there are no broken knobs or connectors, the external surface is not scratched or dented, the meter faces are not damaged, and all controls move freely. Any external damage may be an indication of internal damage. If there is any damage, notify the shipping carrier and Magna-Power immediately: magna-power.com/support.

The following parts are included with all Accessory models:

- BDx Module
- DC input/output metal protective cover
- BDx Module interface cable
- Qty (2) rear support brackets for rack installation
- Qty (16) 10-32 screws
- Qty (8) 10-32 flat washers and lock washers
- Qty (2) handles with mating hardware
- USB drive with software, drivers, and digital documentation

4.2 Rack Installation

The BDx Module is intended for rack mount installations only and is designed to fit in standard 19-inch EIA equipment racks. The BDx Module product is designed to fit in one rack-unit (1U). Additional support, other than that provided by the front panel, is required. Fixed rear support rails are provided, which can be adjusted at time of installation to fit a variety of equipment rack depths. These included rails are designed to mate to inserts on the BDx Module side panels using included hardware. Alternatively, angle slides or cross beam supports can be used to securely fasten the product to the rack and support the rear weight. The unit should be horizontally mounted.

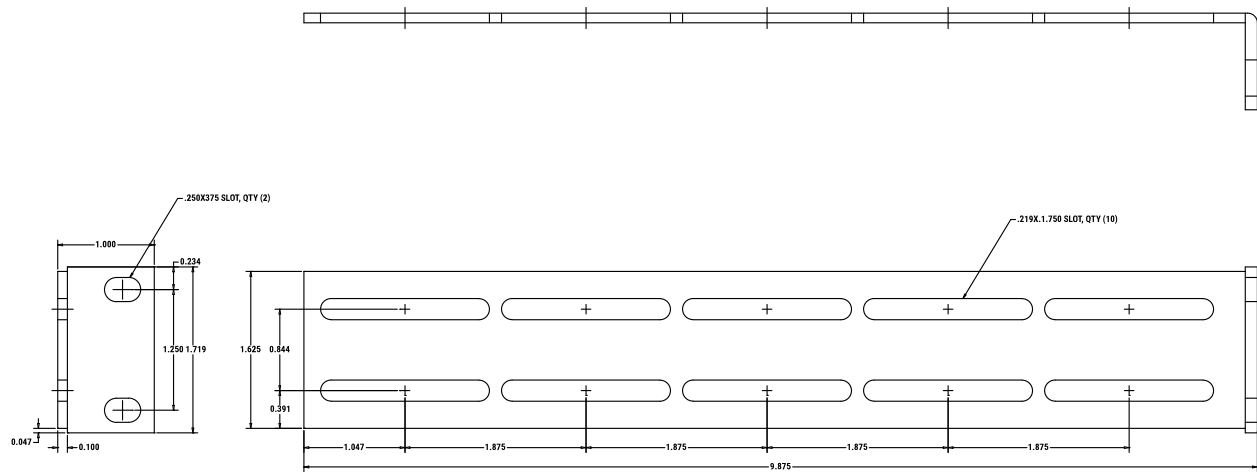


Fig. 4.1: Included rear support rails for BDx Module (inches). Click for a larger view.

4.2.1 Cooling Requirements

Each BDx Module is cooled by suitable fans exhausting warm air to the rear of the cabinet. Fresh air intake is from the sides of the cabinet allowing two or more BDx Module to be stacked without any clearance required. Equipment racks should be equipped with fans or blowers to remove heat generated by the power supplies. Magna-Power recommends fresh air intake at the bottom of the cabinet and exhaust fans at the top pulling air out of the cabinet.

The BDx Module features integrated fans that pull in cool air from sides and exhausts warm air from the rear. Air intake from only the sides of the product allow two or more BDx Module to be stacked with zero clearance between units. Equipment racks housing the BDx Module should be equipped with either an open back, back with grills, or closed back with cabinet fans to remove heat generated by the BDx Module. For fully enclosed cabinets, Magna-Power recommends fresh air intake from the bottom of the cabinet and exhaust at the top.

For cabinet fans to be effective, the ambient intake air temperature outside the rack must be less than the air temperature inside the rack. The BDx Module is rated for 50°C ambient operating temperature. In the case of rack installation, this corresponds to the temperature inside the rack and adequate cooling measures must be taken to ensure the rack's internal temperature stays below 50°C.

The following table provides Magna-Power's recommended per unit cabinet air flow when installing the BDx Module in a fully enclosed cabinet:

BDx Module Model	Maximum Heat Produced	Recommended Cabinet Air Flow 77 °F (25 °C) Room Temperature	Recommended Cabinet Air Flow 104 °F (40 °C) Room Temperature
BDx-A1-1000-300/UI	0.7 kBTU/hr	15 CFM	40 CFM
BDx-A1-150-600/UI	0.9 kBTU/hr	30 CFM	75 CFM
BDx-A1-1000-600/UI	0.9 kBTU/hr	30 CFM	75 CFM
BDx-A1-150-1200/UI	1.8 kBTU/hr	60 CFM	150 CFM

Note: The table above accounts for only a single Accessory. When sizing cabinet fans, it is necessary to account for the heat produced by all the products in the cabinet.

Caution: Do not block the air intake on the front or sides of the instrument, nor the exhaust at the rear of the instrument. Blocking these vents could cause the product to overheat. The recommended minimum clearances are 2 inches (5.1 cm) along the sides and back.

4.3 Interface Cable

The BDx Module includes a 15-pin D-Sub male to 37-pin D-Sub male interface cable to integrate the BDx Module with a MagnaDC programmable DC power supply. Connecting the Interface Cable ensures safe operation, allowing the BDx Module to shut down the power supply in the event of BDx Module thermal alarm.

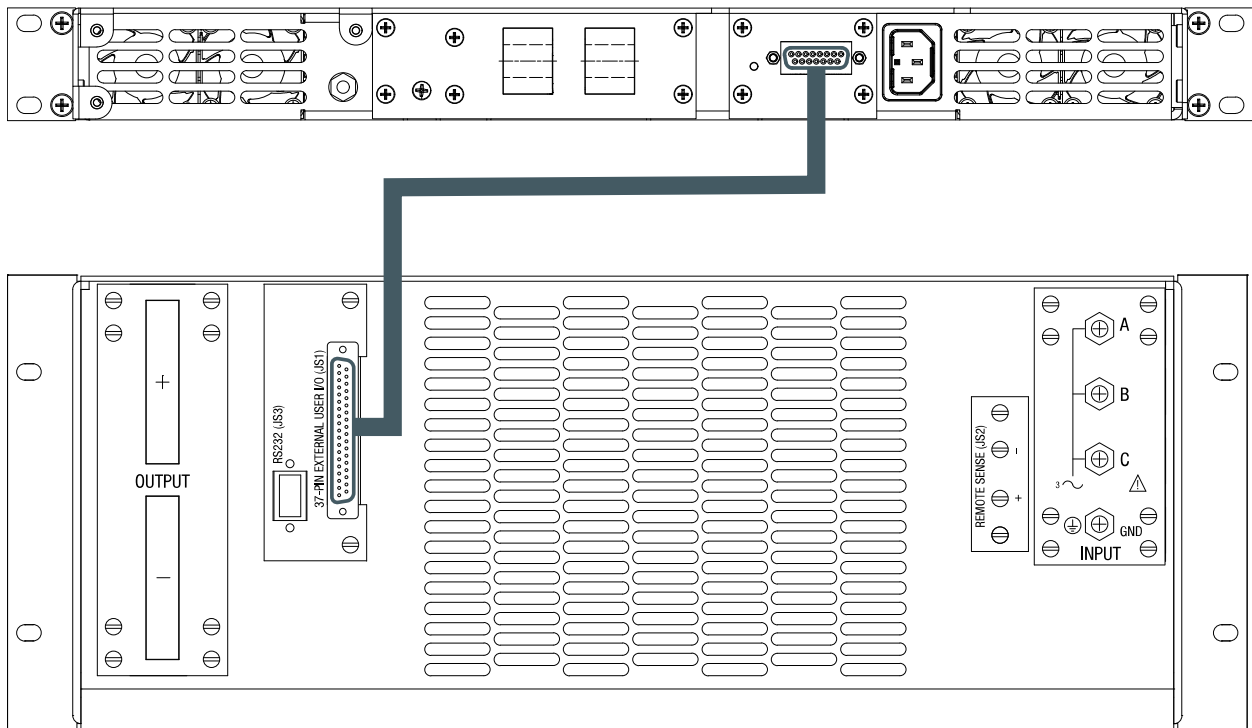


Fig. 4.2: Interface Cable connection from BDx Module (top) to MagnaDC programmable DC power supply (bottom)

The Interface Cable's 15-pin connector is attached to the BDx Module and the 37-pin connector is attached to the MagnaDC programmable DC power supply.

The power supply's interlock feature must be enabled to allow the BDx Module to perform a shutdown. Refer to the [power supply documentation](#) for instructions on how to enable this interlock feature.

Warning: FIRE HAZARD. Failure to connect the Interface Cable or enable interlock on the MagnaDC power supply could result in overheating and catastrophic failure of the BDx Module.

4.4 AC Input Connection

A single-phase AC input connection is used to provide a ground reference and power for the Accessory fans and control circuits. The AC input power requirements are defined on the BDx Module product rating label. The AC input requirements are further defined in this section.

To provide AC power to the BDx Module, connect the provided power cord to the IEC 60320 C13 AC power receptacle, as shown in *BDx Module IEC 60320 C13 AC power receptacle*.

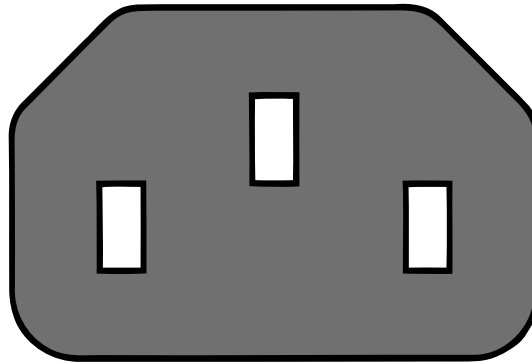


Fig. 4.3: BDx Module IEC 60320 C13 AC power receptacle

Warning: The power cord provides a chassis ground through the third conductor. Be certain that your power outlet is of the three-conductor type with the correct pin connected to earth ground.

4.4.1 Fuse Rating

The BDx Module is fused on its auxiliary power supply assembly, which is a printed circuit board (PCB) assembly located inside the product. The fuse can be accessed by removing the BDx Module top cover and locating the only PCB assembly inside.

The fuse is a through-hole component designated by F3 on the PCB. This fuse carries a 3.15 Aac rating, Bussmann / Eaton manufacturer part number SS-5H-3.15A-APH, Magna-Power Item 32060.

Failure of this fuse typically indicates a failure of this auxiliary power supply assembly and it's recommended to contact Magna-Power support in the event this fuse has cleared.

4.5 DC Connections

Warning: SHOCK HAZARD. The DC input and output connections may still be live despite AC power being off or disconnected. Always measure both the DC input terminal and DC output terminal with respect to ground to ensure zero voltage before making any connections.

The BDx Module DC input and DC output consist of independent heavy-duty copper bus bars with a 3/8" threaded insert. Magna-Power recommends DC power cables be crimped to ring terminals and securely fastened to bus bars using the included 3/8" bolts, washers, and lock washers. The recommended torque for the DC connection is 240 in-lbf (27.1 N-m).

Select a wire size sufficient to handle the maximum output current of the unit, no matter what the intended load current or current limit setting. Connections can be made on top and bottom of the bus bars. Beyond two wire connections, a mating bus bar will need to be added to provide additional mounting holes.

The recommended wire size for different current levels are shown in the table below.

Wire Size (USA)	Equivalent Wire Size (International)	Wires Per Output Terminal	Maximum Current
6 AWG	10 mm ²	1	85 Adc
4 AWG	25 mm ²	1	110 Adc
3 AWG	25 mm ²	1	130 Adc
2 AWG	35 mm ²	1	150 Adc
1 AWG	50 mm ²	1	170 Adc
1/0 AWG	50 mm ²	1	200 Adc
2/0 AWG	70 mm ²	1	235 Adc
3/0 AWG	95 mm ²	1	275 Adc
4/0 AWG	120 mm ²	1	315 Adc
1/0 AWG	50 mm ²	2	400 Adc
2/0 AWG	70 mm ²	2	470 Adc
3/0 AWG	95 mm ²	2	550 Adc
4/0 AWG	120 mm ²	2	630 Adc
1/0 AWG	50 mm ²	4	800 Adc
2/0 AWG	70 mm ²	4	940 Adc
3/0 AWG	95 mm ²	4	1100 Adc
4/0 AWG	120 mm ²	4	1260 Adc

Notes:

1. Capacity for AWG wires derived from the National Electric Code. Maximum ambient temperature: 40°C. Maximum wire temperature: 90°C. Continuous duty with wires in free air, not bundled or in conduit.
2. Capacity of aluminum wire is approximately 84% of the capacity listed for copper wire.
3. For higher current levels, it's recommended to use bus bars with holes for additional cable feeds or direct bus bar connection to the load.

Warning: FIRE HAZARD. Select a wire size large enough to carry the maximum planned operating current to prevent overheating of the wires. Make sure power cable connections are secured tightly in accordance with the torque recommendation to prevent overheating of the bus bars.

4.6 Remote Sense Connection

Remote sensing can improve regulation at a remote reference point. Voltage drop can occur across lead wires and across the diodes in the BDx Module. A MagnaDC power supply can be configured to operate with remote voltage sensing, using high impedance wires connected to the load, providing a remote voltage measurement for the power supply. By default, a MagnaDC power supply measures voltage at its output terminals, but when the remote sense setting is enabled, the feedback measurements are taken from the remote sense leads. Refer to the respective MagnaDC power supply manual for guidance on enabling this feature.

The BDx Module provides a single positive polarity voltage sensing location. The BDx Module is equipped with a 6-32 screw connection designated as remote sense, which provides a voltage sensing location at the DC output terminal. Magna-Power recommends using 20 AWG wires with the remote sense screw terminal. Do not bundle the sense wire-pair together with the load leads; keep the load wires and sense wires separate.

When using the remote sense connection on the BDx Module, the positive remote sense terminal from the MagnaDC power supply is connected to the single remote sense terminal on the BDx Module. The negative remote sense terminal from the power supply is then connected to the return point after the load.

Caution: Always ensure that the positive remote sense lead corresponds to the positive DC bus and, likewise, that the the negative remote sense lead corresponds to the negative DC bus. Connecting sense wires with an incorrect polarity can result in equipment damage.

Caution: WARNING. Switching remote sense leads or disconnecting remote sense leads while the output is enabled can cause a MagnaDC power supply failure. Only switch or disconnect remote sense leads while the power supply is in standby or turned off.

4.7 Protective Cover

The BDx Module includes a single protective cover for the DC input, DC output, and remote sense terminals. For orientation and extra mechanical security, a small notch on the BDx Module's top panel is designed to mate with the lip on cover. Additionally, there are three mating screws, detailed further below.

Before attaching the cover, power and remote sense connections should first be made to the terminals.

Open the cover's insulative feed-through by locating the larger of the two black fiberglass pieces. Loosen this black fiberglass piece by turning the screw on both sides of this piece one full turn counterclockwise.

With power and remote sense connections made, feed the other end of these cables through the inside of the protective cover. A small insulated circular cutout is located to the left of the black fiberglass piece, intended for the remote sense connection. The power cables should be fed between the larger black fiberglass pieces. Slide the cover back on the BDx Module and mate the cover to the notch on the BDx Module's top panel. Align the screw holes and secure the cover using included mating hardware.

Finally, tighten the black fiberglass insulator on the cables and secure this insulator in place by tightening its screws.

4.8 Electrical Check

This section describes the electrical checkout procedure for the BDx Module. This brief electrical checkout procedure validates the product's power circuitry and safety features. This procedure should be followed upon receipt of the product and before it is placed into use.

Diode Verification

Ensure there is no voltage being applied at the BDx Module DC input terminal.

Using a handheld multimeter, set it to Diode Test mode, indicated by a diode symbol on the multimeter's dial. Diode Test mode produces a small voltage between test leads. The multimeter then displays the voltage drop when the test leads are connected across a diode when forward-biased. Connect the test leads between the BDx Module DC Input and DC Output bus bars. The red (positive) test lead should be on the DC Input bus bar and the black (negative) test lead should be on the DC Output bus bar. This forward-bias test should display a voltage drop of 0.5 Vdc to 0.8 Vdc. Reverse the

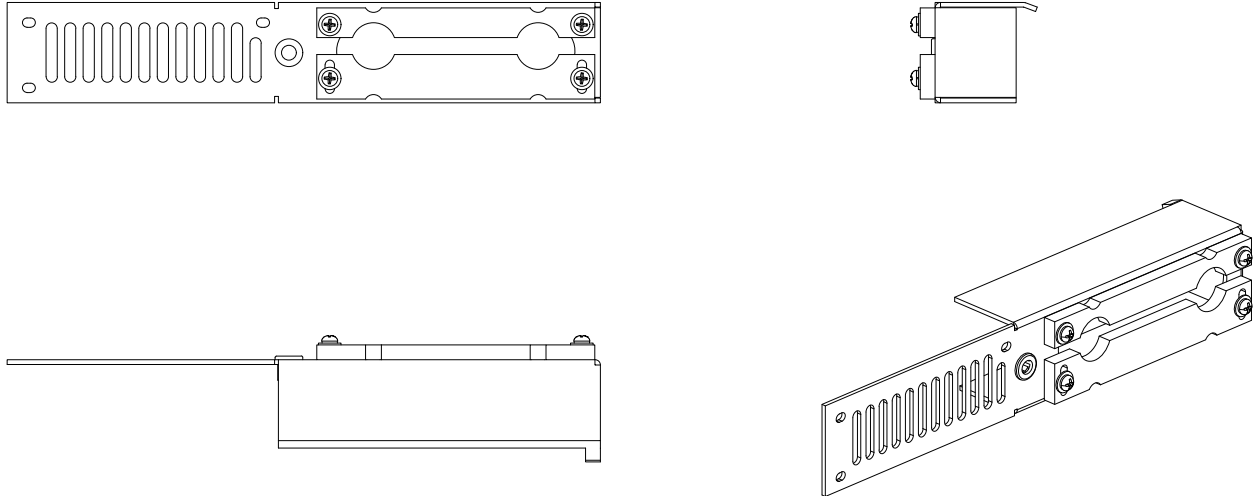


Fig. 4.4: Included BDx Module protective cover

test leads and again record the measurement displayed. This reverse bias test should show overload (OL), indicating that the internal diodes are functioning properly.

If your handheld multimeter does not have a diode test mode, you can instead use the multimeter's Resistance Mode. Set the multimeter to Resistance Mode, indicated by an ohm (Ω) symbol on the multimeter's dial. Connect the test leads between the BDx Module DC Input and DC Output bus bars. The red (positive) test lead should be on the DC Input bus bar and the black (negative) test lead should be on the DC Output bus bar. This forward-bias test should display a resistance of $1000\ \Omega$ to $10\ M\Omega$. Reverse the test leads and again record the measurement displayed. This reverse bias test should show greater than $10\ k\Omega$, indicating that the internal diodes are functioning properly.

If the diode fails the forward- or reverse-bias tests, please contact Magna-Power support.

Cooling Verification

The BDx Module is side air intake, rear exhaust with rear mounted fans. Models BDx-A1-1000-300/UI and BDx-A1-150-600/UI cooling fans only on one side, while models BDx-A1-1000-600/UI and BDx-A1-150-1200/UI have cooling fans on both sides.

While the product has internal temperature monitoring and will shut the MagnaDC power supply down in the event of a temperature alarm, it's important to periodically check that the fans are operating properly.

A simple test for airflow is to use a sheet of printer paper and, while holding it from the short edge, place it behind the unit and observe for displacement.

FEATURES AND FUNCTIONS

5.1 Diode Protection

The BDx Module provides a network of heatsink-mounted diodes, tied together using copper bus bars. An internal auxiliary power supply with a microprocessor provides and control power, while also performing housekeeping and monitoring functions. The BDx Module provides a turn-key blocking diode solution with internal monitoring and plug & play integration with Magna-Power's MagnaDC programmable DC power supplies. Integration with other products is possible, as long as faults are properly monitored to provide a safe shutdown.

5.2 Temperature Monitoring

The BDx Module contains internal fans to remove the heat produced by the diodes. The BDx Module uses thermistors to monitor heatsink temperatures. In the event of a thermal alarm, the BDx Module will indicate a fault via its front status monitoring LED (blinking green) and on its rear 15-pin interface connector (+5V on Pin 2).

5.3 Power Supply Shutdown

The BDx Module communications with a MagnaDC programmable DC power supply using the provided Interface Cable. In the event of a faulted status on the BDx Module, it will break an interlock connection to the power supply, forcing the system to shutdown down. When the fault has been resolved on the BDx Module, the interlock connection will restored and the fault can be cleared on the power supply.

5.4 Statuses

The BDx Module has various statuses corresponding to its present state of operation. A front panel status indicator LED provides information about the BDx Module's operational status, as defined in the following table:

Off BDx Module is disabled or not powered on.

Solid Green BDx Module is powered on and all systems are normal.

Blinking Green There is a fault in the BDx Module and the product should not be operated.

<p>Caution: Ignoring faults and repeatedly operating the BDx Module while in a faulted state will eventually result in product damage.</p>

OPERATION: FRONT PANEL

6.1 Operation: Front Panel

The standard BDx Module front panel provides:

- Model and serial label
- Control power rocker switch
- Status indicator LED

To enable operation of the BDx Module, AC power must be applied and the front panel rocker switch must be set to ON. For more information on the various states for the status indicator LED, refer to: [Statuses](#).



Fig. 6.1: BDx Module front panel

OPERATION: EXTERNAL USER I/O

7.1 Operation: External User I/O

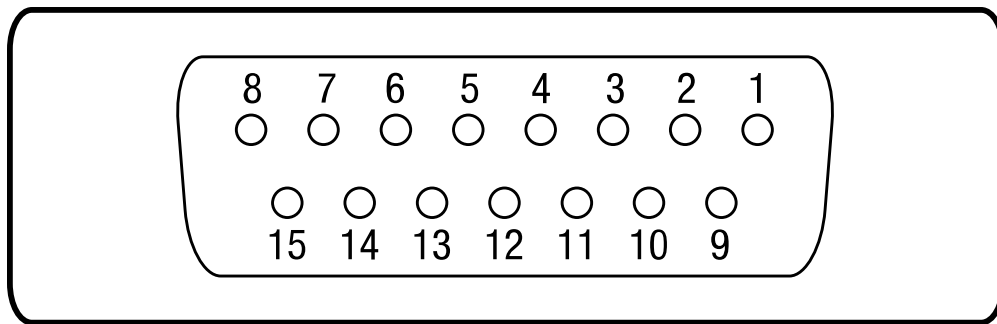


Fig. 7.1: BDx Module D-Sub 15-pin BDx Interface user I/O connector (female) pin numbering

Table 7.1: Complete pin listing and definitions available on the BDx Module D-Sub 15-pin external user I/O connector. Pins not listed have no connection.

User I/O Pin	Definition	Signal Type	Description
5	INTERLOCK	<i>Digital Output</i>	Indication that the product is operating normally, typically to be integrated into digital interlock +5V inputs on MagnaDC power supplies
7	GROUND	Ground	Ground to be used as digital input-output reference

7.1.1 Digital Outputs

The BDx Module has eight digital output signals on its rear 15-pin D-Sub external user I/O. The External User I/O pin layout is defined in *BDx Module D-Sub 15-pin BDx Interface user I/O connector (female) pin numbering*.

The digital outputs are used to monitor the Accessory’s internal states. Digital output pins will output +5V when the associated state is active and 0V when the state is inactive. The maximum output current per pin is 20 mA.

When the BDx Module is in a normal operating state, INTERLOCK (Pin 5) will output +5V with respect to GROUND (Pin 7).

When the BDx Module is in a faulted state, INTERLOCK (Pin 5) will output 0V.

INTERLOCK (Pin 5) is often used to tie in to existing interlock systems and is provided with an ORing diode for protection.

7.1.2 Grounds

A ground pin is provided on the BDx Module 15-pin external user I/O connector on Pin 7 to be used as the reference ground for digital outputs.