

DBx Module



The DBx Module is a performance-enhancing series-connected add-on module for MagnaDC programmable DC power supplies, delivering ultra-high stability, low ripple, high precision and high accuracy, with voltage, current, and power control modes. The combination of the two products provides a broad range of magnet power supply solutions for high-energy physics and medical applications, including driving dipole, quadrupole, and steering magnets, as well as powering coils to establish stable magnetic fields. In addition, the high power density coupled with the high accuracy and low ripple characteristics make the combined solution ideal for ATE calibration applications.

Low Ripple Performance

The DBx Module Configuration A utilizes three stages of filters to suppress differential line-to-line EMI, common-mode line-to-ground EMI, and power supply ripple from the DC bus.

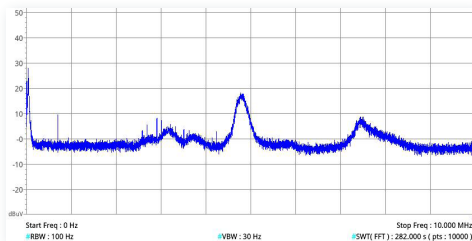
Internally fabricated common-mode and differential-mode EMI filters are integrated in the DBx Module Configuration A, providing insertion loss as high as 62 dB; typical results shown in the table below.

To filter power supply output ripple voltage, with components that can extend down to the mains power frequency, the DBx Module Configuration A utilizes a linear regulator, with a low DC voltage drop across a series-pass power semiconductor.

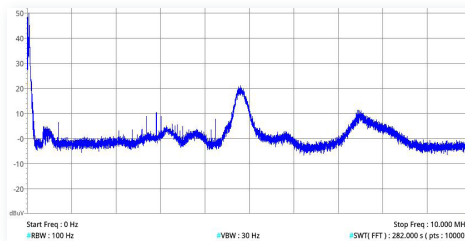
The regulator requires two feedback loops: one to maintain a 1.25 Vdc drop across the linear regulator and the second to produce a AC ripple canceling voltage across the series-pass power semiconductor, equal and opposite of the AC ripple voltage at the input. Adding a series connected diodes across the regulator provides protection for current surging and overvoltage transients—a weak point in conventional linear regulators.

Insertion Loss Measurements¹

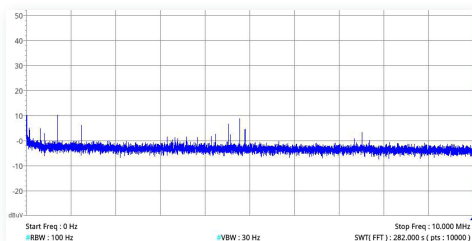
Frequency (MHz)	0.05	0.15	0.50	1.0	10.0	30.0
Differential Mode (dB)	41.0	58.7	46.3	62.7	55.1	50.5
Common Mode (dB)	30.0	47.0	57.4	67.6	56.4	25.4



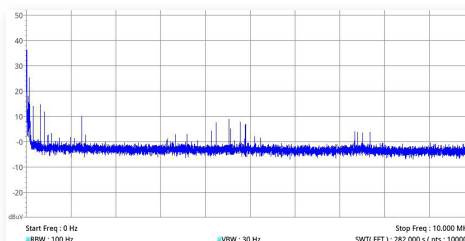
Differential mode noise on DC output without DBx Module



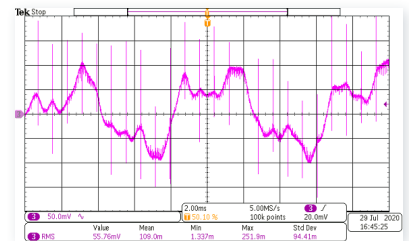
Common mode noise on DC output without DBx Module



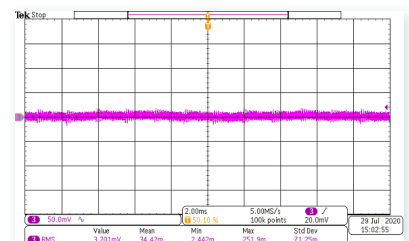
Differential mode noise on DC output with DBx Module¹



Common mode noise on DC output with DBx Module¹



Voltage ripple on DC output without DBx Module



Voltage ripple on DC output with DBx Module¹

Key Facts

- Add-on module for MagnaDC power supplies
- Available from 1.5 kW to 3,000 kW+
- < 5 ppm stability
- Up to 24-bit resolution
- Up to 10x output ripple reduction
- Current ratings up to 6,000 Acd
- Voltage ratings up to 1,000 Vdc
- Voltage, current, and power control

Ultra-Stable, High Accuracy, and High Resolution

An ultra-stable fluxgate direct-current current transformer (DCCT) is used to take high accuracy isolated measurements from a series connection with the power supply's DC output. This ultra-stable transducer, combined with the DBx Module's low temperature drift resistors and temperature stabilized digital programming circuit, provides highly granulated programming (18-bit) and readback (24-bit), and enables long-term stability less than 5 ppm. Critical components are carefully laid out within a specially designed temperature compartment to accelerate the time to temperature stabilization.

Setup and Control

DBx Module Configurations A1 and B1 are provided with copper bus bars with threaded inserts for the DC input and DC output connections. In these configurations, the DC power supply output connects to the DBx Module's DC input and all current sensing is done internal to the DBx Module. The load / device under test gets connected to the DBx Module's DC output bus bars. DBx Module Configuration C1 uses an external DCCT with a control signal providing feedback to the DBx Module via its external user I/O connector. In all configurations, so that the DBx Module can control the power supply, a provided cable connects the DBx Module's interface connector to the power supply's JS1 37-pin external user I/O connector.

Digital programming of set points, trip points, and slew rates are performed using the DBx Module via front panel knob or keypad, front panel up-down arrows for highly granual single-bit control, or using the computer interface connections via provided MagnaWEB software or user defined software using SCPI commands. Included communication interfaces include RS485 and USB with optional TCP/IP Ethernet.



DBx Module rear view with DC input and DC output covers removed

Configurations

The DBx Module is offered in three different configurations—A1, B1, and C1—differing in maximum current capability and internal stages.

The DBx Module **Configuration A1** contains all stages, including the linear regulator, differential- and common-mode DC EMI filters, temperature-stabilized ultra-high stability controller, and DCCT. Configuration A occupies a 1U (1.75" high) rack-mount enclosure and is available for voltages from 10 Vdc to 1,000 Vdc and three different max current ratings, at 75 Adc, 150 Adc, and 225 Adc.

The DBx Module **Configuration B1** is intended for applications that do not require additional DC filtering and contains only the temperature-stabilized ultra-high stability controller and DCCT. Configuration B occupies a 1U rack-mount enclosure and is available for voltages from 10 Vdc to 1,000 Vdc and three different max current ratings, at 75 Adc, 150 Adc, and 225 Adc.

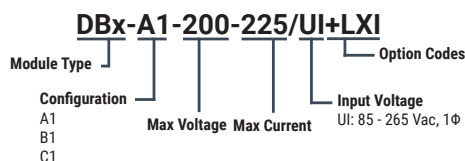
The DBx Module **Configuration C1** is intended for high-current applications, where the 1U rack-mount enclosure contains only the temperature-stabilized ultra-high stability controller, with a provided external DCCT that ties into the DBx Module through a rear connector. Configuration C is available for voltages from 10 Vdc to 1,000 Vdc and max current ratings from 300 Adc to 6,000 Adc.

Available Configurations

Config	EMI/ Ripple Filter	High Stability, Precision, Accuracy	Max Voltage Rating Available	Max Current Rating Available	Form Factor
A1	✓	✓	10 Vdc to 1,000 Vdc	75 Adc, 150 Adc, or 225 Adc	1U Enclosure
B1	✗	✓	10 Vdc to 1,000 Vdc	75 Adc, 150 Adc, or 225 Adc	1U Enclosure
C1	✗	✓	10 Vdc to 1,000 Vdc	300 Adc to 6,000 Adc	1U Enclosure + External Transducer

Model Ordering Guide

DBx Module models are defined by the configuration type and number (see "Available Configurations" table), the maximum voltage rating, and the maximum current rating. Any voltage from Magna-Power's standard MagnaDC power supply offering is available, from 10 Vdc to 1,000 Vdc. The DBx Module resolution step size and calibration is a function of its maximum ratings, therefore it's recommend to specify a model most closely matched to the requirement.



DBx Module right side view (top) and left side view (bottom)

Datasheet (4.5.0)

MagnaDC Programmable DC Power Supplies

Specifications

Performance Specifications

Stability Voltage Control	< 5 ppm; long-term drift (8 hr)
Stability Current Control	< 5 ppm; long-term drift (8 hr)
Temperature Coefficient Voltage Control	< 0.05 ppm/°C
Temperature Coefficient Current Control	< 0.5 ppm/°C
Programming Resolution	18-bit
Measurement Resolution	24-bit
Programming Accuracy	± 0.04%; voltage control ± 0.04%; current control
Power Loss Configuration A1 Only	Current output x 1.5 volts
Warm-up Time	45 min

Connection Specifications

AC Input 1Φ, 2-wire + ground	IEC 60320 connector
AC Input 3Φ, 3-wire + ground	Molex 38660 connector
DC Input	Bus bars with 3/8" threaded insert; 250 Adc max
DC Output	Bus bars with 3/8" threaded insert; 250 Adc max
Communication Interfaces (Standard)	USB Host (Front): Type B USB Host (Rear): Type B RS485 (Rear): RJ-45 External User I/O: 25-pin D-Sub, female
Communication Interfaces (Optional)	LXI TCP/IP Ethernet (Rear): RJ-45

Physical Specifications

Size and Weight Configuration A Configuration B	1U 1.75" H x 19" W x 24" D (4.4 x 48.3 x 61.0 cm) 35 lbs (15.88 kg)
Size and Weight Configuration C	1U (See Above) + External Transducer External transducer size and weight will vary depending on current rating

Environmental Specifications

Ambient Operating Temperature	0°C to 50°C
Storage Temperature	-25°C to +85°C
Humidity	Relative humidity 30% to 90%, non-condensing
Air Flow	Side intake, rear exhaust

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

Note: Specifications measured at full load. Specifications are subject to change without notice.