Sure Cross® DXM100-A1 and A2 Wireless Controller

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Datasheet

The **DXM100-A1** and **DXM100-A2** Controllers are programmable logic controllers with multiple I/O connectivity options or a local ISM radio network and are optimized to be powered by a solar/battery system. Collected data is sent to the cloud through the cellular modem.

- Optimized for use in a solar-powered system
- Cellular modem IIoT connectivity
- 900 MHz ISM radio module (A2 model only)
- Logic controller with action rules and ScriptBasic programming
- Interactive programmable user interface with LCD and LED indicators
- Universal, on-board I/O with analog and discrete I/O
- Industry standard RS-485 (Modbus) and USB communication ports
- Data logging with removable SD card

Models

Models	Cellular Carrier	ISM Radio	Inputs and Outputs
DXM100-A1-V	Verizon	None	Four universal inputs: Sinking/sourcing discrete, 4–20mA analog, 0–10 V analog, counter, and/or temperature with a 10 kOhm thermistor
DXM100-A1-A	AT&T		Four NMOS outputs, two 0–10 V analog outputs, and two DC Latching outputs
DXM100-A2R1-V	Verizon	900 MHz Performance Gateway	Two adjustable 5 V to 24 V switched power outputs, one SDI switched power outputs, and one 5 V courtesy power output
DXM100-A2R1-A	AT&T		

An LTE cellular modem is installed in the **DXM100-A1** or **DXM100-A2** Controller.

DXM100-A Controller Overview

The DXM100-A controller is optimized for solar/battery power. A full-featured application configuration on the controller will operate over 20 days of autonomy with a 5.5 AHr LiFePO4 battery.

Use the DXM Configuration Software, DXM Instruction Manuals, technical notes, and videos at www.bannerengineering.com to configure/program the DXM for your application.

Banner's DXM Logic Controller integrates cellular connectivity and local I/O to provide a platform for the Industrial Internet of Things (IIoT).

Inputs/Outputs—On-board universal and programmable I/O ports connect to local sensors, indicators, and control equipment.

- Universal Inputs
- Discrete outputs
- Courtesy power
- Switch power

- DC latching outputs
- Analog Outputs
- SDI-12 sensor interface
- Battery backup
- Solar controller

Wired Connectivity
Field Bus: Modbus RS-485 Master/Slave

Wireless Connectivity
Cellular modem: 4G LTE CATM1 (Verizon or AT&T)

Logic Controller—Program the DXM's logic controller using action rules and/or ScriptBasic language, which can execute concurrently. The control functions allow freedom when creating custom sensing and control sequences.

Action Rules

Supports simple logic, counters, arithmetic, averaging/trending, and thresholding

Low complexity solutions

SMS text message Notifications

E-mail Notifications

Push data on conditions

Text Programming Language

ScriptBasic

Medium complexity solutions

Scheduler

Time/calendar-based events

Astronomical clock

Dynamic scheduling for scheduling adjustments

Data Logging

Cyclic Data/Event logging

E-mail log files

Data Sampling

Adjust cloud push intervals and sampling intervals between pushes

User Programmable LCD—A simple user interface consists of an LCD screen and four LED indicators. Use the LCD to access the system's status and configuration, view user selectable events and data, and configure inputs and outputs.

I/O Base Board for the DXM100-Ax

Figure 1. I/O base board for the DXM100-A1 and -A2 models
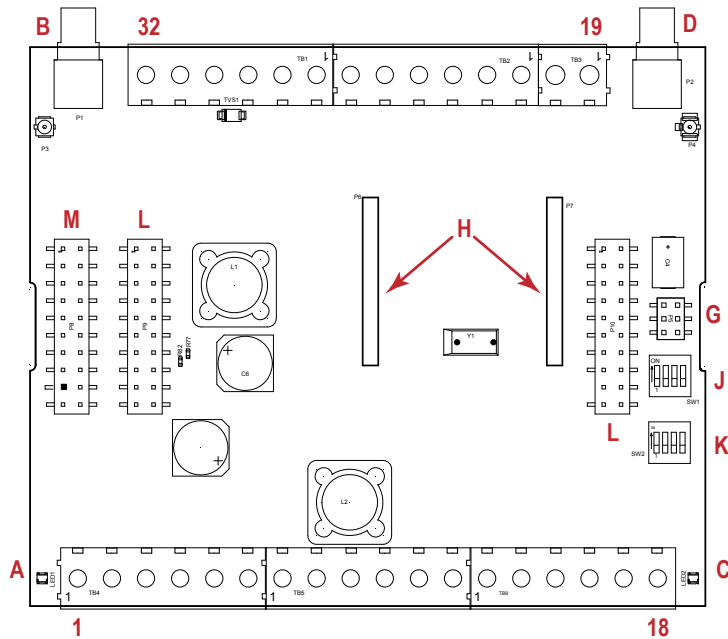
Pin	Name	Description
1	No Connection	Not used
2	**PW**. 12-30 V DC or solar power in (+)	Main power in for DXM Controller, can be 12-30 V DC or solar power (20 W panel max)
3	**GD**. Ground	DXM ground
4	**B+**. Battery in (< 15 V DC)	12 V battery connection, positive
5	**GD**. Ground	DXM ground
6	**M-**. Primary RS-485 -	Modbus master port (+) controlled by the DXM Controller. DXM can read/write Modbus slave devices connected to this port.
7	**M+**. Primary RS-485 +	Modbus master port (-)
8	**GD**. Ground	DXM ground
9	**1A**. DLatch 1A	Input A (+) connection for first external DC latching solenoid. Use I/O board Modbus register 507 to control.
10	**1B**. DLatch 1B	Input B (-) connection for first external DC latching solenoid
11	**2A**. DLatch 2A	Input A (+) connection for second external DC latching solenoid. Use I/O board Modbus register 508 to control.

Pin	Name	Description
12	**2B**. DLatch 2B	Input B (-) connection for second external DC latching solenoid
13	**S-**. Secondary RS-485 -	Modbus Slave RS-485 (+) connection for host system as a Modbus master communicating to the DXM controller as a Modbus Slave device.
14	**S+**. Secondary RS-485 +	Modbus Slave RS-485 (-) connection.
15	**SP**. SDI-12 Courtesy Power	Power connection for external SDI-12 sensors
16	**SD**. SDI-12 Data	Communications line for external SDI-12 sensors
17	**GD**. Ground	Ground connection for SDI-12 sensor (DXM common ground)
18	**P3**. Courtesy Power 5 V	Courtesy Power output 5 V, limited to 500 mA
19	**A2**. Analog OUT 2 (0–10 V)	Analog output 2, (0-10 V) controlled by I/O board Modbus register 508. (values range from 0-10000)
20	**A1**. Analog OUT 1 (0–10 V)	Analog output 1, (0-10 V) controlled by I/O board Modbus register 507. (values range from 0-10000)
21	**P2**. Adjustable Courtesy Power (5–24 V)	Adjustable power output 2, 5–24 V DC. Use DXM Configuration Software to set voltage output and associating power output to input pins.
22	**N4**. NMOS OUT 4	NMOS switch to ground controlled by I/O Modbus registers 504; 1A maximum at 30 V DC.
23	**N3**. NMOS OUT 3	NMOS switch to ground controlled by I/O Modbus registers 503; 1A maximum at 30 V DC.
24	**N2**. NMOS OUT 2	NMOS switch to ground controlled by I/O Modbus registers 502; 1A maximum at 30 V DC.
25	**N1**. NMOS OUT 1	NMOS switch to ground controlled by I/O Modbus registers 501; 1A maximum @ 30VDC.
26	**GD**. Ground	DXM ground
27	**U4**. Universal Input 4	Universal input #4, NPN, PNP, 0–20 mA, 0–10 V, 10k Thermistor. Use DXM Configuration Software or Modbus registers to set input type. I/O Modbus register 4
28	**U3**. Universal Input 3	Universal input #3, NPN, PNP, 0–20 mA, 0–10 V, 10k Thermistor. Use DXM Configuration Software or Modbus registers to set input type. I/O Modbus register 3
29	**GD**. Ground	DXM ground
30	**P1**. Adjustable Courtesy Power (5–24 V)	Adjustable power output 1, 5–24 V DC. Use DXM Configuration Software to set voltage output and associating power output to input pins.
31	**U2**. Universal Input 2	Universal input #2, NPN, PNP, 0–20 mA, 0–10 V, 10k Thermistor. Use DXM Configuration Software or Modbus registers to set input type. I/O Modbus register 2
32	**U1**. Universal Input 1	Universal input #1, NPN, PNP, 0–20 mA, 0–10 V, 10k Thermistor. Use DXM Configuration Software or Modbus registers to set input type. I/O Modbus register 1

A	Base board LED			J	Modbus Slave ID DIP Switches
B	A1. Cellular or secondary antenna			K	Modbus Slave ID DIP Switches
C	Radio LED	G	Programming header	L	Processor Board Connection
D	A2. ISM Antenna	H	ISM Radio Board Connection (A2 model only)	M	Display Connection

DXM100-Ax Documentation

For more information about the DXM100 family of products, please see additional documentation and videos on the Banner website: www.bannerengineering.com.

- DXM100-Bx Wireless Controller Instruction Manual, p/n 190037
- DXM ScriptBasic Instruction Manual, p/n 191745
- DXM Controller API Protocol, p/n 186221
- DXM Controller Configuration Quick Start, p/n 191247
- DXM Enclosure Kit Setup Guide (Solar Kits), p/n 223953
- DXM Configuration Software v4 (p/n b_4496867)
- DXM Configuration Software v4 Instruction Manual, p/n 209933
- Banner CDS Web Service Quick Start Guide, p/n 201126
- Banner CDS Web Service Instruction Manual, p/n 178337
- Additional technical notes and videos

Technical notes, configuration examples, and ScriptBasic program examples are available at www.bannerengineering.com.

DXM100-A Configuration

Use the DXM Configuration Software to customize the configuration of the controller. Select the DXM100-A model when using the configuration software.

When the USB cable is plugged into the DXM Controller, the device is powered by the USB power. When the USB cable is unplugged, the device resets itself and is powered by the connected battery.

The DXM100-A kit has operating limitations based on the storage capacity of the 12 V lithium iron phosphate battery (5.5 Ah), the 5 W solar panel (0.29 A maximum) and the days of autonomy desired. The main power consumption contributors are:
- Cellular push interval, which should be set to 15 minutes or longer (use the Sample Count parameter for greater granularity)
- RS485 communications of external Modbus devices using switched power
- Poor cellular signal strength and/or radio signal strength, creating multiple retry attempts.

Efficient operations include:
- DC Latch operations
- SDI-12 operations
- I/O operations
- ISM radio network operations

Some example configuration that operate on less than 5 mA (on average), and operate using the 12 V battery (5.5 Ah) without sun for over 20 days include:
- SDI-12 reading in 15-minute intervals
- Two DC latching outputs toggling every 5 minutes
- One temperature/humidity probe powered from 16 V switched power reading every 5 minutes
- ScriptBasic program controlling temperature/humidity power and reading, DC latching control
- Read rules operating every 5 to 15 minutes for solar charging parameters and SDI-12 data
- Cellular push every 15 minutes, sampling every 5 minutes, for 16 Local Registers
- ISM radio devices operating at 0.25 W transmit power mode (default radio transmit power is 1 W)

Verify the battery consumption. When creating custom configurations, measure the current draw on the battery. Load the DXM100-A device configuration and measure the average current draw over two or three cellular pushes. A meter in series with the battery may cause the device to brown out if the battery is not fully charged.

Specifications

Supply Voltage
12 to 30 V DC (use only with a suitable Class 2 power supply (UL) or a SELV (CE) power supply) or 12 V lithium iron phosphate battery

Courtesy Power Out
One output at 5 Volts, 500 mA maximum
No short circuit protection

Switched Power Outputs
Two adjustable 5 V to 24 V outputs
One SDI-12 adjustable 5 V to 24 V output
5 V: 400 mA maximum
16 V: 125 mA maximum
24 V: 85 mA maximum

Power Consumption
4 mA average at 12 V (exclusive of load)

Counters, Synchronous
32-bits unsigned
10 ms clock rate minimum

Universal Inputs
Sinking/Sourcing discrete, 4–20 mA analog, 0–10 V analog, counter, and temperature 10 kOhm thermistor

Communication Hardware (MultiHop RS-485)
Interface: 2-wire half-duplex RS-485
Baud rates: 9.6k, 19.2k (default), or 38.4k via DIP switches; 1200 and 2400 via the MultiHop Configuration Software
Data format: 8 data bits, no parity, 1 stop bit

Shock and Vibration
All models meet IEC 60068-2-6 and IEC 60068-2-27 testing criteria
Shock: 30G 11 ms duration, half sine wave per IEC 60068-2-27
Vibration: 10 Hz to 55 Hz, 0.5 mm peak-to-peak amplitude per IEC 60068-2-6

Solar Power
12 V lithium iron phosphate battery
3 A maximum charge current
12 V, 5 W solar panel (supplied with DEK Kit); 12 V, 20 W maximum solar panel

Communication Protocols
Modbus RTU Master/Slave and SDI-12
Cellular modem for Internet connectivity

Logging
8 GB maximum; removable Micro SD card format

Construction
Polycarbonate

Analog Outputs (DAC)
0 to 10 V DC output
Accuracy: 0.1% of full scale +0.01% per °C
Resolution: 12-bit

Discrete Output Rating (NMOS)
Less than 1 A max current at 30 V DC
ON-State Saturation: Less than 0.7 V at 20 mA
ON Condition: Less than 0.7 V
OFF Condition: Open

Operating Conditions [1]
–20 °C to +60 °C (–4 °F to +140 °F)
95% maximum relative humidity (non-condensing)
Radiated Immunity: 10 V/m (EN 61000-4-3)

Environmental Rating
DXM100-A only: IP20
DEK100-A Kit: NEMA 4X

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[1] Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

Specifications for the A2 Model Only

The following specifications apply only to the A2 model.

Radio Range [2]
900 MHz, 1 Watt: Up to 9.6 km (6 miles)

Antenna Minimum Separation Distance
900 MHz, 1 Watt: 4.57 m (15 ft)

Radio Transmit Power
900 MHz, 1 Watt: 30 dBm (1 W) conducted (up to 36 dBm EIRP)

Spread Spectrum Technology
FHSS (Frequency Hopping Spread Spectrum)

900 MHz Compliance (1 Watt)
FCC ID UE3RM1809: FCC Part 15, Subpart C, 15.247
IC: 7044A-RM1809
IFT: RCPBARM13-2283

Antenna Connection
Ext. Reverse Polarity SMA, 50 Ohms
Max Tightening Torque: 0.45 N·m (4 lbf·in)

Link Timeout (Performance)
Gateway: Configurable via User Configuration Software
Node: Defined by Gateway

Accessories

For a complete list of all the accessories for the Sure Cross wireless product line, please download the Accessories List (p/n b_3147091)

Cordsets
MQDC1-506—5-pin M12/Euro-style, straight, single ended, 6 ft
MQDC1-530—5-pin M12/Euro-style, straight, single ended, 30 ft

Misc Accessories
BWA-CG.5-3X5.6-10—Cable Gland Pack: 1/2-inch NPT, Cordgrip for 3 holes of 2.8 to 5.6 mm diam, 10 pack
BWA-HW-052— Cable Gland and Vent Plug Pack: includes 1/2-inch NPT gland, 1/2-inch NPT multi-cable gland, and 1/2-inch NPT vent plug, one each

Power Supplies
PSDINP-24-13 —DC power supply, 1.3 Amps, 24 V DC, with DIN Rail Mount, Class I Division 2 (Groups A, B, C, D) Rated
PSDINP-24-25 — DC power supply, 2.5 Amps, 24 V DC, with DIN Rail Mount, Class I Division 2 (Groups A, B, C, D) Rated
BWA-SOLAR PANEL 5W —Solar Panel, 12 V, 5 W, Multicrystalline, 270 × 222 × 17, Wall/Pole clamp style mounting bracket included (does not include controller)
BWA-SOLAR PANEL 20W—Solar Panel, 12 V, 20 W, Multicrystalline, 573 × 357 × 30, "L" style mounting bracket included (does not include controller)

Warnings

Install and properly ground a qualified surge suppressor when installing a remote antenna system. Remote antenna configurations installed without surge suppressors invalidate the manufacturer's warranty. Keep the ground wire as short as possible and make all ground connections to a single-point ground system to ensure no ground loops are created. No surge suppressor can absorb all lightning strikes; do not touch the Sure Cross® device or any equipment connected to the Sure Cross device during a thunderstorm.

Exporting Sure Cross® Radios. It is our intent to fully comply with all national and regional regulations regarding radio frequency emissions. **Customers who want to re-export this product to a country other than that to which it was sold must ensure the device is approved in the destination country.** The Sure Cross wireless products were certified for use in these countries using the antenna that ships with the product. When using other antennas, verify you are not exceeding the transmit power levels allowed by local governing agencies. This device has been designed to operate with the antennas listed on Banner Engineering's website and having a maximum gain of 9 dBm. Antennas not included in this list or having a gain greater that 9 dBm are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen such that the equivalent isotropically radiated power (EIRP) is not more than that permitted for successful communication. Consult with Banner Engineering Corp. if the destination country is not on this list.

⭐ **Important:** Please download the complete DXM100-A1 or A2 Wireless Controller technical documentation, available in multiple languages, from www.bannerengineering.com for details on the proper use, applications, Warnings, and installation instructions of this device.

⭐ **Important:** Por favor descargue desde www.bannerengineering.com toda la documentación técnica de los DXM100-A1 or A2 Wireless Controller, disponibles en múltiples idiomas, para detalles del uso adecuado, aplicaciones, advertencias, y las instrucciones de instalación de estos dispositivos.

⭐ **Important:** Veuillez télécharger la documentation technique complète des DXM100-A1 or A2 Wireless Controller sur notre site www.bannerengineering.com pour les détails sur leur utilisation correcte, les applications, les notes de sécurité et les instructions de montage.

⚠️ **WARNING:**
- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

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[2]   Radio range is with the 2 dB antenna that ships with the product. High-gain antennas are available, but the range depends on the environment and line of sight. Always verify your wireless network's range by performing a Site Survey.

Important:
- **Never operate a 1 Watt radio without connecting an antenna**
- Operating 1 Watt radios without an antenna connected will damage the radio circuitry.
- To avoid damaging the radio circuitry, never apply power to a Sure Cross® Performance or Sure Cross MultiHop (1 Watt) radio without an antenna connected.

Important:
- **Electrostatic discharge (ESD) sensitive device**
- ESD can damage the device. Damage from inappropriate handling is not covered by warranty.
- Use proper handling procedures to prevent ESD damage. Proper handling procedures include leaving devices in their anti-static packaging until ready for use; wearing anti-static wrist straps; and assembling units on a grounded, static-dissipative surface.

Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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