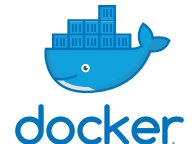# BB-400 NeuronEdge
Smart Controller for Industry 4

- Multiple connections within compact DIN mount design
- Comes with easy to use web interface
- Edge Processing with innovative industrialised Raspberry Pi
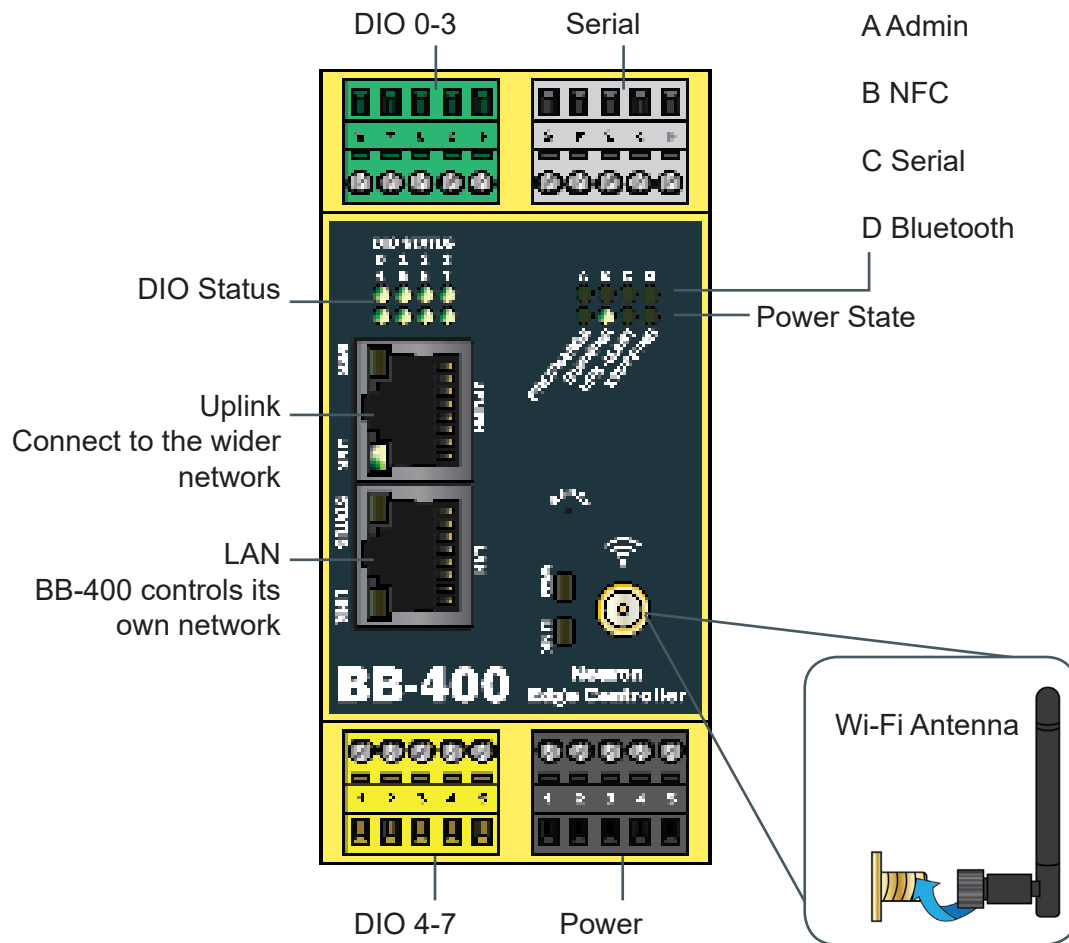- Develop on Pi and deploy seamlessly to Industry

Sense, sort and send your machine data

Minimize downtime, speed up response times and maximise profits.

IP20 | +80°C -25°C | 5-30VDC | DIN | 8 Line | RS232 & RS422/485 | Wi-Fi | Bluetooth | 2

- 8 Digital IO lines
- Works with common 0-30V sensors
- 1 Ethernet port for wider network
- 1 Ethernet port for LAN network
- Extendable Wi-Fi antenna
- Bluetooth - for wireless sensors
- UPS power management - prevents corruption
- Dual redundant 5-30 VDC power supply

- Raspberry Pi Compute 3+ module and Arduino processing power
- Edge processing sends relevant data to your application or the cloud
- Highly compatible open source software
- Customise with APIs and Docker containers, REST, Websockets, or .NET APIs
- Program in your favourite language or use out-of-the-box applications

POWERED BY Raspberry Pi | ARDUINO AT HEART | { REST } | docker

DIO 0-3   Serial

A Admin

B NFC

C Serial

D Bluetooth

DIO Status

Power State

Uplink
Connect to the wider
network

LAN
BB-400 controls its
own network

BB-400   Neuron
Edge Controller

Wi-Fi Antenna

DIO 4-7   Power

LED States	Solid Green	Flashing
Uplink Web	Has internet connection	Checking for internet connection
Uplink Link	Connected	Data
LAN Status	100 Mbps link	
LAN Link	Connected	Data
Wi-Fi Web	Has internet connection	Checking for internet connection
Wi-Fi Link	Connected	Scanning for Wi-Fi
DIO 0-8	User configurable on/off/flashing - default on when line high, off when line low	
A - Admin	Active session	
B - NFC	Available	Data
C - Serial Port	Open	
D - Bluetooth	Available	
Pre-charge	Charging Backup supply	
Running	Device is ready	
UPS Alert	External power loss detected - device using Backup power	
Stopping	Power loss unresolved - clean shutdown initiated	
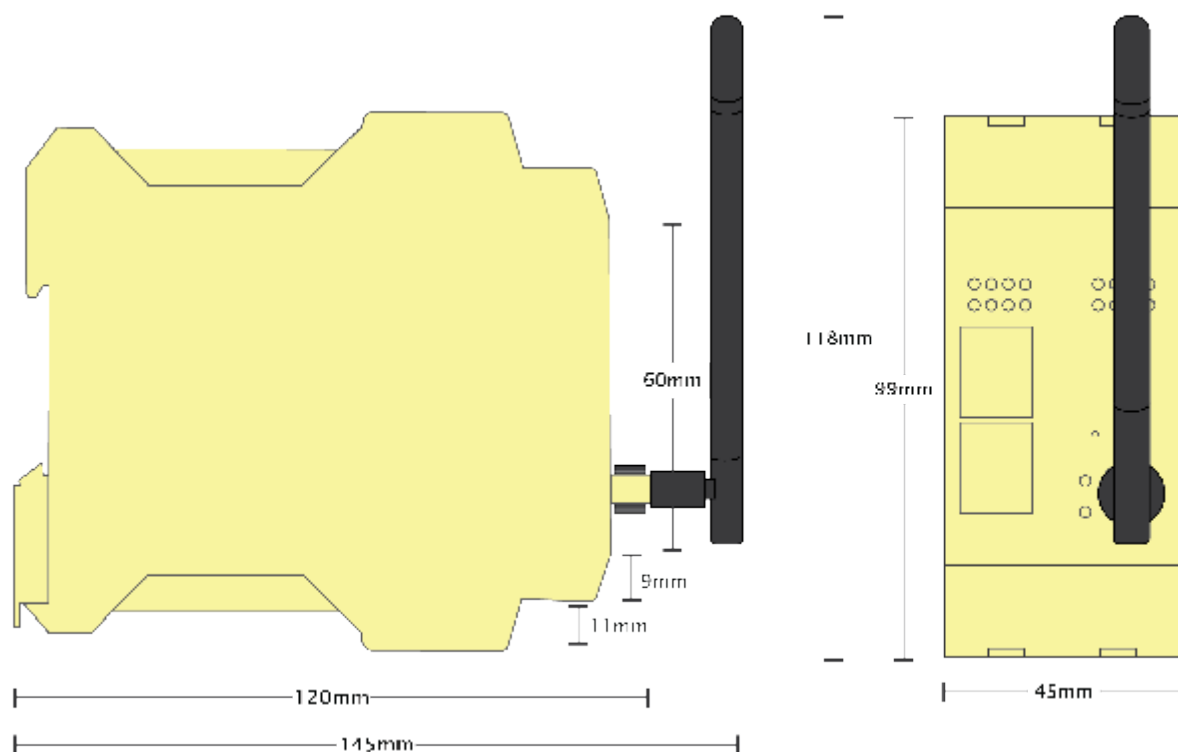
Terminal Block Pin Outs

Ethernet Port Pin Outs

Terminal Block	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
Green	-V	DIO 0	DIO 1	DIO 2	DIO 3
Yellow	-V	DIO 4	DIO 5	DIO 6	DIO 7
Grey - RS232	Sig GND	CTS	RxD	RTS	TxD
Grey - RS422/485 FD	Sig GND	RxD-	RxD+	TxD+	TxD-
Grey - RS485 HD	Sig GND			Data+	Data-
Black	-V	+V A	+V B	-V	Func GND
Power Input	+5V to +30V DC 15W Max				

PIN	FUNCTION
1	RD+ / TD+
2	RD- / TD-
3	TD+ / RD+
4	NC
5	NC
6	TD- / RD-
7	NC
8	NC

Housing	IP-20 rated non-conducting polyamide casing UL94 v-0 certified
Connectors	Removable, colour-coded and numbered 5 pin terminal blocks
Screw Terminals	3.5mm pitch
Wire Thickness Power Terminal	0.5 - 2.5 mm^2, #22 - #14 AWG
Wire Thickness	0.14 - 1.3 mm^2, #26 - #16 AWG
Environmental	
Operating Temperature	-25°C to +80°C/-13°F to +176°F
Storage Temperature	-40°C to +80°C/-40°F to +176°F
Ambient Relative Humidity	5 to 95% (non-condensing)
Heat Sink	Increases the achievable processing performance. Draws heat away from the Pi allowing high processor operating loads for longer www.brainboxes.com/bb-400/heatsink

Power Supply

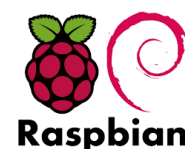|	
Power Consumption	4 Watts typical, 15W Max dependent on application
Power Supply input	+5V to +30V DC, Dual Power Inputs, reverse polarity protected
Max Input	35V
Isolation	1500VRMS Magnetic isolation from Ethernet
UPS	When power is interrupted the system switches to an internal backup supply for a limited time before activating a controlled shutdown (time is application dependent).

Connectivity

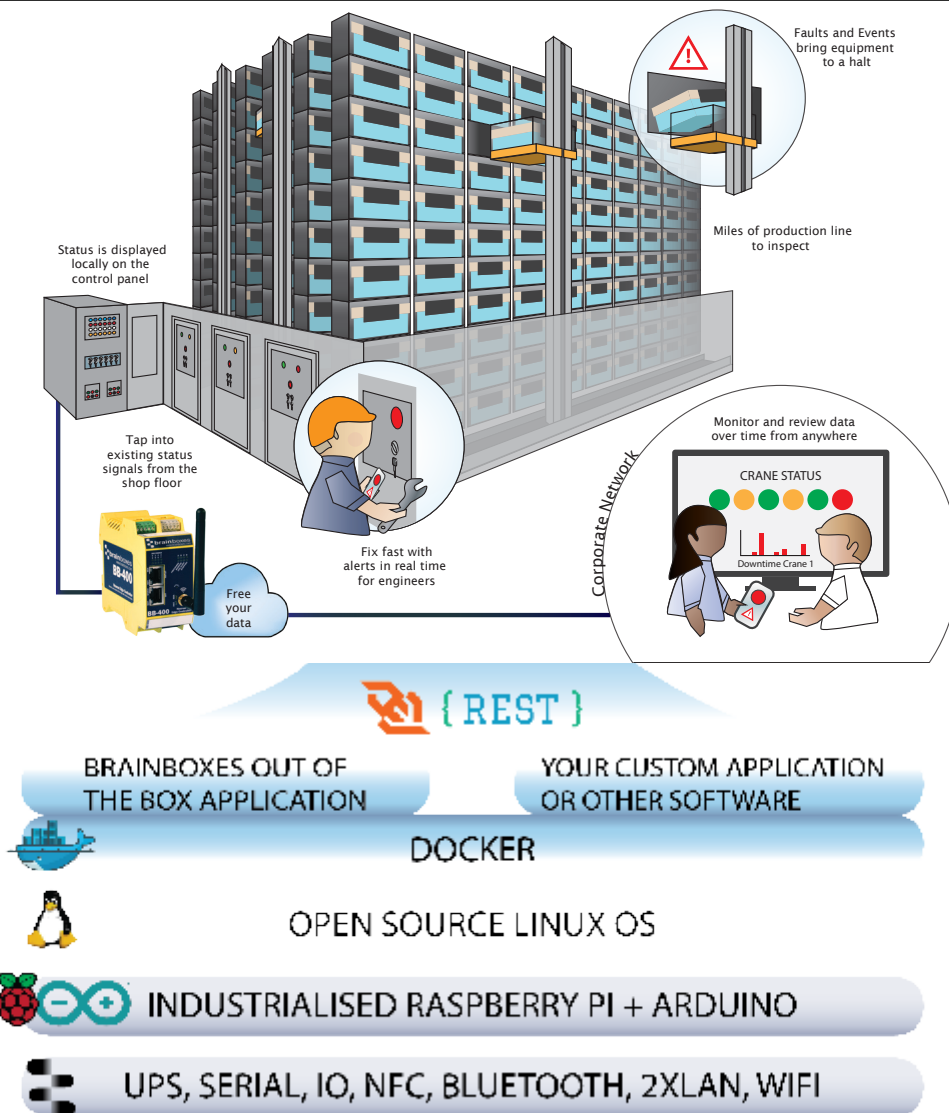|	
Ethernet Uplink Port	1x RJ45 jack, 10/100Mbps autosensing, crossover autosensing (Auto MDIX)
Ethernet LAN Port	1x RJ45 jack, 10/100Mbps autosensing, crossover autosensing (Auto MDIX)
Protection	1500V Magnetic Isolation between ports and network
Wi-Fi	802.11 b/g/n
	Detachable Antenna; can be used with extender cable (not included)
Bluetooth	4.0 (2.1+EDR, LE)
Bluetooth Class	Class 1
Operating Frequency	2402MHz – 2480MHz
NFC	Coming soon via software update
Real Time Clock	Yes, with battery backup; takes CR1220 3v lithium battery (not included)

Edge Processing

Processor	Raspberry Pi Compute Module 3+, 1.2GHz quad-core Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit
RAM	1 Gbyte LPDDR2 RAM
Storage	32GB eMMC Flash memory
Operating System	Raspbian Lite - based on Debian Linux - latest kernel and OS version
Security	Latest SSH and TLS security protocols
Administration	Secure Web administration with user definable roles
Docker Support	Pre-installed with web admin interface, Customised Containers available for Node-RED
Configurability	Full access to secure linux command line, open system, fully configurable, custom OS can be flashed into memory if required
OS Compatibility	Discoverable in Windows using network tab
	Communicate with Device over TCP from any OS
	Suitable for any device with a Web Browser
	Raspberry Pi
	Android
	Linux

{ REST }

BRAINBOXES OUT OF THE BOX APPLICATION

YOUR CUSTOM APPLICATION OR OTHER SOFTWARE

DOCKER

OPEN SOURCE LINUX OS

INDUSTRIALISED RASPBERRY PI + ARDUINO

UPS, SERIAL, IO, NFC, BLUETOOTH, 2XLAN, WIFI

Device administration	
Administration interface	1. Secure web administration over port 9090 2. SSH using user name and passwords or SSH keys 3. USB mount the memory of the device over USB to a PC
Custom code	Multiple FAQs about writing and deploying code to the BB-400 are available on our website. Sample code is available in the following languages; .NET C#, Python, Node.js, Node-RED (visual coding interface). Code can be deployed either by locally using secure copy (SCP) or globally by creating a Docker container.
CLI	A simple uniform interface to configure Linux system properties. Settings are stored into a yaml file which allows 1 configuration to be deployed across a fleet of devices. Brainboxes can manufacture and pre-configure BB-400 using your BB CLI yaml configuration file settings.
Docker	Is a global repository for Linux applications. Docker provides these applications in "containers" that can be downloaded through the web interface on the BB-400. Brainboxes provide a number of pre-built containers and Docker's open source community allows you to use and contribute to even more. Each container runs like a mini virtual machine holding an application in isolation from its environment. Docker provides a good method for automatically updating containers on multiple devices in the field. www.brainboxes.com/bb-400/docker

Digital Channels - 8 Ports individually selectable as Inputs or Outputs

Inputs	User programmable counts positive or negative transitions up to 200Hz
NPN/PNP	Jumper selectable pull up for NPN, active low, type sensors and pull down for PNP, active high, type sensors
Logic Level 0:	0V to +1V
Logic Level 1:	+2V to +30V
Latched Inputs:	Triggered by user programmable positive or negative edges, stays true until acknowledged
Outputs	Default is low = off
Max output current	1 channel driven: Sinks up to 0.85 Amp max Max combined load 4 Amps per BB device
Characteristic:	Open drain output, protected MosFET intelligent short circuit protection up to 36V
Max output load Voltage	30V
ESD Production	16kV
IO processing	Arduino processing real time signals
IO Protocols	DCON ASCII (over TCP or Virtual COM port), REST, WebSocket

The digital I/O lines run on an Arduino compatible microcontroller, giving you access to the vast library of Arduino I/O functionality. Our Arduino code is open and editable.

IO protocols

WebSocket, ASCII TCP, REST, ASCII over Serial	Allow communication with the BB-400 to get and set values of IO lines over the local network or from the device itself. This is different to protocols that send data up to the cloud.		
	ASCII	REST	WebSocket
Max number of commands/sec	400	150	350
Average response time (for 1 user)	2.7 ms	11 ms	2.5 ms
Max Number of simultaneous connections	200	n/a	10
Cloud Connectivity	Brainboxes are developing support for the following cloud platforms…. Amazon Web Services, Azure, Google cloud platform, IBM Watson Soon you will able to stream data to these services simply by entering your credentials. You have the option to write and deploy your own connection to the cloud platform of your choice.		

Serial Port	
Ports	1x RS232, RS422/485 Full Duplex, or RS485 Half Duplex Software Selectable
Baud Rate	Any custom Baud rate between 300 - 921,600 Baud can be selected
Tx FIFO Size	64
Rx FIFO Size	64
Data Bits	5,6,7 or 8 (1 stop bit)
Parity	Odd, Even, None
Stop Bits	1, 1.5 or 2
Flow Control	RTS/CTS, XON/XOFF
Operating Distance	RS422/485 Standard (4000 ft : 1200 metres) / EIA - RS232 Standard
Software	Manage Serial connections through the web admin interface. Alternatively use a program like Node-RED, or any programming language like python, C#, and bash. Code examples are available on our website.
Connect	Connect to weigh scales, PLCs, CNC machines, vibration sensors, barcode scanners, printers, scientific and medical equipment using the ubiquitous Serial port. Integrate a host of traditionally stand alone or legacy equipment into your networked smart factory.

USB Port	
Ports	1x USB 2.0 Micro AB
	Enclosed USB port for developer use. The BB-400 is a USB host, much like a regular computer. For example, files can be copied to and from a memory stick by logging in and using Linux commands to mount the memory stick as a drive inside the Pi. It is also possible to set the BB-400 to 'Flash' mode, by changing the jumper. Note this is only recommended in specific applications as doing so will reformat the device and wipe the Pi's image.

sales@brainboxes.com

Packaging Information

Packaging	Quick Start Guide
Device	BB-400 + Antenna
Packaged Weight	0.334 kg, 11.78 ounces
Packaged Dims	160x135x49 mm, 6.3x5.3x1.9 inches
GTIN Universal Code	837324004441

Approvals

Industry Approvals	Microsoft Certified Gold Partner, WEEE, RoHS, AEO (C-TPAT), CE

Product Support

Warranty	Lifetime - online registration required
Support	Lifetime Web, Email and Phone Support from fully qualified, friendly staff who work in and alongside the Product Development Team

Additional Information

Made In	Manufactured in the UK by Brainboxes
Customisable	Brainboxes operate a 'Perfect Fit Custom Design' policy for volume users. More info:sales@brainboxes.com

Raspberry Pi is a trademark of the Raspberry Pi Foundation.

Optional Accessory

PW-400
12VDC power supply with connectors for UK, USA, EU and AUS mains socket. 'Tails' are suitable for connecting to screw terminal blocks.

RoHS | CE | AEO GB AEOF 00031/11 | MADE IN BRITAIN | GLOBAL ACCREDITATIONS | LIFETIME SUPPORT | LIFETIME WARRANTY | nqa ISO 9001 ISO 14001 INTEGRATED MANAGEMENT | UKAS MANAGEMENT SYSTEMS 015

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USA Toll free: +1 855 958 2502

LIFETIME WARRANTY LIFETIME SUPPORT

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www.brainboxes.com

Quick Start Guide
for Brainboxes NeuronEdge Controller

This guide will help you set up your BB-400. Out of the box your BB-400 comes with sensible defaults to help you get started fast.

For more detailed information, the product manual, and a host of resources for programming and software integration visit our website:

www.brainboxes.com

⚠ WARNING   Risk of injury from energy stored in capacitors.

Wait at least 5 minutes after shutdown of device before opening case.

? Help   This product comes with Brainboxes' Lifetime Warranty and Support

For full terms and conditions, as well as information on accreditations, and correct disposal of this product can be found on our website:
www.brainboxes.com

Status

DIO 0-3

Serial

A Admin
B NFC*
C Serial
D Bluetooth

DIO STATUS
0 1 2 3
4 5 6 7

A B C D

DIO Status

Power State

PRECHARGE
RUNNING
UPS ALERT
STOPPING

WEB

UPLINK

Uplink

Reset

STATUS

LAN

LAN

LINK

WEB

LINK

BB-400

Neuron
Edge Controller

Wi-Fi
Antenna

DIO 4-7
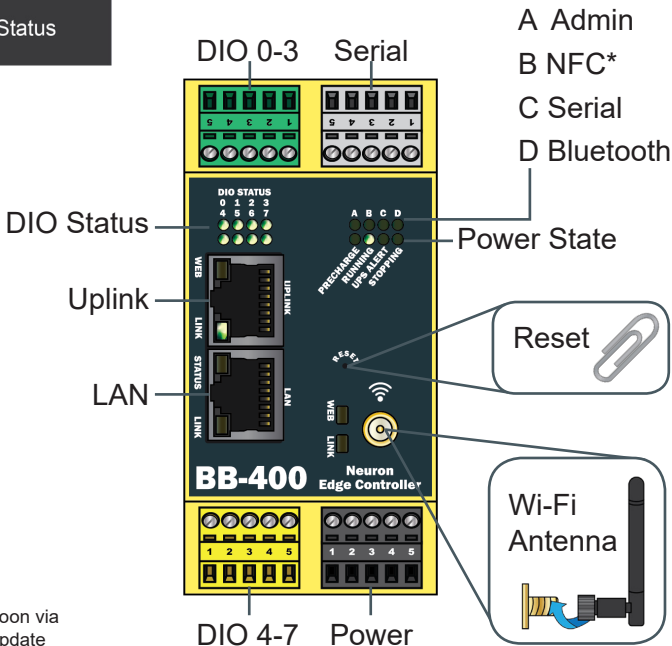
Power

*Coming soon via
software update
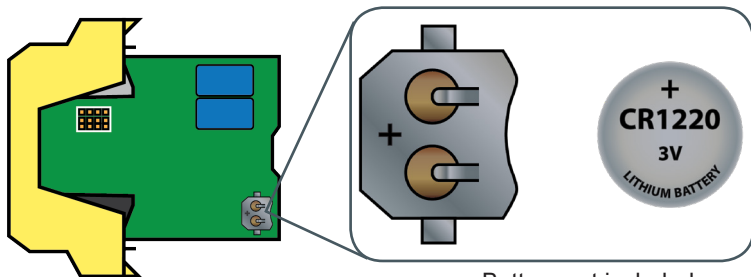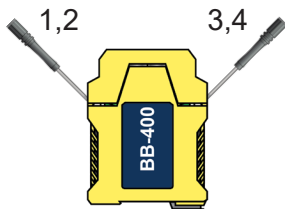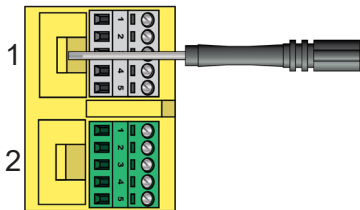
Battery not included

To set the clock:

Terminal

```
bb@bb400-XXXX:~ $ sudo bb config.system.rtc true
```

Optional Accessory Item
Power Supply

PW-400 (UK/EU/US/AUS)
- Suitable for use with BB-400

1	2	3	4	5
-V	+VA	+VB	-V	⏚
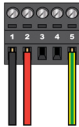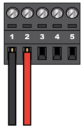
+5VDC to +30VDC
15W Max Typical

PRECHARGE RUNNING UPS ALERT STOPPING 🕐

PRECHARGE RUNNING UPS ALERT STOPPING ✔

Network Discovery

UPLINK

LAN

192.168.127.2/24

Wi-Fi Hot Spot

SSID: BB-400-XXXX

MAC ADDRESS

Login

MAC: 00:0A:4F:40:XX:XX

https://bb400-xxxx:9090

https://bb400-xxxx.local:9090

https://bb400-xxxx:9090

Secure webpages require an SSL certificate.

This can only be applied for once an IP address or name has been assigned. This is the case for all IoT devices.

The connection however is encrypted and secure

ADVANCED

User name	bb
Password	XXXX

Log in

DIO 0-3

5	DIO 3
4	DIO 2
3	DIO 1
2	DIO 0
1	-V

DIO 4-7

5	DIO 7
4	DIO 6
3	DIO 5
2	DIO 4
1	-V
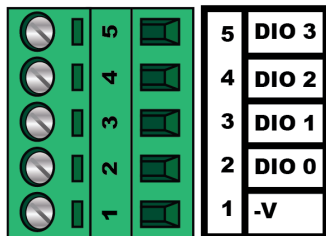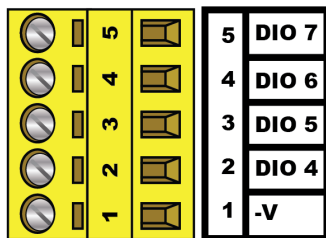
Jumpers for NPN/PNP
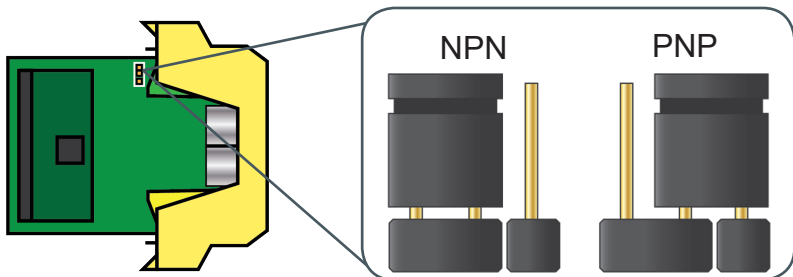
NPN   PNP

DIO Values

Digital Inputs	NPN/PNP	Jumper selectable pull up for NPN, active low, type sensors and pull down for PNP, active high, type sensors
	Logic Level 0:	0V to +1V maximum
	Logic Level 1:	+2.0V to +30V maximum
	Latched Inputs:	Triggered by user programmable positive or negative edges, stays true until acknowledged
	Counter Inputs:	User programmable – counts positive or negative transitions, up to 250Hz count rate. 16-bit (65335 count) or 32-bit (4.2 billion count) counters. Counter values persist over power-off periods
Digital Outputs	Max output current	Sinks up to 0.85 Amp per pin, 30V max load Max combined load 4 Amps per BB device
	Max output load Voltage	30V
	ESD Protection	Protection to 16kV

Terminal

ASCII		
Command	Response	Description
@01	>(Data)	Reads the Digital I/O Status
@01(Data)	>	Sets the state of all the digital outputs
#01N	!01(Data)	Reads the Digital Input Counter of channel N (0-7)

```
@01
>00FF
```

REST		
Request	REST Verb	Response

http://bb400-xxxx:9000/io	GET	{
		"inputs": [1, 1, 1, 1, 1, 1, 1, 1],
		"outputs": [0, 0, 0, 0, 0, 0, 0, 0]
		}

http://bb400-xxxx:9000/io/inputs	GET	[1, 1, 1, 1, 1, 1, 1, 1]
http://bb400-xxxx:9000/io/inputs/0	GET	1
http://bb400-xxxx:9000/io/outputs	GET	[0, 0, 0, 0, 0, 0, 0, 0]
http://bb400-xxxx:9000/io/outputs body: [1, 1, 1, 1, 0, 0, 0, 0]	POST	header: 200 OK
http://bb400-xxxx:9000/io/outputs	GET	[1, 1, 1, 1, 0, 0, 0, 0]

Bluetooth | **Make Discoverable** | **Refresh**

Software Updates | **Install All Updates**

It is recommended to install all updates when you first use the device. This will ensure you are running the latest version of the operating system and software.
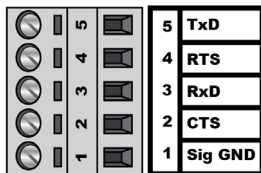
Coming soon via software update:

NFC - Tap your smartphone or NFC enabled device to get device status information and IP address.
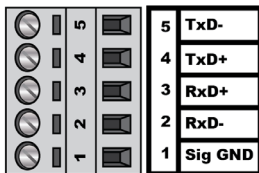
Modbus - Coming soon support for Modbus TCP

RS232

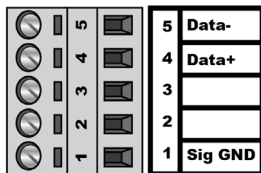|		
5	TxD	
4	RTS	
3	RxD	
2	CTS	
1	Sig GND	

RS422-485 FD

5	TxD-	
4	TxD+	
3	RxD+	
2	RxD-	
1	Sig GND	

RS485 HD

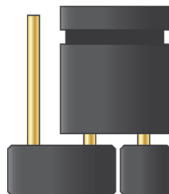|		
5	Data-	
4	Data+	
3		
2		
1	Sig GND	

A B C D

C Open

C Closed

Jumpers for RS422/485

Default

FT
HT
B-
B+
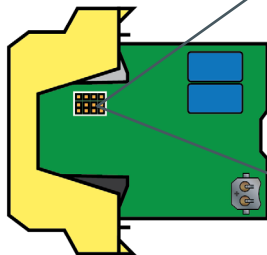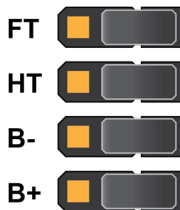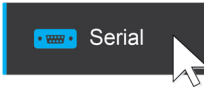
PARK

Serial

Port Type:

✓ RS422/485
RS422 Full Duplex Mode
RS485 Half Duplex Mode

Baud Rate	Any custom Baud rate between 300 - 921,600Baud
Data Bits	5,6,7 or 8 (1 stop bit)
Parity	Odd, Even, None
Stop Bits	1, 1.5 or 2
Flow Control	RTS/CTS, XON/XOFF

POWERED BY Raspberry Pi

Raspbian Lite
- based on Debian Linux

www.brainboxes.com/bb-400 provides a range of resources and example code to get you started with some common machine monitoring scenarios.

Sample code is available in the following languages;
- .NET C# & VB
- Python
- Node.js
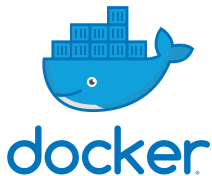- Node-RED (visual coding interface)

{ REST }

REST	http://bb400-xxxx:9000/io
WebSocket	ws://bb400-xxx:8989
ASCII TCP	bb400-xxxx:9500

Docker is an online repository for secure/isolated apps that can run on your BB-400.

To get started search for Brainboxes and find prebuilt containers.

⊕ Get new image

🔍 *brainboxes*|

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