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# OpenBlocks IoT Family
# Developer Guide


Version 3.3.0

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# Chapter 1 General

This manual is a developer guide for the OpenBlocks IoT Family.

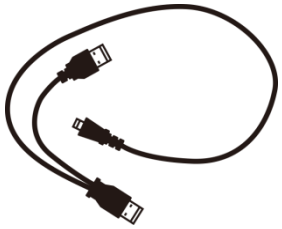
If a general user, please refer to the OpenBlocks IoT Family WEB UI Set-up Guide.

## 1-1. Items included in package for VX1

The standard configuration of OpenBlocks IoT VX1 is as follows:

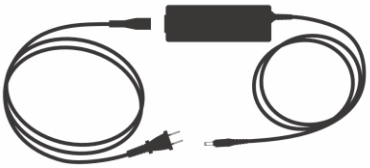
1 x VX1 main body

1 x USB Type-A Micro USB cable

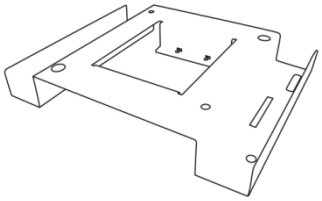


1 x Start-up Guide

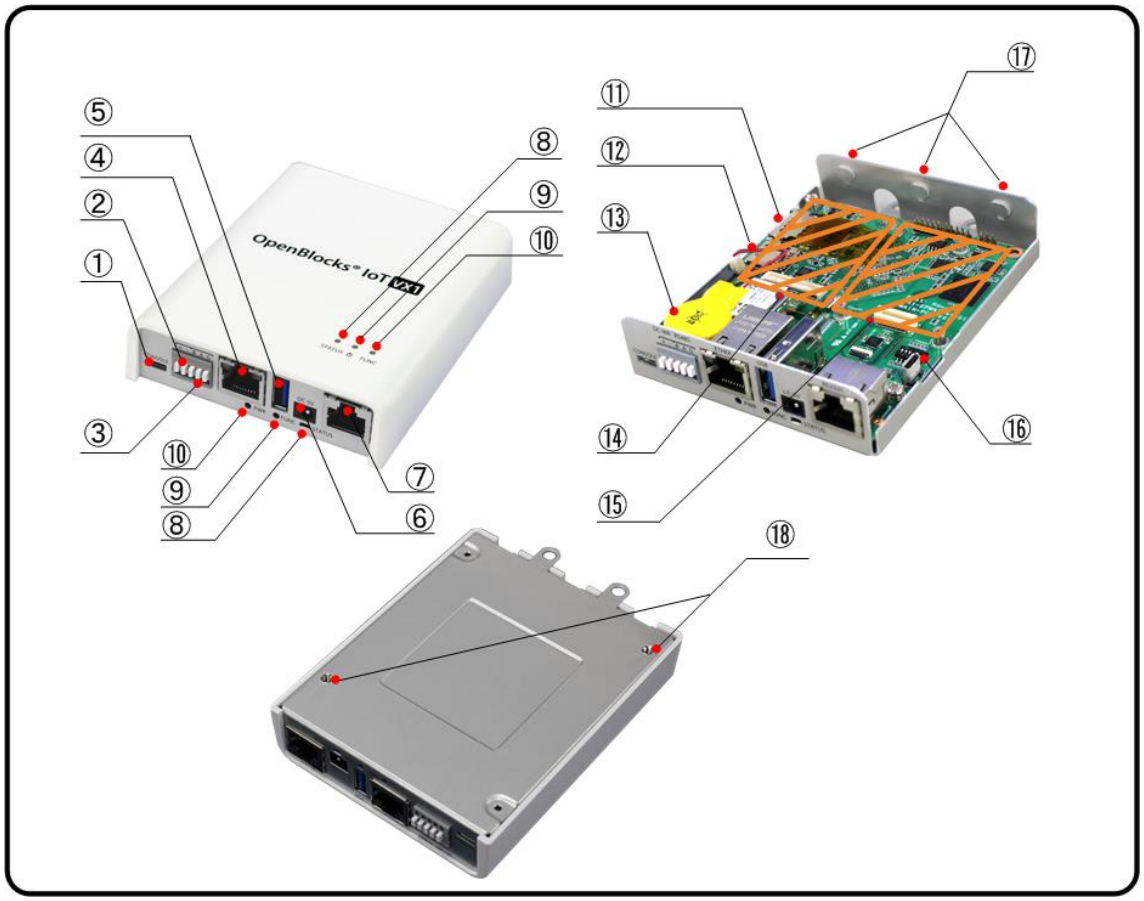

1 x AC adapter



1 x Heat radiation and installation bracket



## 1-2. Names of parts (VX1 main body)




| No. | Name | Remarks |
|---|---|---|
| ① | USB serial console port | Micro USB Micro-B |
| ② | Wide range power supply input | 6 to 48 VDC supported. (The Rev.1 board supports up to 12 V.) |
| ③ | RS-485 (half duplex) connector | |
| ④ | Ethernet port | 10BASE-T / 100BASE-TX / 1000BASE-T |
| ⑤ | USB host mode port | A-Type/USB3.0 |
| ⑥ | AC Adapter input | 5VDC |
| ⑦ | RS-232C port | RJ-45.<br>The connector to connect the D-Sub9 pin is optionally available.<br>A general straight network cable can be used for connection. |
| ⑧ | Status indicator | The LED lights up or flashes in seven colors. |

| No. | Name | Remarks |
|---|---|---|
| ⑨ | Power switch | Power on and boot the OS.<br>Shutdown the OS and power off, if during operation. |
| ⑩ | FUNC switch | OS specified function will work..<br>See also section 7-2. |
| ⑪ | SIM slot | Slot which you insert the SIM into.<br>* The shape of the supported SIM is mini-SIM (2FF) (standards generally called standard SIM). |
| ⑫ | MMC slot | Use the MMC for file exchange, log storage or other purpose because the MMC cannot ensure sufficient reliability for system operation. |
| ⑬ | RTC battery holder | Coin type lithium battery (CR2032) connected. |
| ⑭ | Expansion slot 1 | Expansion slot for mobile adaptor card for mobile line.<br>Attach the mobile adaptor card that supports your carrier.<br>In principle, this is a factory option. |
| ⑮ | Expansion slot 2 | Expansion slot for EnOcean, Wi-SUN module and so on. |
| ⑯ | DIP switch | Normally, do not change these settings. They are configured at the factory. |
| ⑰ | External antenna slot | Filled in the image. |
| ⑱ | Bracket mounting slot | |

* To insert the SIM, reverse the VX1 main unit and insert the SIM until the end of the SIM slot. Likewise, reverse the VX1 main unit when removing the SIM.

●Modem type identification

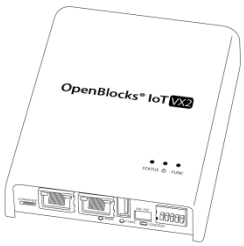
| Modem type | SW1 | SW2 | SW3 |
|---|---|---|---|
| 3G module | ON | OFF | OFF |
| LTE module　for SoftBank | ON | OFF | OFF |
| LTE module　for KDDI | ON | ON | OFF |
| LTE modul for NTT docomo | ON | OFF | ON |
| LTE module for KDDI and NTT docomo | OFF | ON | ON |
| BWA module | OFF | ON | ON |
| Modem uninstalled | ON | ON | ON |

*SoftBank and KDDI and NTT docomo are domestic carrier in Japan

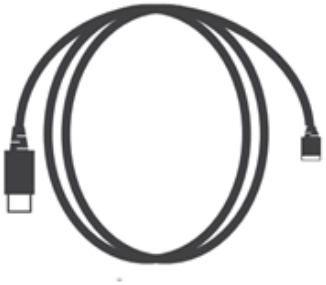
# 1-3. Items included in package for VX2

The standard configuration of OpenBlocks IoT VX2 is as follows:

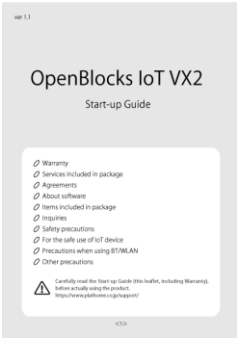
1 x VX2 main body



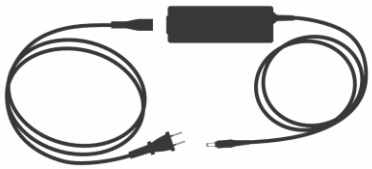

1 x USB Type-A Micro USB cable



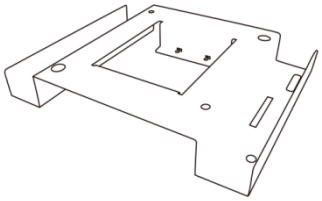
1 x Start-up Guide



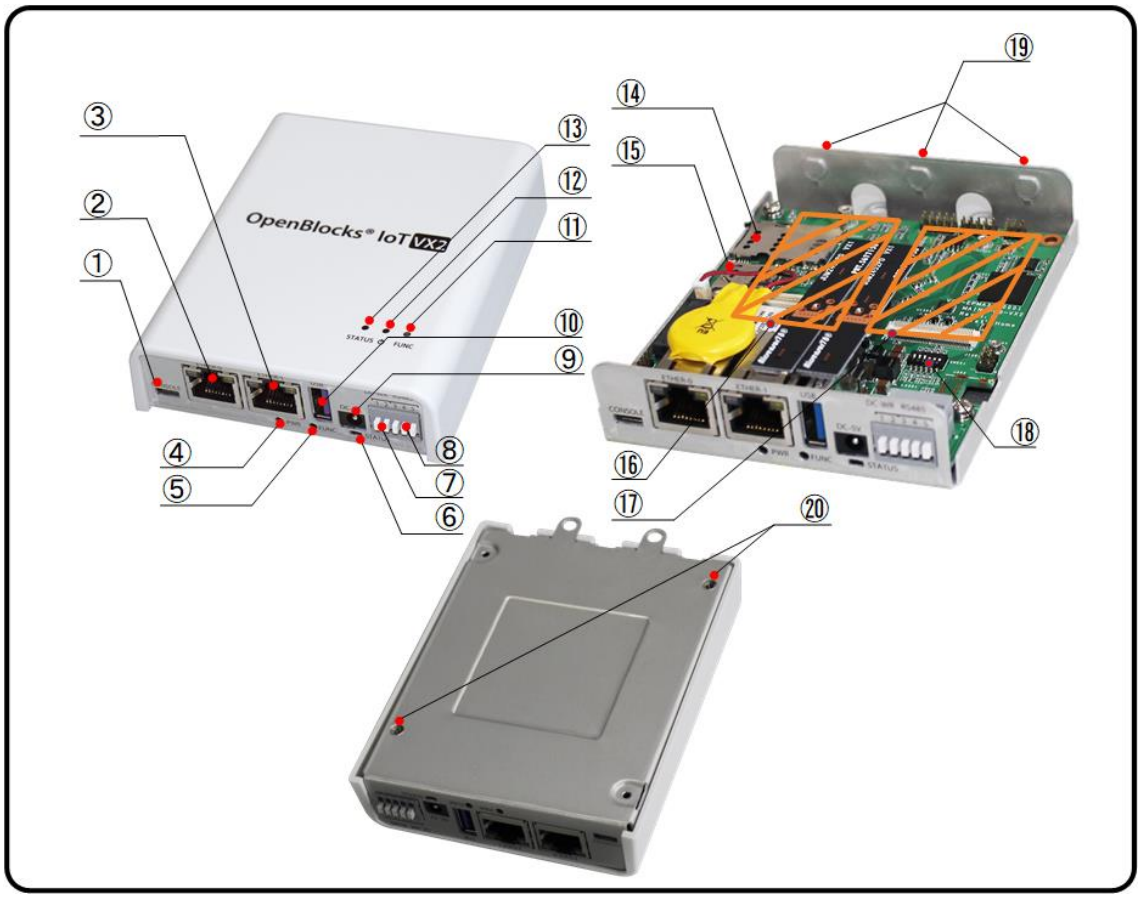

1 x AC adapter



1 x Heat radiation and installation bracket



## 1-4. Names of parts (VX2 main body)




| No. | Name | Remarks |
|---|---|---|
| ① | USB serial console port | Micro USB Micro-B |
| ② | Ethernet port 0 | 10BASE-T / 100BASE-TX / 1000BASE-T |
| ③ | Ethernet port 1 | 10BASE-T / 100BASE-TX / 1000BASE-T |
| ④ | Power switch | Shuts down OS if in operation.<br>Starts up OS if not in operation. |
| ⑤ | FUNC switch | Enables allocated function. |
| ⑥ | Status indicator | LEDs illuminate or flash in seven colors. |
| ⑦ | RS-485 (half duplex) connector | |
| ⑧ | Wide range power supply input | 6 to 48 VDC supported. (The Rev.1 board supports up to 12 V.) |
| ⑨ | AC Adapter input | 5VDC |
| ⑩ | USB host mode port | A-Type/USB3.0 |
| ⑪ | FUNC switch | Enables allocated function. |

| No. | Name | Remarks |
|---|---|---|
| ⑫ | Power switch | Shuts down OS if in operation.<br>Starts up OS if not in operation. |
| ⑬ | Status indicator | LEDs illuminate or flash in seven colors. |
| ⑭ | SIM slot | Slot to insert SIM card.<br>*Supports mini-SIM card format (2FF) (standard SIM) |
| ⑮ | MMC slot | As MMC cards cannot secure sufficient reliability for system operations, use them for file exchanges and log storage only. |
| ⑯ | Expansion slot 2 | Expansion slot for EnOcean, Wi-SUN and other modules. |
| ⑰ | Expansion slot 1 | Expansion slot of mobile adapter card for mobile networks.<br>A mobile adapter card supporting carrier To be use is mounted. Essentially, this is a factory option. |
| ⑱ | DIP switch | As this switch is set before factory shipment, do not alter the settings.<br>SW1-3: For modem identification<br>SW4-5: Not used<br>SW6: OFF=RS485 terminator ON (default) |
| ⑲ | External antenna slot | Holes are unopened in image. |
| ⑳ | Bracket mounting slot | |

*To insert a SIM card, turn the VX2 main body upside down and insert into the back of the slot. Similarly, to remove a SIM card, turn the VX2 main body upside down and extract the card.

●Modem type identification

| Modem type | SW1 | SW2 | SW3 |
|---|---|---|---|
| 3G module | ON | OFF | OFF |
| LTE module　for SoftBank | ON | OFF | OFF |
| LTE module　for KDDI | ON | ON | OFF |
| LTE modul for NTT docomo | ON | OFF | ON |
| LTE module for KDDI and NTT docomo | OFF | ON | ON |
| BWA module | OFF | ON | ON |
| Modem uninstalled | ON | ON | ON |

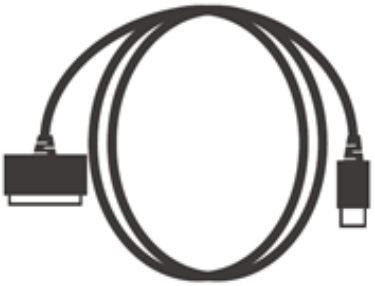
*SoftBank and KDDI and NTT docomo are domestic carrier in Japan

# 1-5. Items included in package for BX1

The standard configuration of OpenBlocks IoT BX1 is as follows:

BX1 main unit x 1


USB power console cable x 1



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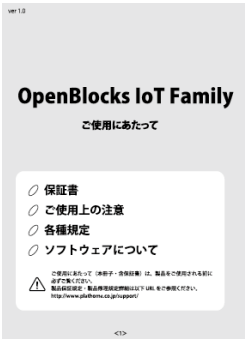
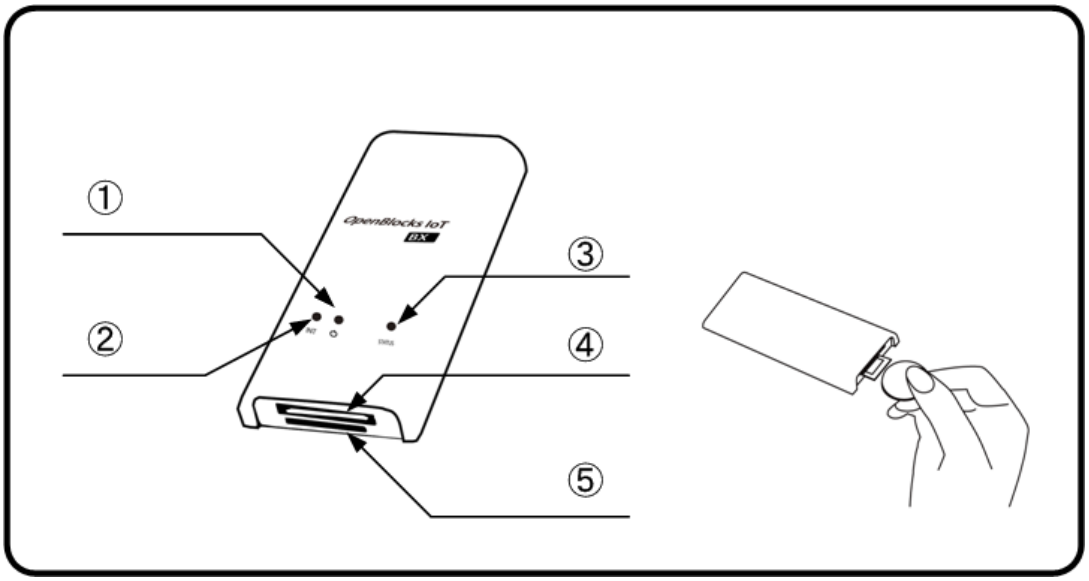


## 1-6. Names of parts (BX1 main body)




| No. | Name | Remarks |
|---|---|---|
| ① | Power switch | Press this switch to halt the OS.<br>(This is the same operation as when you hold down the FUNC switch for 4 or more seconds.)<br>Hold down this switch for 8 or more seconds to forcibly turn off the power. |
| ② | FUNC switch | Enables allocated function.<br>Some units are printed with INIT. |
| ③ | Status indicator | The LED lights up or flashes in seven colors. |
| ④ | BX1 connector | Connector that supports a variety of IOs.<br>The cable for each IO can be connected to this connector. |
| ⑤ | SIM slot | Slot which you insert the SIM with the 3G line for NTT docomo contract into.<br>*The shape of the supported SIM is mini-SIM (2FF) (standards generally called standard SIM). |

*Insert the SIM all the way using a coin or other tool with the connector side face upward. To remove the SIM, further push it to the end of the SIM slot using a coin. The SIM is unlocked and pops out.

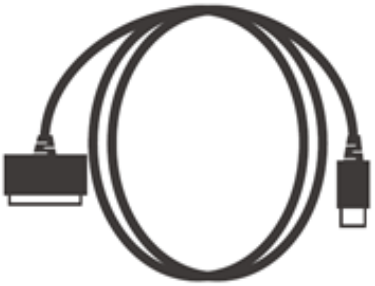
*NTT docomo is domestic carrier in Japan.

# 1-7. Items included in package for BX3

The standard configuration of OpenBlocks IoT BX3 is as follows:

BX3 main unit x 1


USB power console cable x 1



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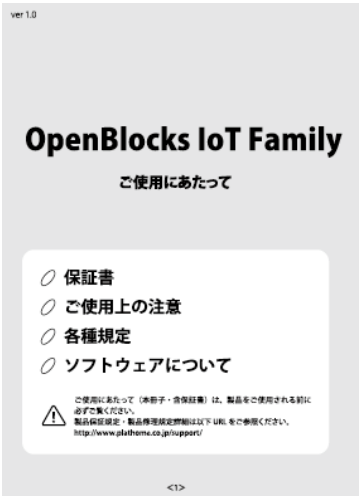
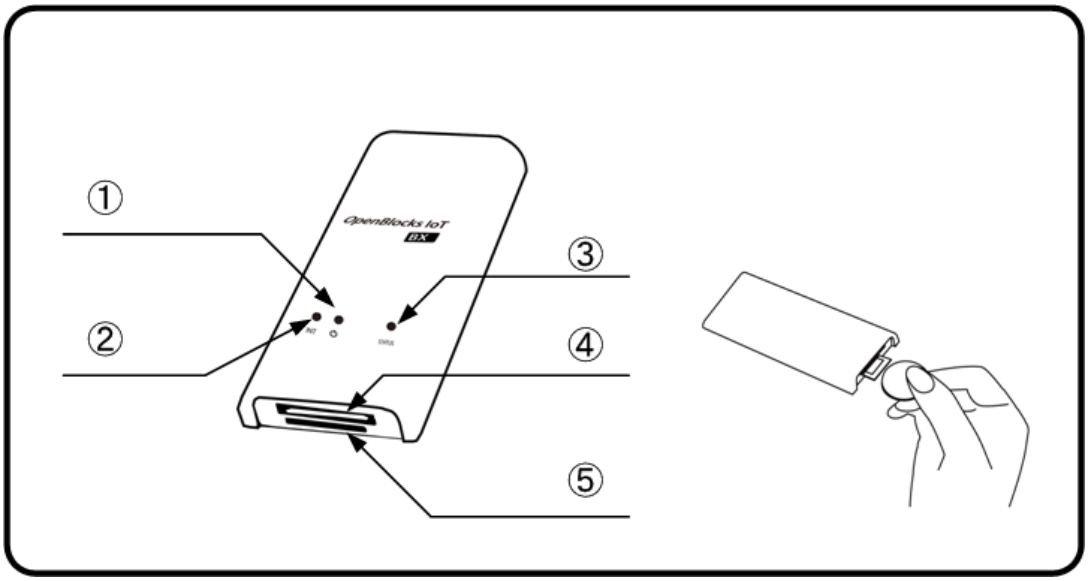


## 1-8. Names of parts (BX3 main body)




| No. | Name | Remarks |
|---|---|---|
| ① | Power switch | Press this switch to halt the OS.<br>(This is the same operation as when you hold down the FUNC switch for 4 or more seconds.)<br>Hold down this switch for 8 or more seconds to forcibly turn off the power. |
| ② | FUNC switch | Enables allocated function.<br>Some units are printed with INIT. |
| ③ | Status indicator | The LED lights up or flashes in seven colors. |
| ④ | BX1 connector | Connector that supports a variety of IOs.<br>The cable for each IO can be connected to this connector. |
| ⑤ | SIM slot | Slot which you insert the SIM with the 3G line for SoftBank contract into.<br>*The shape of the supported SIM is mini-SIM (2FF) (standards generally called standard SIM). |

*Insert the SIM all the way using a coin or other tool with the connector side face upward. To remove the SIM, further push it to the end of the SIM slot using a coin. The SIM is unlocked and pops out.

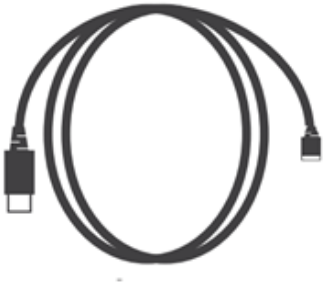
*SoftBank is domestic carrier in Japan.

# 1-9. Items included in package for EX1

The standard configuration of OpenBlocks IoT EX1 is as follows:

1 x EX1 main body


1 x USB Type-A Micro USB cable



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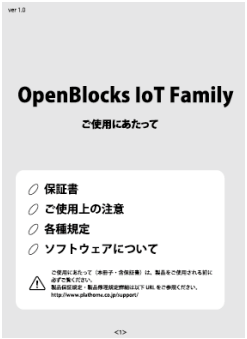
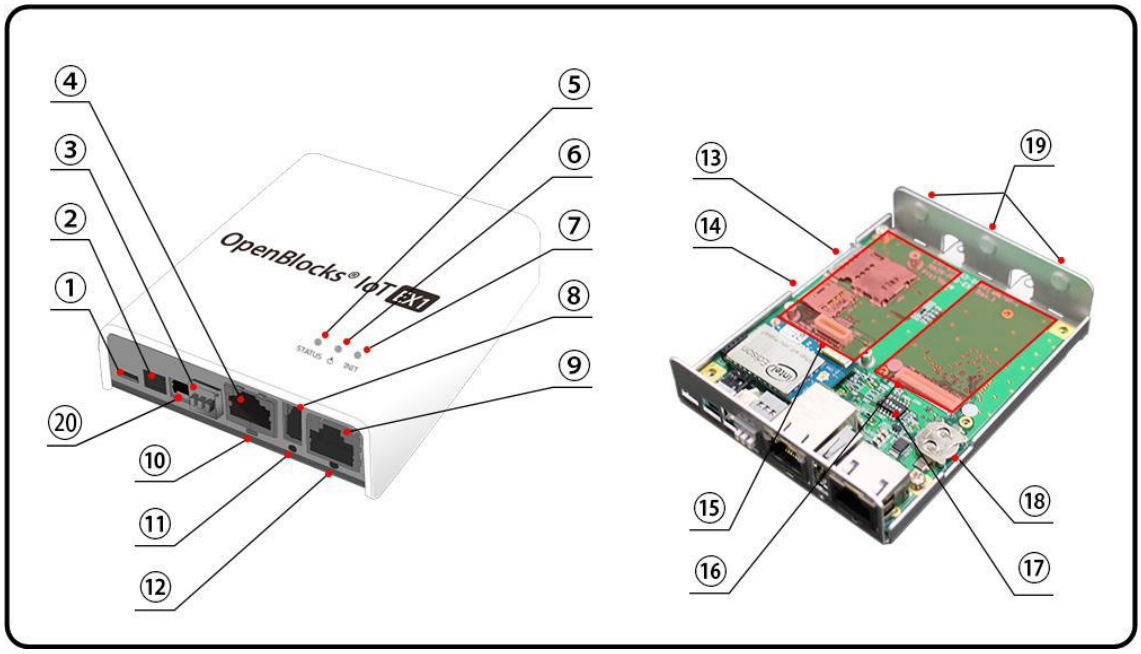


## 1-10. Names of parts (EX1 main body)




| No. | Name | Remarks |
|---|---|---|
| ① | USB serial console port | Micro USB Micro-B.<br>USB serial console port that supports bus power. |
| ② | AC adapter input | 5VDC |
| ③ | RS-485 (half duplex) connector | |
| ④ | Ethernet port | 10BASE-T / 100BASE-TX |
| ⑤ | Status indicator 1 | The LED lights up or flashes in seven colors. |
| ⑥ | Power switch 1 | Press this switch to halt the OS.<br>(This is the same operation as when you hold down the FUNC switch for 4 or more seconds.)<br>Hold down this switch for 8 or more seconds to forcibly turn off the power. |
| ⑦ | FUNC switch 1 | Enables allocated function.<br>Some units are printed with INIT. |
| ⑧ | USB host mode port | A-Type/USB2.0 |

| No. | Name | Remarks |
|---|---|---|
| ⑨ | RS-232C port | RJ-45.<br>The connector to connect the D-Sub9 pin is optionally available.<br>A general straight network cable can be used for connection. |
| ⑩ | Status indicator 2 | Same as Status indicator 1 |
| ⑪ | Power switch 2 | Same as Power switch 1 |
| ⑫ | FUNC switch 2 | Same as FUNC switch 1 |
| ⑬ | SIM slot | Slot which you insert the SIM into.<br>* The shape of the supported SIM is mini-SIM (2FF) (standards generally called standard SIM). |
| ⑭ | MMC slot | Use theMMC for file exchange, log storage or other purpose because the MMC cannot ensure sufficient reliability for system operation. |
| ⑮ | Expansion slot 1 | Expansion slot for EnOcean, Wi-SUN module and so on. |
| ⑯ | Expansion slot 1 | Expansion slot for mobile adaptor card for mobile line. Attach the mobile adaptor card that supports your carrier. In principle, this is a factory option. |
| ⑰ | DIP switch | Normally, do not change these settings. They are configured at the factory.<br>SW1: Always ON<br>SW4: -<br>SW6: OFF=RS485 terminator ON (default)<br>●Model number：OBSEX1<br>SW2/SW3 : For modem type identification<br>SW5: OFF=Use RS-232C (default),<br>ON=Use RS-485<br>●Model number：OBSEX1G<br>SW2/SW3/SW5 : For modem type identification |
| ⑱ | RTC battery holder | Coin type lithium battery (CR2032) connected. |
| ⑲ | External antenna slot | Filled in the image. |
| ⑳ | Wide range power supply input | 6 to 48 VDC supported. (The Rev.1 board supports up to 12 V.) |

* To insert the SIM, reverse the VX1 main unit and insert the SIM until the end of the SIM slot. Likewise, reverse the VX1 main unit when removing the SIM.

●Modem type identification

| Model number | Modem type | SW2 | SW3 | SW5 |
|---|---|---|---|---|
| OBSEX1 | 3G module | OFF | OFF | - |
| | LTE/3G module for SoftBank | OFF | OFF | - |
| | LTE module for KDDI | ON | OFF | - |
| | LTE module for NTT docomo | OFF | ON | - |
| | Modem uninstalled | ON | ON | - |
| OBSEX1G | 3G module | OFF | OFF | OFF |
| | LTE/3G module for SoftBank | OFF | OFF | OFF |
| | LTE module for KDDI | ON | OFF | OFF |
| | LTE module for NTT docomo | OFF | ON | OFF |
| | LTE module for KDDI and NTT docomo | ON | OFF | ON |
| | BWA module | ON | OFF | ON |
| | Modem uninstalled | ON | ON | OFF |

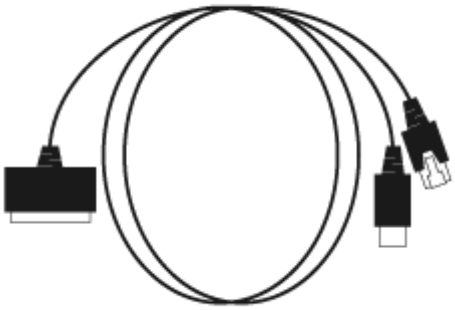
*SoftBank and KDDI and NTT docomo are domestic carrier in Japan

# 1-11. Items included in package for BX0

The standard configuration of OpenBlocks IoT BX0 is as follows:

BX0 main unit x 1

USB power console cable x 1



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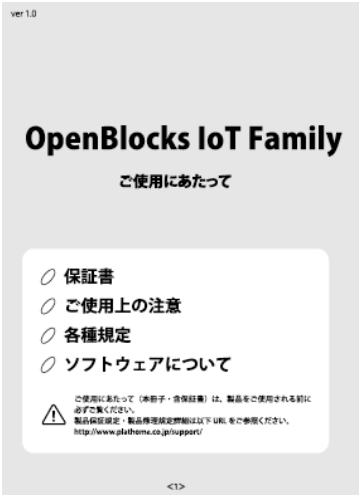
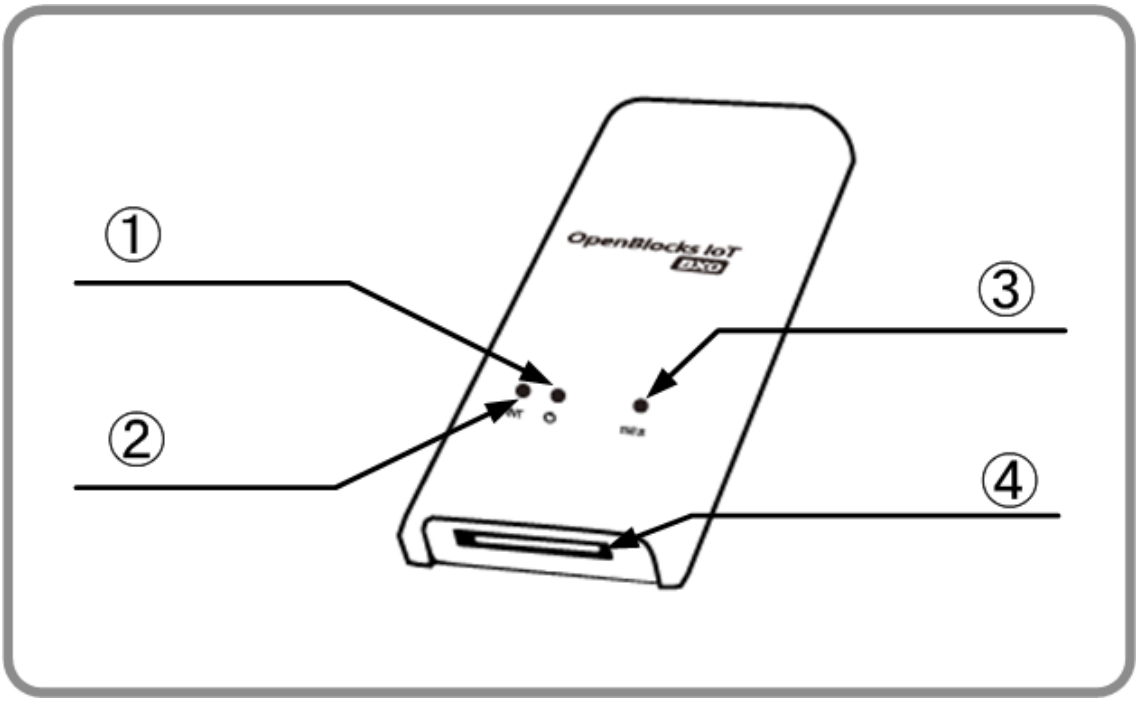


## 1-12. Names of parts (BX0 main body)



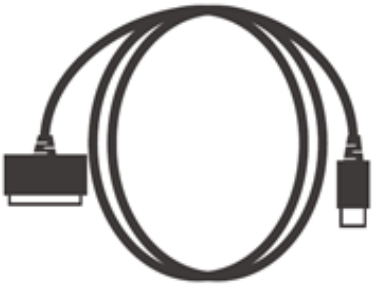

| No. | Name | Remarks |
|---|---|---|
| ① | Power switch | Press this switch to halt the OS.<br>(This is the same operation as when you hold down the FUNC switch for 4 or more seconds.)<br>Hold down this switch for 8 or more seconds to forcibly turn off the power. |
| ② | FUNC switch | Enables allocated function.<br>Some units are printed with INIT. |
| ③ | Status indicator | The LED lights up or flashes in seven colors. |
| ④ | BX1 connector | Connector that supports a variety of IOs.<br>The cable for each IO can be connected to this connector. |

# 1-13. Items included in package for BX5

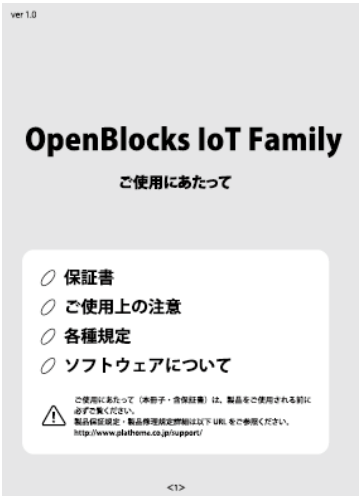
The standard configuration of OpenBlocks IoT BX5 is as follows:

BX5 main unit x 1

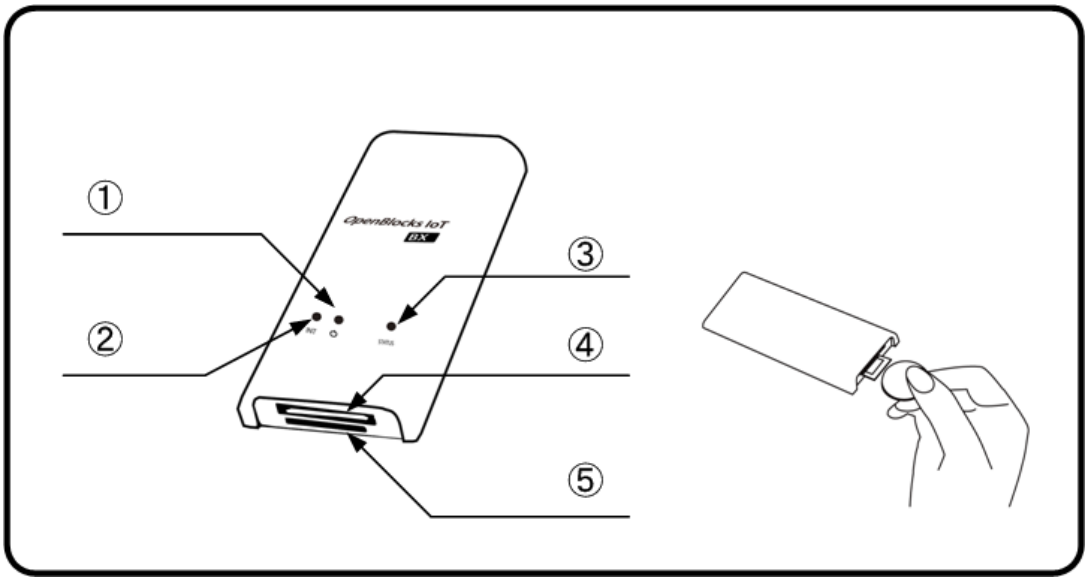

USB power console cable x 1



User's Guide x 1



## 1-14. Names of parts (BX5 main body)




| No. | Name | Remarks |
|---|---|---|
| ① | Power switch | Press this switch to halt the OS.<br>(This is the same operation as when you hold down the FUNC switch for 4 or more seconds.)<br>Hold down this switch for 8 or more seconds to forcibly turn off the power. |
| ② | FUNC switch | Enables allocated function.<br>Some units are printed with INIT. |
| ③ | Status indicator | The LED lights up or flashes in seven colors. |
| ④ | BX1 connector | Connector that supports a variety of IOs.<br>The cable for each IO can be connected to this connector. |
| ⑤ | SIM slot | Slot which you insert the SIM with the LTE line for KDDI or NTT docomo or BWA contract into.<br>*The shape of the supported SIM is mini-SIM (2FF) (standards generally called standard SIM). |

*Insert the SIM all the way using a coin or other tool with the connector side face upward. To remove the SIM, further push it to the end of the SIM slot using a coin. The SIM is unlocked and pops out.

*KDDI and NTT docomo are domestic carrier in Japan

# Chapter 2 Before starting to use the OpenBlocks IoT Family

## 2-1. Product overview

The OpenBlocks IoT Family is a general-purpose server product employing Debian GNU/Linux as an OS. Though customized to take advantage of hardware properties, it is possible to use the OpenBlocks IoT Family in a general operational method for Debian and other Linux products, apart from such customization.

## 2-2 Cautions about SSD-based system development

In recent times, cost reductions in flash memories have led to the employment of Solid State Drives ("SSD"), replacing conventional hard disk drives used in smartphones, laptop PCs and many other devices. This product uses embedded MMC (eMMC), which is a type of SSD.

With advantages such as high-speed random access performance and solid-state design, SSD has extremely high resistance against mechanical failures and environmental performance. However, compared to hard disk drives, the data writing limit is a lot less.

SSD can generally be divided into SLC and MLC. The SLC type with tens of thousands of counts of write performance was the mainstream in the capacity range of a few gigabytes, but the low-cost MLC with a write count of thousands has drastically increased capacity and is applied to smartphones and PCs. Currently, SLC SSDs are gradually being faded out.
In actual fact, SLC products as options for our micro-servers only remain in the range of small capacity products.

Thus, the number of operations with micro-servers using MLC SSD is enormous.

Generally, MLC has a write capability of 3,000 times. Just beyond 3,000 times, it starts to cause bit errors, which can be recovered with ECC.
As soon as MLC exceeds the limit for an ECC recovery, read errors will be caused.
Therefore, consider system design to avoid MLC being in this condition.

●Write count per cell and block size of flash memory

Despite a write capacity of 3,000 times per cell, just one byte of writing onto an SSD means one count.

To support large capacity with a small number of address lines, recent flash memory is read and written in a block as large as 512 KB.

In other words, writing one byte or 512 KB is counted once.

For this reason, in relation to writing on SSD, it is possible to minimize the number of write counts on SSD by writing in large data sizes through accumulating as much data as possible in a buffer, as opposed to writing in small data sizes with more counts.

●Wear leveling function

As SSD can endure only a relatively small number of write cycles in a specific block, it will average the number of writes so that the writes do not concentrate on the same actual block address against actions to write onto the same block over and over.

This is achieved by virtualizing block addresses.

OS will notify used and unused blocks to SSD. In order to be ready for a next write to be performed, SSD will prepare a block with the smallest number of writes for a write.

By doing so, the number of writes to individual blocks are consequently averaged out.

●Static wear leveling

In the case of conventional wear leveling, it is assumed that 50% of data is in a used domain and rarely rewritten. This means that since installation of OS, 50% of available blocks are written only once. While these blocks are virtually new, the remaining 50% are rewritten over and over. Compared to the case where rewriting is averaged, the end life for SSD comes twice as fast.

As a countermeasure to this, static wear leveling was devised. Data in rarely rewritten blocks are moved to frequently rewritten blocks, while applying blocks that are virtually new to a domain for reuse.

By doing so, even if 50% of blocks are rarely written, the life of SSD is almost fully exploited.

●Assuming total write cycles of SSD

For example, supposing there is a 4-gigabyte SSD using 512 KB blocks and 3,000 write cycles per cell available. If writing data of 512 KB or less, we can assume that the total number of write cycles of SSD is as follows:

4,294,967,296 Bytes ÷ 524,288 Bytes = 8,192 (4 GB ÷ 512 KB）

Number of physical blocks is 8,192.
If each of them are rewritten 3,000 times:

8,192 × 3,000 = 24,576,000 times

In other words, if writing one-byte data per time, the life will end when writing 18.4MB. (Actually, SSD promotes efficiency of such writes). Furthermore, if assuming that for writes of 512 KB in size, a block segment does not overlap the border of 512 KB, it will be one write, whereas in fact, file access by OS may start writing in the middle of the block, so even if a write of 512 KB or less is written twice with a 50% probability.
i.e.

24,576,000 times x 75% = 18,432,000 times (Only 512 KB writes are assumed here).

Furthermore, with access from OS, one more write cycle is added.
This is due to the fact that updating a file control block in the file closing process will result in at least one rewrite.
Of course, SSD further reduces the number of write cycles by, for example, using cache, but basically, this is the mechanism for processing.

●Use an SSD that is as large as possible
For example, the above-mentioned 4-gigabyte SSD has 8,192 blocks, but if there is a 8-gigabyte SSD, it has 16,384 blocks, which is twice that of a 4-gigabyte SSD. Simply put, the number of write cycles is twice.
If SSDs have the same block size, the number of write cycles will simply increase in proportion to the size.
For this reason, by using an SSD as large in size as possible, it will resist against problems caused by an increasing number of writes.

●Reducing the number of writes to SSD by using tmpfs
In a Linux system, system development without due consideration will assume that storage can be used as a device that can be used infinitely.
Even if no data storage is required, storage domain will be carelessly used as a buffer for operation.
To avoid reducing the life of SSD for such a reason, give due consideration to system design

so that the storage necessary for operation processes are stored in tmpfs as much as possible.
In addition, open source software frequently uses a storage domain secured for its use as a temporary storage area. In this case, and as a countermeasure, that file is linked to a domain in tmpfs.

●Log
It is general practice with a Linux system to keep a log in storage for everything. However, if there is a process that records logs on a very frequent basis, contrivances such as writing in tmpfs first and then moving logs to SSD periodically are recommended.
Though such countermeasures cannot respond to a sudden blackout, due consideration should be given to whether one regards this as a trade-off or to send logs to a system log server equipped with UPS.

## 2-3 About SIM cards

SIM cards that can be mounted onto OpenBlocks IoT Family are in a mini-SIM (2FF) format. If there is a need to use micro-SIM or nano-SIM cards, use an adapter that can fix a SIM card with a fall-preventing film and adhesive tape. Please note that any damage to the SIM slot while a SIM adapter is used will be subject to repair on an at-cost basis.

## 2-4 eMMC storage partition information

Partition information of eMMC used for this product is as follows:

●In the OpenBlocks IoT VX1

| Number | Format | Size | OBS application | Device name |
|---|---|---|---|---|
| 1 | fat16 | 1.5 GB | Boot filesystem | mmcblk0p1 |
| 2 | ext4 | 6.5 GB | Primary filesystem | mmcblk0p2 |

●In the OpenBlocks IoT VX2

| Number | Format | Size | OBS application | Device name |
|---|---|---|---|---|
| 1 | fat16 | 1.5 GB | Boot filesystem | mmcblk0p1 |
| 2 | ext4 | 30.5 GB | Primary filesystem | mmcblk0p2 |

●In the OpenBlocks IoT BX and EX series

| Number | Format | Size | OBS application | Device name |
|---|---|---|---|---|
| 1 | - | 1MB | u-boot for normal boot | mmcblk0p1 |
| 2 | - | 2MB | u-boot for normal boot Environment variable | mmcblk0p2 |
| 3 | - | 1MB | u-boot for recovery boot | mmcblk0p3 |
| 4 | - | 2MB | u-boot for recovery boot Environment variable | mmcblk0p4 |
| 5 | ext2 | 1MB | Serial number and MAC address, etc. | mmcblk0p5 |
| 6 | - | 1MB | For saving kernel panic messages | mmcblk0p6 |
| 7 | fat16 | 210MB | Filesystem for normal boot | mmcblk0p7 |
| 8 | ext4 | 105MB | Backup area | mmcblk0p8 |
| 9 | fat16 | 210MB | Filesystem for recovery boot | mmcblk0p9 |
| 10 | ext4 | 3351MB | Primary filesystem | mmcblk0p10 |

## 2-5 Storage mode

Operation is conducted by referring to basic user land data from eMMC. Should an unexpected power interruption occur, there is a risk of damage to files in physical storage, but for Docker and other applications, data in storage are referenced by unionfs, thereby securing normal operation. (Docker will not work on OpenBlocks IoT BX and EX series)

Damage to files by a sudden power interruption mainly happen to files into which data is being written. For this reason, it is recommended that to reduce any influence on OS, files that are normally written should be limited to log files or such like.

*Execution results of mount command

```
root@obsiot:/var/webui/docroot# mount
/dev/mmcblk0p2 on / type ext4 (rw,relatime,data=ordered)
devtmpfs on /dev type devtmpfs (rw,relatime,size=956312k,nr_inodes=239078,mode=755)
sysfs on /sys type sysfs (rw,nosuid,nodev,noexec,relatime)
proc on /proc type proc (rw,nosuid,nodev,noexec,relatime)
securityfs on /sys/kernel/security type securityfs (rw,nosuid,nodev,noexec,relatime)
tmpfs on /dev/shm type tmpfs (rw,nosuid,nodev)
devpts on /dev/pts type devpts (rw,nosuid,noexec,relatime,gid=5,mode=620,ptmxmode=000)
tmpfs on /run type tmpfs (rw,nosuid,nodev,mode=755)
tmpfs on /run/lock type tmpfs (rw,nosuid,nodev,noexec,relatime,size=5120k)
tmpfs on /sys/fs/cgroup type tmpfs (ro,nosuid,nodev,noexec,mode=755)
cgroup on /sys/fs/cgroup/systemd type cgroup
(rw,nosuid,nodev,noexec,relatime,xattr,release_agent=/lib/systemd/systemd-cgroups-agent,name=systemd)
cgroup on /sys/fs/cgroup/freezer type cgroup (rw,nosuid,nodev,noexec,relatime,freezer)
cgroup on /sys/fs/cgroup/memory type cgroup (rw,nosuid,nodev,noexec,relatime,memory)
cgroup on /sys/fs/cgroup/cpuset type cgroup (rw,nosuid,nodev,noexec,relatime,cpuset)
cgroup on /sys/fs/cgroup/perf_event type cgroup (rw,nosuid,nodev,noexec,relatime,perf_event)
cgroup on /sys/fs/cgroup/pids type cgroup (rw,nosuid,nodev,noexec,relatime,pids)
cgroup on /sys/fs/cgroup/devices type cgroup (rw,nosuid,nodev,noexec,relatime,devices)
cgroup on /sys/fs/cgroup/blkio type cgroup (rw,nosuid,nodev,noexec,relatime,blkio)
cgroup on /sys/fs/cgroup/net_cls,net_prio type cgroup (rw,nosuid,nodev,noexec,relatime,net_cls,net_prio)
cgroup on /sys/fs/cgroup/cpu,cpuacct type cgroup (rw,nosuid,nodev,noexec,relatime,cpu,cpuacct)
cgroup on /sys/fs/cgroup/debug type cgroup (rw,nosuid,nodev,noexec,relatime,debug)
systemd-1 on /proc/sys/fs/binfmt_misc type autofs
(rw,relatime,fd=37,pgrp=1,timeout=0,minproto=5,maxproto=5,direct)
mqueue on /dev/mqueue type mqueue (rw,relatime)
debugfs on /sys/kernel/debug type debugfs (rw,relatime)
tmpfs on /tmp type tmpfs (rw,relatime)
```

## 2-6. Connecting PC to OpenBlocks IoT Family

The OpenBlocks IoT Family and a PC are connected via an accessory USB cable.
The OpenBlocks IoT VX series must be supplied with power via an AC adapter or a wide-range power supply input.

In the case of a Windows PC, connection to a USB port will automatically install a USB serial driver (if Windows PC is connected to an Internet environment).
After completing installation of driver, it is possible to make serial port connections via terminal software such as TeraTerm and PuTTY.

Default communication parameters of serial port on OpenBlocks IoT Family are as follows:

Communication speed: 115,200 bps
Data length: 8-bit
Parity: None
Stop bit: 1-bit

When the startup process is completed after establishing communication, a login prompt will be displayed. With default root privileges, start the login process.

Login: root
Password: 0BSI0T
*The above password is a default password. If the password has been changed via WEB UI, please use password already set.

## 2-7. WEB UI

To enable basic system setup, this system is installed with WEB UI.

Use WEB UI to set up networks and control mobile networks.

In addition, WEB UI enables various functions to be added. Please refer to the WEB UI Set-up Guide for basic use, etc. For functions added, refer to corresponding manuals.

# Chapter 3 Using the OpenBlocks IoT Family

The OpenBlocks IoT Family is a general-purpose server product employing Debian GNU/Linux.

The OpenBlocks IoT Family can be used in the same way as with a regular Debian product.

This Chapter describes information that is particular to the OpenBlock IoT Family.

## 3-1. Indication colors of status indicators

The LEDs at the front of the OpenBlocks IoT Family product illuminate in seven colors with a combination of RGB colors. For each color, flashing, etc. is controlled by script.

When WEB UI is employed, the specifications for default LED illuminations are as follows:

| Status | Color | Illumination status | Remarks |
|---|---|---|---|
| Main body and OS in operation | Yellow | Illuminating | After completing startup of the main body and OS, the unit will begin to check for signal reception in the mobile network.<br>*Flashes green if no SIM card is inserted. |
| When the SIM slot is unused | Green | Flashing | Normal operation without a SIM card or in a waiting status before changing over to waiting for signal reception |
| Mobile network signal: Strong | White | Flashing | Refer to "Details of signal status" |
| Mobile network signal: Medium | Light blue | Flashing | Refer to "Details of signal status" |
| Mobile network signal: Weak | Blue | Flashing | Refer to "Details of signal status"<br>*Communication at this field intensity may cause frequent retrials. Therefore, if a mobile network is used, use the unit with a medium field strength or better. |
| Mobile network signal: No signal | Purple | Flashing | Refer to "Details of signal status" |
| When the function is enabled by FUNC button | Yellow | Flashing | Alternately flashes with the status indicator displaying that the mobile network or SIM slot is not used. |
| Terminating OS | Yellow | Illuminated | |

| Status | Color | Illumination status | Remarks |
|---|---|---|---|
| Initial trial to access AirManage failed | Red | Illuminated | This indication is shown when initial access to AirManage remote control server has failed. If no WEB UI is used, the OS will terminate in 5 minutes. |
| When failed to recognized modemo's device file or SIM card in force SIM mode. | Red | Illuminated | This will be displayed when the force SIM mode is enabled on the modem installed model and the modem's device file does not exist or the SIM card can not be recognized at startup. The OS restarts in 5 minutes. |
| OS shutdown due to failed to recognized SIM card or AirManage | Red | Illuminated | |

*Details of signal status

| HW / Modem type | Signal: Strong | Signal: Medium | Signal: Weak | Signal: No signal |
|---|---|---|---|---|
| BX1 | -87dBm or higher | -88 to -108dBm | -109 to -112dBm | -113dBm or lower |
| BX3 | -87dBm or higher | -88 to -108dBm | -109 to -112dBm | -113dBm or lower |
| BX5 with 3G | 3/3 | 2/3 | 1/3 | 0 |
| BX5 with LTE | -95dbm or higher | -95.1 to -105dBm | -105.1 to -120dBm | -120.1dBm or lower |
| 3G module for NTT docomo | -87dBm or higher | -88 to -108dBm | -109 to -112dBm | -113dBm or lower |
| 3G module for SoftBank | -87dBm or higher | -88 to -108dBm | -109 to -112dBm | -113dBm or lower |
| LTE/3G module for SoftBank | -87dBm or higher | -88 to -108dBm | -109 to -112dBm | -113dBm or lower |
| LTE module for KDDI | 5/5 | 4/5 or 3/5 | 2/5 or 1/5 | 0 |
| LTE module for NTT docomo | 3/3 | 2/3 | 1/3 | 0 |
| LTE module for KDDI and NTT docomo with 3G | 3/3 | 2/3 | 1/3 | 0 |
| LTE module for KDDI and NTT docomo with LTE | -95dbm or higher | -95.1to -105dBm | -105.1 to -120dBm | -120.1dBm or lower |
| BWA module | -95dbm or higher | -95.1 to -105dBm | -105.1 to -120dBm | -120.1dBm or lower |

*SoftBank and KDDI and NTT docomo are domestic carrier in Japan

*Method for decisioning radio wave condition

| Modem type | Line | Method |
|---|---|---|
| BX1 (3G) | 3G | Decision by RSSI |
| BX3 (3G)) | 3G | Decision by mapping value of RSCP |
| BX5 (LTE/3G) | 3G | Decision by ECIO and RSCP |
| | LTE | Decision by RSRP |
| 3G module for NTT docomo | 3G | Decision by mapping value of RSCP |
| 3G module for SoftBank | 3G | Decision by mapping value of RSCP |
| LTE/3G module for SoftBank | 3G | Decision by mapping value of RSCP |
| | LTE | Decision by mapping value of RSRP |
| LTE module for KDDI | LTE | Decision by modem module |
| LTE module for NTT docomo | LTE | Decision by modem module |
| LTE module for KDDI and NTT docomo | 3G | Decision by ECIO and RSCP |
| | LTE | Decision by RSRP |
| BWA module | LTE | Decision by RSRP |

*SoftBank and KDDI and NTT docomo are domestic carrier in Japan

LED illumination control script when WEB UI is used

/var/webui/bin/set_signal_value.sh

/var/webui/scripts/led_updater.sh

●LED control

To change indication colors and illumination statuses of LEDs, edit /tmp/.runled file.

Please note that when a SIM card is inserted while using WEB UI, it will work with the field strength, regularly updating this file. For this reason, to intentionally change this file, stop using WEB UI or terminate the script to control LED illumination.

| Line | Setting description | Remarks |
|---|---|---|
| 1st line | Illumination #1 hours (msec) | 1 or more |
| 2nd line | Illumination #2 hours (msec) | 1 or more |
| 3rd line | Illumination #1 color | Refer to table below. |
| 4th line | Illumination #2 color | Refer to table below. (If omitted: 0) |

| Color # | Color |
|---|---|
| 0 | Not illuminated |
| 1 | Red |
| 2 | Green |

| Color # | Color |
|---|---|
| 3 | Yellow |
| 4 | Blue |
| 5 | Purple |
| 6 | Light blue |
| 7 | White |
| Out of range | Not illuminated |

*Yellow flash every second

```
# echo -e "1000¥n1000¥n3" > /tmp/.runled
```

*Yellow and green flash alternately every second

```
# echo -e "1000¥n1000¥n3¥n2" > /tmp/.runled
```

## 3-2. Modem control for mobile networks

A tool to check the power ON/OFF state of module installed in this unit and radio wave state is provided.

Command name: atcmd

Startup method 1: atcmd [Command]

Startup method 2: atcmd [Command 1] [Command 2] [Command 3]

Startup method 3: atcmd -d [Device file] [Command]

As shown in Startup method 2, it is possible to list commands and execute them in sequence.

As shown in Startup method 3, it is also possible to designate a device file to use and execute it.

| Command | Function | Remarks |
|---|---|---|
| PON | Turn the modem ON | |
| POFF | Turn the modem OFF | |
| PRST | Modem reboot | Software reset<br>(Partial hardware reset) |
| HRST | Modem reboot | Hardware reset |
| SMONI | Obtain radio wave strength | BX1 only |
| CSQ | Obtain radio wave strength | In the LTE module for NTT docomo and KDDI and the BWA module, it is impossible to obtain the correct radio field intensity. |
| SIND | Time acquisition from the base station | BX1 only |
| CCLK | Time acquisition from the base station | BX3 only |
| CCID | Obtain SIM number | |
| CTZU 1 | Automatically obtain time zone | Only for models other than LTE module for NTT in BX 1 and EX, VX series<br>*With a space |
| ATI | Obtain modem type number | |
| CGSN | Obtain modem serial number | |

*KDDI and NTT docomo are domestic carrier in Japan

Commands to be assigned as per the above content.

*Turn the modem ON, obtain SIM number, turn the modem OFF

```
# atcmd PON CCID POFF
Xxxxxxxxxxxxx
```

*Turn the modem ON, obtain radio wave strength, turn the modem OFF

```
# atcmd PON CSQ POFF
-86
```

When constantly obtaining radio wave status, WEB UI will occupy the device file. For this command, designate a device file not used by WEB UI and execute it. In an environment or user control not using WEB UI, this restriction will not apply.

Please note that depending on module in use, the device files that can be used by atcmd will differ.

●BX1

| Device file | Can atcmd be used? |
|---|---|
| /dev/ttyACM0 | Yes |
| /dev/ttyACM1 | No |
| /dev/ttyACM2 | No |
| /dev/ttyACM3 | Yes |
| /dev/ttyACM4 | Yes |
| /dev/ttyACM5 | No |
| /dev/ttyACM6 | No |

●BX3

| Device file | Can atcmd be used? |
|---|---|
| /dev/ttyACM0 | Yes |
| /dev/ttyACM1 | Yes |
| /dev/ttyACM2 | Yes |
| /dev/ttyACM3 | No |
| /dev/ttyACM4 | No |
| /dev/ttyACM5 | No |
| /dev/ttyACM6 | No |

●BX5

| Device file | Can atcmd be used? |
|---|---|
| /dev/ttyACM0 | Yes |
| /dev/ttyACM1 | No |
| /dev/ttyACM2 | No |
| /dev/ttyACM3 | Yes |
| /dev/ttyACM4 | No |

●LTE/3G module for SoftBank in EX and VX serise

| Device file | Can atcmd be used? |
|---|---|
| /dev/ttyACM0 | Yes |
| /dev/ttyACM1 | Yes |
| /dev/ttyACM2 | Yes |
| /dev/ttyACM3 | No |
| /dev/ttyACM4 | No |
| /dev/ttyACM5 | No |
| /dev/ttyACM6 | No |

*SoftBank is domestic carrier in Japan

●LTE module for KDDI in EX and VX serise

| Device file | Can atcmd be used? |
|---|---|
| /dev/ttyACM0 | Yes |

*KDDI is domestic carrier in Japan

●LTE module for NTT docomo in EX and VX serise

| Device file | Can atcmd be used? |
|---|---|
| /dev/ttyACM0 | Yes |
| /dev/ttyACM1 | Yes |

*NTT docomo is domestic carrier in Japan

●LTE module for NTT docomo and KDDI in EX and VX serise

| Device file | Can atcmd be used? |
|---|---|
| /dev/ttyACM0 | Yes |
| /dev/ttyACM1 | No |
| /dev/ttyACM2 | No |
| /dev/ttyACM3 | Yes |
| /dev/ttyACM4 | No |

*NTT docomo and KDDI are domestic carrier in Japan

●BWA module in EX and VX serise

| Device file | Can atcmd be used? |
|---|---|
| /dev/ttyACM0 | Yes |
| /dev/ttyACM1 | No |
| /dev/ttyACM2 | No |
| /dev/ttyACM3 | Yes |
| /dev/ttyACM4 | No |

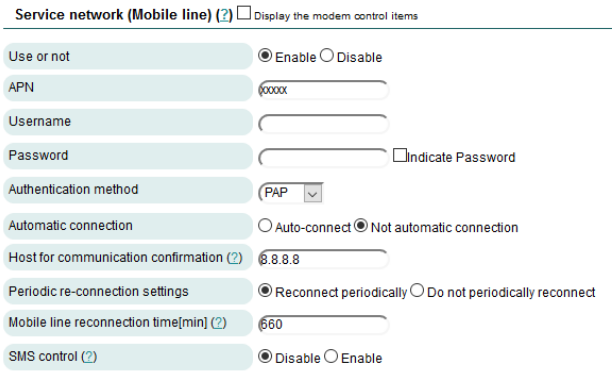
## 3-3. Mobile network connection

It can control the mobile line's modem using the **Service network (Mobile line)** menu in the **[Network]-[Basic]** tab in WEB UI.

The OpenBlocks IoT Family supports a method to make a connection to mobile networks whenever necessary through control by WEB UI (On-demand connections), and a method to make a connection by the user fully excluding control by the modem.

## 3-3-1. On-demand connections

Press the **[Network]-[Basic]** tab and enter necessary information for mobile network connections.




Following information is required:

・APN (There is no item for LTE module for KDDI) .

・Username

・Password

・Authentication method

・Automatic connection: Choose "Not automatic connection."

・Host for communication confirmation

・Periodic re-connection settings

・Mobile network reconnection times

・SMS control(There is no item for LTE module for KDDI)

*Enable this item only when it is used.

Press the Save button and reboot the unit to reflect changes to mobile network modem.

To connect/disconnect to a mobile network at on-demand, use the following commands. The number "1" on the command line below assumes on-demand connection. When "0" is specified, it is always connected to hold connection.

●Connection to a mobile network

```
# /var/webui/scripts/mobile_control.sh con 1
```

●Disconnection from a mobile network

```
# /var/webui/scripts/mobile_control.sh coff 1
```

Below is a sample of a combination of the above commands, meaning:

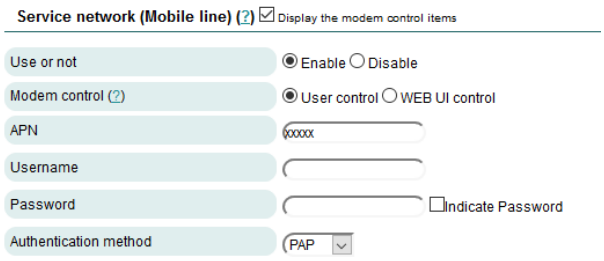
1. Connect to mobile network.
2. Execute ping command to DNS server.
3. Disconnect from mobile network.

```
#!/bin/bash


echo "#------------------------------------------------------------#"
echo "# Connect (`date`)"
echo "#------------------------------------------------------------#"
/var/webui/scripts/mobile_control.sh con 1
sleep 2
echo ""
echo "#------------------------------------------------------------#"
echo "# Command Exec (`date`)"
echo "#------------------------------------------------------------#"
ping -c 3 8.8.8.8
echo ""
echo "#------------------------------------------------------------#"
echo "# Disconnect (`date`)"
echo "#------------------------------------------------------------#"
/var/webui/scripts/mobile_control.sh coff 1
sleep 2
exit 0
```

## 3-3-2. User control of mobile network modem

Press the **[Network]-[Basic]** tab and set up necessary information for mobile network connections. Note that the LTE module does not support this function.




To implement this item, check "Display the modem control items."

The following information is required for settings:

- Modem control: Choose "User control."
- APN
- Username
- Password
- Authentication method

Information set up via WEB UI can be reflected upon modem using the following command:

●Command to reflect modem settings

```
# /var/webui/scripts/setapn.sh
```

Config. files used by command to reflect modem settings are as follows:

●Config. files to reflect modem settings

```
/var/webui/config/ppp0_device.sh
/var/webui/upload_dir/modem.sh
```

If further changes have been made to setting information, it is possible to overwrite information by creating and setting the file below:

●File to overwrite information

```
/var/webui/upload_dir/user_modem.sh
```

●Description of variables

| Variable | Description | Remarks |
|---|---|---|
| modem_ppp0_apn | APN | |
| modem_ppp0_user | Username | |
| modem_ppp0_pass | Password | |
| modem_ppp0_authtype | Authentication method | PAP or CHAP |
| modem_ppp0_provier | Provider name | To be designated by PON/POFF command |
| DEVICE_CONNECT | Device file for mobile network connections | Will be /dev/ttyACM[0-9]*. |
| DEVICE_SETTING | Device file for mobile network connections | Will be /dev/ttyACM[0-9]*. |

●Sample settings

```
modem_ppp0_apn="iixxxx.jp"
modem_ppp0_user="test@iixxxx"
modem_ppp0_pass="xxxx"
modem_ppp0_authtype="PAP"
modem_ppp0_provier="usermobile"
```

With each of the following commands, can connect to or disconnect from mobile network.

●Command for mobile network connection

```
# pon <modem_ppp0_provier>
```

●Command for mobile network disconnection

```
# poff <modem_ppp0_provier>
```

*<modem_ppp0_provier> is set up by a variable. If not changed by user_modem.sh, it will be "mobile."

ⓘ ●To obtain radio wave strength, etc., use atcmd. Cannot obtain information from a device file connected to the network.

ⓘ ●If default gateway has been set up before connection to a mobile network, it will not be reflected at the time of connection. For this reason, open the default gateway before making connection to mobile network.

After disconnecting from mobile network, the default gateway will remain open. For this reason, to separately access an Internet environment, etc. set up the default gateway.

## 3-4. Backup

When customizing the filesystem etc, It can back up the file system that will be booted as Normal boot mode, to TGZ format file in following.

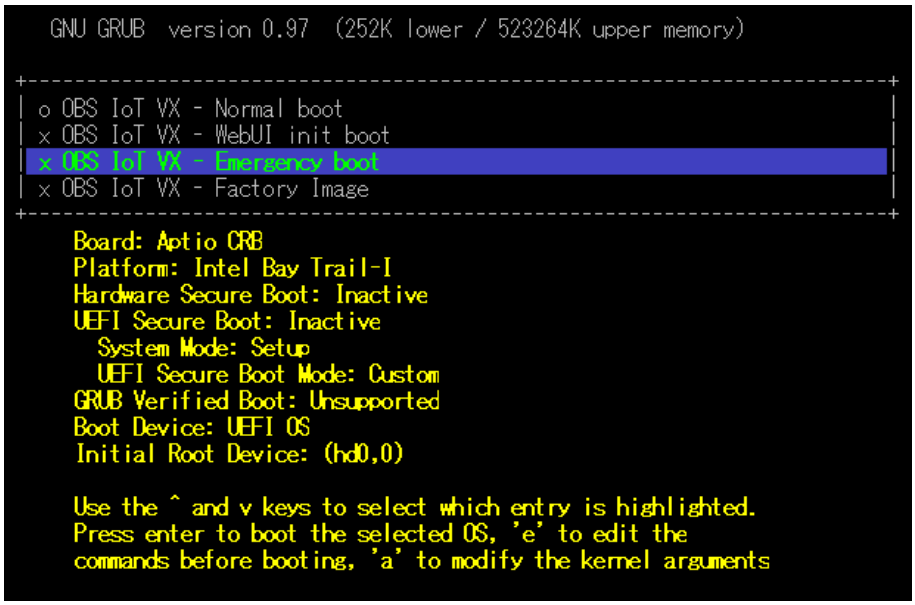
◆For OpenBlocks IoT VX series

1. Rebooting the unit

```
# sync
# reboot
```

2. Startup in emergency boot mode

For the OpenBlocks IoT VX series, choose "Emergency boot" from the GRUB screen at the time of startup.



3. Deletion of unnecessary data and backup

```
obsiot login: root
Password: root

# mount /dev/mmcblk0p2 /mnt
      *Delete files particular to hardware, etc. below /mnt. BT information is deleted.
# rm -rf /mnt/var/lib/bluetooth/*

# cd /mnt

# tar --exclude=lost+found --exclude=<tgz filename> -cpzf <tgz filename> .
```

/mnt/<*tgz filename*> will be a backed up file.

Caution:

Under the /var/lib/bluetooth/ directory, information particular to hardware is included.

It is recommended to delete intermediate files during programming.

◆For OpenBlocks IoT BX and EX series

1. Startup by recovery boot

On the OpenBlocks IoT BX and EX series, the u-boot prompt is displayed by key input during u-boot startup at startup. At the u-boot prompt, you can execute commands to start with the recovery filesystem and start up in the RAM disk mode.

```
*******************************
PSH KERNEL VERSION: b0182727
                    WR: 20104000
*******************************

SCU IPC: 0x800000d0    0xfffce92c

PSH miaHOB version: TNG.B0.VVBD.0000000c

microkernel built 23:15:13 Apr 24 2014

******* PSH loader *******
PCM page cache size = 192 KB
Cache Constraint = 0 Pages
Arming IPC driver ..
Adding page store pool ..
PagestoreAddr(IMR Start Address) = 0x04899000
pageStoreSize(IMR Size)          = 0x00080000

*** Ready to receive application ***


U-Boot 2014.04 (Oct 14 2014 - 15:19:04)

          Watchdog enabled
DRAM:   980.6 MiB
MMC:    tangier_sdhci: 0
```

```
In:      serial
Out:     serial
Err:     serial
Hit any key to stop autoboot:  0          *key input here
boot > run bootRecovery
```

2. Deletion of unnecessary data and backup

```
obsiot login: root
Password:root

# mount /dev/mmcblk0p10 /mnt
   *Delete hardware specific files etc. under the / mnt directory. In the following example,
    BT information is deleted.
# rm -rf /mnt/var/lib/bluetooth/*

# cd /mnt

# tar --exclude=lost+found --exclude=<tgz filename> -cpzf <tgz filename> .
```

/mnt/<*tgz filename*> is the backed up file.

Caution:

Under the /var/lib/bluetooth/ directory, information particular to hardware is included.

It is recommended to delete intermediate files during programming.

## 3-5. Restoration

Using emergency boot mode, It can restore file system using the shell scripts (init.sh and post-init.sh) described in Chapter 3-6 from the TGZ format backup file saved in external storage such as USB memory.

For details on how to make backup files, please refer to Chapter 3-4.

The external storage is one of ext2/ext3/vfat filesystem, and the volume label of **DB_CONFIG** needs to be set.

Caution:

・Before decompressing a backed up file, format the /dev/mmcblk0p2 for OpenBlocks IoT VX series, /dev/mmcblk0p10 for OpenBlocks IoT BX and EX series.

・Backed up file and kernel-image must be consistent. Separately check the kernel-image of the unit to be restored.

## 3-6. Applications

In emergency boot mode (or recovery boot mode), in addition to a backup file, it is possible to run a script, etc. by preparing a file with a designated name as a volume label in **DEB_CONFIG**. This will be effective only if a file actually exists.

・init.sh (sh script; line feed code is LF only)
Execution before mounting overlayfs(or aufs) while KERNEL is starting up.

・post-init.sh (sh script; line feed code is LF only)
Execution after mounting overlayfs(or aufs) while KERNEL is starting up.

In emergency boot (or recovery boot mode), it starts up in RAMDISK mode. Therefore, we do not need to take special consideration on the above mounting work.

*This products employs systemd. For this reason, at the stage when KERNEL is starting up, systemd has not been started up, and soem commands (such as poweroff/reboot) cannot be used. To use such a command, execute commands to be used after starting up daemon and other programs that need to be started up in the background.

## 3-7. Recommended device fileme

The names of Linux device files are assigned in order of device recognition. Therefore, the name of the device file may change depending on the operating status of the device.
In order to suppress this issue as much as possible, OpenBlocks IoT Family automatically creates a symbolic link of device file for each model.
When accessing the device file, we recommend using the following device filename.

●For OpenBlocks IoT VX series

| Recommended device filename | Device |
|---|---|
| /dev/ttyRS485 | Device file for RS-485 |
| /dev/ttyEX1 | Device file for extension slot 1 (LoRaWAN, etc.) |
| /dev/ttyEX2 | Device file for extension slot 2 (EnOcean, etc.) |
| /dev/ttyS4 | Device file for RS-232C<br>(For VX1 only) |

●For OpenBlocks IoT EX1

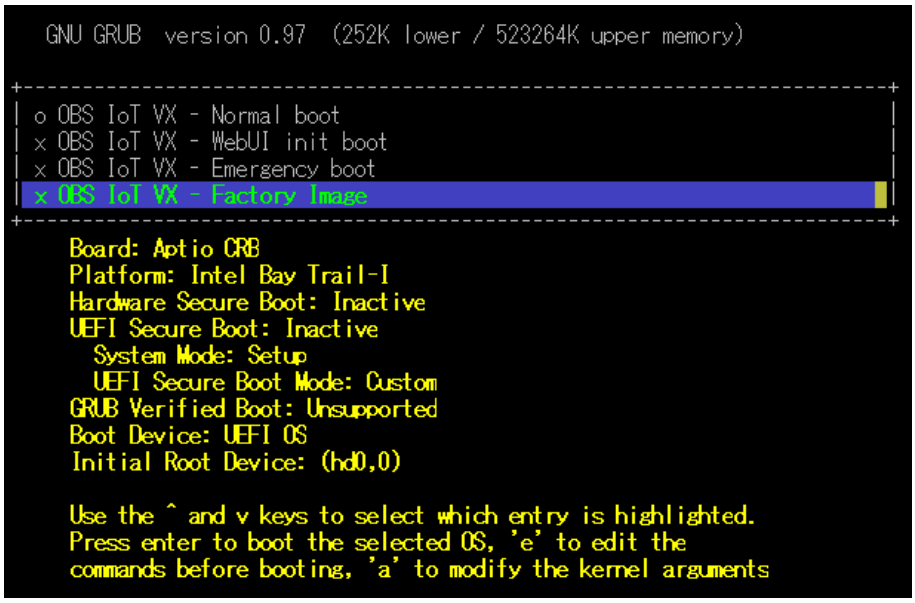
| Recommended device filename | Device |
|---|---|
| /dev/ttyEX1 | Device file for extension slot 1 (LoRaWAN, etc.) |
| /dev/ttyEX2 | Device file for extension slot 2 (EnOcean, etc.) |
| /dev/ttyMFD1 | Device file for RS-485 or RS-232C |

●For OpenBlocks IoT EX1G

| Recommended device filename | Device |
|---|---|
| /dev/ttyRS485 | Device file for RS-485 |
| /dev/ttyEX1 | Device file for extension slot 1 (LoRaWAN, etc.) |
| /dev/ttyEX2 | Device file for extension slot 2 (EnOcean, etc.) |
| /dev/ttyMFD1 | Device file for RS-232C |

# 3-8. Factory Reset (Reset to condition at time of factory shipment)

With the OpenBlocks IoT VX series, if a package has been added to the storage domain or if important data has been deleted and to reset the unit to the condition at the time of factory shipment, choose "Factory Image" in the GRUB menu to do so.
Please note that if resetting the unit to the condition at the time of factory shipment, data set up, etc. will be deleted.




For OpenBlocks IoT BX/EX series, please refer to **[Documents]-[Factory_Reset]** from the following URL.

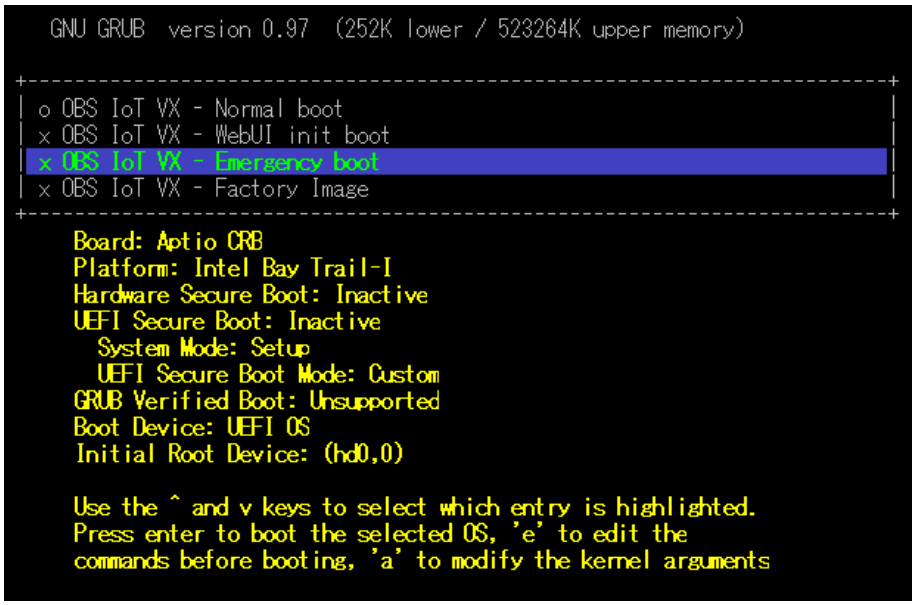
**http://www.plathome.com/services/**

## 3-9. Recovery startup

A file system for recovery is prepared for the case where the file system used for normal startup is damaged and can not be started.

On the OpenBlocks IoT VX series, choose "Emergency boot" from the GRUB menu to start up the unit in the RAM disk mode.

Login account and password by the console in this startup mode is "root"/"root".




On the OpenBlocks IoT BX and EX series, the uboot prompt is displayed by key input during uboot startup at startup. At the u-boot prompt, you can execute commands to start with the recovery filesystem and start up in the RAM disk mode.

Please reinstall the kernel - image data, restore the storage data, etc. after booting.

```
******************************
PSH KERNEL VERSION: b0182727
                   WR: 20104000
******************************

SCU IPC: 0x800000d0    0xfffce92c

PSH miaHOB version: TNG.B0.VVBD.0000000c

microkernel built 23:15:13 Apr 24 2014

******* PSH loader *******
PCM page cache size = 192 KB
Cache Constraint = 0 Pages
Arming IPC driver ..
```

```
Adding page store pool ..
PagestoreAddr(IMR Start Address) = 0x04899000
pageStoreSize(IMR Size)          = 0x00080000

*** Ready to receive application ***


U-Boot 2014.04 (Oct 14 2014 - 15:19:04)

          Watchdog enabled
DRAM:   980.6 MiB
MMC:     tangier_sdhci: 0
In:       serial
Out:     serial
Err:     serial
Hit any key to stop autoboot:   0          *key input here
boot > run bootRecovery
```

If you are using WEB UI, you can invoke the recovery mode from next time by execute the following command on the command line at normal mode. Similarly, for the command that starts from the recovery mode the next time onwards as the normal mode, it is as follows.

*Command to switch from normal mode to recovery mode startup.

```
# /var/webui/bin/bxex_uboot_runrecovery.sh
```

*Command to switch from recovery mode to normal mode startup.

```
# /usr/sbin/fw_setenv bootcmd 'setenv firm_part 0:7;run bootDebian;'
```

*Attension)*

When executing the command to switch from the normal mode to the recovery mode, the next and subsequent startup will always be in recovery mode. Therefore, please do not execute in OpenBlocks in actual operation state.

## 3-10. Build a development environment

The method of creating firmware of OpenBlocks IoT Family is provided on the following URL. Please refer to when build a development environment.

https://github.com/plathome/debian_based_firmware

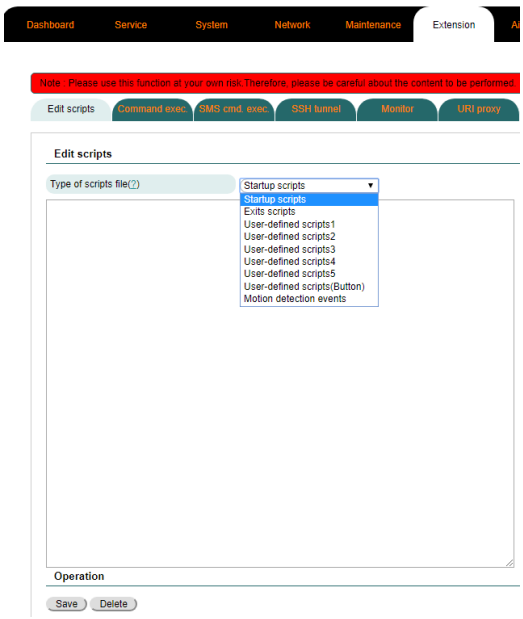
# 3-11. WEB UI extensions

Various extended functions are provided for WEB UI.

## 3-11-1. Install extension

In this enclosure in the state immediately after shipment, only software that sets network settings etc. is installed. You can extend the functions such as using as an IoT Gateway and installing Node-RED and etc.
This is described in the WEB UI Set-up Guide for the OpenBlocks IoT Family. Please refer to said document.

## 3-11-2. Script editing




Choose the **[Extension] –[Edit Scripts]** tab to create and edit the following scripts from WEB UI.

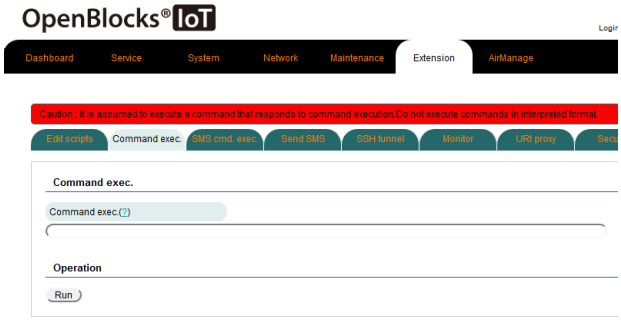
- Startup scripts
- Exit scripts
- User-defined scripts 1-5
- User-defined scripts (Button)
- Motion detection events

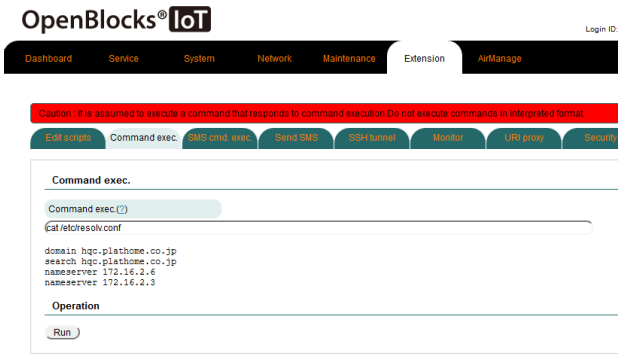
Please note that this function depends on what user has actually installed.

| # | Script type | Execution timing | Remarks |
|---|---|---|---|
| 1 | Startup scripts | Executed after startup process of WEB UI is completed at the time of starting up the unit. | |
| 2 | Exit scripts | Executed immediately after termination process of WEB UI has started at the time of terminating the unit. | |

| # | Script type | Execution timing | Remarks |
|---|---|---|---|
| 3 | User-defined scripts | Not executed in normal processes. Executed when instruction is applied using the SMS control function. | |
| 4 | User-defined scripts (Button) | If such scripts are set up using the FUNC function allocation, executed when FUNC switch is pressed. | |
| 5 | Motion detection events | It is carried out when the event trigger is enabled when saving the moving image when detecting the moving object in the camera function. | |

## 3-11-3. Command execution



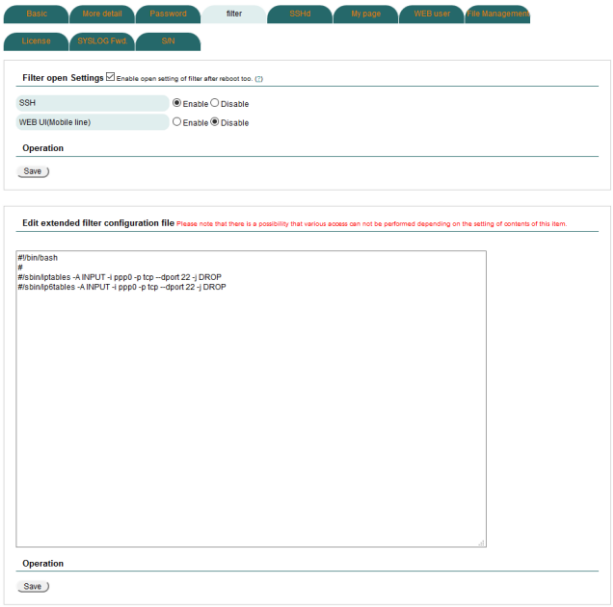

Use the **[Extension]-[Command exec.]** tab, can execute a command of one line or so. When executing a command, response results will be displayed.

Please note that if executing a command that is permanently run in the foreground with this function, will not obtain web response.

## 3-11-4. Special setting of WEB UI filter table

If a /var/webui/local/bin/iptables-ext.sh file is present, the Edit extended filter configuration file item will be displayed in the **[System]-[Filter]** tab in WEB UI.
For this item, customization of filter setting by iptables and ip6tables commands is assumed.

Execution timing of iptables-ext.sh is at the time of startup and changing filter settings.




What is described in this section is a shell script.

Edit with iptables command as appropriate.

## 3-11-5. Sending SMS messages

If the unit uses WEB UI, is equipped with a modem module (other than an LTE module for KDDI) and is inserted with a SIM card that can send SMS messages, it is possible to send SMS messages from the command line.
Use the following command to use create a form of SMS data.
*After creating form, message will be automatically sent.
*KDDI is domestic carrier in Japan

```
# /var/webui/bin/create_sms.py <recipient's telephone number> <body>
```

*Example of execution

```
# /var/webui/bin/create_sms.py 09012345678 “TEST MESSAGE”
```

## 3-11-6. Switching operations of LTE module for KDDI

The LTE module for KDDI has a function to serve as a SIM card. With the commands below, can switch between internal SIM mode to turn the module into a SIM card and external SIM mode to refer to an inserted SIM card.
*KDDI is domestic carrier in Japan

●Command to switch to internal SIM mode

```
# /var/webui/scripts/kym_set_mode.sh in
```

●Command to switch to external SIM mode

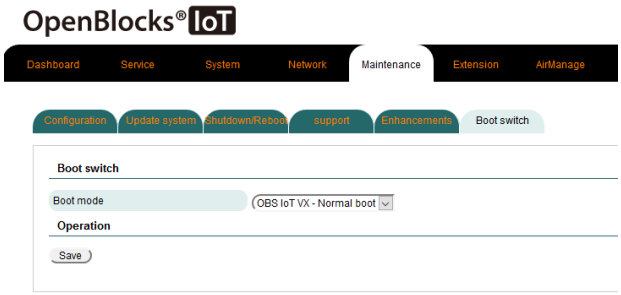
```
# /var/webui/scripts/kym_set_mode.sh out
```

## 3-11-7. Automatic external storage mounting in WEB UI

If WEB UI finds storage devices with specific volume labels, they will be automatically mounted.
Please use this function to manage storage using WEB UI functions, etc.

| Volume label | Mounting destination | Supplement |
|---|---|---|
| WEBUI_STORAGE | /var/tmp/storage | Use the NTFS file system. |

## 3-11-8. Switching boot modes




◆For OpenBloks IoT VX series only

Can set up boot mode at the next startup using the **[Maintenance]-[Boot switch]** tab .

At the time of normal factory shipment, only one boot mode can be selected.

*By rewriting a part of /dev/mmcblk0p1/EFI/boot/bootx64.conf file, can show boot modes here. However, selectable boot modes mean a risk to actual operations, for example, restoring setting to factory condition.

For this reason, examine each boot mode to determine if it should be added for display.

## 3-11-9. About GPS information

When installing the LTE module for NTT and KDDI or the BWA module and enable the GPS in the Web UI, The position information at the time of the last acquisition is written in the following file in JSON format.

Please use this file when you want to utilize location information.

*NTT docomo and KDDI domestic carrier in Japan

●GPS information JSON file

/tmp/.gps_posi.json

Also, when acquiring GPS position information, write the above file contents to Node-RED 's Unix domain socket.

●GPS information writing Unix domain socket (Abstract socket)

@/tmp/node-red-gpsin.sock

For information on adding GPS information to JSON with Node-RED, please refer to "Nod-RED Starter Guide".

## 3-11-10. About Default gateway and DNS server in DHCP

When DHCP is set for IP address assignment of the network interface in WEB UI, the IP address of the default gateway and the DNS server is the value given from DHCP .
Although general DHCP assigns the IP address of the default gateway and DNS server, there are cases in which these are not granted from the viewpoint of security.
In such a case, you can specify the IP address of the default gateway and DNS server in the environment using DHCP by preparing the following file.
The above default gateway to be assigned when DHCP assigned an IP address. Also, the IP address of the DNS server is applied when the local network interface is up.

●Configuration file
/var/webui/upload_dir/force_network.sh

●Description of file

```
force_network_defaultroute=<IP address of defult gateway>
force_network_nameservers="<IP address of DNS1> <IP address of DNS2>"
```

●Description example

```
force_network_defaultroute=192.168.130.1
force_network_nameservers="127.0.0.1 192.168.130.1"
```

# 3-12. Docker

Docker can be operated with the OpenBlocks IoT VX series.
Docker can be installed by using the function to add extensions in the **[Maintenance]-[Enhancements]** tab in WEBUI.
Can also use the following commands to install Docker.

●How to install Docker (Connection to an Internet environment required).

```
# apt-get update
# apt-get -y install docker-ce
```

At present, there is no function to control Docker containers from WEB UI. To control containers, use a command line. If using Docker after going live, refer to the official Docker site for commands, including container startup and stop.

# Chapter 4 Product specifications

## 4-1. Open Blocks IoT VX1 main unit specifications

| | | |
|---|---|---|
| Model # | | OBSVX1 |
| CPU | Model | Intel Atom E3805 |
| | Clock speed | 1.3 GHz (dual core) |
| | Built-in secondary cache | 1024 kB/Core |
| Main memory | On-board | 1GB(64bit bus DDR3L) |
| Built-in storage | | 8GB(eMMC) |
| Additional storage | | 1 x MMC slot |
| Wireless interface | | BT 4.0+2.1 EDR |
| | | WLAN (IEEE802.11a/b/g/n/ac) *4 |
| SIM interface | | MiniSIM for communication (25 mm x 15 mm x 0.76 mm) card slot |
| Wired interface | USB (HOST) | 1 x USB 3.0 (type-A) *2 |
| | USB (Console) | 1 x Micro USB (type-B) |
| | Ethernet | 2 x 10Base-T/100BASE-TX/1000BASE-T |
| | RS-232C | 1 x RJ45 |
| | RS-485 | 1 x half-duplex<br>(Applicable electric wire range: AWG28 to AWG22) |
| Case Size | | 91.9 mm (W) x 114.8 mm (D) x 25 mm (H) (Excluding protrusions) |
| Weight | | 160 g |
| Power supply | | DC-Jack: 4.75 to 5.25VDC<br>Wide DC: 10 to 48VDC*3 |
| Power consumption | In an idle mode | 5.1W |
| | At a high load | 8.2W |
| MTBF | | 432,644h |
| EMC standard | | VCCI class A |
| Energy consumption efficiency based on the Energy Conservation Law. [Unit: W/GTOPS] *1 | | Classification: H |
| | | 0.48 |

| | |
|---|---|
| Natural environmental protection | Conforms to RoHS Directives |
| Certification | JATE/ TELEC |
| RTC backup time | 10 years |
| OS at the time of shipment | Debian GNU/Linux |

*1: Energy Consumption Efficiency is measured power consumption (Measurement method defined by the Act Concerning the Rational Use of Energy) divided by composite theoretical performance, as defined by the Act Concerning the Rational Use of Energy.

*2: Supported cable length is less than 3 meters.

*3: To use this function, it is necessary to connect an external nose filter (SNR-10-223-T (COSEL) or an equivalent).

*4: Access point function of 802.11ac not supported.

# 4-2. Open Blocks IoT VX2 main unit specifications

| | | |
|---|---|---|
| Model # | | OBSVX2 |
| CPU | Model | Intel Atom E3805 |
| | Clock speed | 1.3 GHz (dual core) |
| | Built-in secondary cache | 1024 kB/Core |
| Main memory | On-board | 2 GB (64 bit bus DDR3L) |
| Built-in storage | | 32 GB (eMMC) |
| Additional storage | | 1 x MMC slot |
| Wireless interface | | BT 4.0+2.1 EDR |
| | | WLAN (IEEE802.11a/b/g/n/ac) *4 |
| SIM interface | | MiniSIM for communication (25 mm x 15 mm x 0.76 mm) card slot |
| Wired interface | USB (HOST) | 1 x USB 3.0 (type-A) *2 |
| | USB (Console) | 1 x Micro USB (type-B) |
| | Ethernet | 2 x 10Base-T/100BASE-TX/1000BASE-T |
| | RS-485 | 1 x half-duplex<br>(Applicable electric wire range: AWG28 to AWG22) |
| Case Size | | 91.9 mm (W) x 114.8 mm (D) x 25 mm (H) (Excluding protrusions) |
| Weight | | 160 g |
| Power supply | | DC-Jack: 4.75 to 5.25VDC |

| | | |
|---|---|---|
| | | Wide DC: 10 to 48VDC*3 |
| Power consumption | In an idle mode | 5.5 W |
| | At a high load | 9.0 W |
| MTBF | | 435,613 hours |
| EMC standard | | VCCI class A |
| Energy consumption efficiency based on the Energy Conservation Law. [Unit: W/GTOPS] *1 | | Classification: H |
| | | 0.52 |
| Natural environmental protection | | Conforms to RoHS Directives |
| Certification | | JATE/ TELEC |
| RTC backup time | | 10 years |
| OS at the time of shipment | | Debian GNU/Linux |

*1: Energy Consumption Efficiency is measured power consumption (Measurement method defined by the Act Concerning the Rational Use of Energy) divided by composite theoretical performance, as defined by the Act Concerning the Rational Use of Energy.

*2: Supported cable length is less than 3 meters.

*3: To use this function, it is necessary to connect an external nose filter (SNR-10-223-T (COSEL) or an equivalent).

*4: Access point function of 802.11ac not supported.

# 4-3. Options for OpenBlocks IoT VX series

## 4-3-1. LTE/3G module for SoftBank

| | | |
|---|---|---|
| Supported frequencies | | GSM:<br>850/900/1800/1900MHz<br>W-CDMA:<br>850/900/1900/2100MHz<br>LTE:<br>(1)/(3)/(5)/(7)/(8)/(20) |
| Data communication speed | | Downstream: 150Mbps<br>Upstream: 50Mbps *Theoretical values |
| Control method | | AT command and Dedicated command |
| Certification | | JATE/TELEC |
| Power consumption | Idle | 0.05W *Average power |
| | At a high load | 2.5W *Average power |
| MTBF | | 97,808h at 25℃ |

*1 : (n) is a band

*SoftBank is domestic carrier in Japan

## 4-3-2. LTE module for KDDI

| | | |
|---|---|---|
| Supported frequencies | | RX：860.0MHz to 875.0MHz<br>TX：815.0MHz to 830.0MHz |
| Data communication speed | | Downstream: 75Mbps<br>Upstream: 25Mbps　*Theoretical values |
| Control method | | AT command and Dedicated command |
| Certification | | JATE/TELEC |
| Power consumption | Idle | 0.16W　*Average power |
| | At a high load | 2.4W　*Average power |

*KDDI is domestic carrier in Japan

## 4-3-3. LTE module for NTT docomo and KDDI

| | | |
|---|---|---|
| Supported frequencies | | GSM: 900/1800MHz<br>W-CDMA: 800(6)/900(8)/ 2100MHz(1)<br>LTE: 800(18)/800(19)/900(8)/1800(3)/2100(1)/ 2600(41) MHz[*1 *2]<br>GNSS: GPS/GLONASS |
| Data communication speed | | Downstream: 75Mbps<br>Upstream: 25Mbps　*Theoretical values |
| Control method | | AT command and Dedicated command |
| Certification | | JATE[150051003] / TELEC[003-150053] |
| Power consumption | Idle | 0.02W　*Average power |
| | At a high load | 2.9W　*Average power |
| MTBF | | 500,000h　at 25℃ |

*1 : (n) is a band

*2: Blue value is a band not used in Japan

*NTT docomo and KDDI are domestic carrier in Japan

## 4-3-4. BWA module

| | | |
|---|---|---|
| Supported frequencies | | GSM: 900/1800MHz<br>W-CDMA: 800(6)/900(8)/ 2100MHz(1)<br>LTE: 800(18)/800(19)/900(8)/1800(3)/2100(1)/ 2600(41) MHz[*1 *2]<br>GNSS: GPS/GLONASS |
| Data communication speed | | Downstream: 100Mbps<br>Upstream: 50Mbps *Theoretical values |
| Control method | | AT command and Dedicated command |
| Certification | | JATE[150051003] / TELEC[003-150053] |
| Power consumption | Idle | 0.02W *Average power |
| | At a high load | 2.9W *Average power |
| MTBF | | 500,000h at 25℃ |

*1 : (n) is a band

*2: Blue value is a band not used in Japan

## 4-3-5. EnOcean module

| | | |
|---|---|---|
| Frequency | | 928.35MHz |
| Data communication speed | | 125kbps |
| HOST I/F | | UART |
| Certification | | TELEC |
| Power consumption | Idle | 0.13W |
| | At a high load | 0.11W |
| MTBF | | 862,664h at 25℃ |

## 4-3-6. Wi-SUNmodule

| | | |
|---|---|---|
| Frequencies | | 922.5～927.9MHz(28ch) |
| Data communication speed | | 100kbps |
| HOST I/F | | UART |
| Certification | | TELEC |
| Power consumption | Idle | 0.1W |
| | At a high load | 0.15W |
| MTBF | | 559,409h at 25℃ |

## 4-3-7. LoRaWAN module

| | | |
|---|---|---|
| Frequencies | | 920.6～928.0MHz |
| Data communication speed | | 11kbps |
| HOST I/F | | UART |
| Certification | | TELEC |
| Power consumption | Idle | 0.05W |
| | At a high load | 0.12W |
| MTBF | | 4,076,190h at 25℃ |

# 4-4. Options for OpenBlocks IoT VX1

## 4-4-1. LTE module for NTT docomo

| | | |
|---|---|---|
| Supported frequencies | | LTE：2GHz / 800MHz |
| Data communication speed | | Downstream: 112.5Mbps<br>Upstream: 37.5Mbps *Theoretical values |
| Control method | | AT command and Dedicated command |
| Certification | | JATE/TELEC |
| Power consumption | Idle | 0.03W *Average power |
| | At a high load | 3.7W *Average power |

*NTT docomo and KDDI are domestic carrier in Japan

# 4-5. Options for OpenBlocks IoT VX2

## 4-5-1. Built-in battery

| Item | Specification | Remarks |
|---|---|---|
| HOST I/F | I2C | Charge control and battery module voltage detection |
| Nominal voltage | 4.8VDC | |
| Rated capacity | 500mAh | |
| Charging current | Rapid charge：150mA<br>Trickle charge：20mA | |
| Charging time | Rapid charge：2h<br>Trickle charge：13h | The backup function can be used after the end of rapid charging |
| Discharge time | Depends on load | Rated capacity÷Quiescent current×0.5 [h] |

| | | |
|---|---|---|
| End-of-discharge voltage | 4.0 to 4.4VDC | |
| Operating temperature and humidity range | 0 to +40℃ /<br>45 to 85% | |
| Storage temperature and humidity range | -20 to +35℃ /<br>45 to 85% | Within 1 year |
| Protective parts | Thermal protector | Built in battery pack |
| Lifetime (number of charge and discharge) | Depending on usage conditions | 500 times or 2 to 3 years |

* It is non factory shipping option.

***** Be sure to read "Before Using Battery Module for OpenBlocks IoT Family" before use.

# 4-6. Open Blocks IoT BX1 main unit specifications

| | | |
|---|---|---|
| Model # | | OBSBX1 |
| CPU | Model | Intel® Atom™ processor |
| | Clock speed | 500MHz (dual core) |
| Main memory | On-board | 1GB(LPDDR3) |
| FLASH ROM | | 4GB(eMMC) |
| Additional storage | | - |
| Wireless interface | | 3G(W-CDMA)*1 |
| | | BT 4.0 |
| | | WLAN(IEEE802.11a/b/g/n) |
| SIM interface | | MiniSIM for communication (25 mm x 15 mm x 0.76 mm) card slot |
| Wired interface | | BX1 connecter<br>Supplied Accessory:USB2.0(Bus power/type-A) |
| Case Size | | 41.6mm(W) x 96mm (D) x 11.3mm(H) (Excluding protrusions) |
| Weight | | 45g |
| Power supply | | 4.75 to 48VDC<br>* When power supplied by USB cable :<br>4.75 to 5.25VDC |
| Power consumption | In an idle mode | When active 3G module：0.8W<br>When inactive 3G module：0.1W*2 |
| | At a high load | 4.6W |
| MTBF | | 445,951h |
| EMC standard | | VCCI Class-B |
| Energy consumption efficiency based on the Energy Conservation Law. [Unit: W/GTOPS] *3 | | Classification: H |
| | | 0.17 |
| Natural environmental protection | | Conforms to RoHS Directive, PFOS regulation and Energy Conservation Law. |
| Certification | | JATE/TELEC |
| RTC backup time | | Up to about 10 minutes |
| OS at the time of shipment | | Debian GNU/Linux |

*1 : Compatible with NTT docomo's FOMA communication network

*2 : It is a value when Power Save is set to “Auto”.

*3: Energy Consumption Efficiency is measured power consumption (Measurement method defined by the Act Concerning the Rational Use of Energy) divided by composite theoretical performance, as defined by the Act Concerning the Rational Use of Energy.
*NTT docomo is domestic carrier in Japan

# 4-7. Open Blocks IoT BX3 main unit specifications

| | | |
|---|---|---|
| Model # | | OBSBX3 |
| CPU | Model | Intel® Atom™ processor |
| | Clock speed | 500MHz (dual core) |
| Main memory | On-board | 1GB(LPDDR3) |
| FLASH ROM | | 4GB(eMMC) |
| Additional storage | | - |
| Wireless interface | | 3G(W-CDMA)*1 |
| | | BT 4.0 |
| | | WLAN(IEEE802.11a/b/g/n) |
| SIM interface | | MiniSIM for communication (25 mm x 15 mm x 0.76 mm) card slot |
| Wired interface | | BX1 connecter<br>Supplied Accessory:USB2.0(Bus power/type-A) |
| Case Size | | 41.6mm(W) x 96mm (D) x 11.3mm(H) (Excluding protrusions) |
| Weight | | 45g |
| Power supply | | 4.75 to 48VDC<br>* When power supplied by USB cable :<br>4.75 to 5.25VDC |
| Power consumption | In an idle mode | 1.3W |
| | At a high load | 4.6W |
| MTBF | | 224,858h |
| EMC standard | | VCCI Class-B |
| Energy consumption efficiency based on the Energy Conservation Law. [Unit: W/GTOPS] *2 | | Classification: H |
| | | 0.17 |
| Natural environmental protection | | Conforms to RoHS Directive, PFOS regulation and Energy Conservation Law. |
| Certification | | JATE/TELEC |
| RTC backup time | | Up to about 10 minutes |
| OS at the time of shipment | | Debian GNU/Linux |

*1 : Compatible with SoftBank's 3G communication network

*2: Energy Consumption Efficiency is measured power consumption (Measurement method defined by the Act Concerning the Rational Use of Energy) divided by composite theoretical

performance, as defined by the Act Concerning the Rational Use of Energy.
*SoftBank is domestic carrier in Japan

# 4-8. Open Blocks IoT EX1 main unit specifications

| Model # | | OBSEX1 | OBSEX1G |
|---|---|---|---|
| CPU | Model | Intel® Atom™ processor | |
| | Clock speed | 500MHz (dual core) | |
| Main memory | On-board | 1GB(LPDDR3) | |
| FLASH ROM | | 4GB(eMMC) | |
| Additional storage | | 1 x MMC slot | |
| Wireless interface | | BT 4.0 | |
| | | WLAN(IEEE802.11a/b/g/n) | |
| SIM interface | | MiniSIM for communication (25 mm x 15 mm x 0.76 mm) card slot | |
| Wired interface | USB(HOST) | 1 x USB 2.0 (type-A) | |
| | USB(Console) | 1 x Micro USB(type-B)<br>*Bus power supply available | |
| | Ethernet | 10Base-T/100BASE-TX x 1 | |
| | RS-232C/RS-485 | 1 x RS-232C：RJ45 / 1 x RS-485:Terminal Block (Exclusion) | 1 x RS-232C：RJ45 / 1 x RS-485:Terminal Block |
| Case Size | | 91.9mm(W) x 114.8mm (D) x 25mm(H) (Excluding protrusions) | |
| Weight | | 135g | |
| Power supply | | DC-Jack:<br>4.75 to 5.25VDC<br>When power supplied by USB cable :<br>4.75 to 5.25VDC | DC-Jack:<br>4.75 to 5.25VDC<br>When power supplied by USB cable :<br>4.75 to 5.25VDC<br>When power supplied by XA connecter:<br>7 to 48VDC |
| Power consumption | In an idle mode | 1.8W | |
| | At a high load | 3.3W | |
| MTBF | | 485,265h | 468,231h |
| EMC standard | | - | VCCI Class-B |
| Energy consumption efficiency based | | Classification: H | |

| | | |
|---|---|---|
| on the Energy Conservation Law. [Unit: W/GTOPS] *1 | 0.23 | 0.23 |
| Natural environmental protection | Conforms to RoHS Directive, PFOS regulation and Energy Conservation Law. | |
| Certification | TELEC | |
| RTC backup time | Up to 250 days | 10 years |
| OS at the time of shipment | Debian GNU/Linux | |

*1: Energy Consumption Efficiency is measured power consumption (Measurement method defined by the Act Concerning the Rational Use of Energy) divided by composite theoretical performance, as defined by the Act Concerning the Rational Use of Energy.

# 4-9. Options for OpenBlocks IoT EX1

## 4-9-1. 3G module for NTT docomo

| | | |
|---|---|---|
| Supported frequencies | | GSM/GPRS/EDGE:<br>Quad band 850/900/1800/1900MHz<br>W-CDMA(UMTS/HSPA+):<br>Five band 800/850/900/1900/2100MHz |
| Data communication speed | | Downstream: 7.2Mbps<br>Upstream: 5.7Mbps *Theoretical values |
| Control method | | AT command |
| Certification | | JATE/TELEC |
| Power-supply voltage | | 3.3 to 4.4VDC |
| Power consumption | Idle | 0.01W *Average power |
| | At a high load | 2.6W *Average power |

*NTT docomo is domestic carrier in Japan

## 4-9-2. 3G module for SoftBank

| | |
|---|---|
| Supported frequencies | GSM/GPRS/EDGE:<br>Quad band 850/900/1800/1900MHz<br>W-CDMA(UMTS/HSPA+):<br>Five band 800/850/900/1900/2100MHz |
| Data communication speed | Downstream: 7.2Mbps<br>Upstream: 5.7Mbps *Theoretical values |
| Control method | AT command |

| | | |
|---|---|---|
| Certification | | JATE/TELEC |
| Power-supply voltage | | 3.3 to 4.4VDC |
| Power consumption | Idle | 0.01W　*Average power |
| | At a high load | 2.6W　*Average power |

*SoftBank is domestic carrier in Japan

## 4-9-3. LTE/3G module for SoftBank

| | | |
|---|---|---|
| Supported frequencies | | GSM:<br>850/900/1800/1900MHz<br>W-CDMA:<br>850/900/1900/2100MHz<br>LTE:<br>(1)/(3)/(5)/(7)/(8)/(20) |
| Data communication speed | | Downstream: 150Mbps<br>Upstream: 50Mbps　*Theoretical values |
| Control method | | AT command and Dedicated command |
| Certification | | JATE/TELEC |
| Power consumption | Idle | 0.05W　*Average power |
| | At a high load | 2.5W　*Average power |
| MTBF | | 97,808h at 25℃ |

*1 : (n) is a band

*SoftBank is domestic carrier in Japan

## 4-9-4. LTE module for KDDI

| | | |
|---|---|---|
| Supported frequencies | | RX：860.0MHz to 875.0MHz<br>TX：815.0MHz to 830.0MHz |
| Data communication speed | | Downstream: 75Mbps<br>Upstream: 25Mbps　*Theoretical values |
| Control method | | AT command and Dedicated command |
| Certification | | JATE/TELEC |
| Power consumption | Idle | 0.16W　*Average power |
| | At a high load | 2.4W　*Average power |

*KDDI is domestic carrier in Japan

## 4-9-5. LTE module for NTT docomo

| | |
|---|---|
| Supported frequencies | LTE：2GHz / 800MHz |
| Data communication speed | Downstream: 112.5Mbps |

| | | |
|---|---|---|
| | | Upstream: 37.5Mbps *Theoretical values |
| Control method | | AT command and Dedicated command |
| Certification | | JATE/TELEC |
| Power consumption | Idle | 0.03W *Average power |
| | At a high load | 3.7W *Average power |

*NTT docomo is domestic carrier in Japan

## 4-9-6. LTE module for NTT docomo and KDDI

| | | |
|---|---|---|
| Supported frequencies | | GSM: 900/1800MHz<br>W-CDMA: 800(6)/900(8)/ 2100MHz(1)<br>LTE: 800(18)/800(19)/900(8)/1800(3)/2100(1)/ 2600(41) MHz*1 *2<br>GNSS: GPS/GLONASS |
| Data communication speed | | Downstream: 75Mbps<br>Upstream: 25Mbps *Theoretical values |
| Control method | | AT command and Dedicated command |
| Certification | | JATE[150051003] / TELEC[003-150053] |
| Power consumption | Idle | 0.02W *Average power |
| | At a high load | 2.9W *Average power |
| MTBF | | 500,000h at 25℃ |

*1 : (n) is a band

*2: Blue value is a band not used in Japan

*NTT docomo and KDDI are domestic carrier in Japan

## 4-9-7. BWA module

| | | |
|---|---|---|
| Supported frequencies | | GSM: 900/1800MHz<br>W-CDMA: 800(6)/900(8)/ 2100MHz(1)<br>LTE: 800(18)/800(19)/900(8)/1800(3)/2100(1)/ 2600(41) MHz*1 *2<br>GNSS: GPS/GLONASS |
| Data communication speed | | Downstream: 100Mbps<br>Upstream: 50Mbps *Theoretical values |
| Control method | | AT command and Dedicated command |
| Certification | | JATE[150051003] / TELEC[003-150053] |
| Power consumption | Idle | 0.02W *Average power |

| | | |
|---|---|---|
| | At a high load | 2.9W　*Average power |
| MTBF | | 500,000h at 25℃ |

*1 : (n) is a band

*2: Blue value is a band not used in Japan

## 4-9-8. EnOcean module

| | | |
|---|---|---|
| Frequency | | 928.35MHz |
| Data communication speed | | 125kbps |
| HOST I/F | | UART |
| Certification | | TELEC |
| Power consumption | Idle | 0.13W |
| | At a high load | 0.11W |
| MTBF | | 862,664h at 25℃ |

## 4-9-9. Wi-SUNmodule

| | | |
|---|---|---|
| Frequencies | | 922.5～927.9MHz(28ch) |
| Data communication speed | | 100kbps |
| HOST I/F | | UART |
| Certification | | TELEC |
| Power consumption | Idle | 0.1W |
| | At a high load | 0.15W |
| MTBF | | 559,409h　at 25℃ |

## 4-9-10. Built-in battery

| Item | Specification | Remarks |
|---|---|---|
| HOST I/F | I2C | Charge control and battery module voltage detection |
| Nominal voltage | 4.8V | |
| Rated capacity | 500mAh | |
| Charging current | Rapid charge：150mA<br>Trickle charge：20mA | |
| Charging time | Rapid charge：2h<br>Trickle charge：13h | The backup function can be used after the end of rapid charging |
| Discharge time | Depends on load | Rated capacity÷Quiescent current×0.5 [h] |
| End-of-discharge | 4.0 to 4.4V | |

| | | |
|---|---|---|
| voltage | | |
| Operating temperature and humidity range | 0 to +40℃ /<br>45 to 85% | |
| Storage temperature and humidity range | -20 to +35℃ /<br>45 to 85% | Within 1 year |
| Protective parts | Thermal protector | Built in battery pack |
| Lifetime (number of charge and discharge) | Depending on usage conditions | 500 times or 2 to 3 years |

* It is non factory shipping option.

***** Be sure to read "Before Using Battery Module for OpenBlocks IoT Family" before use.

# 4-10. Open Blocks IoT BX0 main unit specifications

| | | |
|---|---|---|
| Model # | | OBSBX0 |
| CPU | Model | Intel® Atom™ processor |
| | Clock speed | 500MHz (dual core) |
| Main memory | On-board | 1GB(LPDDR3) |
| FLASH ROM | | 4GB(eMMC) |
| Additional storage | | - |
| Wireless interface | | BT 4.0 |
| | | WLAN(IEEE802.11a/b/g/n) |
| Wired interface | | BX1 connecter<br>Supplied Accessory: USB2.0(Bus power/type-A with Ether) |
| Case Size | | 41.6mm(W) x 96mm (D) x 11.3mm(H) (Excluding protrusions) |
| Weight | | 45g |
| Power supply | | ・4.75 to 5.25VDC (USB)<br>・48VDC PoE TypeA(1-2,3-6 ) |
| Power consumption | In an idle mode | 1.9W |
| | At a high load | 2.4W |
| MTBF | | 479,898h |
| EMC standard | | VCCI Class-B |
| Energy consumption efficiency based on the Energy Conservation Law. [Unit: W/GTOPS] *1 | | Classification: H |
| | | 0.24 |
| Natural environmental protection | | Conforms to RoHS Directive, PFOS regulation and Energy Conservation Law. |
| Certification | | JATE/TELEC |
| RTC backup time | | Up to about 16 years |
| OS at the time of shipment | | Debian GNU/Linux |

*1: Energy Consumption Efficiency is measured power consumption (Measurement method defined by the Act Concerning the Rational Use of Energy) divided by composite theoretical performance, as defined by the Act Concerning the Rational Use of Energy.

# 4-11. Open Blocks IoT BX1 main unit specifications

| | | |
|---|---|---|
| Model # | | OBSBX5 |
| CPU | Model | Intel® Atom™ processor |
| | Clock speed | 500MHz (dual core) |
| Main memory | On-board | 1GB(LPDDR3) |
| FLASH ROM | | 4GB(eMMC) |
| Additional storage | | - |
| Wireless interface | | LTE(with W-CDMA)*1 |
| | | BT 4.0 |
| | | WLAN(IEEE802.11a/b/g/n) |
| SIM interface | | MiniSIM for communication (25 mm x 15 mm x 0.76 mm) card slot |
| Wired interface | | BX1 connecter<br>Supplied Accessory:USB2.0(Bus power/type-A) |
| Case Size | | 41.6mm(W) x 96mm (D) x 11.3mm(H) (Excluding protrusions) |
| Weight | | 45g |
| Power supply | | DC 4.75 to 48V<br>* When power supplied by USB cable :<br>DC4.75 to 5.25V |
| Power consumption | In an idle mode | 1.4W |
| | At a high load | 4.6W |
| MTBF | | 273,475h |
| EMC standard | | VCCI Class-B |
| Energy consumption efficiency based on the Energy Conservation Law. [Unit: W/GTOPS] *2 | | Classification: H |
| | | 0.18 |
| Natural environmental protection | | Conforms to RoHS Directive, PFOS regulation and Energy Conservation Law. |
| Certification | | JATE/TELEC |
| RTC backup time | | Up to about 10 minutes |
| OS at the time of shipment | | Debian GNU/Linux |

*1:Compatible with LTE communication network of NTT docomo and KDDI, and BWA communication network.

*2: Energy Consumption Efficiency is measured power consumption (Measurement method defined by the Act Concerning the Rational Use of Energy) divided by composite theoretical performance, as defined by the Act Concerning the Rational Use of Energy.
*NTT docomo and KDDI are domestic carrier in Japan

# Chapter 5 Cautions and supplementary information

## 5-1. Countermeasures against delays due to script processing

When writes to storage are made using init.sh and post-init.sh scripts in emergency boot mode, a next command process may be implemented before writing is complete. For this reason, expressly execute sleep and sync commands.

## 5-2. List of ports used

The OpenBlocks IoT Family with WEB UI uses or may use the following ports:

| Service type | Port # | Supplementary information |
|---|---|---|
| SSH | 22 | Port number can be changed |
| DNS | 53 | |
| DHCP | 67 | |
| NetBIOS | 137 | When Samba is installed (UDP) |
| NetBIOS | 138 | |
| NetBIOS | 139 | When Samba is installed |
| Samba | 445 | |
| Modbus | 502 | When IoT data control is installed |
| WEB UI (HTTP access) | 880 | |
| Node-RED | 1880 | When Node-RED is installed (Port # can be changed) |
| ECHONET(HVSMC) | 3610 | When IoT data control is installed |
| Shell in a box (WEB SSH) | 4200 | |
| WEB UI (HTTPS access) | 4430 | |
| SSH | 50022 | When LTE/3G module for SoftBank is installed. WAN side only. |
| WEB UI(HTTP access) | 50880 | |
| WEB UI(HTTPS access) | 54430 | |
| Node-RED | 51880 | |

*SoftBank is domestic carrier in Japan

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