



**EM Series**  
**Panel Computer**  
**With Embedded Linux OS**

**Software Development Manual**

DMC Co., Ltd

<https://www.dush.co.jp/english/>

# Introduction

This document describes the development process of Linux applications for the EM Series of product, as well as application specifications.

This document describes working with the following models:

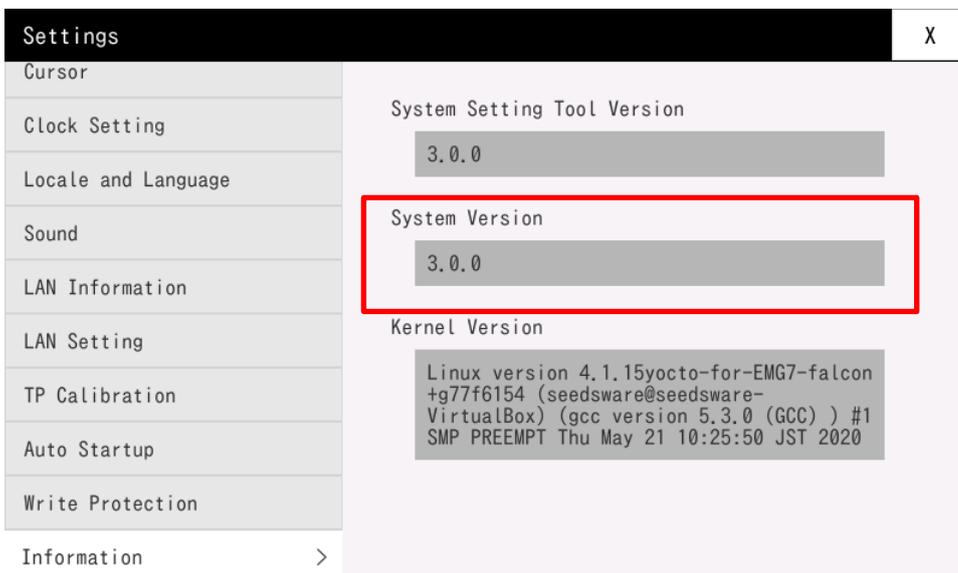
Model	Abbreviated model names	
EMG7-W207A8-00**-*07	EMG7-A8	EMG7-7W
EMG7-312A8-00**-*07		EMG7-12
EM8-W104A7-00**-*07	EM(G)8-A7	EM(G)8-4
EMG8-W104A7-00**-*07		
EM8-205A7-00**-*07		EM(G)8-5
EMG8-205A7-00**-*07		
EM8-W207A7-00**-*07		EM(G)8-7W
EMG8-W207A7-00**-*07		
EM8-W310A7-00**-*07		EM(G)8-10W
EMG8-W310A7-00**-*07		

The following system version products are targeted.

Target system version	3.0.0 ~
-----------------------	---------

Check the system version of the EM series from the system setting tool.

For the system setting tool, refer to the attached "EM Series Tool Manual".



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# 1 About the Development Environment

The method of creating the Linux application development environment of this machine (hereinafter referred to as “EM”) is described.

## 1.1 Configuring the Development Environment

### 1.1.1 Requirements

#### Equipment

Items	Description
PC	You need an environment where you can install SDK for Linux.
LAN cable	Used for data transmission. Cross cable or a HUB and straight cable

#### Data

Items	Description
Linux SDK	Linux cross toolchain Rootfs image
USB device driver	Driver to use the USB device of the EM series as USB-Ether

#### Applications

Items	Description
Terminal emulator	Used for console connections. Supports SSH connections. *This document uses Tera Term4.84 in its examples.
FTP client	Used for data transmission. Supports SFTP connections. *This document uses FileZilla 3.9.0.2 in its examples.

## 1.1.2 Install Linux SDK

Install the SDK in your Linux environment.

Load the following files (SDK) from the DVD-ROM (Development Environment Kit) to the virtual machine.

Files:

For EMG7-A8

- poky-glibc-x86\_64-meta-toolchain-armv7a-neon-toolchain-2.1.2.sh
- poky-glibc-x86\_64-meta-toolchain-qt5-armv7a-neon-toolchain-2.1.2.sh
- poky-glibc-x86\_64-em-image-mx53-armv7a-neon-toolchain-2.1.2.sh

For EM(G)8-A7

- poky-glibc-x86\_64-meta-toolchain-cortexa7hf-neon-toolchain-2.1.2.sh
- poky-glibc-x86\_64-meta-toolchain-qt5-cortexa7hf-neon-toolchain-2.1.2.sh
- poky-glibc-x86\_64-em-image-mx6ul-cortexa7hf-neon-toolchain-2.1.2.sh

Install the Linux SDK. Launch the installation operation from the terminal.

```
$ cd <location of copied files in step 1>
--- Change File Attributes ---
$ chmod a+x poky-glibc-x86_64-meta-toolchain-*****.sh
$ chmod a+x poky-glibc-x86_64-meta-toolchain-qt5-*****.sh
$ chmod a+x poky-glibc-x86_64-em-image-*****.sh
--- Install Toolchain ---
$ ./poky-glibc-x86_64-meta-toolchain-*****.sh
Enter the target directory for SDK (default: /opt/poky/2.1.2): /opt/poky/2.1.2/ "Return"
You are about to install the SDK to "/opt/poky/2.1.2/em*". Proceed[Y/n]?y ← "y"
[sudo] password for ubuntu: ← "Login user password"
Extracting SDK...done
Setting it up...done
SDK has been successfully set up and is ready to be used.
--- Installing QT5 SDK ---
$ ./ poky-glibc-x86_64-meta-toolchain-qt5-*****.sh
Enter the target directory for SDK (default: /opt/poky/2.1.2): /opt/poky/2.1.2/ "Return"
The directory "/opt/poky/2.1.2" already contains a SDK for this architecture.
If you continue, existing files will be overwritten! Proceed[y/N]?y ← "y"
[sudo] password for ubuntu: ← "Login user password (display depends on circumstances)"
Extracting SDK...done
Setting it up...done
SDK has been successfully set up and is ready to be used.
--- Installing QT5 rootfs ---
$ ./poky-glibc-x86_64-em-image-*****.sh
Enter the target directory for SDK (default: /opt/poky/2.1.2): /opt/poky/2.1.2/ "Return"
```

## 1.2 Connection between PC and EM series

Configure the settings for connecting the PC and EM series with a network.

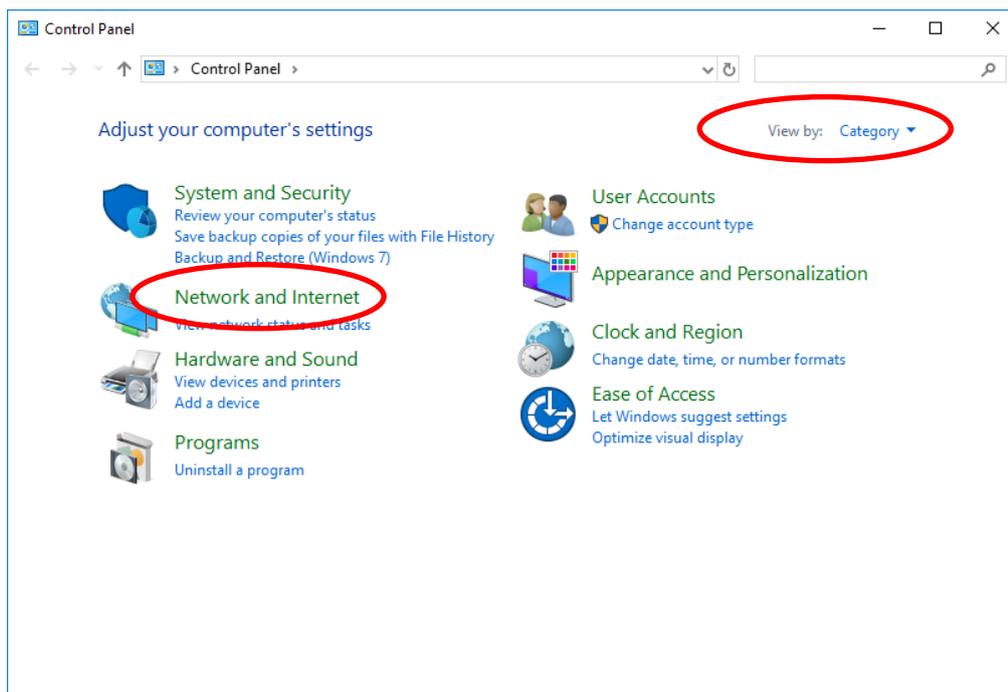
You can connect using the LAN port or USB device port.

### 1.2.1 Network settings on the LAN port

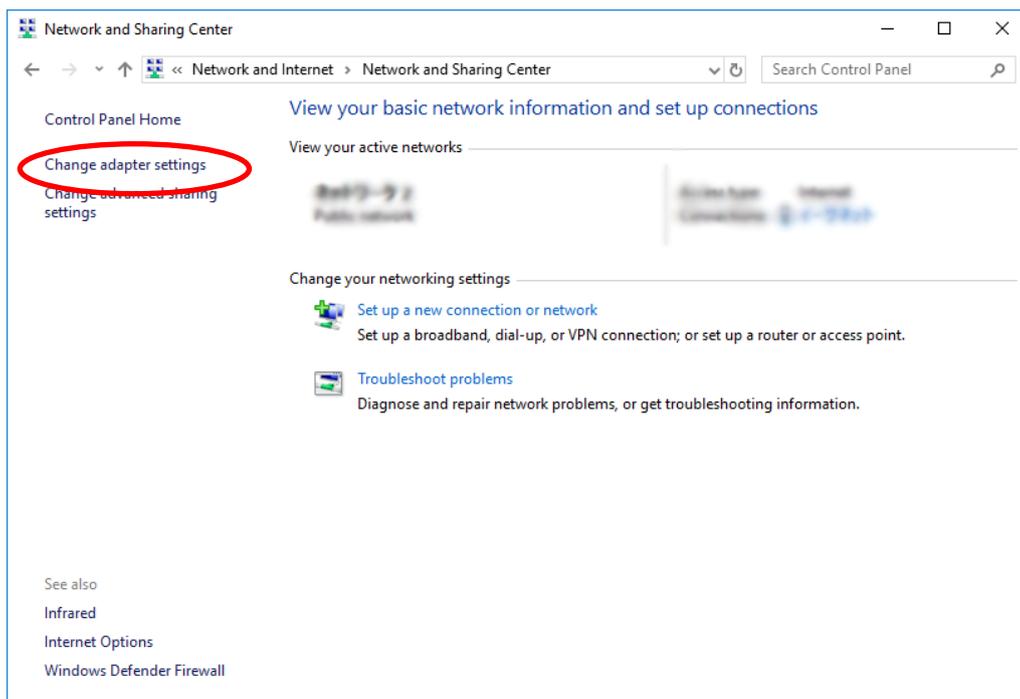
From Windows, change the network settings so that Windows can connect with EM.

1) Open the Control Panel and click [Network and Internet].

\* If your screen looks different, in the top-right corner set [View by] to [Category].

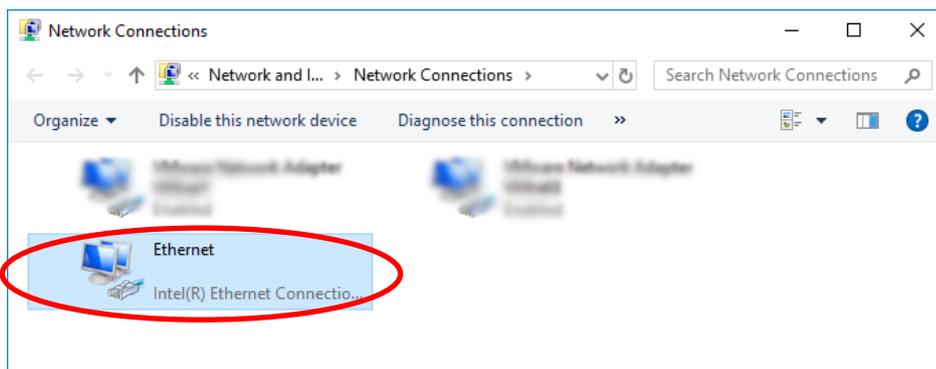


2) Click [Change adapter settings].

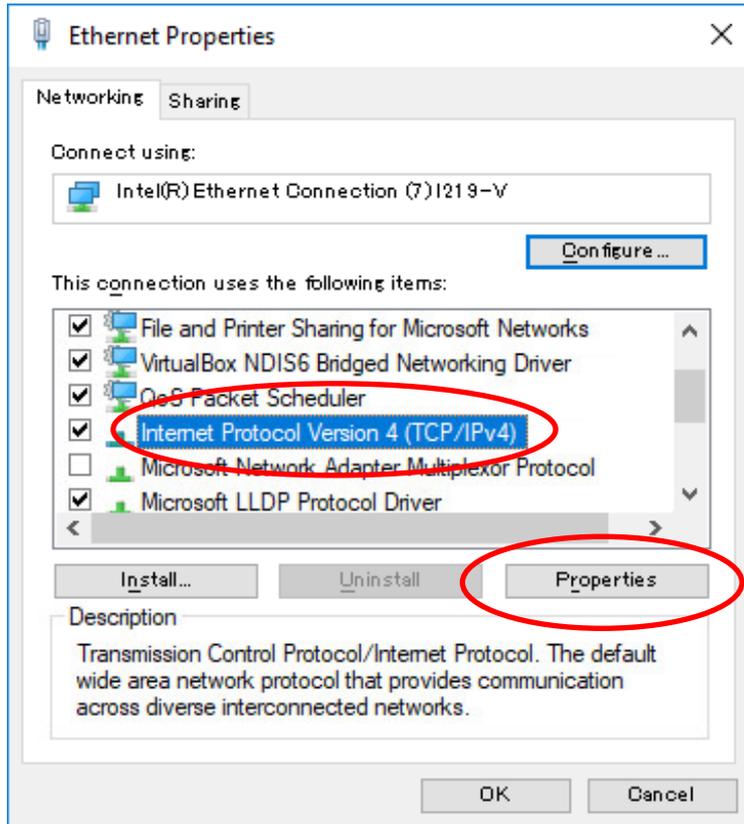


Right-click [Ethernet] and select [Properties].

\* Depending on your environment, you may see a different name such as Local Area Connection. Select an adapter for the wired LAN port.



Select [Internet Protocol Version 4 (TCP/IPv4)], then click [Properties].



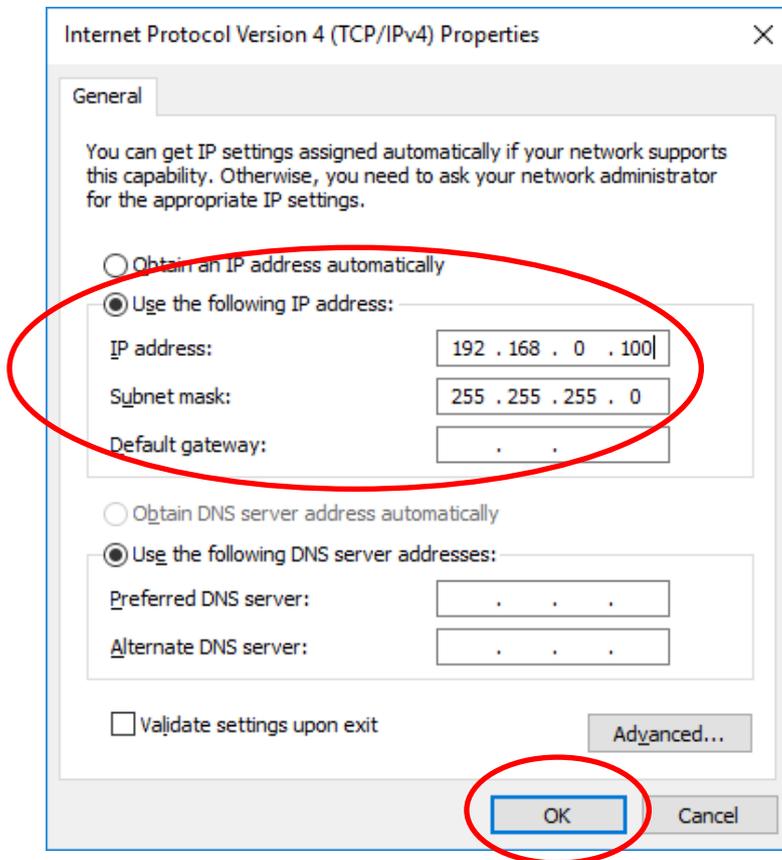
Set the IP address, sub-net mask, and default gateway, and then click OK.

This example uses the following settings:

IP address	192.168.0.100
Sub-net mask	255.255.255.0
Default gateway	not configured

\* Change the settings, such as IP, to match your environment.

\* "192.168.10.\*" cannot be used because it is used for USB-Ether (usb0).



The Windows network settings on the host PC are now updated as defined.

## 1.2.2 Network settings on USB device port

Since the USB device of the EM series main unit is used as USB-Ether, it is necessary to install the USB device driver and set the network on the PC.

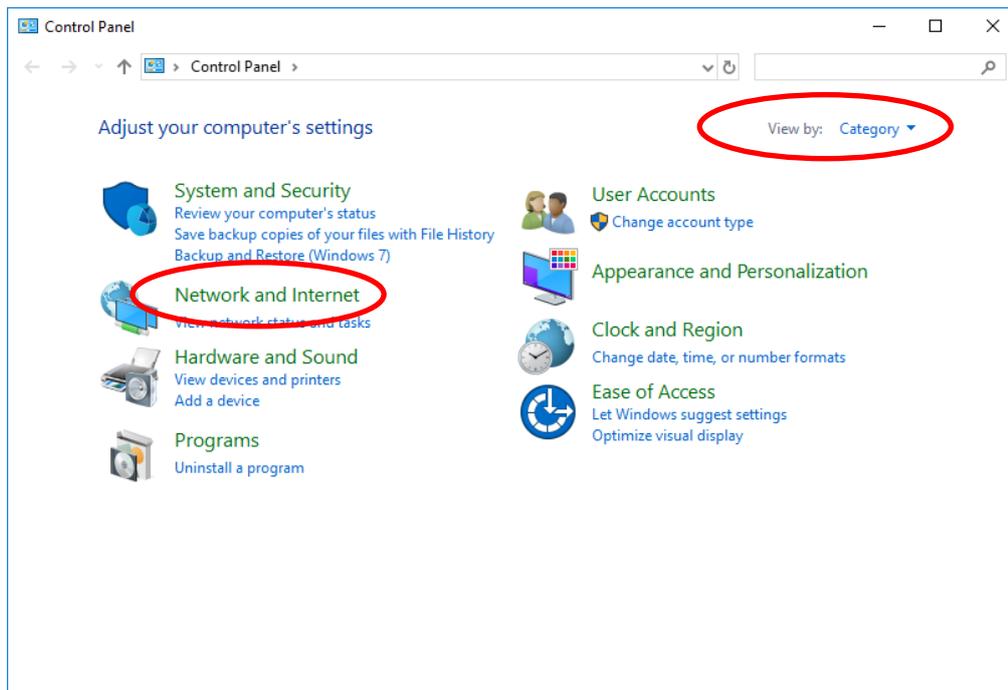
With this setting, it is possible to connect the EM series main unit and the PC via LAN using the USB device port.

- 1) Install the USB device driver on your PC.

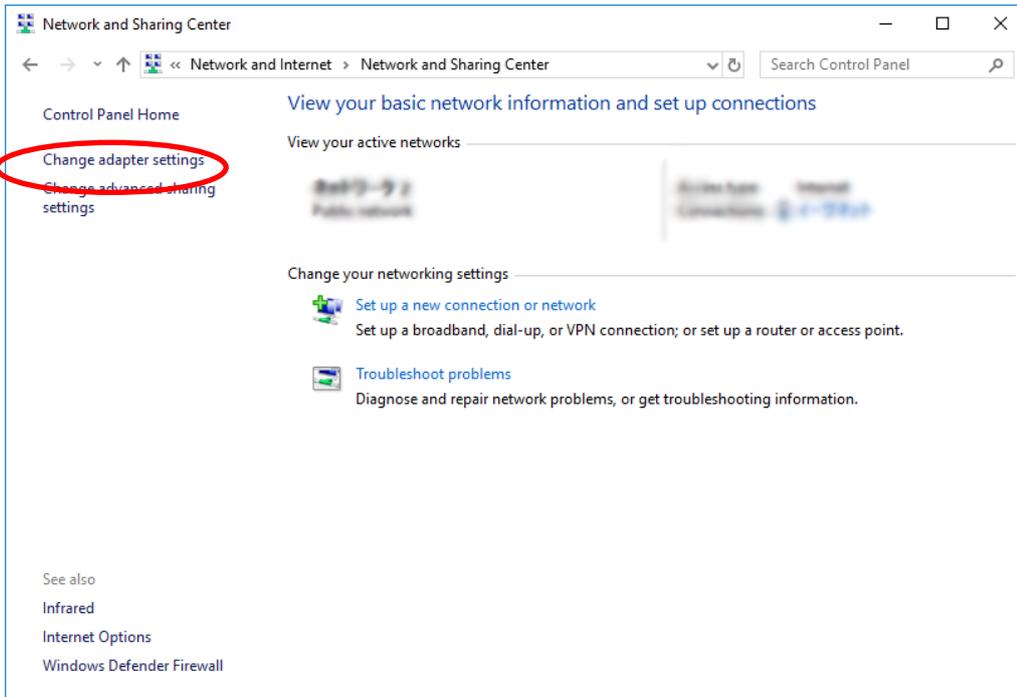
Please execute "Install" from the right-click menu of "em\_usbd.inf" in the "software"->"driver"->"em" folder in the sample kit disk.

- 2) Open the Control Panel and click [Network and Internet].

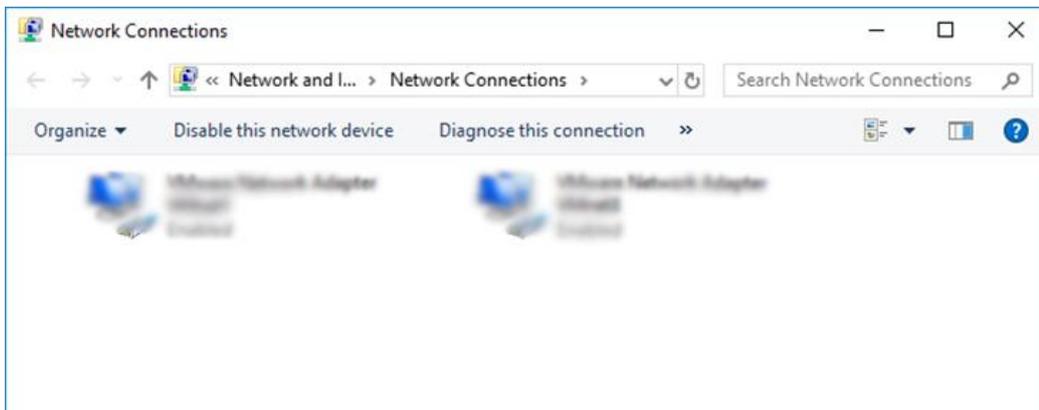
\* If your screen looks different, in the top-right corner set [View by] to [Category].



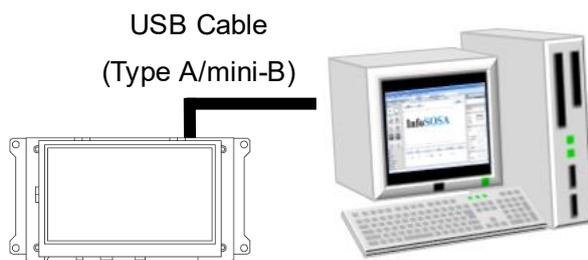
3) Click [Change adapter settings].



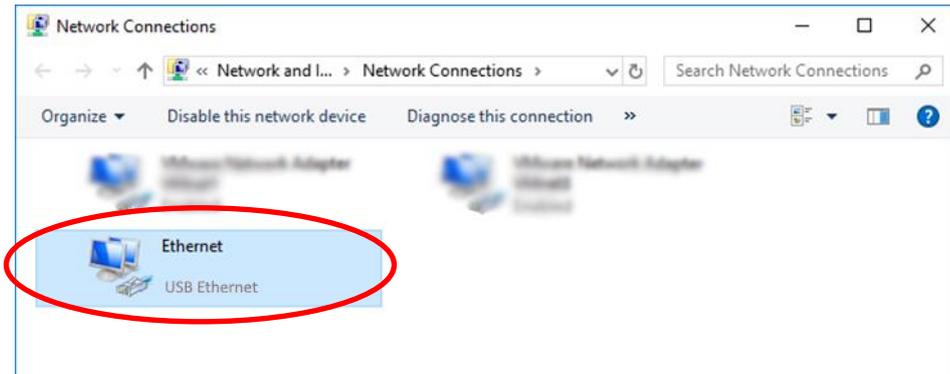
4) The [Change adapter settings] window opens.



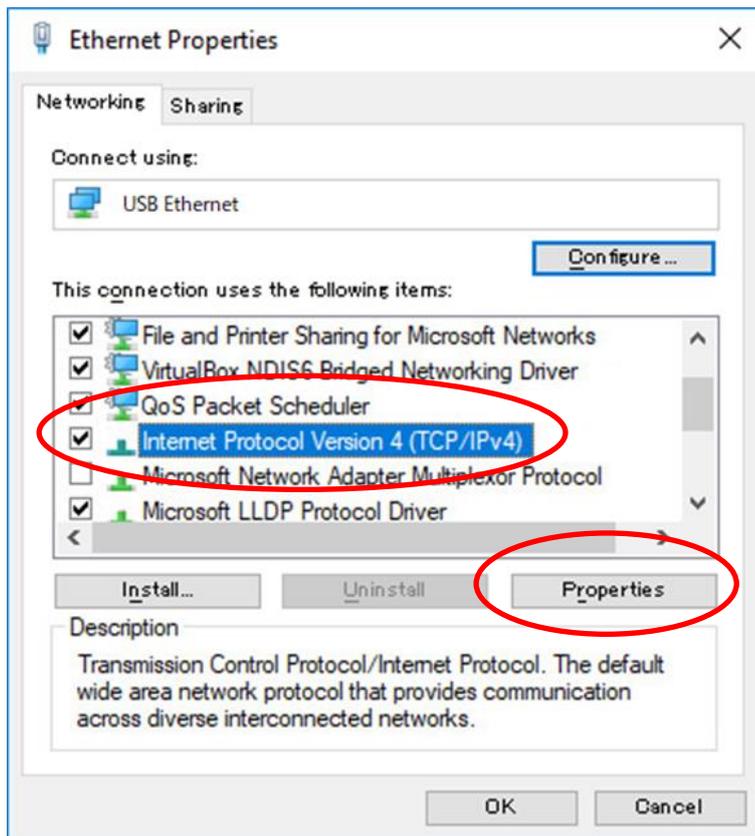
5) While the EM Series unit is on, connect to the PC with a USB cable (Type A/mini-B).



6) Right-click the added adapter and click "Properties".

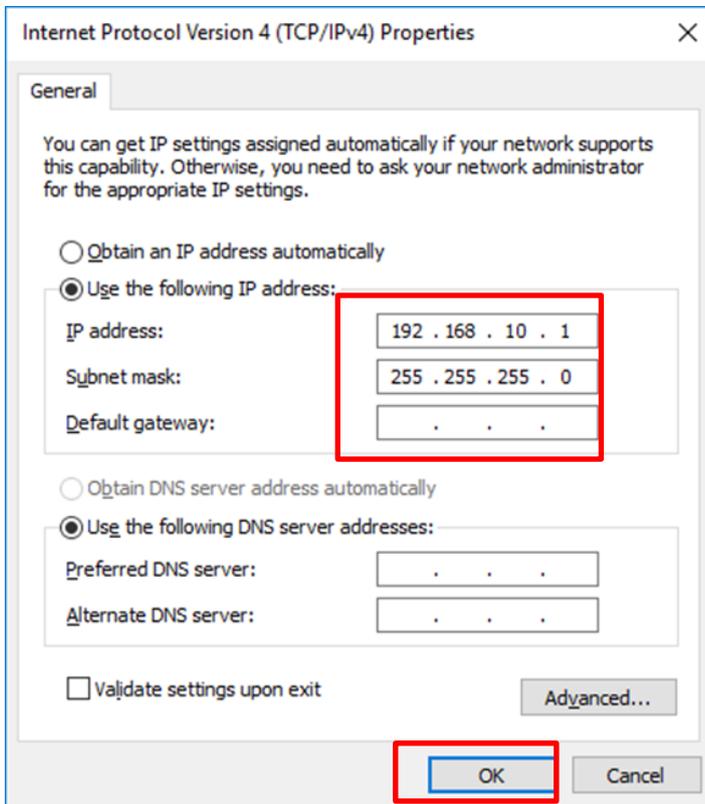


7) Select [Internet Protocol Version 4 (TCP/IPv4)], then click [Properties].



8) Set the IP address, subnet mask, and default gateway to the values below and click the OK button..

IP address	192.168.10.1
Sub-net mask	255.255.255.0
Default gateway	not configured



The Windows network settings on the host PC are now updated as defined.

## 1.2.3 How to connect the console

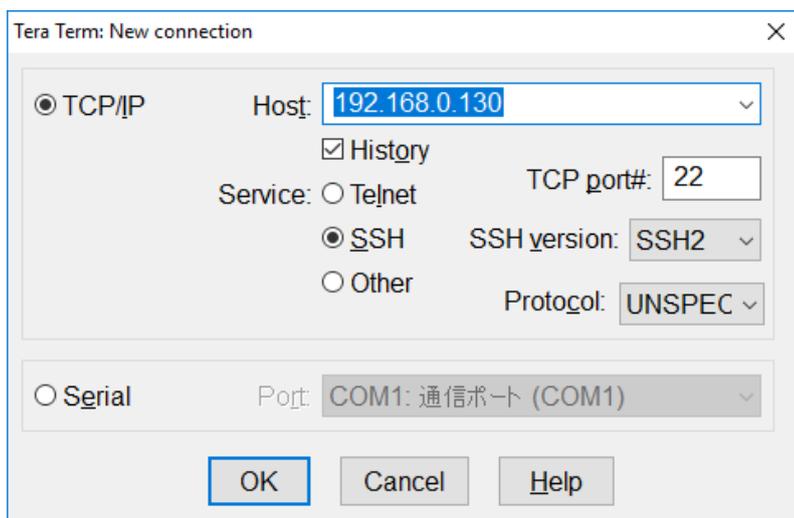
You can use a terminal emulator that has the SSH protocol to connect to EM.

In this example, we use Tera Term4.84.

- 1) Start the terminal emulator, and configure the connection settings.

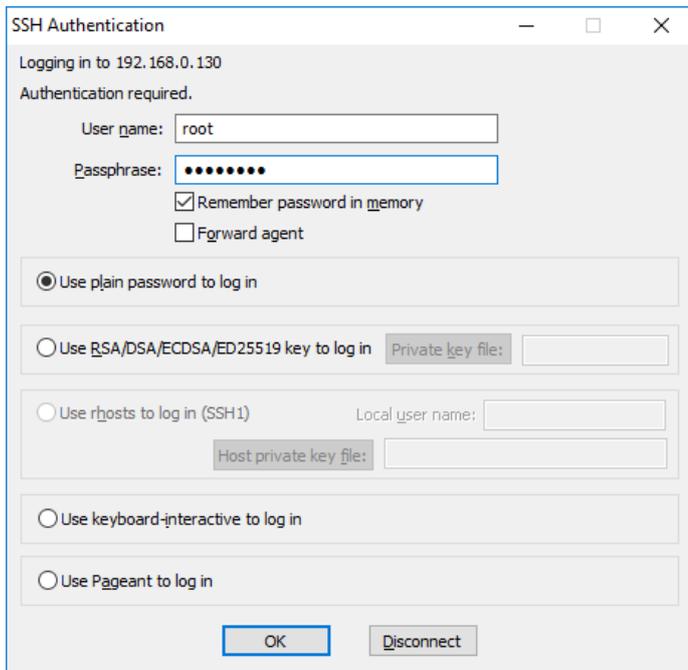
Set the following:

IP address	LAN cable : 192.168.0.130 USB cable : 192.168.10.130 * If the EM IP address has been updated, change this setting to match.
Port	22



Log in as the following user:

User that can log in	Same as user account * See "1.4 EM User Account Settings"
----------------------	--



SSH Authentication

Logging in to 192.168.0.130

Authentication required.

User name:

Passphrase:

Remember password in memory

Forward agent

Use plain password to log in

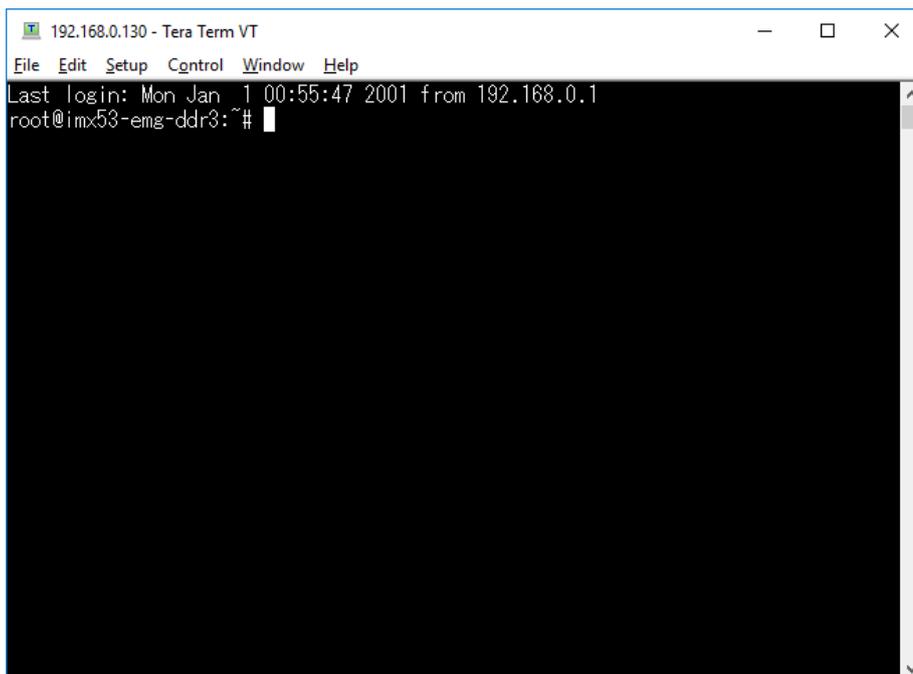
Use RSA/DSA/ECDSA/ED25519 key to log in Private key file:

Use rhosts to log in (SSH1) Local user name:   
Host private key file:

Use keyboard-interactive to log in

Use Pageant to log in

A connection is established.



## 1.2.4 File transfer method (FTP)

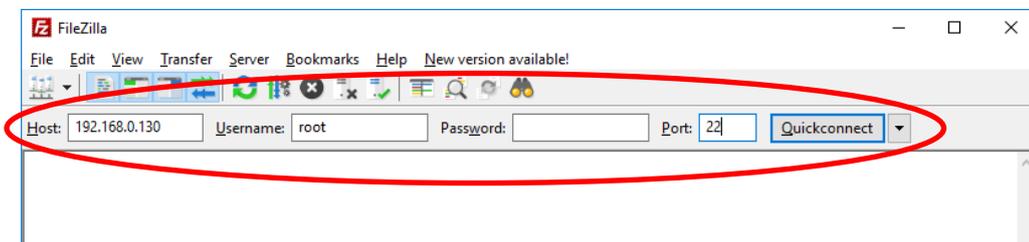
Transfer to EM with FTP client.

- 1) Start a FTP client that can use SFTP connections, and configure the connection settings.

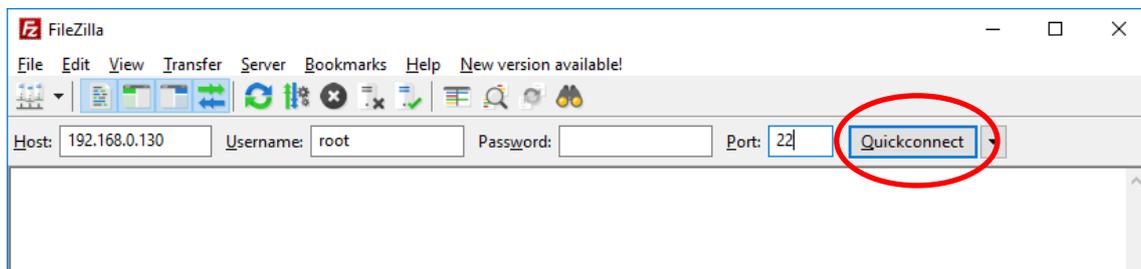
FileZilla 3.9.0.2. is used in this example.

Set the following:

Protocol	SFTP
IP address	LAN cable : 192.168.0.130 USB cable : 192.168.10.130 * If the IP address has changed, change this setting to match.
Port	22
Log In	Same as user account * See "1.4 EM User Account Settings"



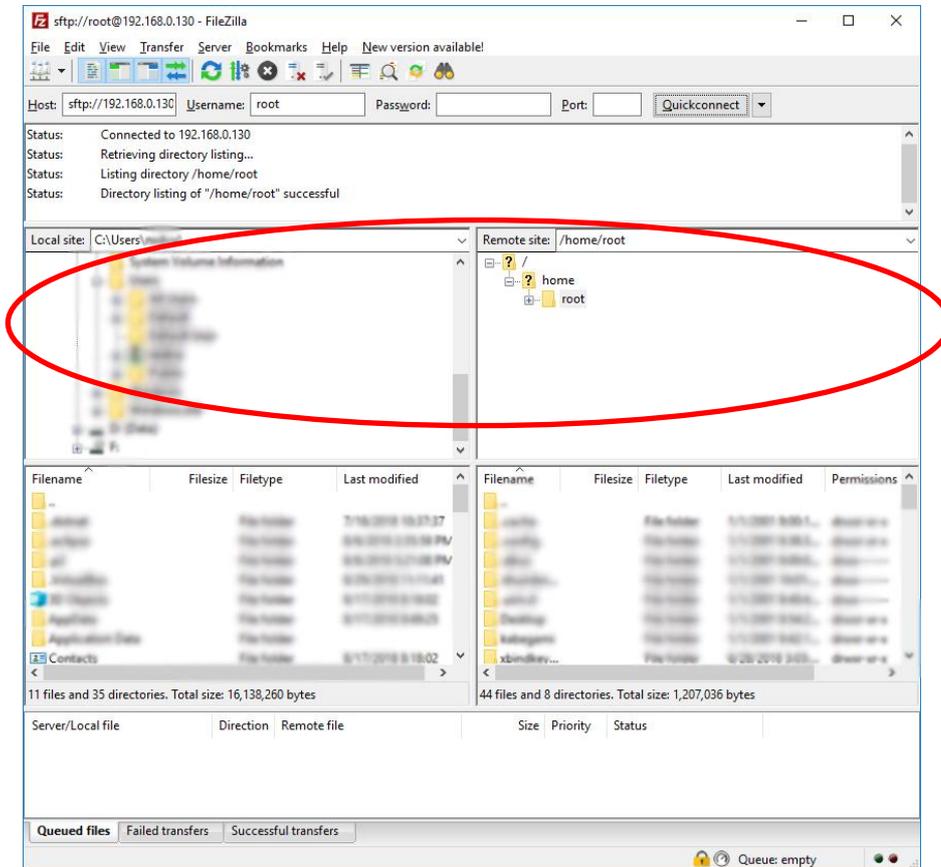
Click [Quickconnect].



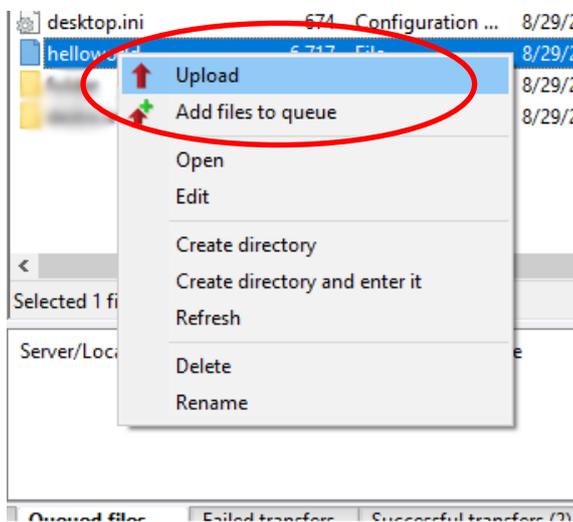
Set the local and remote sites.

This example uses the following settings:

Local site	Desktop
Remote site	/mnt/user/



Right-click the executable file, and from the shortcut menu click [Upload].



The target file has been copied to /mnt/user/.

## 1.2.5 File transfer method (Samba)

1) Access the following address with Explorer etc.

User folder1	LAN cable : \\192.168.0.130\em\user USB cable : \\192.168.10.130\em\user * If the IP address has changed, change this setting to match.
User folder2*	LAN cable : \\192.168.0.130\em\user2 USB cable : \\192.168.10.130\em\user2 * If the IP address has changed, change this setting to match.

\*User folder 2 may not be available depending on the product.

2) Please log in as the following user.

Log In	Same as user account * See "1.4 EM User Account Settings"
--------	--

With the above operation, the user folder in EM can be accessed.

Copy the file with Explorer etc.

## 1.3 Specifications of Development Environment

---

### Toolchain

---

Model	EMG7-A8	EM(G)8-A7
Toolchain	poky-glibc-x86_64-meta-toolchain-armv7a-neon-toolchain-2.1.2.sh	poky-glibc-x86_64-meta-toolchain-cortexa7hf-neon-toolchain-2.1.2.sh
	poky-glibc-x86_64-meta-toolchain-qt5-armv7a-neon-toolchain-2.1.2.sh	poky-glibc-x86_64-meta-toolchain-qt5-cortexa7hf-neon-toolchain-2.1.2.sh
	poky-glibc-x86_64-em-image-mx53-armv7a-neon-toolchain-2.1.2.sh	poky-glibc-x86_64-em-image-mx6ul-cortexa7hf-neon-toolchain-2.1.2.sh
Path	/opt/poky/2.1.2/	

## 1.4 EM User Account Settings

---

User	User ID	Password
root	root	not configured

On EM, by default the password is not configured.

If you are using Qt and performing either transfer or remote debug, from the EM console use the following command to set up a password.

For instructions on how to connect to the console, see "1.2 Connection between PC and EM series".

```
# passwd
Change the root password.
Enter the new password (minimum 5 characters)
Use uppercase, lowercase, and numbers.
New Password: (Any password)
Enter New Password Again: (Any password)
passwd: The password has been updated.
```

## 2 Disabling Write Protection

To prevent system damage due to malfunctions and unexpected problems on EM, some folders are set as read-only (RO).

To write to a read-only folder, turn off the write protection temporarily.



### Note

**If you turn off write protection to write to a read-only folder, turn on write protection again as soon as writing is complete. If you leave write protection off, the system could get damaged by malfunctions or unexpected problems, resulting in abnormal operation.**

### 2.1 Setting the write-protected area in the user area

The user area (/mnt/user/, /mnt/user2/) can also be included in the write protection range.

#### 2.1.1 Connecting the console

\*For the connection method, refer to "1.2 Connection between PC and EM series".

#### 2.1.2 Include the user area in the write-protected area

Operate the EM console.

To include the user area in the write-protected area, execute the following command.

User area 1 (mnt/user/)

```
# set_mode_of_user_area1 1
```

User area 2 (mnt/user2/)

```
# set_mode_of_user_area2 1
```

## 2.1.3 Do not include the user area in the write-protected area

Operate the EM console.

If the user area is not included in the write protection range, execute the following command.

User area 1 (mnt/user/)

```
# set_mode_of_user_area1 0
```

User area 2 (mnt/user2/)

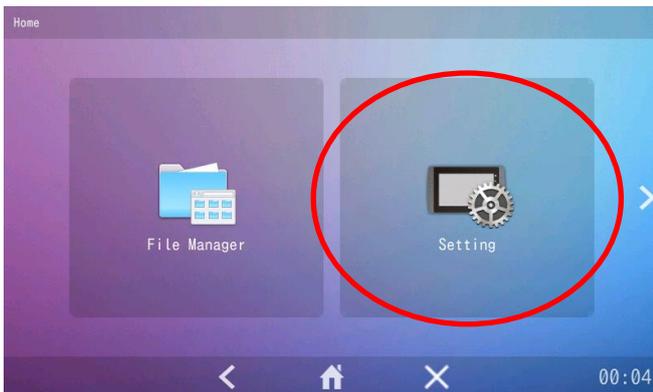
```
# set_mode_of_user_area2 0
```

## 2.2 Canceling temporary protection with System Setting Tool

### 2.2.1 Starting the System Setting Tool

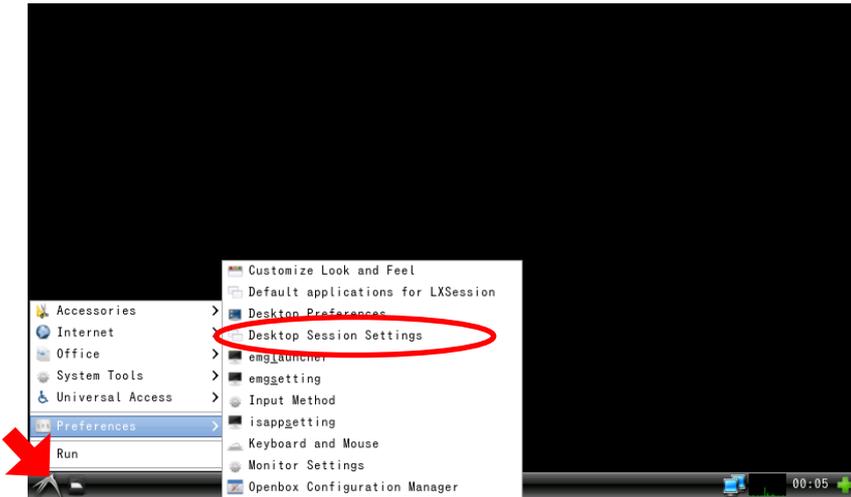
Method 1

Start the tool by opening the [EMG Launcher] application and clicking [Setting].



## Method 2

Start the tool from [Start] menu > [Preferences] > [emgsetting].



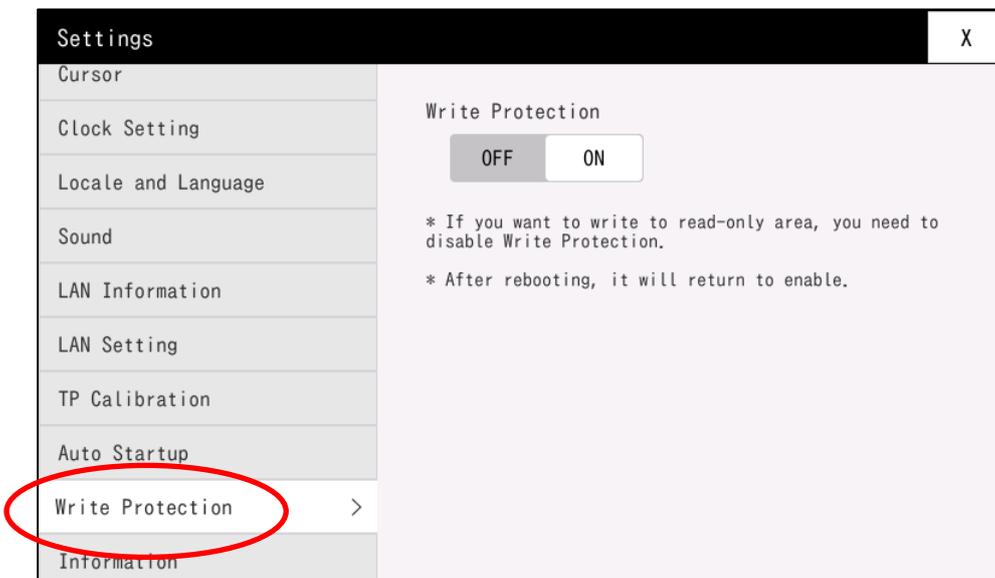
## Method 3

Start the tool by running the following program:

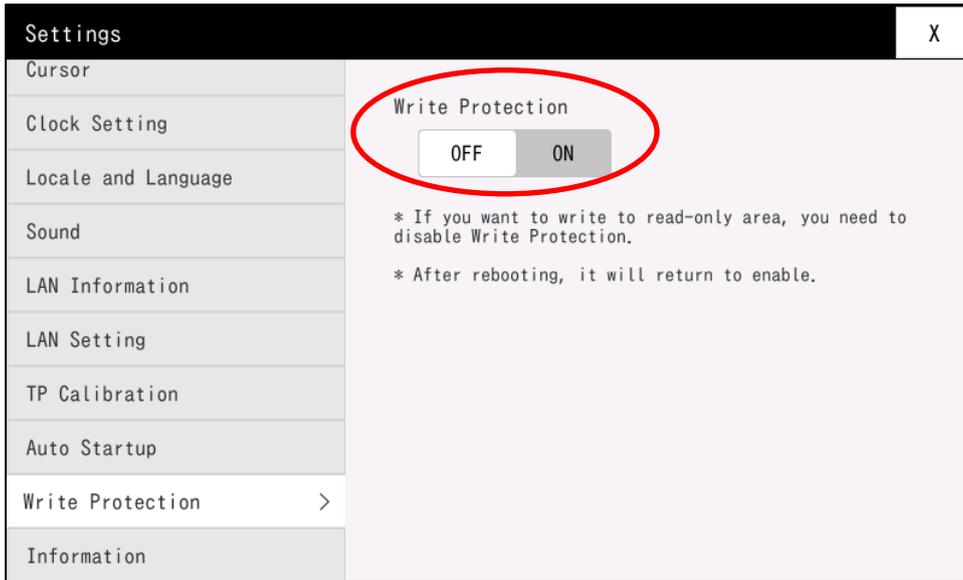
```
/usr/bin/emg_setting
```

## 2.2.2 Disabling Write Protection

1) From the menu, select [Write Protection].



Select OFF to disable write protection.

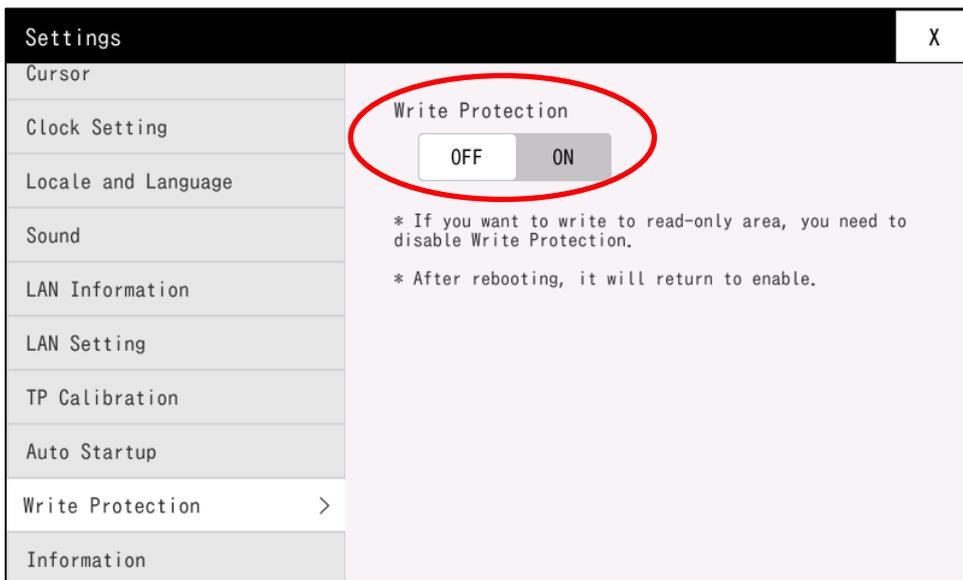


\*If the user area is set as write-protected, the user's write-protection will also be disabled.

\* Write protection is turned on again when you restart the system.

## 2.2.3 Enabling Write Protection

Touch [Write Protection] again to turn write protection on.



## 2.3 Set Up Using Commands

---

### 2.3.1 Connecting From Console

\* For instructions on how to connect from the console, see "1.2 Connection between PC and EM series".

### 2.3.2 Disabling Write Protection

Run the EM console.

Execute the following command to disable write protection.

```
# wprotect_off
```

\*If the user area is set as write-protected, the user's write-protection will also be disabled.

\* Write protection is turned on again when you restart the system.

### 2.3.3 Enabling Write Protection

Run the EM console.

Execute the following commands to enable write protection.

```
# wprotect_on
```

\*If the user area is set as write-protected, the user's write-protection will also be enable.

# 3 Application Development

This chapter describes the steps to develop an application that displays "Hello, world!" on the EM console.

## 3.1 Create Source Files

---

Create a source file on the virtual machine. Launch the virtual machine, see "1 About the Development Environment"

- 1) Start up a text editor to write the source code. Enter the following.

```
#include <iostream>

int main()
{
    std::cout << "Hello, world!" << std::endl;
}
```

- 2) Save the code as shown below.

Directory	/home/em/
File Name	helloworld.cpp

## 3.2 Build

---

Build the source files. Run on the virtual machine.

1) start the [Terminal].

2) Enter commands as shown below.

Move to the source file directory

```
$ cd /home/em/
```

Set up build environment

\* Set variables such as the PATH. You must perform this once every time you start the terminal.

For EMG7-A8

```
$ source /opt/poky/2.1.2/EM-A8/environment-setup-armv7a-neon-poky-linux-gnueabi
```

For EM(G)8-A7

```
$ source /opt/poky/2.1.2/EM-A7/environment-setup-cortexa7hf-neon-poky-linux-gnueabi
```

Build helloworld.cpp:

```
$ $CXX -o helloworld helloworld.cpp
```

The following executable file is generated.

Executable file	helloworld
-----------------	------------

[Note]

By default, an executable file with debug symbols is generated. If you do not need debug symbols, change the setup script as follows.

\* Executable files with debug symbols will be larger than usual.

#### Setup script

For EMG7-A8

```
/opt/poky/2.1.2/EM-A8/environment-setup-armv7a-neon-poky-linux-gnueabi
```

For EM(G)8-A7

```
/opt/poky/2.1.2/EM-A7/environment-setup-cortexa7hf-neon-poky-linux-gnueabi
```

With debug symbol

```
export CFLAGS=" -O2 -pipe -g -feliminate-unused-debug-types "  
export CXXFLAGS=" -O2 -pipe -g -feliminate-unused-debug-types "
```

No debug symbol

```
export CFLAGS=" -O2 -pipe -feliminate-unused-debug-types "  
export CXXFLAGS=" -O2 -pipe -feliminate-unused-debug-types "
```

## 3.3 Transfer

---

### 3.3.1 Connecting the Console

\* For instructions on how to connect from the console, see "1.2 Connection between PC and EM series".

### 3.3.2 Transferring the Executable file

Transfer the generated executable file to EM.

Perform the following steps with the console connected.

#### Step 1. Configure network settings

\* For instructions on how to connect from the console, see "1.2 Connection between PC and EM series".

#### Step 2. Copying the File From Virtual Machine To Windows

Using a shared folder or other method, copy the generated executable file to Windows.

In this example the file is copied to the desktop.

#### Step 3. Transfer the executable file to EM

\* For instructions on how to connect from the console, see "1.2 Connection between PC and EM series".

1) Start a FTP client that can use SFTP connections, and configure the connection settings.

FileZilla 3.9.0.2. is used in this example.

Move to the transferred directory.

```
# cd /mnt/user/
```

Display the file information for the directory.

```
# ls
```

The executable file (helloworld) has been copied to /home/root/.

## 3.4 Run

---

Run the executable file that was transferred.

Use the EM console.

- 1) Navigate to the directory where the executable file was transferred.

```
# cd /mnt/user/
```

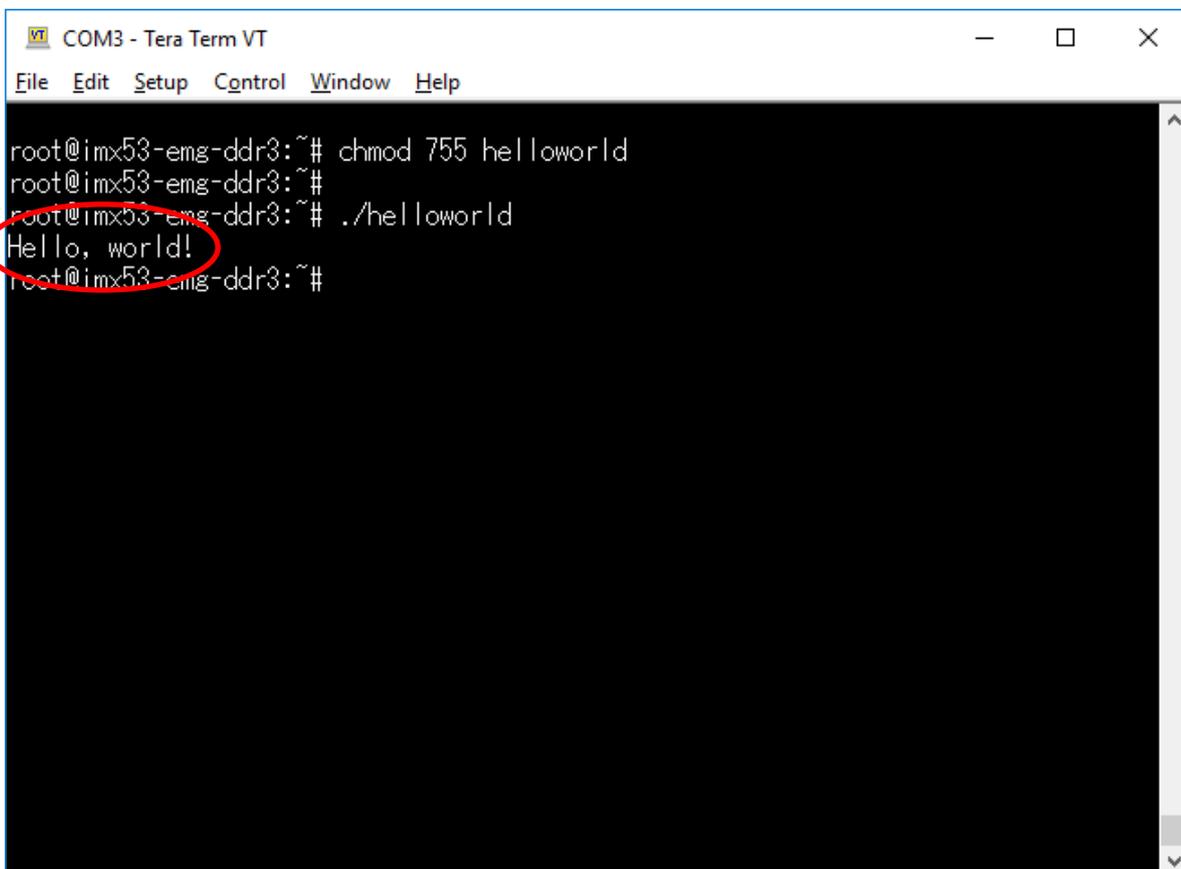
Set access rights for the executable file.

```
# chmod 755 helloworld
```

Enter the following command to execute.

```
# ./helloworld
```

The console displays " Hello, world!".



The screenshot shows a terminal window titled "COM3 - Tera Term VT". The terminal output is as follows:

```
root@imx53-emg-ddr3:~# chmod 755 helloworld
root@imx53-emg-ddr3:~#
root@imx53-emg-ddr3:~# ./helloworld
Hello, world!
root@imx53-emg-ddr3:~#
```

The text "Hello, world!" is circled in red in the original image.

# 4 Changing the Startup Screen

This chapter describes how to change the startup screen on the EM.

## 4.1 Create Source Files

---

Please prepare the image file in the following format.

Format	Uncompressed 24-bit bitmap
Size	Same as the actual resolution

## 4.2 Transfer

---

### 4.2.1 Connecting the Console

\* For instructions on how to connect from the console, see "1.2 Connection between PC and EM series".

### 4.2.2 Transferring image files

Transfer the image file to EM.

\* For instructions on how to connect from the console, see "1.2 Connection between PC and EM series".

After the transfer is completed, use the following command to write the image file to the boot screen area (/dev/mtd6) of the actual device. \*Here, /mnt/user/abc.bmp is the path to the image file.

```
# psplash -w /mnt/user/abc.bmp /dev/mtd6
```

The startup screen is changed by the above procedure.

After writing to the dedicated area, the transferred image file can be deleted.

# 5 Auto Startup Setting

This chapter describes how to change the applications that launch automatically when the physical machine starts up.

By default, the task bar, desktop, and EMG Launcher launch at startup. To disable this setting, change the startup script.

## 5.1 Specifications

EM executes the following script at startup.

Items	Specification
Startup Script	/home/root/.config/lxsession/LXDE/autostart

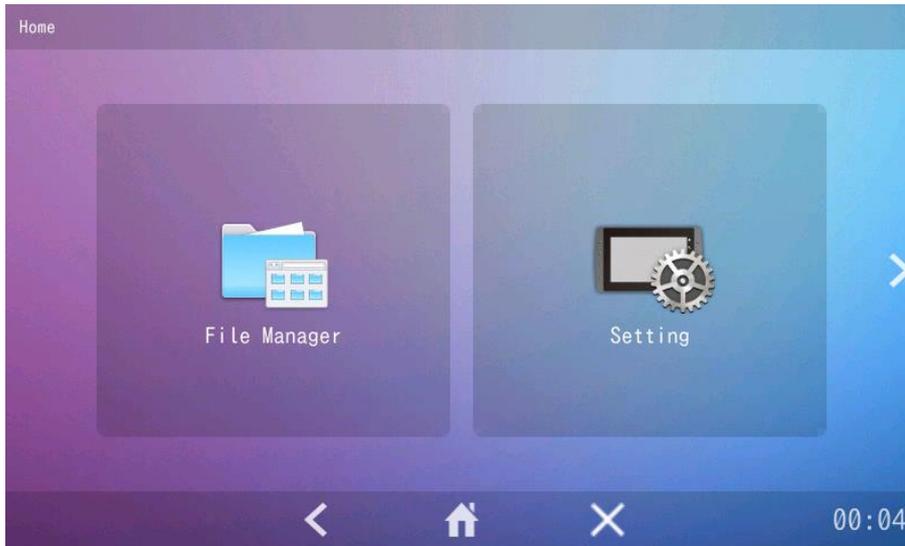
By default, the following processes are registered.

Process	Contents
@lxpanel --profile LXDE	Task bar
@pcmanfm --desktop --profile LXDE	Desktop
/usr/bin/emsystem/autostart	EM Auto Start



With EM Auto Start, the items set in "Automatic startup" of the System Setting Tool are executed. The EMG launcher is started by default.

### EMG Launcher



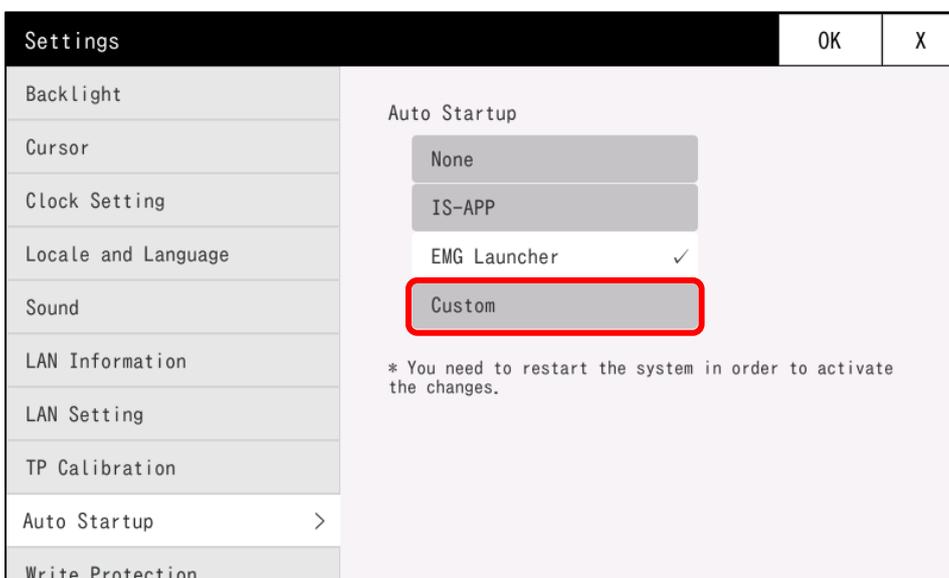
## 5.2 How to run an arbitrary program

Select "Custom" in "Auto Start" of System Setting Tool.

If you select Custom, `/mnt/user/startup.sh` will be executed.

Edit `/mnt/user/startup.sh` with vi editor (text editor).

Please refer to the separate "Tool Manual" for details on "Automatic startup" of the system setting tool.





Change from command mode to edit mode. Press [i] on the keyboard.

Edit the startup script.

To disable a process, add "#" at the beginning of the line.

Example: To disable task bar

```
#@lxpanel --profile LXDE
#@pcmanfm --desktop --profile LXDE
/usr/bin/emsystem/autostart
```

Example: To disable task bar and desktop

```
#@lxpanel --profile LXDE
#@pcmanfm --desktop --profile LXDE
/usr/bin/emsystem/autostart
```

Exit edit mode and return to command mode. Press [Esc] on the keyboard.

Save the changes and exit. Using the keyboard, type ":wq" and press [Enter].

Use the command below to restart the system.

```
# reboot
```

To display it again, delete "#".

```
@lxpanel --profile LXDE
@pcmanfm --desktop --profile LXDE
/usr/bin/emsystem/autostart
```

# 6 EM Specifications

This chapter describes EM specifications such as the file map.

## 6.1 Operating System Specifications

### 6.1.1 Boot loader

Item	Specification
Boot loader	u-boot 2015.04

24V version of EM(G)8-7W, EM(G)8-10W only

Item	Specification
Boot loader	u-boot 2016.03

### 6.1.2 Linux kernel

Item	Specification
Kernel	Linux 4.1.15

### 6.1.3 Desktop environment

Item	Specification
Desktop environment	XWindow system (LXDE)

## 6.1.4 Start Menu

By default, the following items are registered in the Start menu.



Item		Specification
Accessories	Note	Leafpad
	Terminal	Terminal
	Image viewer	Display image
Internet	X11VNC server	VNC server
System Tools	LXTerminal	Terminal
	Task Manager	Task Display
	File Manager PCManFM	File manager
Universal Access	Florence Virtual Keyboard	Software keyboard
Preferences	Default applications for LXSession	Settings for Auto Startup and startup
	Openbox Configuration Manager	Settings for Windows display and behaviors
	emglauncher	Launcher application (emg_launcher)
	emgetting	EM Setting Tool
	isappsetting	IS-APP Setting Tool
	Keyboard and Mouse	Settings for keyboard and mouse
	Desktop Preferences	Settings for desktop display
	Desktop Session Settings	Auto Startup Setting
	Monitor Settings	Display settings
	Customize Look and Feel	Widget / Icon / Font settings
	Input Method	Input locale setting
Run		Run command

## 6.2 File map

---

Folder structure	Application	Location	FileSystem	Type	Size *3	R/W
/bin	RootFileSystem	/	/dev/mtd3	ubifs	340M	RO*1
/boot						
/home						
/lib						
/media						
/mnt						
/sbin						
/usr						
/var						
/www						
/etc						
/dev						
/proc	procfs	/proc	proc	proc	(RAM)	RW
/sys	sysfs	/sys	sysfs	sysfs	(RAM)	RW
/run	temporary file	/run	tmpfs	tmpfs	(RAM)	RW
/tmp	temporary file	/tmp	tmpfs	tmpfs	(RAM)	RW
/var/volatile	temporary file	/var/volatile	tmpfs	tmpfs	(RAM)	RW
/mnt/user	user area 1	/mnt/user	/dev/mtd4	ubifs	90MB	RW *2
/mnt/user2	user area 2	/mnt/user2	/dev/mtd5	ubifs	65MB	RW *2

\*1 RootFileSystem is shipped as read-only (RO). If you want to write a file to the read-only area, you need to remove the write protection. For details, refer to “2 Disabling Write Protection”.

\*2 The user area can also be changed to read-only (RO). For more details, please refer to “2.1 Setting the write-protected area in the user area”.

\*3 The size shown in the disk space of the file system will be smaller because it is used for management of some systems..

## 6.3 Root file system

---

### Package/ Licence

---

For the packages installed in EM and their license terms, refer to licenses.tar.gz in the DVD-ROM (set of development environment).

## 6.4 Drivers

### 6.4.1 LAN Specifications

Port	Device	IP	Description
Wired LAN	eth0	dhcp/static	10/100BASE-TX * The initial IP address is 192.168.0.130 / 24

LAN setting file

File	Description
/etc/resolv.conf	DNS server settings
/etc/network/interfaces	Network Settings
/etc/network/lan0.conf	Eth0 settings

### 6.4.2 Touch Panel Specifications

Conforms to the Linux standard InputDriver.

Item	Description
Specification	Supported by LinuxInputSubsystem and tslib
Sampling frequency	50 /second
Device	/dev/input/touchscreen0
Calibration tool (Capacitance offset)	EMG7-A8 /usr/bin/Calibration  EMG8-A7 *Excluding EMG8-10W /usr/bin/tpoffset  EMG8-10W None (auto calibration)
Calibration tool (Coordinates Calibration)	EM8-A7 /usr/bin/xinput_calibrator

## 6.4.3 Sound Specifications

Item	Description
Driver	ALSA Driver1.1.0
Specification	Conform to LinuxALSA driver specifications
Supported format	Uncompressed WAV file
Execution method	For EMG7-7W, EMG7-12
	<pre>aplay Example: aplay -D hw:0,0 sample.wav   arecord -D hw:0,0 -f S16_LE -r 44100 -c 2 -d 5 record.wav</pre>
	For EM(G)8-7W, EM(G)8-10W
	<pre>alsaplayer Volume : 0.0 - 1.0 (0.0=Mute, 0.35=35%, 1.0=100%) *Specify a volume for each execution. Example: alsaplayer --startvolume &lt;Volume&gt; --enqueue sample.wav</pre>

## 6.4.4 USB Specifications

### USB host

Host driver: EHCI HCD (USB2.0)

Class driver	Description
USB HUB	USB hub
USB Mass Storage	USB drive
USB HID	USB mouse and keyboard

## USB device

USB Gadget Drivers: USB-Ether

Gadget	Explanation
USB-Ether	<p>When the USB port of this unit is connected to a PC, it is recognized as an Ethernet Adapter by the PC.</p> <p>*USB device driver must be installed on the PC. For details, refer to "1.2.2 Network settings on USB device port".</p> <p>*Please use a one-to-one connection between this unit and your PC.</p> <p>Device : usb0            IP Address : 192.168.10.130            LAN configuration file : /etc/network/glan0.conf</p>

## 6.4.5 LCD Specifications

Supports the Linux standard frame buffer.

Device file: /dev/fb0

Function		Description
open		Conforms to Linux frame buffer driver specifications
close		
ioctl	FBIOGET_FSCREENINFO	<p>Gets fixed screen information.</p> <p>Return value 0: successful            Other than 0: failed</p> <p>Input: none            Output: fb_fix_screeninfo* type: retrieved fixed screen information</p>
	FBIOGET_VSCREENINFO	<p>Gets variable screen information.</p> <p>Return value 0: successful            Other than 0: failed</p> <p>Input: none            Output: fb_var_screeninfo* type: retrieved variable screen information</p>
	FBIOPUT_VSCREENINFO	<p>Sets the variable screen information.</p> <p>Return value 0: successful            Other than 0: failed</p>

	Input: fb_var_screeninfo* type: variable screen information to set
mmap	Conforms to Linux mmap specifications

Note 1) You can use mmap to map one screen worth of memory in the screen information to buffer memory.

However, because there is no exclusive control for system drawing, if drawing is run on the system-side, the drawing on the screen may not display as intended.

(The system side drawing take precedence.)

To prevent drawing from the system side, you could for example hide the task bar.

## 6.4.6 Backlight Specifications

File Path: /sys/class/backlight/backlight/

The following files control the backlight.

File	Read/Write	Description
bl_power	R/W	Backlight ON/OFF get / set 0: On 1: Off
brightness	R/W	get / set brightness 1 - 8 (8 levels) 0=OFF
bl_autooffenable	R/W	Backlight Auto Off get / set enable/disable 0: disable 1: enable
bl_autoofftime	R/W	Backlight Auto Off get / set time 1 - 65535 (seconds)

Note 1) After a touch input, Backlight Auto Off turns off the backlight automatically when there is no touch input for the amount of time specified as the Backlight Auto Off time.

Note 2) If the backlight is turned off by the Backlight Auto Off function, the backlight turns on again when there is a touch input, or an application executes bl\_power with the value 0.

Note 3) If the backlight is turned on by something other than touch input (such as bl\_power), the Backlight Auto Off does not function. Only after a touch input is the backlight turned off automatically when the amount of time specified as the Backlight Auto Off time has elapsed.

Note 4) When you set the parameters for Brightness, Backlight Auto Off (enabled/disabled), and Backlight Auto Off Time, they are saved automatically. As a result, the last defined parameters are used the next time you boot up.

## 6.4.7 SIO Specifications

### Port assignments

#### EMG7-7W

Port	Device file	Interface	Description
SIO1	/dev/com1	RS232C	Link to /dev/ttymx0

#### EMG7-12

Port	Device file	I/F	Description
SIO1	/dev/com1	RS232C	Link to /dev/ttymx0
SIO2	/dev/com2	RS485	Link to /dev/ttymx3

#### EM(G)8-4/ EM(G)8-5/ EM(G)8-7W/ EM(G)8-10W

Port	Device file	I/F	Description
SIO1	/dev/com1	RS232C	Link to /dev/ttymx4
SIO2	/dev/com2	RS422/RS485	Link to /dev/ttymx2 I/F is switched by DIPSW

### Common Specifications

Function	Description
General	Conforms to Linux serial driver specifications

### RS422 Specifications

Set the communication mode to RS422 in the initialization process.

Turn RTS ON when sending data, and turn it OFF after sending.

The extended control code is defined in "seedsware\_ext\_ioctl.h" in "software" - "ioctl\_include" in the DVD-ROM (development environment set).

Function	Description	
General	Conforms to Linux serial driver specifications	
ioctl	IOCTL_UART_MODE_RS422	Sets the communication mode to RS422. Return value 0: Success -1: Failure Input 0
	IOCTL_UART_ASSERT_DE	Turns RTS on. Return value 0:Success -1: Failure Input NULL

	IOCTL_UART_DEASSERT_DE	Turns off RTS. Return value 0:Success -1: Failure Input NULL
--	------------------------	---

### RS485 Specifications

Set the communication mode to RS485 in the initialization process.

The extended control code is defined in "seedsware\_ext\_ioctl.h" under "software" - "ioctl\_include" in the DVD-ROM (development environment set).

Function		Description
General		Conforms to Linux serial driver specifications
ioctl	IOCTL_UART_MODE_RS485	Sets the communication mode to RS485. Return value 0: Success -1: Failure Input 0
	TIOCSRS485	Sets the details for RS485 operation. Return value 0: successful Other than 0: failed Input: rs485_config type pointer Output: none
	TIOCGRS485	Retrieves the details for RS485 operation. Return value 0: successful Other than 0: failed Input: none Output: rs485_config type pointer
flags	SER_RS485_ENABLED	Driver allows for RS485 operations
	SER_RS485_RTS_ON_SEND	Turns RTS on before transmission, and turns it off after transmission
	SER_RS485_RTS_AFTER_SEND	Turns RTS off before transmission, and turns it on after transmission
	SER_RS485_RX_DURING_TX	Enables incoming transmission while there is an outgoing transmission.

Note 1) If termination is required, enable by following the steps below.

For EMG7-12

Enable by writing 1 to: /sys/class/gpio/status\_terminate/value.

Enable by command: echo 1 >/sys/class/gpio/status\_terminate/value

For EM(G)8-4 / EM(G)8-5 / EM(G)8-7W / EM(G)8-10W

Enable termination from the serial port settings. From the dipswitch, turn ON SW1.

## 6.4.8 RTC Specifications

Function	Specification
Configure date/time	2000/1/1 00:00:00 - 2037/12/31 23:59:59
Leap years	Supported from 2000 to 2037
Out-of-battery operations	Detect the battery level on driver initialization (= OS startup) If there is no power left, the device is reset to 1970/1/1 00:00:00

Device file: /dev/rtc0

This driver is for controlling an external RTC.

An external RTC can use batteries to operate even when the power is off.

Function	Specification
open	Conforms to Linux standard RTC driver specifications
close	
ioctl	

Note 1) You can set regular date/time settings through a standard Linux interface.

To the set date/time so it shows on an external RTC, execute the hwsync function.

If you do not execute hwsync, the setting becomes invalid when the power is turned off.

## 6.4.9 Status LED Specifications

### EMG7-7W / EMG7-12

Applicable models
EMG7-7W
EMG7-12

The status LED on the front of the machine operates as follows:

Status	LED Display Color
Power OFF	Off
Boot loader in operation	Orange
OS startup	Orange
Normal	Green
Backlight off	Flashing green (at 0.5 second intervals)
Backlight problem	Flashing red (at 0.5 second intervals)

Additionally, get the LED status by reading the following files, and set the LED status by writing to the following files.

#### EMG7-7W

File	Read/Write	Instruction
/sys/class/leds/status_led_green/brightness	R/W	LED green 1: On 0: Off
/sys/class/gpio/status_led_red/brightness	R/W	LED red 1: On 0: Off

#### EMG7-12

File	Read/Write	Instruction
/sys/class/leds/status_led_green/brightness	R/W	LED green 1: On 0: Off
/sys/class/gpio/status_led_red/brightness	R/W	LED red 1: On 0: Off

Note 1) Although the system itself controls the LED, if you use the files above to set the LED, the system settings are also updated.

However, even if the application sets the LED status, if the backlight turns off or a problem occurs with the backlight, the LED will flash green or flash red accordingly.

## 6.4.10 SRAM Specifications

Applicable models
EMG7-7W
EMG7-12
EM(G)8-4
EM(G)8-5

EMG7-7W / EMG7-12 can access SRAM as a /dev/mem memory device.

EM(G)8-4 / EM(G)8-5 can access SRAM as a /dev/sram1 SPI device.

Device file: /dev/mem (EMG7-7W / EMG7-12)

Function	Specification
open	Conforms to Linux standard mem driver specifications
close	
mmap	
read	
write	
ioctl	

Device file: /dev/sram1 (EM(G)8-4 / EM(G)8-5)

Extended control code is defined in "seedsware\_ext\_ioctl.h" of "software"->"ioctl\_include" in DVD-ROM (complete development environment). Please include it before use.

Function	Specification
open	Conforms to Linux standard driver specifications
close	
read	
write	
mmap	Function call specifications are equivalent to Linux standard mmap. Because the interface with SRAM is SPI, the driver secures internal memory and supports quasi-mmap specifications.

ioctl	IOCTL_SRAM_GET_SIZE	Gets the size of SRAM. Return value 0: successful Other than 0: failed Input: none Output: int type variable pointer to the size of SRAM
	IOCTL_SRAM_FLUSH_M2D	Writes to SRAM the total internal memory data area retrieved by mmap. Return value 0: successful Other than 0: failed Input: none Output: none
	IOCTL_SRAM_FLUSH_M2D_PAR	Writes to SRAM the area specified by io_sram_t of the total internal memory data area retrieved by mmap. Return value 0: successful Other than 0: failed Input: io_sram_t type pointer (offset size) Output: none
	IOCTL_SRAM_FLUSH_D2M	Reads out all SRAM data to the internal memory data area retrieved by mmap. Return value 0: successful Other than 0: failed Input: none Output: none
	IOCTL_SRAM_FLUSH_D2M_PART	Reads out the specified SRAM area data to the internal memory data area retrieved by mmap. Return value 0: successful Other than 0: failed Input: io_sram_t type pointer (offset size) Output: none
	IOCTL_SRAM_SEEK	Specify the offset for read/write functions. Return value 0: successful Other than 0: failed Input: int type pointer, offset: 0 to SRAM max value - 1 Output: none

Note 1) The read and write functions use the SPI interface to directly read from and write to SRAM. Before using the read or write function, set the offset using IOCTL\_SRAM\_SEEK. Executing the read or write function does not change the offset. If the read or write offset changes, specifying the offset with IOCTL\_SRAM\_SEE is required.

Note 2) The minimum and maximum sizes for offset and read/write functions are as follows:  
Minimum size: 1. Maximum size: SRAM size - offset

Note 3) The size requested by mmap must be the size of SRAM.

Note 4) The mmap function only reserves internal memory.

Because internal memory is undefined, use IOCTL\_SRAM\_FLUSH\_D2M to read SRAM data to internal memory.

(A) You can read/write from an application using the pointer to an area reserved with mmap.

If you use the pointer to read or write, no data is written to SRAM.

Use either IOCTL\_SRAM\_FLUSH\_D2M or IOCTL\_SRAM\_FLUSH\_D2M\_PART to write internal memory data to SRAM.

(B) If either IOCTL\_SRAM\_FLUSH\_D2M or IOCTL\_SRAM\_FLUSH\_D2M\_PART is not run, data from internal memory is flushed when the power is turned off. As a result, SRAM data remains as it was when either IOCTL\_SRAM\_FLUSH\_D2M or IOCTL\_SRAM\_FLUSH\_D2M\_PART was last executed.

Note 5) When the battery runs out, the value in the SRAM will be indefinite data.

## 6.4.11 BUZZER Specifications

Device file: /dev/buzzer

Extended control code is defined in "seedsware\_ext\_ioctl.h" of "software"- "ioctl\_include" in DVD-ROM (complete development environment). Please include it before use.

Function		Specifications
open		Open / close device
close		
ioctl	IOCTL_PLAY	Sound the buzzer. Return value: Always 0 Input: none Output: none
	IOCTL_STOP	Stop the buzzer. Return value: Always 0 Input: none Output: none
	IOCTL_BEEP	Sound buzzer for the specified duration. Return value 0: successful Other than 0: failed Input: int type variable: buzzer duration (units of 100 ms) Output: none
	IOCTL_SET_BEEP_INTERVAL	Sets the buzzer frequency. Return value 0: successful Other than 0: failed Input: int type variable: frequency (1 - 30000 Hz) Output: none
	IOCTL_GET_BEEP_INTERVAL	Gets the defined buzzer frequency. Return value 0: successful

		Other than 0: failed Input: none Output: int type variable: the defined frequency (Hz)
	IOCTL_GET_BUZZER_STATE	Get the buzzer status. Return value 0: successful Other than 0: failed Input: none Output 0: buzzer off 1: buzzer on

Note 1) Buzzer sound commands are processed as they are received.

As a result, when the buzzer is emitting a sound triggered by IOCTL\_BEEP, and IOCTL\_BEEP is requested again with a different sound duration, the buzzer is applied with the duration of the second IOCTL\_BEEP.

Note 2) If touch sound is enabled on the system, the buzzer may not sound for the intended duration of time if touch sound is triggered as the driver's buzzer and touch sounds are not exclusive processes.

To avoid this issue, disable touch sound on the system, and create a program with the driver at the application level to trigger the touch sound.

## 6.4.12 DIO Specifications

You can connect switches, LEDs, etc. to the DIO interface of the product.

Depending on the model, control may be performed using the DIO API or normal GPIO.

### EM(G)8-4 / EM(G)8-5

Applicable models
EM(G)8-4
EM(G)8-5

For the target model, you can switch the operation mode and perform input/output operations through the DIO API.

Please refer to "6.4.12 DIO Specifications" for DIO API.

There are 3 operation modes:

The default operation mode is "GPIO SCAN mode".

Use the DIO API to change operation modes or modify input/output.

For information about the DIO API, see "6.6.1 DIO API".

## **DIO mode (with scan)**

Using DOUT 4 pins as a SCAN line, and 6 pins as DIN, operate as 24 pin DIN.

Treat as normal DIN input and use the DIO API to get the DIN status of the 24 pins.

In GPIO SCAN mode, SCAN is executed on get.

You can also control 8 pin DOUT with the DIO API.

Number of DIN	Number of DOUT
24	8

## **DIO mode (without scan)**

Operates as 12 pin DOUT and 6 pin DIN.

Use the DIO API to control the 12 pin DOUT and 6 pin DIN.

Number of DIN	Number of DOUT
6	12

## **Sheet Key Mode**

Using DOUT 4 pins as a SCAN line, and 6 pin DIN as a RETURN line, operate as 24 pin sheet key.

4 lines are executed per process, with a processing interval of 100 ms.

The 24 pins are mapped to key codes and recognized as key inputs.

Key inputs are for key codes and ON/OFF status.

Key repeat is not supported.

You can also control 8 pin DOUT using the DIO API.

Number of DIN	Number of DOUT
-	8

## EM(G)8-7W / EM(G)8-10W

---

Applicable models
EM(G)8-7W
EM(G)8-10W

Use the normal GPIO to control the 4 pin DOUT and 4 pin DIN.

Operates with positive logic.(On:1/Off:0)

It can be accessed by reading/writing /sys/class/gpio/gpio<GPIO number>/value.

4 pin DOUT

DOUT1	DOUT2	DOUT3	DOUT4
GPIO4_25(gpio121)	GPIO4_26(gpio122)	GPIO4_27(gpio123)	GPIO4_28(gpio124)

4 pin DIN

DIN1	DIN2	DIN3	DIN4
GPIO4_17(gpio113)	GPIO4_18(gpio114)	GPIO4_19(gpio115)	GPIO4_20(gpio116)

## 6.5 Applications

### 6.5.1 EMG Launcher

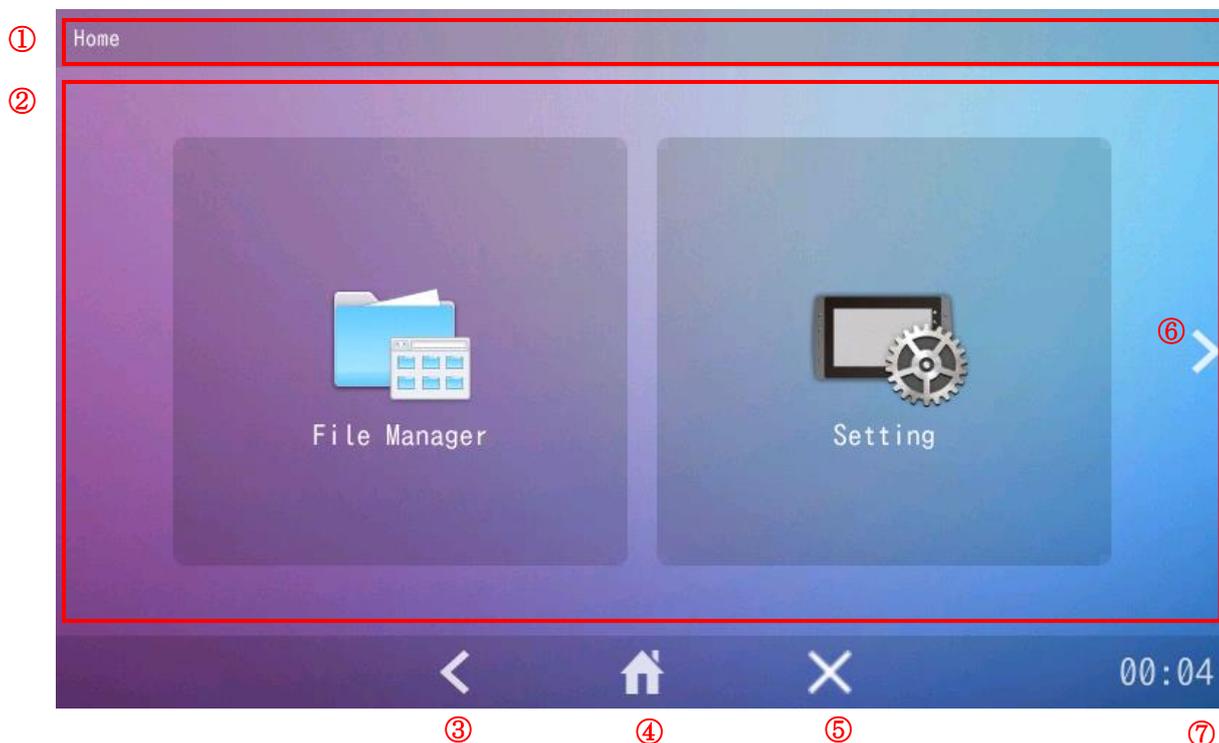
After turning on the power, EMG Launcher starts up automatically. From there launch the System Setting Tool, or register and start your own applications.

In the factory setting, there are 3 registered applications: File Manager, System Setting, and ISApp Setting.

#### Executable file

/usr/bin/emg\_launcher

#### Basic Operation



Number	Items	Contents
①	Titlebar	Displays the title of the current screen.
②	Menu Screen	Tap a button to start the corresponding application.
③	Return button	Go back to the previous screen using this button. Nothing happens if you tap this button on the home screen.
④	Home button	Tap this button to jump to the first page.
⑤	Exits button	Exits the EMG Launcher.
⑥	Next page	Displays the next page.
⑦	Clock	Displays the current time.

## Application list

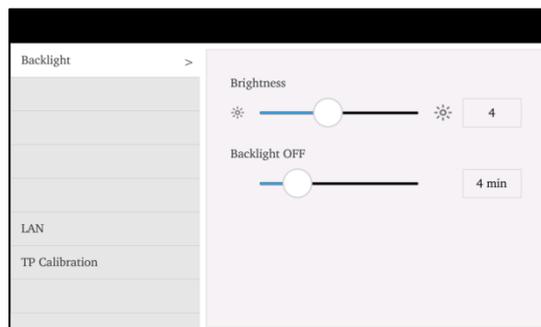
---

Icon	Item Name	Contents
	File Manager	Use the File Manager to display and operate the files stored in EMG7-Linux.
	Setting	Set the IP, clock, and other settings on the machine.
	ISAppSetting	Specify the ISApp launch method, communication settings, and other settings.

## Launching Applications

---

Tap an icon to start the registered application.

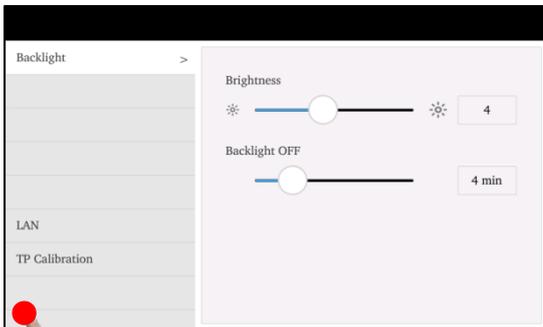


## Exiting Applications

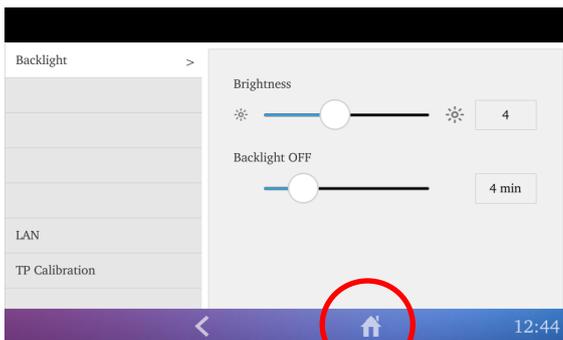
---

The following operation displays the taskbar.

Press and hold the bottom left corner for more than 2 seconds.



Touch  and the current application will stop.



Touch  to hide the taskbar.

## Registering Applications

---

Register an application to the EMG Launcher by adding a desktop entry file in the following folder.

The change takes effect after restarting.

Folder Path	/etc/emg_launcher/applications/
-------------	---------------------------------

The Desktop Entry file is a data file with information about the button to display on the Home menu. You can create the file using a text editor.

[Common Settings]

Value	Description
Name	Text that is displayed on the button as its application name. (Default)
Name[ja_JP]	Text that is displayed on the button as its application name when the locale is Japanese
Exec	Command that is executed when you tap the button. %f, %F, %u, %U, and other specifications are ignored.
Icon	Icon that is displayed on the button.
Type	Specify "Application".

- \* The first line must be [Desktop Entry].
- \* The file extension must be ".desktop".
- \* Save the file in "UTF-8" character encoding format.
- \* The file is ignored if any other settings are used.

Example:

```
[Desktop Entry]
Name=Setting
Name[ja_JP]=システム設定
Exec=/usr/bin/emg_setting
Icon=/etc/emg_launcher/icons/menu_tablet_settings.png
Type=Application
```

## Deleting Applications

---

Delete an application from the EMG Launcher by deleting the associated desktop entry file in the following folder.

The change takes effect after restarting

Folder Path	/etc/emg_launcher/applications/
-------------	---------------------------------

## 6.5.2 VNC server

To start the VNC server, from the Start menu select [Internet] > [x11VNC Server], or enter the command `"/usr/bin/x11vnc"`.

Remotely connect from a computer that has a VNC client, to display and operate the server.

### Executable file

---

`/usr/bin/x11vnc`

### Options

---

Use the following command to view the run-time options.

`/usr/bin/x11vnc --help`

## 6.5.3 VNC client

Start the client with the command `"/usr/bin/vncviewer"`.

Use the VNC client to remotely connect to the computer where the VNC server is installed so you can display and operate the server.

### Executable file

---

`/usr/bin/vncviewer`

### Options

---

Use the following command to view the run-time options.

`/usr/bin/vncviewer -help`

## 6.6 API

---

### 6.6.1 DIO API

Applicable models
EM(G)8-4
EM(G)8-5

API for controlling the DIO interface.

### Library file

---

libem\_dio.so

### Header file

---

em\_dio.h

em\_dio-c.h

em\_dio-c++.h

em\_types.h

The library and header files are located in the DVD-ROM (Development Environment Kit). Copy to the development environment.

### Constants

---

Operation Mode

MODE_SHEETKEY	0	Sheet Key Mode
MODE_DIO_SCAN	1	DIO mode (with scan)
MODE_DIO_NON_SCAN	2	DIO mode (without scan)

Reference: Number of DIN and DOUT in each operation mode

	Number of DIN	Number of DOUT
DIO mode (with scan)	24	8
DIO mode (without scan)	6	12
Sheet Key Mode	-	8

## DOUT Output

DOUT_OFF	0	Off
DOUT_ON	1	On

## DIN Input

DIN_OFF	0	Off
DIN_ON	1	On

## Error Codes

ERROR_CODE_SUCCESS	0x00000000	Successful
ERROR_CODE_INVALID_PARAMETER	0x20000001	Invalid parameter
ERROR_CODE_LIB_NOT_OPEN	0x20000002	Function call before library is open
ERROR_CODE_LIB_OPEN_FAILURE	0x20000011	Failed to open library
ERROR_CODE_LIB_CLOSE_FAILURE	0x20000012	Failed to close library
ERROR_CODE_INVALID_MODE	0x20000013	Operation mode error
ERROR_CODE_DRIVER_INTERNAL	0x20000021	Internal driver error

## API (for C++)

---

### Open library

Function	int OpenLib (int mode)
Argument	mode: Specify the operation mode [Operation Mode] MODE_SHEETKEY: Sheet Key Mode MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)
Return value	[Error Code] Successful: ERROR_CODE_SUCCESS Failed: ERROR_CODE_INVALID_PARAMETER ERROR_CODE_LIB_OPEN_FAILURE ERROR_CODE_DRIVER_INTERNAL
Function	Open library and make it available.

Note 1) You must call OpenLib before working with the library.

### Close library

Function	int CloseLib()
Argument	(None)
Return value	[Error Code] Successful: ERROR_CODE_SUCCESS Failed: ERROR_CODE_LIB_CLOSE_FAILURE
Function	Closes the library.

### Get operation mode

Function	int GetMode(int* mode)
Argument	mode: Specify the pointer to the memory of the get mode operation [Operation Mode] MODE_SHEETKEY: Sheet Key Mode MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)
Return value	[Error Code] Successful: ERROR_CODE_SUCCESS Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_DRIVER_INTERNAL
Function	Gets the current DIO operation mode.

### DOUT Output

Function	int SetDout(int num, int set)
Argument	num: Specify the DOUT number [DOUT number] Sheet Key Mode: 1 - 8 DIO mode (with scan): 1 - 8 DIO mode (without scan): 1 - 12  set: Specify the DOUT output [DOUT output] (negative logic) DOUT_OFF: off DOUT_ON: on

Return value	[Error Code] Successful: ERROR_CODE_SUCCESS Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_INVALID_PARAMETER ERROR_CODE_DRIVER_INTERNAL
Function	Set the DOUT output.

#### Get DOUT status

Function	int GetDout(int num, int* val)
Argument	num: Specify the DOUT number [DOUT number] Sheet Key Mode: 1 - 8 DIO mode (with scan): 1 - 8 DIO mode (without scan): 1 - 12  val: Specify the pointer to the memory of the get DOUT status operation [DOUT output] (negative logic) DOUT_OFF: off DOUT_ON: on
Return value	Successful: ERROR_CODE_SUCCESS Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_INVALID_PARAMETER ERROR_CODE_DRIVER_INTERNAL
Function	Get the current DOUT status.

#### Get all DIN status

Function	int GetDinAll(DWORD* val)
Argument	val: Specify the pointer to the memory of the get DIN status operation DIO mode (with scan): Bit 31 - bit 24: reserved (fixed to the value 0). Bit 23 - bit 0: DIN24 - DIN1 DIO mode (without scan): Bit 31 - bit 6: reserved (fixed to the value 0). Bit 5 - bit 0: DIN6 - DIN1 [DIN Input] (negative logic) DIN_OFF: off DIN_ON: on

Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_INVALID_MODE ERROR_CODE_DRIVER_INTERNAL
Function	Gets the current status all of the DIN.

Note 1) If the operation mode is Sheet Key mode, the return value is an error.

#### Get specific DIN status

Function	int GetDin(int num, int* val)
Argument	num: Specify the DIN number [DIN number] DIO mode (with scan): 1 - 24 DIO mode (without scan): 1 - 6  val: Specify the pointer to the memory of the get DIN status operation [DIN Input] (negative logic) DIN_OFF: off DIN_ON: on
Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_INVALID_PARAMETER ERROR_CODE_INVALID_MODE ERROR_CODE_DRIVER_INTERNAL
Function	Gets the current DIN status of the specified pin number.

Note 1) If the operation mode is Sheet Key mode, the return value is an error.

#### Set key code map

Function	int SetKeyMap(int keyCodeMap, int num)
Argument	keyCodeMap: Specify the pointer to the key code array.  num: Specify the number of key codes. [Number of key codes] 24 (fixed)

Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_INVALID_PARAMETER ERROR_CODE_INVALID_MODE ERROR_CODE_DRIVER_INTERNAL
Function	Set up the key code map.

Note 1) If the operation mode is not Sheet Key mode, the return value is an error.

### Key code array

int type     keyCodeMap[24]     Key code array

### Relationship with key code positions

	RETURN LINE1	RETURN LINE2	RETURN LINE3	RETURN LINE4	RETURN LINE5	RETURN LINE6
SCAN LINE1	keyCodeMap[0]	keyCodeMap[1]	keyCodeMap[2]	keyCodeMap[3]	keyCodeMap[4]	keyCodeMap[5]
SCAN LINE2	keyCodeMap[6]	keyCodeMap[7]	keyCodeMap[8]	keyCodeMap[9]	keyCodeMap[10]	keyCodeMap[11]
SCAN LINE3	keyCodeMap[12]	keyCodeMap[13]	keyCodeMap[14]	keyCodeMap[15]	keyCodeMap[16]	keyCodeMap[17]
SCAN LINE4	keyCodeMap[18]	keyCodeMap[19]	keyCodeMap[20]	keyCodeMap[21]	keyCodeMap[22]	keyCodeMap[23]

### DOUT output (OpenLib and CloseLib processes not required)

Function	int SetDoutDirect(int mode, int num, int set)
Argument	mode: Specify the operation mode [Operation Mode] MODE_SHEETKEY: Sheet Key Mode MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)  num: Specify the DOUT number [DOUT number] Sheet Key Mode: 1 - 8 DIO mode (with scan): 1 - 8 DIO mode (without scan): 1 - 12  set: Specify DOUT output [DOUT output] (negative logic) DOUT_OFF: off DOUT_ON: on

Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_OPEN_FAILURE ERROR_CODE_INVALID_PARAMETER ERROR_CODE_DRIVER_INTERNAL
Function	Sets the DOUT output.

Note 1) You can call this function without OpenLib. Note that there is some processing load for each function call as the driver is loaded and then released within the function.

Get DOUT status (OpenLib and CloseLib processes not required)

Function	int GetDoutDirect(int mode, int num, int* val)
Argument	mode: Specify the operation mode [Operation Mode] MODE_SHEETKEY: Sheet Key Mode MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)  num: Specify the DOUT number [DOUT number] Sheet Key Mode: 1 - 8 DIO mode (with scan): 1 - 8 DIO mode (without scan): 1 - 12  val: Specify the pointer to the memory of the get DOUT status operation [DOUT output] (negative logic) DOUT_OFF: off DOUT_ON: on
Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_OPEN_FAILURE ERROR_CODE_INVALID_PARAMETER ERROR_CODE_DRIVER_INTERNAL
Function	Gets the current DOUT status.

Note 1) You can call this function without OpenLib. Note that there is some processing load for each function call as the driver is loaded and then released within the function.

Get all DIN status (OpenLib and CloseLib processes not required)

Function	int GetDinAllDirect(int mode, DWORD* val)
----------	---

Argument	<p>mode: Specify the operation mode [Operation Mode]</p> <p>MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)</p> <p>val: Specify the pointer to the memory of the get DIN status operation</p> <p>DIO mode (with scan): Bit 31 - bit 24: reserved (fixed to the value 0). Bit 23 - bit 0: DIN24 - DIN1</p> <p>DIO mode (without scan): Bit 31 - bit 6: reserved (fixed to the value 0). Bit 5 - bit 0: DIN6 - DIN1</p> <p>[DIN Input] (negative logic)</p> <p>DIN_OFF: off DIN_ON: on</p>
Return value	<p>ERROR_CODE_SUCCESS</p> <p>Failed:</p> <p>ERROR_CODE_LIB_OPEN_FAILURE ERROR_CODE_INVALID_PARAMETER ERROR_CODE_DRIVER_INTERNAL</p>
Function	Get all the current DIN status in a block.

Note 1) If you specify Sheet Key mode for the operation mode, the return value is an error.

Note 2) You can call this function without OpenLib. Note that there is some processing load for each function call as the driver is loaded and released within the function.

Get individual DIN status (OpenLib and CloseLib processes not required)

Function	int GetDinDirect(int mode, int num, int* val)
Argument	<p>mode: Specify the operation mode [Operation Mode]</p> <p>MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)</p> <p>num: Specify the DIN number [DIN number]</p> <p>DIO mode (with scan): 1 - 24 DIO mode (without scan): 1 - 6</p> <p>val: Specify the pointer to the memory of the get DIN status operation [DIN Input] (negative logic)</p> <p>DIN_OFF: off DIN_ON: on</p>

Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_OPEN_FAILURE ERROR_CODE_INVALID_PARAMETER ERROR_CODE_INVALID_MODE ERROR_CODE_DRIVER_INTERNAL
Function	Gets the current DIN status of the specified pin number.

Note 1) If you specify Sheet Key mode for the operation mode, the return value is an error.

Note 2) You can call this function without OpenLib. Note that there is some processing load for each function call as the driver is loaded and released within the function.

#### Get library version

Function	string GetLibVersion()
Argument	(None)
Return value	Version string [Library version] string ver: "1.0.0" (five single-byte characters)
Function	Gets the library version.

Note 1) You can call this function without OpenLib.

## API (for C)

---

#### Open library (for C language)

Function	int EmDio_OpenLib(int mode)
Argument	mode: Specify the operation mode [Operation Mode] MODE_SHEETKEY: Sheet Key Mode MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)
Return value	[Error code] Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_INVALID_PARAMETER ERROR_CODE_LIB_OPEN_FAILURE ERROR_CODE_DRIVER_INTERNAL
Function	Open library and make it available.

Note 1) You must call EmDio\_OpenLib before working with the library.

Close library (for C language)

Function	int EmDio_CloseLib()
Argument	(None)
Return value	[Error code] Successful: ERROR_CODE_SUCCESS Failed: ERROR_CODE_LIB_CLOSE_FAILURE
Function	Close the library.

Get operation mode (for C language)

Function	int EmDio_GetMode(int* mode)
Argument	mode: Specify the pointer to the memory of the get mode operation [Operation Mode] MODE_SHEETKEY: Sheet Key Mode MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)
Return value	[Error code] Successful: ERROR_CODE_SUCCESS Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_DRIVER_INTERNAL
Function	Gets the current DIO operation mode.

DOUT output (for C language)

Function	int EmDio_SetDout(int num, int set)
Argument	num: Specify the DOUT number [DOUT number] Sheet Key Mode: 1 - 8 DIO mode (with scan): 1 - 8 DIO mode (without scan): 1 - 12  set: Specify the DOUT output [DOUT output] (negative logic) DOUT_OFF: off DOUT_ON: on

Return value	[Error code] Successful: ERROR_CODE_SUCCESS Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_INVALID_PARAMETER ERROR_CODE_DRIVER_INTERNAL
Function	Set the DOUT output.

Get DOUT status (for C language)

Function	int EmDio_GetDout(int num, int* val)
Argument	num: Specify the DOUT number [DOUT number] Sheet Key Mode: 1 - 8 DIO mode (with scan): 1 - 8 DIO mode (without scan): 1 - 12  val: Specify the pointer to the memory of the get DOUT status operation [DOUT output] (negative logic) DOUT_OFF: off DOUT_ON: on
Return value	Successful: ERROR_CODE_SUCCESS Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_INVALID_PARAMETER ERROR_CODE_DRIVER_INTERNAL
Function	Gets the current DIO status.

Get all DIN status (for C language)

Function	int EmDio_GetDinAll(DWORD* val)
Argument	val: Specify the pointer to the memory of the get DIN status operation DIO mode (with scan): Bit 31 - bit 24: reserved (fixed to the value 0). Bit 23 - bit 0: DIN24 - DIN1 DIO mode (without scan): bit 31 - bit 6: reserved (fixed to the value 0). Bit 5- bit 0: DIN6 - DIN1 [DIN Input] (negative logic) DIN_OFF: off DIN_ON: on

Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_INVALID_MODE ERROR_CODE_DRIVER_INTERNAL
Function	Get all the current DIN status in a block.

Note 1) If the operation mode is Sheet Key mode, the return value is an error.

#### Get individual DIN status (for C language)

Function	int EmDio_GetDin(int num, int* val)
Argument	num: Specify the DIN number [DIN number] DIO mode (with scan): 1 - 24 DIO mode (without scan): 1 - 6  val: Specify the pointer to the memory of the get DIN status operation [DIN Input] (negative logic) DIN_OFF: off DIN_ON: on
Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_INVALID_PARAMETER ERROR_CODE_INVALID_MODE ERROR_CODE_DRIVER_INTERNAL
Function	Gets the current DIN status of the specified pin number.

Note 1) If the operation mode is Sheet Key mode, the return value is an error.

#### Set key code map (for C language)

Function	int EmDio_SetKeyMap(int keyCodeMap, int num)
Argument	keyCodeMap: Specify the pointer to the key code array.  num: Specify the number of key codes. [Number of key codes] 24 (fixed)

Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_NOT_OPEN ERROR_CODE_INVALID_PARAMETER ERROR_CODE_INVALID_MODE ERROR_CODE_DRIVER_INTERNAL
Function	Set up the key code map.

Note 1) If the operation mode is not Sheet Key mode, the return value is an error.

Key code array

int type     keyCodeMap[24]     Key code array

Relationship with key code positions

	RETURN LINE1	RETURN LINE2	RETURN LINE3	RETURN LINE4	RETURN LINE5	RETURN LINE6
SCAN LINE1	keyCodeMap[0]	keyCodeMap[1]	keyCodeMap[2]	keyCodeMap[3]	keyCodeMap[4]	keyCodeMap[5]
SCAN LINE2	keyCodeMap[6]	keyCodeMap[7]	keyCodeMap[8]	keyCodeMap[9]	keyCodeMap[10]	keyCodeMap[11]
SCAN LINE3	keyCodeMap[12]	keyCodeMap[13]	keyCodeMap[14]	keyCodeMap[15]	keyCodeMap[16]	keyCodeMap[17]
SCAN LINE4	keyCodeMap[18]	keyCodeMap[19]	keyCodeMap[20]	keyCodeMap[21]	keyCodeMap[22]	keyCodeMap[23]

DOUT output (EmDio\_OpenLib and EmDio\_CloseLib processes not required ) (for C language)

Function	int EmDio_SetDoutDirect(int mode, int num, int set)
Argument	<p>mode: Specify the operation mode [Operation Mode]  MODE_SHEETKEY: Sheet Key Mode  MODE_DIO_SCAN: DIO mode (with scan)  MODE_DIO_NON_SCAN: DIO mode (without scan)</p> <p>num: Specify the DOUT number [DOUT number]  Sheet Key Mode: 1 - 8  DIO mode (with scan): 1 - 8  DIO mode (without scan): 1 - 12</p> <p>set: Specify the DOUT output [DOUT output] (negative logic)  DOUT_OFF: off  DOUT_ON: on</p>

Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_OPEN_FAILURE ERROR_CODE_INVALID_PARAMETER ERROR_CODE_DRIVER_INTERNAL
Function	Set the DOUT output.

Note 1) You can call this function without EmDio\_OpenLib. Note that there is some processing load for each function call as the driver is loaded and released within the function.

Get DOUT status (EmDio\_OpenLib and EmDio\_CloseLib processes not required ) (for C language)

Function	int EmDio_GetDoutDirect(int mode, int num, int* val)
Argument	mode: Specify the operation mode [Operation Mode] MODE_SHEETKEY: Sheet Key Mode MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)  num: Specify the DOUT number [DOUT number] Sheet Key Mode: 1 - 8 DIO mode (with scan): 1 - 8 DIO mode (without scan): 1 - 12  val: Specify the pointer to the memory of the get DOUT status operation [DOUT output] (negative logic) DOUT_OFF: off DOUT_ON: on
Return value	Successful: ERROR_CODE_SUCCESS  Failed: ERROR_CODE_LIB_OPEN_FAILURE ERROR_CODE_INVALID_PARAMETER ERROR_CODE_DRIVER_INTERNAL
Function	Retrieves the current DIO status.

Note 1) You can call this function without EmDio\_OpenLib. Note that there is some processing load for each function call as the driver is loaded and released within the function.

Get all DIN status (EmDio\_OpenLib and EmDio\_CloseLib processes not required) (for C language)

Function	int EmDio_GetDinAllDirect(int mode, DWORD* val)
Argument	mode: Specify the operation mode [Operation Mode] MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)

	val: Specify the pointer to the memory of the get DIN status operation DIO mode (with scan): Bit 31 - bit 24: reserved (value is fixed as 0). Bit 23 - bit 0: DIN24 - DIN1 DIO mode (without scan): bit 31 - bit 6: reserved (value is fixed as 0). Bit 5- bit 0: DIN6 - DIN1 [DIN Input] (negative logic) DIN_OFF: off DIN_ON: on
Return value	ERROR_CODE_SUCCESS Failed: ERROR_CODE_LIB_OPEN_FAILURE ERROR_CODE_INVALID_PARAMETER ERROR_CODE_DRIVER_INTERNAL
Function	Get all the current DIN status in a block.

Note 1) If you specify Sheet Key mode for the operation mode, the return value is an error.

Note 2) You can call this function without EmDio\_OpenLib. Note that there is some processing load for each function call as the driver is loaded and released within the function.

Get individual DIN status (EmDio\_OpenLib and EmDio\_CloseLib processes not required ) (for C language)

Function	int EmDio_GetDinDirect(int mode, int num, int* val)
Argument	mode: Specify the operation mode [Operation Mode] MODE_DIO_SCAN: DIO mode (with scan) MODE_DIO_NON_SCAN: DIO mode (without scan)  num: Specify the DIN number [DIN number] DIO mode (with scan): 1 - 24 DIO mode (without scan): 1 - 6  val: Specify the pointer to the memory of the get DIN status operation [DIN Input] (negative logic) DIN_OFF: off DIN_ON: on
Return value	Successful: ERROR_CODE_SUCCESS Failed: ERROR_CODE_LIB_OPEN_FAILURE ERROR_CODE_INVALID_PARAMETER ERROR_CODE_INVALID_MODE ERROR_CODE_DRIVER_INTERNAL
Function	Gets the current DIN status of the specified pin number.

Note 1) If you specify Sheet Key mode for the operation mode, the return value is an error.

Note 2) You can call this function without EmDio\_OpenLib. Note that there is some processing load for each function call as the driver is loaded and released within the function.

Get library version (for C language)

Function	char* EmDio_GetLibVersion()
Argument	(None)
Return value	Version string [Library version] char ver[6]: "1.0.0" (five single-byte characters)
Function	Gets the library version.

Note 1) You can call this function without EmDio\_OpenLib.

# Inquiries

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If you have any questions, feel free to contact us.

## **By E-mail**

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## **FAQ**



[www.dush.co.jp/english/support/faq/](http://www.dush.co.jp/english/support/faq/)

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8th Edition March, 2023

DMC Co., Ltd.

Office hours: 9:00 - 17:00 weekdays

(except Saturdays, Sundays, national holidays, and year-end and New Year holidays)

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