MaxRT wRTOS 1.0 Runtime

BETA

INSTALLATION GUIDE

IntervalZero

MaxRT wRTOS

MaxRT wRTOS 1.0 Runtime Installation Guide

BETA

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IntervalZero

200 Fifth Avenue, FL 6, STE 6020
Waltham, MA 02451
Phone: 781-996-4481
www.intervalzero.com

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Editions and Requirements

This guide describes system requirements and provides installation and setup instructions for MaxRT wRTOS Runtime.

Product Editions

The table below lists the available wRTOS Runtime editions and the maximum number of Real-Time Subsystem (RTSS) cores they support.

The edition...	**Supports real-time operations on...**
Solo	1 dedicated RTSS core.
Entry	Up to 2 dedicated RTSS cores.
Basic	Up to 3 dedicated RTSS cores.
Professional	Up to 7 dedicated RTSS cores.
Premium	Up to 15 dedicated RTSS cores.
Ultimate	Up to 63 dedicated RTSS cores.

Hardware Requirements

This section lists hardware requirements for wRTOS Runtime.

Hardware Considerations

wRTOS requires a multiprocessor platform that supports 64-bit Windows 11 or Windows 10. Uniprocessor systems are not supported since at least one core must be dedicated to Windows and one to wRTOS Runtime. Multiprocessor systems can have as many as 64 cores and as few as 2 cores.

General Considerations

- Windows 11 and Windows 10 may boot into x2APIC mode if the system supports x2APIC. To use wRTOS on these systems, you must either disable x2APIC in the BIOS or select xAPIC if allowed to choose between xAPIC and x2APIC.
- wRTOS Runtime installations do not support some hardware configurations. When the wRTOS Runtime can detect an unsupported configuration, it displays an error message.
- Windows 11 and Windows 10 may launch with a Hypervisor if software security features require Virtual Secure Mode (VSM) in Hypervisor. To use wRTOS on these systems, you must disable virtualization in the BIOS.

Hyper-Threading

- We recommend disabling Hyper-Threading. If Hyper-Threading remains enabled, we recommend that you assign an even number of processors between Windows and wRTOS. The Windows logical processor and RTSS logical processor must not share the same physical processor, as Windows processes could impact real-time performance on the shared physical processor.

Intel® Resource Director Technology (RDT)

- Intel® Resource Director Technology (RDT) functionality will only be available if the hardware supports it.
- For systems where Intel® Resource Director Technology (RDT) functionality is supported and enabled, we recommend disabling Hyper-Threading in the system BIOS when MBA is set to *Priority-based*.

Processor Support

Although wRTOS Runtime runs on most x64 platforms, unique attributes of some processors require special consideration before selecting them as a target system.

- See the *wRTOS Processor Compatibility* document, available from the Customer Center and in the wRTOS Help, for an outline of supported wRTOS versions and tested system processors.
- For a comprehensive list of Windows 11 system requirements, see the *Windows 11 System Requirements* web page:

  https://www.microsoft.com/en-us/windows/windows-11-specifications?r=1
- For a comprehensive list of Windows 10 system requirements, see the *Windows 10 System Requirements* web page:

  https://www.microsoft.com/en-us/windows/windows-10-specifications#sysreqs

Network Link Layer (NL2) Requirements

The optional wRTOS Network Link Layer (NL2) provides a virtual network but for receiving traffic from outside the system. A dedicated Network Interface Card (NIC) is required. The NL2 provides support for several network adapters. See the *wRTOS Supported NICs* topic in the wRTOS Help for a detailed list.

TCP/IP Requirements

The optional wRTOS TCP/IP Stack requires a dedicated Network Interface Card (NIC) supported by wRTOS. See the *wRTOS Supported NICs* topic in the wRTOS Help for a detailed list.

GigE Vision Requirements

The optional wRTOS GigE Vision requires at least one GigE camera, CAT5 (category 5) or higher cables, and a dedicated Network Interface Card (NIC) supported by wRTOS. See the *wRTOS Supported NICs* topic in the wRTOS Help for a detailed list.

GigE Vision supports GigE Vision standards, but not all GigE cameras will work out of the box. See the *Camera Compatibility* topic in the wRTOS Help for a list of cameras we've tested. Untested cameras might require additional setup—either through the wRTOS Vision Camera Setup tool or another—before they can be used with GigE Vision.

E-CAT Requirements

The optional wRTOS E-CAT network component uses EtherCAT technology for communication. E-CAT requires EtherCAT capable devices, CAT5 (category 5) or higher cables, and a dedicated Network Interface Card (NIC) supported by wRTOS. See the *wRTOS Supported NICs* topic in the wRTOS Help for a detailed list.

Software Requirements

This section lists software requirements for wRTOS Runtime.

Operating System Requirements

wRTOS Runtime is supported on the 64-bit multi-processor configurations of Windows 11 and Windows 10.

Windows 11

- Windows 11 (up to Version 24H2)
- Windows 11 IoT Enterprise (Long-Term Servicing Channel, version 24H2)

For a complete list of tested Windows 11 updates, see https://www.intervalzero.com/library/Windows11Updates/SupportForWindows11Updates.htm.

Windows 10

- Windows 10 (up to Version 22H2)
- Windows 10 IoT Enterprise LTSC (Long Term Servicing Channel, up to version 22H2)

For a complete list of tested Windows 10 updates, see https://www.intervalzero.com/library/Windows10Updates/Windows10UpdatesTestMatrix.htm.

> **Note:** wRTOS Runtime is supported on machines running Windows 10 IoT Enterprise on IoT deployed systems (deferred activation).

> **Note:** wRTOS Runtime cannot be installed on a 32-bit operating system. Attempts to do so will result in the following Windows error: *This installation package is not supported by this processor type. Contact your product vendor.*

Note: wRTOS Runtime is not compatible with the Windows *Memory integrity* security feature. You must turn off that feature before you install wRTOS Runtime. You can do this in the Windows Security app under **Device security / Core isolation / Core isolation details**. If the *Memory integrity* feature is on when you attempt to install wRTOS Runtime, a warning will appear, and the installer will terminate.

Microsoft .NET Support

wRTOS supports the following versions under .NET Standard 2.0:

.NET Implementation	Version Support
.NET and .NET Core	2.0, 2.1, 2.2, 3.0, 3.1, 5.0, 6.0, 7.0, 8.0
.NET Framework	4.6.2, 4.7, 4.7.1, 4.7.2, 4.8, 4.8.1

Note: wRTOS does not support other implementations of .NET Standard 2.0 that involve multi-platform support.

Note: When building an application using .NET 6.0, you must provide `IntervalZero.MaxRT.wRTOS.Internal.dll` and `IntervalZero.MaxRT.wRTOS.MessageBus.dll` in the project. You can find these DLLs at `C:\Program Files\IntervalZero\MaxRT\wRTOS SDK\1.0\bin`

Note: When building an application using .NET Framework, you may need to provide `Microsoft.Win32.Registry.dll` in the project. You can find this DLL at `C:\Program Files\IntervalZero\MaxRT\wRTOS SDK\1.0\bin`

VMware

wRTOS 1.0 supports VMware Workstation 17.x.

Note: wRTOS Runtime may run on a Virtual Machine, but it is not supported for Real-Time applications. wRTOS Runtime requires a dongle to run on a Virtual Machine.

Note: To run wRTOS Runtime on a Virtual Machine, select **Enable virtual machine support** during wRTOS Runtime installation.

Administrator Privileges

Administrator privileges are required for installing and uninstalling the wRTOSproduct.

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End User Installation

Before You Begin

Please review this information before you install wRTOS Runtime:

- Verify that your system meets the hardware and software requirements described earlier in this guide.
- Verify that a valid current boot configuration is present on the system.
- You must have administrator privileges on your system.
- Exit all Windows programs.
- wRTOS Runtime cannot be installed on the same system as RTX64 Runtime.
- IntervalZero recommends that you turn off the Windows "Automatically reboot" option. You can find this option under **Start > Control Panel > System and Security > System > Advanced System Settings > Startup and Recovery > Automatically Restart**. Clearing selection of this option allows you to view blue screen information.
- The wRTOS Runtime installer automatically turns off *Fast Startup* on Windows 11 and Windows 10 machines. When wRTOS is uninstalled, *Fast Startup* will remain turned off.

Installing wRTOS Runtime

Note: You can also install wRTOS Runtime silently. For instructions, see Installing wRTOS Runtime from the Command Line.

Note: This installer will check for and install .NET 8.0 if it is not already on the system.

To install wRTOS Runtime:

1. Download the zip file `MaxRT_wRTOS_1.0_BETA_Runtime_Setup.zip`.
2. Extract the contents of the zip file.
3. Double-click the self-extracting executable `MaxRT_wRTOS_1.0_Runtime_Setup.exe`.
4. The MaxRT wRTOS Runtime Installer Wizard appears. Click **Next** on the Welcome screen.
5. Read the End User License Agreement, select **I accept the terms of the license agreement**, and then click **Next**.
6. On the Destination Folder screen, optionally browse for a different destination location or accept the default location: `C:\Program Files\IntervalZero\MaxRT\wRTOS\`. Click **Next** to continue.
7. On the Custom Setup screen, select the features and components you want to install. Clear selection of the features and components you don't want to install. Click **Next** to continue.

   Note: TCP/IP requires the wRTOS Basic Networking package. GigE Vision requires the wRTOS GigE Vision and wRTOS Basic Networking packages. E-CAT requires the wRTOS Fieldbus package. Contact IntervalZero Sales to purchase product licenses.

8. On the Virtual Machine Support screen, select **Enable virtual machine support** if you plan to run wRTOS Runtime on a Virtual Machine. Otherwise, leave this check box cleared. Click **Next** to continue.
9. On the Ready to Install the Program screen, click **Install**.

10. Once wRTOS Runtime has been successfully installed, click **Finish** to exit the Installer Wizard and open wRTOS Settings, where you can activate components and configure the RTSS core configuration. See Activating and Configuring wRTOS Runtime.

11. Reboot the system, and then choose the wRTOS boot configuration at system startup:

    [Operating System] - wRTOS

    > **Important:** If you boot into a non-wRTOS configuration during startup, a warning message will appear, and wRTOS may not behave as expected.

Activating and Configuring wRTOS Runtime

MaxRT wRTOS Runtime product components must be activated with a valid license. You can activate your product components and lock them to a specific machine or IntervalZero-provided dongle.

If you choose to install the wRTOS Settings feature, which is selected to be installed by default, the wRTOS Settings **Licensing and Activation** page appears immediately after a successful program installation. If wRTOS Settings is not installed, you can use the `MaxRTActivationUtil.exe` command line utility to activate wRTOS components and configure system processors.

> **Note:** RTX64 licenses will not work with MaxRT products. You must purchase a new license to activate wRTOS Runtime.

> **Note:** Dongle activation is required when installing wRTOS Runtime on a Virtual Machine.

Once wRTOS Runtime product components are licensed, you must configure the Subsystem before you can run a real-time application. You can create an RTSS configuration on the **Core Configuration** page in wRTOS Settings or through the `MaxRTActivationUtil.exe` command line utility. See Setting the RTSS Configuration later in this guide.

Activating with wRTOS Settings

If you install the wRTOS Settings feature with wRTOS Runtime, you can activate wRTOS components on the Licensing and Activation page. If wRTOS Settings is not installed, you can use the `MaxRTActivationUtil.exe` command line utility to activate wRTOS components.

Activation Options

You can activate a wRTOS Runtime product feature with a key or license file.

> **Note:** The steps required to activate the features depend on whether the machine is connected to the Internet.

Option	Description
Activate with a key	Activate using a valid activation key. You can activate immediately over the network (this option requires a network connection with access to the IntervalZero License Server) or generate a fingerprint file with a valid activation key which you can then convert to a license file and import using the Activate with a license file option.
Activate with a license file	Activate by importing a valid license file.

Activate with a key

Use this option to activate your product feature with a valid activation key. You can activate immediately over the network (this option requires a network connection with access to the IntervalZero License Server) or generate a fingerprint file with a valid activation key which you can then convert to a license file and import using the Activate with a license file option.

To activate with a key:

1. Click **Activate with a key**.
2. Determine whether your machine is connected to the Internet with access to the IntervalZero License Server:

Status	Meaning
Connection established	The machine is connected to the network.

Status	Meaning
Unable to establish a network connection	A network connection could not be established. Make sure all network cables are plugged in and click the Network icon to refresh. If a network connection cannot be established, you can do one of the following: • Follow the steps under Configuring a Proxy Server. • Generate a fingerprint file.

3. Enter a valid activation key.

> **Note:** You can find your activation key in the email you received from IntervalZero Sales upon purchase of wRTOS. If you can't locate your key, click **Don't have an activation key?** to contact Sales.

4. Do one of the following:

   - If your machine is connected to the network, click **Activate Over the Network**. The product features activated by this key are added to the **Licensed components** list.
   - If your machine is not connected to the network, click **Generate a Fingerprint File**. This creates a fingerprint file with a valid activation key which you can then convert to a license file and import using the Activate with a license file option. See Generating a Fingerprint File for more information on this step.

Configuring a Proxy Server

You can try configuring a proxy server if a network connection cannot be established,

To configure a proxy server:

1. Click **Configure proxy server**. The **Configure proxy server** dialog appears.
2. Enter the requested settings:

- Server
- Port
- Username
- Password

> **Note:** This information can be provided by your IT department.

3. Click **Apply**.

Generating a Fingerprint File

Use this option to create a fingerprint file with a valid activation key which you can then import using the Activate with a license file option.

To generate a fingerprint file:

1. Under Activate with a key, enter a valid activation key, and then click **Generate a fingerprint file**.
2. In the **Save As** dialog, name the file `fingerprint.rfp`. By default, the file will be saved to the desktop.
3. Navigate to the desktop and then copy and paste the file `fingerprint.rfp` to an external device.
4. Connect the device to a machine with Internet connectivity.
5. Launch a web browser and navigate to https://Activation.IntervalZero.com.
6. Browse for and open the file `fingerprint.rfp`.
7. Click **Activate** to generate a license (`.lic`) file.
8. Click **Save** if your browser prompts you to save the license file. Some browsers automatically save the downloaded license file without prompting.
9. Copy the file `License.lic` to the external device and transfer it to the machine on which wRTOS is installed.
10. Follow the steps under **Activate with a license file**.

Activate with a license file

Use this option to activate a product feature by importing a valid license file, such as a license file created from a fingerprint file.

To activate with a license file:

1. Click **Activate with a license file**.
2. Click **Import...** and then browse for and open the `License.lic` file.

Activating Product Components to a Dongle

You have three options when purchasing an IntervalZero-provided dongle and a product license at the same time:

- **Option 1 (default)** – IntervalZero activates the dongle for you when you purchase the software and a small form factor dongle. Connect the dongle to use wRTOS. See Using a Pre-Activated Dongle below.
- **Option 2** – Request that IntervalZero not activate the dongle for you when you purchase the software and a small form factor dongle. You will then need to activate the product to the dongle yourself, following the steps above. See Using a Non-Activated Dongle below.
- **Option 3**– Use an existing small form factor dongle. You will need to activate the product the dongle yourself, following the steps above. See Using a Non-Activated Dongle below.

> **Note:** You can also license wRTOS features to an IntervalZero-provided dongle using the MaxRT Dongle Activation Utility. This allows you to activate licensed features on other machines similar to the pre-activation service you can request from IntervalZero. You can download the MaxRT Dongle Activation Utility from the Customer Center.

If you have a dongle that has already been activated, jump to step To use a dongle that has already been activated.

> **Important:** You cannot license wRTOS features to a dongle when more than one dongle is connected to the machine.

Important: You cannot license wRTOS features to a dongle from a remote connection.

Note: Dongle activation is required when installing wRTOS Runtime on a Virtual Machine.

Using a Non-Activated Dongle

To activate product features to a non-activated dongle:

Note: You cannot license wRTOS features to a dongle when more than one dongle is connected to the machine.

1. Make sure wRTOS Settings detects the dongle. If the dongle is not detected, make sure it is securely connected to the machine.

   Note: If the dongle isn't recognized, the wRTOS feature(s) will be locked to the machine.

   Important: Once features are locked to a dongle, that dongle must be connected to use wRTOS features on that machine.

2. Choose the appropriate activation option. See Activation Options above.

Using a Pre-Activated Dongle

A pre-activated dongle already contains a license file. Follow the steps below to use a pre-activated dongle.

To use a dongle that has already been activated:

1. Connect the dongle to a USB port on the machine.
2. Make sure wRTOS Settings detects the dongle. If the dongle is not detected, make sure it is securely connected to the machine.

   Once the dongle is detected, the product features activated by its key are added to the **Licensed features** list.

Activating with MaxRTActivationUtil.exe (Command Line)

If wRTOS Settings is not installed, you can use the `MaxRTActivationUtil.exe` command line utility to activate wRTOS components and configure system processors.

To activate your product (Internet connection required):

1. Navigate to the `C:\Program Files\IntervalZero\MaxRT\Common\bin` directory and run `MaxRTActivationUtil.exe` as Administrator.
2. Type the `-a` flag, and then provide your activation key. For example:

   ```
   MaxRTActivationUtil.exe -a WRTOS64-111-2222-3333-4444-5555-WNET64-111-2222-3333-4444-5555
   ```

   > **Note:** You can find your activation key in the email you received from IntervalZero Sales.

   If running from a command prompt, the activated components are displayed.

Force-Activating to a Dongle or Machine

You can use the `-dongle` flag to force activation to an IntervalZero-provided dongle. If you want to force activation to ignore a dongle, use the `-nodongle` flag.

To force activation to a dongle:

```
MaxRTActivationUtil.exe -a WRTOS64-111-2222-3333-4444-5555-WNET64-111-2222-3333-4444-5555 -dongle
```

To force activation to ignore a dongle:

```
MaxRTActivationUtil.exe -a WRTOS64-111-2222-3333-4444-5555-WNET64-111-2222-3333-
4444-5555 -nodongle
```

To look for an IntervalZero-provided dongle and activate to the machine if a dongle is not found:

```
MaxRTActivationUtil.exe -a WRTOS64-111-2222-3333-4444-5555-WNET64-111-2222-3333-
4444-5555
```

Setting the RTSS Configuration

Once wRTOS Runtime is licensed, you must set an RTSS configuration before you can use it. To do this, assign available processors to Windows or wRTOS on the Core Configuration page in wRTOS Settings, if installed, or through the `MaxRTActivationUtil.exe` command line utility.

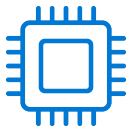
> **Note:** We recommend that you turn off Hyper-Threading. If Hyper-Threading remains enabled, we recommend assigning an even number of processors between Windows and wRTOS. The Windows logical processor and RTSS logical processor must not share the same physical processor.

Using wRTOS Settings

If you install the wRTOS Settings feature with wRTOS Runtime, you can create an RTSS configuration on the Core Configuration page. If wRTOS Settings is not installed, you can use the `MaxRTActivationUtil.exe` command line utility to configure system processors.

To set the RTSS configuration:

1. Open **wRTOS Settings** if it is not already open.
2. Navigate to the **Core Configuration** page:
   - From the Home page, click **Core Configuration**.

     
   - From any other wRTOS Settings page, click **Core Configuration** (Contents / Core Configuration) in the sidebar menu.
3. View the number of **total cores available** at the top of the Core Configuration page. This is the number of cores you can assign between Windows and wRTOS. Keep in mind that at least the first core is always assigned to Windows. For example, on a machine with 8 cores, and a Professional wRTOS Runtime license at minimum, you can assign up to 7 cores to wRTOS.
4. Assign system cores to Windows. Enter a value or choose a number from the **Windows** combo box.

5. Assign remaining cores to the wRTOS Real-time Subsystem (RTSS). Enter a value or choose a number from the **RTSS** combo box.
6. If the specified configuration is valid, click **Apply** to complete the configuration.

> **Note:** The **Apply** button is grayed-out until a valid configuration is provided. A valid configuration meets these requirements:
>
> • The total number of cores assigned to Windows and RTSS is equal to or less than the total number of system cores.
>
> • The number of cores assigned to RTSS is equal to or less than the number of cores allowed by your wRTOS Runtime Edition license.

7. When you are prompted, click **Yes** to reboot your computer.
8. Choose the wRTOS configuration when the system starts.

> **Note:** Even if you don't reboot immediately, all changes will be saved and will take effect after the next reboot. The wRTOS Subsystem will not work correctly until after the next reboot.

Using MaxRTActivationUtil.exe (Command Line

If wRTOS Settings is not installed, you can use the `MaxRTActivationUtil.exe` command line utility to configure system processors.

Setting the RTSS configuration:

1. Navigate to the `C:\Program Files\IntervalZero\MaxRT\Common\bin` directory.
2. Run `MaxRTActivationUtil.exe` as Administrator. You must license the product before you configure the system.
3. Specify the number of Windows `-w` and RTSS `-r` processors. For example, to assign 3 processors to Windows and 5 processors to wRTOS on a dedicated system, you would type:

   ```
   MaxRTActivationUtil.exe -w 3 -r 5
   ```

4. Restart the system.

Verifying Installation

Once wRTOS Runtime has been installed and you are booted into the wRTOS configuration, you can run the System Response Time Measurement (SRTM) utility to verify that the installation was successful.

Steps:

1. Start the Subsystem if it is not already running. You can do this through wRTOS Settings or wRTOS Control Panel.
2. Open a command prompt as Administrator and type `RtssRun srtm.rtss`

   You should hear a steady 1 KHz tone for 15 seconds and a histogram of the system's response time measurements should appear on the screen.

   Sample Output from srtm.rtss

```
SRTM v1.0 timer delivery latencies for a periodic wRTOS timer:
  Timer Period = 100 us, Clock Resolution = 0.1 us.
  Sample Period = 15 s, Total Ticks = 149999.

Summary:
  Minimum = 0 us, Average = 0 us, Maximum = 3 us

Histogram:
    0 - 1 us: 29607
    1 - 2 us: 375
    2 - 3 us: 16
    3 - 4 us: 1
    4 - 1000 us: 0 ***
```

Uninstalling wRTOS Runtime

Follow the appropriate steps below based on your version of Windows to uninstall wRTOS Runtime. Before uninstalling, consider the following:

- After wRTOS Runtime is uninstalled, any devices that had been converted to wRTOS will no longer have an associated driver. You must convert these devices back to Windows using the Windows Device Manager.
- All Subsystem settings are removed during uninstall. If you want to save the current state of wRTOS Runtime settings, you can export an XML file from the Support page in wRTOS Settings.
- wRTOS user groups are not removed when the wRTOS Runtime is uninstalled.

Uninstalling

Important: Stop all real-time processes and the Subsystem before you uninstall wRTOS Runtime.

Note: If the wRTOS boot configuration is the only boot configuration present on uninstall, it will be retained so that you can boot your system.

Windows 11:

1. Open **Windows Settings** and navigate to **Apps / Installed apps**.
2. Locate **MaxRT wRTOS 1.0 Runtime**.
3. Click **More options** (**...**) and then click **Uninstall**.
4. Click **Yes** to confirm.
5. Click **Finish** once wRTOS Runtime has been uninstalled.

Windows 10:

1. Open **Windows Settings** and navigate to **Apps & features**.
2. Click **MaxRT wRTOS 1.0 Runtime** and then click **Uninstall**.

3. Click **Yes** to confirm.
4. Click **Finish** once wRTOS Runtime has been uninstalled. The machine will now reboot.

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Silent Installation

The silent installer provides the ability to install wRTOS Runtime from the command line. This makes it possible to install wRTOS Runtime within another product installation.

> **Note:** You must have administrator privileges to install wRTOS Runtime.

Before You Begin

Please review this information before you install wRTOS Runtime:

- Verify that your system meets the hardware and software requirements described earlier in this guide.
- Verify that a valid current boot configuration is present on the system.
- You must have administrator privileges on your system.
- Exit all Windows programs.
- wRTOS Runtime cannot be installed on the same system as RTX64 Runtime.
- IntervalZero recommends that you turn off the Windows "Automatically reboot" option. You can find this option under **Start > Control Panel > System and Security > System > Advanced System Settings > Startup and Recovery > Automatically Restart**. Clearing selection of this option allows you to view blue screen information.
- The wRTOS Runtime installer automatically turns off *Fast Startup* on Windows 11 and Windows 10 machines. When wRTOS is uninstalled, *Fast Startup* will remain turned off.

Installing wRTOS Runtime Silently

You can install wRTOS Runtime silently using a response file. The response file contains information on the data and system customizations selected by the user at run time.

IntervalZero-Provided Response File

IntervalZero provides a default response file for silent installation of wRTOS Runtime, available from the `ResponseFiles` folder.

- `wRTOS_1.0_Runtime_Install_Response_File.iss` – installs wRTOS 1.0 Runtime product to the default location and includes all features.

Creating a Custom Response File

Follow these instructions to create a new response file called `Setup.iss`. This file is similar to an INI file.

To create a new response file:

Run this command:

```
wRTOS_1.0_Runtime_Setup.exe /r
```

This launches the wRTOS Runtime installer, records the selections and customizations you make, and saves the data to a custom .iss file called `Setup.iss` in the system's Windows folder.

To specify a new name and location:

To specify an alternative response file name and location, use the */f1* option.

For example, to create a response file named `wRTOSRuntime.iss` in the `C:\temp` directory, you would run:

```
wRTOS_1.0_Runtime_Setup.exe /r /f1”C:\temp\wRTOSRuntime.iss”
```

To customize features:

The sections of a response file must be ordered as follows:

1. Dialog Sequence Section
2. Dialog Data Sections (one per dialog)

Data entries consist of <name=value> pairs, as in the following example:

```
Dlg0={7D178B36-BCD6-4EBE-90B7-92D719136B38}-Component-0
```

For more information on manually creating a response file, visit https://community.flexera.com/t5/InstallAnywhere-Knowledge-Base/How-to-Create-Response-File-to-Be-Used-as-Silent-Install/ta-p/3530

Installing with a Response File

To silently install with the IntervalZero-provided default response file:

Run `wRTOS_1.0_Runtime_Setup.exe /s /f1"<path to the ResponseFiles folder>\wRTOS_1.0_Runtime_Install_Response_File.iss"`

To silently install with A custom response file:

Run `wRTOS_1.0_Runtime_Setup.exe /s /f1"<path to your custom response file>"`

For example:

```
wRTOS_1.0_Runtime_Setup.exe /s /f1"C:\temp\wRTOSRuntime.iss"
```

Note: The InstallShield icon appears on the system Task Bar during silent installation.

Log Files

When running a wRTOS installation in silent mode (using the */s* option), the log file `Setup.log` is created in the same directory as the response file. To specify an alternative log file location and/or file name, use the */f2* option.

For example:

```
wRTOS_1.0_Runtime_Setup.exe /s /f2"C:\Setup.log"
```

Activating and Configuring wRTOS Runtime Silently

You can use the `MaxRTActivationUtil.exe` command line utility to silently activate wRTOS components and configure system processors.

To activate your product (Internet connection required):

1. Navigate to the `C:\Program Files\IntervalZero\MaxRT\Common\bin` directory and run `MaxRTActivationUtil.exe` as Administrator.
2. Type the `-a` flag, and then provide your activation key. For example:

   ```
   MaxRTActivationUtil.exe -a WRTOS64-111-2222-3333-4444-5555-WNET64-111-2222-3333-4444-5555
   ```

   > **Note:** You can find your activation key in the email you received from IntervalZero Sales.

   If running from a command prompt, the activated components are displayed.

Force-Activating to a Dongle or Machine

You can use the `-dongle` flag to force activation to an IntervalZero-provided dongle. If you want to force activation to ignore a dongle, use the `-nodongle` flag.

To force activation to a dongle:

```
MaxRTActivationUtil.exe -a WRTOS-111-2222-3333-4444-5555-WNET64-111-2222-3333-4444-5555 -dongle
```

To force activation to ignore a dongle:

```
MaxRTActivationUtil.exe -a WRTOS-111-2222-3333-4444-5555-WNET64-111-2222-3333-4444-5555 -nodongle
```

To look for an IntervalZero-provided dongle and activate to the machine if a dongle is not found:

```
MaxRTActivationUtil.exe -a WRTOS-111-2222-3333-4444-5555-WNET64-111-2222-3333-
4444-5555
```

Setting the RTSS configuration:

1. Navigate to the `C:\Program Files\IntervalZero\MaxRT\Common\bin` directory.
2. Run `MaxRTActivationUtil.exe` as Administrator. You must license the product before you configure the system.
3. Specify the number of Windows `-w` and RTSS `-r` processors. For example, to assign 3 processors to Windows and 5 processors to wRTOS on a dedicated system, you would type:

   ```
   MaxRTActivationUtil.exe -w 3 -r 5
   ```

4. Restart the system.

BATCH FILE EXAMPLE

You can install wRTOS components silently via a batch (`.bat`) file. Below are examples of typical commands that might be used:

Command	Result
`MaxRT_wRTOS_1.0_Runtime_Setup.exe /s ”C:\ResponseFiles\wRTOS_1.0_Runtime_Install_Response_File.iss"`	Installs the wRTOS Runtime silently
`cd C:\Program Files\IntervalZero\MaxRT\wRTOS 1.0\Common\bin`	Changes the directory to the location where `MaxRTActivationUtil.exe` resides
`MaxRTActivationUtil.exe -a <license number>`	Activates the components included in the activation key
`MaxRTActivationUtil.exe -w 2 -r 2`	Sets the boot configuration. In this example, 2 processors are assigned to Windows and 2 to wRTOS.

Uninstalling wRTOS Runtime Silently

You can uninstall wRTOS Runtime silently using a response file. The response file contains information on the data and system customizations selected by the user at run time.

IntervalZero provides a default response file, available from the `ResponseFiles` folder, for use when uninstalling wRTOS Runtime silently.

- `wRTOS_1.0_Runtime_Uninstall_Response_File.iss` – uninstalls wRTOS 1.0 Runtime and reboots the system.

To silently uninstall wRTOS Runtime with the IntervalZero-provided default response file:

Run `wRTOS_1.0_Runtime_Setup.exe /s”<path to the ResponseFiles folder>\wRTOS_1.0_Runtime_Uninstall_Response_File.iss"`

Note: The system will reboot after wRTOS 1.0 Runtime is silently uninstalled using the IntervalZero-provided response file. If you want to suppress the reboot, create an alternative response file. See *Creating a Custom Response File* earlier in this guide.

To silently uninstall wRTOS Runtime with a custom response file:

Run `wRTOS_1.0_Runtime_Setup.exe /s /f1"<path to your custom response file>"`

For example:

```
wRTOS_1.0_Runtime_Setup.exe /s /f1"C:\temp\wRTOSRuntime.iss"
```

Note: The InstallShield icon appears on the system Task Bar during silent installation.

The same system configuration changes will result when performing a silent install as would occur when using the Windows Add/Remove program utility. For more information, see Uninstalling.

Note: Silent uninstall of wRTOS results in an automatic reboot of the system. To install silently without forcing a reboot of the system, use the `/norestart` command.

4

Next Steps

Once you've successfully installed wRTOS Runtime, we recommend you review the wRTOS documentation installed with the product.

Managing Users and Groups

The wRTOS Runtime installation creates two Windows user groups: *wRTOSUsers*, and *wRTOSAdministrators*. These groups allow for granular control of wRTOS permissions. A user must belong to a group to use wRTOS.

Group	Permissions
wRTOSAdministrators	• *Full* access to all wRTOS resources
wRTOSUsers	• *Read* access to all wRTOS resources • Ability to execute RTSS applications • Ability to terminate RTSS processes

All authenticated users who log on to the system can control, configure, and run the wRTOS Subsystem and RTSS applications by default. The default wRTOS groups include:

- The Windows group **Authenticated Users**
- The Windows user **SYSTEM** (also known as LocalSystem)

System administrators can control access to the wRTOS resources by configuring members of the *wRTOSAdministrators* and *wRTOSUsers* groups.

Important: The Windows user SYSTEM must never be removed from any of the wRTOS groups.

When modifying wRTOS groups, remove Authenticated Users from all wRTOS groups, then add individual users to specific groups based on their usage needs.

To add a user to a group:

1. From the **Start** menu, right-click on **Computer**, and then click **Manage**. The Computer Management window appears.
2. Click **Local Users and Groups > Groups**.
3. Click the group name. **Add** users in the Properties window that appears.

Notes

- For a member of *wRTOSUsers* to perform the actions listed in the table above, one of the following scenarios is required:
    - Someone with greater permissions must first start the Subsystem for them.
    - The *wRTOSUsers* member must elevate the application they wish to run or terminate.
- User Administrator and processes elevated to Administrator will always have the same rights as members of the *wRTOSAdministrators* group, and all rights associated with user Administrator.
- When you change any of the wRTOS groups above, you must log out and then log back in for the change to take effect.

Starting and Stopping the Subsystem

You can view Subsystem status and start or stop it using wRTOS Settings or wRTOS Control Panel.

Note: By default, the Subsystem, Network Link Layer (NL2), and TCP/IP (if licensed) start automatically when you run an RTSS application. You can change component startup behavior in wRTOS Settings.

To start or stop the Subsystem:

1. Open wRTOS Settings or wRTOS Control Panel.
2. Do one of the following:
    - Click Start to start the Subsystem.
    - Click Stop to stop the Subsystem.

Note: wRTOS Settings and wRTOS Control Panel are optional features. If you choose not to install them with wRTOS Runtime, you can start the Subsystem using the RtssRun command line utility. See the Help for more information.

Preparing wRTOS for Network Components

MaxRT wRTOS network components can be optionally installed with wRTOS Runtime. Most network components require a separate product package and license. Contact IntervalZero Sales to purchase licenses.

Component	Product package	Description
Network Link Layer (NL2)	wRTOS Runtime	The Network Link Layer (NL2) software component provides real-time applications with abstract APIs to access network services at the Layer 2 of the OSI model, independent of the underlying hardware. Using the NL2, you can more easily take advantage of network resources.
TCP/IP Stack	wRTOS Basic Networking	A protocol stack that provides processing and network capability within the RTSS environment. wRTOS provides an API that conforms to a subset of the functions defined in the Windows Sockets 2.0 (Winsock) specification for Windows.

Component	Product package	Description
Virtual Network	wRTOS Basic Networking	A virtual point-to-point connection between Windows and wRTOS that emulates a local area network connection between Windows and the Real-time Subsystem with no additional hardware required. This virtual network allows Windows and RTSS application on the same system to use sockets to communicate.
Bridging	wRTOS Basic Networking	Allows the connection of two network interfaces to communicate with each other.

Component	Product package	Description
GigE Vision	wRTOS GigE Vision	GigE Vision provides functionality for using GigE Vision Cameras within the real-time wRTOS environment. Using Vision, you can quickly discover cameras on the network, query different camera configurations, and acquire image data. Through a provided communication library images can be passed between RTSS and Windows. Or a third-party vision library, such as OpenCV, can be layered on top of GigE Vision interface to provide additional image processing functionality within RTSS. **Note:** This component also requires the **wRTOS Basic Networking** package.

Component	Product package	Description
E-CAT	wRTOS Fieldbus	E-CAT exposes Windows and real-time interfaces that offer support for CANopen over EtherCAT and simplifies configuration of EtherCAT networks with its unique plug-and-play approach. Optional add-on feature packages: • High Speed Timer • Multiple MainDevice • Hot Connect • Cable Redundancy
Generalized Precision Time Protocol (gPTP)	wRTOS Time Sensitive Networking	The gPTP stack supports the protocol and procedures as defined in the IEEE 802.1AS-2011 standard.

Convert a Supported Device to wRTOS Control

Before you can use one of the above network components with wRTOS, you must first convert a supported Network Interface Card (NIC) from Windows control to wRTOS control. You can do this using the Windows Device Manager, which you can access from wRTOS Settings. For more information, see the wRTOS Help topic *Converting a Device from Windows to wRTOS*. For a complete list of supported NICs, see *wRTOS Supported NICs* in the Help and available from the Customer Center.

Note: You should not convert a device that is currently in use.

Additional Component Setup

In addition to converting a device to wRTOS control, each network component requires setup before first use. See the appropriate section below for information on preparing wRTOS for the network component(s) you have installed.

Network Link Layer (NL2) and NIC Drivers

Create a network interface in wRTOS Settings.

To create an interface:

1. Open wRTOS Settings and navigate to the **Interfaces** page (Network / Interfaces).
2. Click **Add** and configure the interface through the **Add Interface** dialog. See *Network Interfaces* in the wRTOS Settings Help for more information.
3. When an interface is added on the Interfaces page, a separate interface-specific page appears under **Network / Interfaces /** where you can configure that interface. Click the name of the interface to view the settings for that interface.
4. On the settings page for the selected interface, expand the **Network Link Layer (NL2)** section and configure the NL2 settings.

TCP/IP

Create a network interface in wRTOS Settings.

To create an interface:

1. Open wRTOS Settings and navigate to the **Interfaces** page (Network / Interfaces).
2. Click **Add** and configure the interface through the **Add Interface** dialog. See *Network Interfaces* in the wRTOS Settings Help for more information.
3. Select the **Support TCP/IP** check box to support TCP/IP functionality and specify these settings:
    - The **IPv4 Address** of the interface in dotted-quad notation. If you specify an IPv4 Address that matches that of another enabled interface, a dialog appears with a list of the duplicate IPv4 address(es).
    - The IPv4 **Netmask** of the interface in dotted-quad notation.

4. When an interface is added on the Interfaces page, a separate interface-specific page appears under **Network / Interfaces /** where you can configure that interface. Click the name of the interface to view the settings for that interface.
5. On the settings page for the selected interface, expand the **TCP/IP** section and configure the TCP/IP settings.

Virtual Network

When the wRTOS Virtual Network Interface is installed, the Interfaces list in wRTOS Settings will contain an interface called *VirtualNIC*. To use the wRTOS Virtual Network, you must configure the IP Address and Subnet mask values for the Windows wRTOS Virtual Ethernet Adapter through Windows Device Manager.

To configure the IP Address and Subnet mask:

> **Note:** The connection for Internet Protocol Version 4 (TCP/IPv4) must be selected for the Virtual Network to function. Internet Protocol Version 6 (TCP/IPv6) is not supported and does not need to be selected.

1. Open the Internet Protocol Version 4 (TCP/IPv4) Properties: Windows Control Panel > Network and Internet > View Network Status and Tasks > Connection: Ethernet > Properties > Internet Protocol Version 4 (TCP/IPv4) > Properties > **Use the following IP address**
2. Set the **IP Address**.

   > **Note:** Leave the **Default gateway** and **DNS fields** empty.

   > **Important:** The Subnet mask you specify in Windows *must* match the Subnet mask specified in wRTOS Settings. By default, the VirtualNIC interface sets the Subnet mask to 255.255.255.0

3. Click **OK**.

GigE Vision

Use the wRTOS Settings tool to configure the Subsystem for use with GigE Vision.

To configure the wRTOS Subsystem:

1. Open **wRTOS Settings** and navigate to the **Interfaces** page.
2. Add a new TCP/IP interface or modify an existing interface.

   > **Note:** The GigE Vision sample uses the name *RtGigE_01_Nic* as the name of the interface. If you specify a different name, you must manually replace *RtGigE_01_Nic* with that custom name in the sample.

3. On the settings page for the interface, expand the **TCP/IP** section and set the **Use with GigE Vision** toggle switch to **ON**.
4. Restart TCP/IP for your changes to take effect.

The system is now set up to run a GigE Vision application.

> **Note:** TCP/IP must be started before you can run your GigE Vision application.

E-CAT

Perform the following steps before running your wRTOS application on your hardware.

To set up your EtherCAT network:

1. Ensure your computer and devices have network interface cards (NICs) or chips that support the EtherCAT protocol. Follow these steps to determine whether the hardware supports EtherCAT:
   - Computers: open Windows Device Manager and locate the NIC under Network adapters. Note of the model number of the NIC and look for that model number in the list of *wRTOS Supported NICs*

available in the wRTOS Help. If the NIC is listed, it supports EtherCAT.

- Devices: consult the device manual or contact the device manufacturer.

2. Prepare the Ethernet cables that are CAT-5 (Category 5) or higher. The transmission rate must be at least 100 Mbps.
3. Connect your computer and devices using Ethernet cables.

You must also create a network interface in wRTOS Settings.

To create an interface:

1. Open wRTOS Settings and navigate to the **Interfaces** page (Network / Interfaces).
2. Click **Add** and configure the interface through the **Add Interface** dialog. See *Network Interfaces* in the wRTOS Settings Help for more information.
3. When an interface is added on the Interfaces page, a separate interface-specific page appears under **Network / Interfaces /** where you can configure that interface. Click the name of the interface to view the settings for that interface.
4. On the settings page for the selected interface, expand the **E-CAT** section and configure the E-CAT settings.

Generalized Precision Time Protocol (gPTP)

Create a network interface in wRTOS Settings.

To create an interface:

1. Open wRTOS Settings and navigate to the **Interfaces** page (Network / Interfaces).
2. Click **Add** and configure the interface through the **Add Interface** dialog. See *Network Interfaces* in the wRTOS Settings Help for more information.
3. When an interface is added on the Interfaces page, a separate interface-specific page appears under **Network / Interfaces /** where you can configure that interface. Click the name of the interface to view the settings for that interface.
4. On the settings page for the selected interface, expand the **gPTP** section and configure the gPTP settings.

Support

For help with MaxRT wRTOS, contact IntervalZero Technical Support by phone or access the online support resources available at https://www.intervalzero.com/en-support/en-customer-service/

Contacting Technical Support by Phone

> **Note:** If you purchased an IntervalZero product through a third-party reseller, please contact the reseller for support.

Location	Number	Hours
United States	1-781-996-4481 At the prompt, press 3 for Support.	Monday - Friday, 8:30 a.m. – 5:30 p.m. US Eastern Time (GMT-500), excluding holidays.
R.O.C. Taiwan	+ 886-2-2556-8117	Monday - Friday, 9:00 a.m. – 5:00 p.m. Taipei Standard Time (GMT+8), excluding holidays.

Before Calling Technical Support

Please have this information ready when you contact IntervalZero Technical Support:

- Your Support ID

  Customers who purchase direct support receive an e-mail address and password for accessing the IntervalZero Customer Support Portal.

- Your MaxRT wRTOS version number

> **Note:** You must have a valid maintenance contract to receive product support.

Online Resources

Visit https://www.intervalzero.com/en-support/en-customer-service/ to log in to the Customer Support Portal (requires valid credentials), access online product Help, and view Support and Lifecycle policies and Product Release Notices.

Appendix A

System Modifications During Installation

wRTOS Runtime does not support Windows hibernation or hybrid sleep. These features must be disabled to provide real-time performance. To facilitate this process, the installer clones your machine's existing power plan and creates and enables a new power plan called *wRTOS-Recommended*. We strongly advise modifying this new power plan to match the settings detailed below.

> **Note:** When wRTOS Runtime is uninstalled, the installer reactivates the original power plan and deletes the *wRTOS-Recommended* plan.

Configure wRTOS-Recommended power plan:

1. From the *Start* menu, choose **Control Panel**.
2. Click **System and Security**, and then click **Power Options**.
3. Click **wRTOS-Recommended**, and then click **Change plan settings**.
4. Set **Turn off the display** to **Never**.
5. Set **Put the computer to sleep** to **Never**.
6. Click **Change advanced power settings**. Configure the advanced settings as recommended below.
7. Click **OK** in the **Power Options** dialog.
8. Click **Save changes**.

Basic Settings

Category	Settings
Sleep	Sleep After = Never Allow hybrid sleep = Off Hibernate after = Never

Advanced Settings

Category	Settings
Hard disk	Turn off hard disk after = Never
Sleep	Sleep After = Never Allow hybrid sleep = Off Hibernate after = Never
PCI Express	Link State Power Management = Off
Processor power management	Minimum processor state = 100% Maximum processor state = 100%

Recommended Laptop Settings

Both AC and DC behaviors are set for all the above settings on laptops. We also recommend the following settings when running wRTOS on a laptop:

Category	Settings
Processor power management	System cooling policy
On battery	Active
Plugged in	Passive

Note: For optimal performance when running wRTOS Runtime on a laptop, we recommend converting *Display adapters* to *Microsoft Basic Display Adapter* in Windows Device Manager. If you choose not to convert display adapters, you may experience latency.

Battery Power Settings on Laptops Running Windows 10 Anniversary

The *wRTOS-Recommended* power plan implements these battery power settings on laptops running Windows 10 Anniversary:

Setting	Value
Critical Action	0 - Do nothing
Low Battery Level	10
Critical Battery Level	5
Low Level Battery Notify	1 - Display notification
Low Level Battery Action	0 - Do nothing
Reserve Battery Level	15

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