# Check and Monitor CPU Temperature

SUSE Linux Enterprise Server for NVIDIA reports CPU and other component temperatures through Advanced Configuration and Power Interface (ACPI) thermal zones and hardware monitoring devices. Read the CPU temperature from the ACPI thermal zones without installing any software, or list all sensors with the **`sensors`** command. Monitoring the temperature helps you reduce energy costs and detect cooling problems early.

**Prerequisites**

- `sudo` privileges to install the `sensors` package and to run **`sensors-detect`** (reading the temperature requires no special privileges)

Publication Date: 05 Nov 2026

## Contents

1 Why monitor CPU temperature? 3

2 Installing and configuring hardware sensors 3

3 Reading the CPU temperature 5

4 Monitoring CPU temperature in real time 8

5 Troubleshooting 8

6 For more information 10

7 Legal Notice 10

A GNU Free Documentation License 11

# 1 Why monitor CPU temperature?

Checking and monitoring CPU temperature has several benefits.

- Energy savings and cost reduction. When a CPU runs at full speed, it consumes more energy than when it is idling. Keeping CPUs cool is also a major cost factor, especially in data centers.
- Identifying and monitoring processes that consume too much CPU power. Doing that can help free CPU resources and increase responsiveness.
- Easier detection of cooling issues. If the CPU temperature approaches or exceeds the high or critical limits that your hardware reports, it indicates that there is a problem with the cooling system or the fan, or that the thermal paste was not applied correctly.
- A long-term reduction of the carbon footprint can be achieved by adjusting the cooling parameters.

You can read the temperature in two ways: from the ACPI thermal zones that the kernel exposes, which needs no additional software, or with the **`sensors`** command, which lists all sensors that the kernel provides. For details, see *Section 3, "Reading the CPU temperature"*.

# 2 Installing and configuring hardware sensors

The **`sensors`** command is part of the `sensors` package. To read the temperature from the ACPI thermal zones, you do not need the package. For details, see *Section 3.1, "Reading the ACPI thermal zones"*.

1. Install the required package.

   - On the mutable system:

     ```
     > sudo zypper install sensors
     ```

   - On the immutable system:

     ```
     > sudo transactional-update pkg install sensors
     ```

     Reboot the system to activate the change.

2. Check which sensors the kernel already provides:

   ```
   > sensors
   ```

The output lists the sensors that the kernel has registered, for example, ACPI thermal zones and NVMe drives. For a sample and an explanation, see *Section 3.3, "Reading all sensors with the sensors command"*. If the kernel has registered no sensor, the command reports `No sensors found!`

3. Optionally, search for additional hardware monitoring chips that the kernel does not register on its own, for example, on an I2C or SMBus adapter. Do this only if a sensor that you need is missing from the output of **`sensors`**.



### Warning: Hardware probing can hang or damage a system

The **`sensors-detect`** command accesses hardware to identify chips. According to its man page, this can lock up the SMBus and, in rare cases, damage hardware. The man page advises against running the command on production servers.

If you accept this risk, run the following command:

```
> sudo sensors-detect --auto
```

The `--auto` option runs the command without interaction and assumes the default answer to every question. Without it, the command asks each question and waits for your answer.
If the command finds a chip, it prints a summary of the chips that it found. Because of the `--auto` option, it accepts the default answer to the last question:

```
Now follows a summary of the probes I have just done.

Driver `coretemp':
  * Chip `Intel digital thermal sensor' (confidence: 9)

Driver `to-be-written':
  * ISA bus, address 0xa40
    Chip `ITE IT8686E Super IO Sensors' (confidence: 9)

Do you want to generate /etc/sysconfig/lm_sensors? (YES/no):
Created symlink '/etc/systemd/system/multi-user.target.wants/lm_sensors.service' →
 '/usr/lib/systemd/system/lm_sensors.service'.
```

The command generates the file `/etc/sysconfig/lm_sensors` and enables and starts the `lm_sensors` service. The unit file of the service is part of the `sensors` package. To check the status of the service, run:

```
> systemctl status lm_sensors
```

Sample output:

```
● lm_sensors.service - Initialize hardware monitoring sensors
     Loaded: loaded (/usr/lib/systemd/system/lm_sensors.service; enabled; preset: disabled)
     Active: active (exited) since Mon 2026-09-21 07:40:32 CEST; 16ms ago
 Invocation: e3f984a1d2cf43528b9b753f1d698a65
    Process: 1433 ExecStart=/sbin/modprobe -qab $BUS_MODULES $HWMON_MODULES (code=exited, status=0/SUCCESS)
    Process: 1436 ExecStart=/usr/bin/sensors -s (code=exited, status=0/SUCCESS)
   Main PID: 1436 (code=exited, status=0/SUCCESS)
        CPU: 34ms
```

If the command finds no chip, it reports `Sorry, no sensors were detected`. It generates no configuration file, and the service stays disabled. The sensors that the **`sensors`** command already lists are not affected.

To read the temperature, continue with *Section 3, "Reading the CPU temperature"*.

# 3 Reading the CPU temperature

This section describes two ways to read the temperature. If neither shows a temperature, the operating system has no access to a temperature sensor, as is the case in a virtual machine that does not emulate one.

## 3.1 Reading the ACPI thermal zones

The kernel exposes each ACPI thermal zone as a directory named `/sys/class/thermal/thermal_zone`*N*. Reading these files requires neither the `sensors` package nor special privileges.

EXAMPLE 1: LISTING THE TYPE AND TEMPERATURE OF ALL ACPI THERMAL ZONES

```
> grep . /sys/class/thermal/thermal_zone*/{type,temp}
```

Sample output:

```
/sys/class/thermal/thermal_zone0/type:acpitz
/sys/class/thermal/thermal_zone1/type:acpitz
/sys/class/thermal/thermal_zone0/temp:40900
```

```
/sys/class/thermal/thermal_zone1/temp:52900
```

The **`grep .`** command prints the name of each file in front of its content, so that every value stays assigned to its zone. The temperature is given in millidegrees Celsius: `40900` means 40.9°C. The type `acpitz` identifies an ACPI thermal zone.

If `/sys/class/thermal` contains no `thermal_zone`*N* directory, the system has no ACPI thermal zone. Use the **`sensors`** command instead.

Each zone can define trip points. To list the first trip point of the first zone, run:

EXAMPLE 2: LISTING THE FIRST TRIP POINT OF AN ACPI THERMAL ZONE

```
> grep . /sys/class/thermal/thermal_zone0/trip_point_0_{type,temp}
```

Sample output:

```
/sys/class/thermal/thermal_zone0/trip_point_0_type:critical
/sys/class/thermal/thermal_zone0/trip_point_0_temp:100000
```

A trip point of type `critical` gives the temperature at which the kernel shuts down the system to protect the hardware. Its value is also in millidegrees Celsius: `100000` means 100°C. When a zone reaches this temperature, the kernel logs the messages `critical temperature reached` and `HARDWARE PROTECTION shutdown (Temperature too high)`.

## 3.2 Identifying readings that come through ACPI

You can recognize a reading that comes through ACPI in two ways:

- Its zone in `/sys/class/thermal` has the type `acpitz`.
- In the output of the **`sensors`** command, its chip name is `acpitz-acpi-0` and its adapter is `ACPI interface`.

To see the name that the system firmware gave to each zone, read the `path` file of the zone:

EXAMPLE 3: LISTING THE FIRMWARE NAMES OF ALL ACPI THERMAL ZONES

```
> grep . /sys/class/thermal/thermal_zone*/device/path
```

Sample output:

```
/sys/class/thermal/thermal_zone0/device/path:\_TZ_.TZ00
/sys/class/thermal/thermal_zone1/device/path:\_TZ_.TZ01
```

The kernel reports that a reading comes through ACPI, but not which component the zone measures. The firmware chooses the names.

Sensors that the **`sensors`** command lists under another chip name, such as the NVMe drive `nvme-pci-0090` in the following section, are provided by their own kernel drivers and do not come through ACPI.

## 3.3 Reading all sensors with the sensors command

The **`sensors`** command lists every temperature sensor that the kernel has registered, not only the ACPI thermal zones. It needs the `sensors` package, as described in *Section 2, "Installing and configuring hardware sensors"*, but no special privileges. To obtain a snapshot of the current temperatures, run:

```
> sensors
```

Sample output:

```
nvme-pci-0090 ❶
Adapter: PCI adapter ❷
Composite:    +49.9°C  (low  = -273.1°C, high = +69.8°C) ❸
                       (crit = +99.8°C)

acpitz-acpi-0 ❹
Adapter: ACPI interface
temp1:        +40.9°C
temp2:        +52.9°C
```

❶ The device that reports the values. The name consists of the driver (`nvme`), the bus (`pci`) and the address of the device on that bus.

❷ The interface through which the device is accessed, for example, `PCI adapter` or `ACPI interface`.

❸ The temperature of the device, followed by the low, high and critical limits that the device reports.

❹ The ACPI thermal zones. Each zone is one temperature. In this example, `temp1` is `thermal_zone0` (40.9°C) and `temp2` is `thermal_zone1` (52.9°C).

The **`sensors`** command lists the sensors that the kernel has already registered. It does not depend on **`sensors-detect`**, which only searches for additional chips (see *Section 2, "Installing and configuring hardware sensors"*). The kernel drivers `coretemp` for Intel processors and `k10temp` for AMD processors provide the CPU temperature.

### Note: Output depends on the type of hardware

The output of the **`sensors`** command depends on the type of hardware installed on your machine, as different hardware components have different sensors.

## 4 Monitoring CPU temperature in real time

To monitor the temperature in real time, run the **`sensors`** command with the **`watch`** command:

```
> watch sensors
```

The **`watch`** command is part of the `procps` package. It runs a command at regular intervals and shows its output in the terminal. Sample output:

```
Every 2.0s: sensors                                          sles16: 07:23:01 AM
                                                                   in 0.007s (0)
nvme-pci-0090
Adapter: PCI adapter
Composite:    +49.9°C  (low  = -273.1°C, high = +69.8°C)
                       (crit = +99.8°C)

acpitz-acpi-0
Adapter: ACPI interface
temp1:        +40.9°C
temp2:        +52.9°C
```

By default, the **`watch`** command updates the output every two seconds. You can change this interval with the `-n` option followed by the number of seconds. For example, to change the interval to 5 seconds, run:

```
> watch -n 5 sensors
```

Press `Ctrl` – `C` to stop the **`watch`** command.

## 5 Troubleshooting

This part describes potential problems when monitoring CPU temperatures and their solutions.

## 5.1 Why are the displayed temperatures unrealistic?

If you suspect that the displayed temperature is too low or too high, you can try the following:

- Compare the temperatures of the ACPI thermal zones with the `acpitz` entries in the output of the **`sensors`** command. Both show the same zones, so the values should agree. For the commands, see *Section 3, "Reading the CPU temperature"*.

- Use a different tool that reads the same kernel sensors, for example, **`s-tui`**, a terminal utility that shows the temperatures that the system reports together with the CPU frequency and utilization. It is provided by SUSE Package Hub, whose packages are community-maintained and delivered without L3 support. If Package Hub is not enabled, run **`SUSEConnect --list-extensions`**, which prints the command to enable it.
  Install the `s-tui` package:

  - On the mutable system:

    ```
    > sudo zypper install s-tui
    ```

  - On the immutable system:

    ```
    > sudo transactional-update pkg install s-tui
    ```

    Reboot the system to activate the change.

  Then run **`s-tui`** from the terminal.

If none of these recommendations solve the issue, the problem might be due to unsupported or faulty hardware. In this case, you need to seek help from your hardware manufacturer.

## 5.2 Why is the displayed temperature too high?

If the CPU temperature is too high, here are actions you can take:

- Verify that the CPU cooling system, such as the fan or heat sink, works correctly. Ensure that the fan is spinning properly and that the heat sink is making proper contact with the CPU. If necessary, you may need to replace the thermal paste between the CPU and the heat sink to improve heat transfer.
- Adjust the power settings on your system to reduce heat generation. Lowering the CPU frequency or enabling power-saving features can help keep the temperature in check.
- Monitor the system load and CPU usage. High CPU usage for extended periods can lead to increased temperatures. Identify resource-intensive processes with tools such as **`top`** or **`ps`**, then consider optimizing or limiting their usage. For more information, see https://www.suse.com/support/kb/doc/?id=000016916.

# 6 For more information

- For more information about the **`sensors`** command and its configuration, see the man pages **`man sensors`**, **`man sensors-detect`** and **`man 5 sensors.conf`**.
- For more information about monitoring CPU load and other system metrics from a Web interface, see Viewing metrics and history (https://documentation.suse.com/sles/16.1/html/SLES-cockpit/index.html#cockpit-cockpit-metrics) in Cockpit.
- For more information about making your computing more environmentally sustainable, see https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1009324.

# 7 Legal Notice

Copyright© 2006– 2026 SUSE LLC and contributors. All rights reserved.

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2 or (at your option) version 1.3; with the Invariant Section being this copyright notice and license. A copy of the license version 1.2 is included in the section entitled “GNU Free Documentation License”.

For SUSE trademarks, see https://www.suse.com/company/legal/. All other third-party trademarks are the property of their respective owners. Trademark symbols (®, ™ etc.) denote trademarks of SUSE and its affiliates. Asterisks (*) denote third-party trademarks.

All information found in this book has been compiled with utmost attention to detail. However, this does not guarantee complete accuracy. Neither SUSE LLC, its affiliates, the authors, nor the translators shall be held liable for possible errors or the consequences thereof.

# A GNU Free Documentation License

Copyright (C) 2000, 2001, 2002 Free Software Foundation, Inc. 51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA. Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

### 0. PREAMBLE

The purpose of this License is to make a manual, textbook, or other functional and useful document "free" in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or non-commercially. Secondarily, this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

This License is a kind of "copyleft", which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.

We have designed this License to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

### 1. APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work, in any medium, that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. Such a notice grants a world-wide, royalty-free license, unlimited in duration, to use that work under the conditions stated herein. The "Document", below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as "you". You accept the license if you copy, modify or distribute the work in a way requiring permission under copyright law.

A "Modified Version" of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.

A "Secondary Section" is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document's overall subject (or to related matters) and contains nothing that could fall directly within that overall subject. (Thus, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.

The "Invariant Sections" are certain Secondary Sections whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released under this License. If a section does not fit the above definition of Secondary then it is not allowed to be designated as Invariant. The Document may contain zero Invariant Sections. If the Document does not identify any Invariant Sections then there are none.

The "Cover Texts" are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this License. A Front-Cover Text may be at most 5 words, and a Back-Cover Text may be at most 25 words.

A "Transparent" copy of the Document means a machine-readable copy, represented in a format whose specification is available to the general public, that is suitable for revising the document straightforwardly with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup, or absence of markup, has been arranged to thwart or discourage subsequent modification by readers is not Transparent. An image format is not Transparent if used for any substantial amount of text. A copy that is not "Transparent" is called "Opaque".

Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML, PostScript or PDF designed for human modification. Examples of transparent image formats include PNG, XCF and JPG. Opaque formats include proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML, PostScript or PDF produced by some word processors for output purposes only.

The "Title Page" means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this License requires to appear in the title page. For works in formats which do not have any title page as such, "Title Page" means the text near the most prominent appearance of the work's title, preceding the beginning of the body of the text.

A section "Entitled XYZ" means a named subunit of the Document whose title either is precisely XYZ or contains XYZ in parentheses following text that translates XYZ in another language. (Here XYZ stands for a specific section name mentioned below, such as "Acknowledgements", "Dedications", "Endorsements", or "History".) To "Preserve the Title" of such a section when you modify the Document means that it remains a section "Entitled XYZ" according to this definition.

The Document may include Warranty Disclaimers next to the notice which states that this License applies to the Document. These Warranty Disclaimers are considered to be included by reference in this License, but only as regards disclaiming warranties: any other implication that these Warranty Disclaimers may have is void and has no effect on the meaning of this License.

## 2. VERBATIM COPYING

You may copy and distribute the Document in any medium, either commercially or non-commercially, provided that this License, the copyright notices, and the license notice saying this License applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this License. You may not use technical measures to obstruct or control the reading or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section 3.

You may also lend copies, under the same conditions stated above, and you may publicly display copies.

## 3. COPYING IN QUANTITY

If you publish printed copies (or copies in media that commonly have printed covers) of the Document, numbering more than 100, and the Document's license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition. Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.

If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.

If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a computer-network location from which the general network-using public has access to download

using public-standard network protocols a complete Transparent copy of the Document, free of added material. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.

It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.

## 4. MODIFICATIONS

You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:

A. Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.

B. List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has fewer than five), unless they release you from this requirement.

C. State on the Title page the name of the publisher of the Modified Version, as the publisher.

D. Preserve all the copyright notices of the Document.

E. Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.

F. Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.

G. Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.

H. Include an unaltered copy of this License.

I. Preserve the section Entitled "History", Preserve its Title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section Entitled "History" in the Document, create one stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.

J. Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.

K. For any section Entitled "Acknowledgements" or "Dedications", Preserve the Title of the section, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.

L. Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.

M. Delete any section Entitled "Endorsements". Such a section may not be included in the Modified Version.

N. Do not retitle any existing section to be Entitled "Endorsements" or to conflict in title with any Invariant Section.

O. Preserve any Warranty Disclaimers.

If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Sections and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their titles to the list of Invariant Sections in the Modified Version's license notice. These titles must be distinct from any other section titles.

You may add a section Entitled "Endorsements", provided it contains nothing but endorsements of your Modified Version by various parties--for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.

You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by arrangement made by the same entity you are acting on behalf of, you may not add another; but you may replace the old one, on explicit permission from the previous publisher that added the old one.

The author(s) and publisher(s) of the Document do not by this License give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.

## 5. COMBINING DOCUMENTS

You may combine the Document with other documents released under this License, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice, and that you preserve all their Warranty Disclaimers.

The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.

In the combination, you must combine any sections Entitled "History" in the various original documents, forming one section Entitled "History"; likewise combine any sections Entitled "Acknowledgements", and any sections Entitled "Dedications". You must delete all sections Entitled "Endorsements".

## 6. COLLECTIONS OF DOCUMENTS

You may make a collection consisting of the Document and other documents released under this License, and replace the individual copies of this License in the various documents with a single copy that is included in the collection, provided that you follow the rules of this License for verbatim copying of each of the documents in all other respects.

You may extract a single document from such a collection, and distribute it individually under this License, provided you insert a copy of this License into the extracted document, and follow this License in all other respects regarding verbatim copying of that document.

## 7. AGGREGATION WITH INDEPENDENT WORKS

A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, is called an "aggregate" if the copyright resulting from the compilation is not used to limit the legal rights of the compilation's users beyond what the individual works permit. When the Document is included in an aggregate, this License does not apply to the other works in the aggregate which are not themselves derivative works of the Document.

If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one half of the entire aggregate, the Document's Cover Texts may be placed on covers that bracket the Document within the aggregate, or the electronic equivalent of covers if the Document is in electronic form. Otherwise they must appear on printed covers that bracket the whole aggregate.

## 8. TRANSLATION

Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this License, and all the license notices in the Document, and any Warranty Disclaimers, provided that you also include the original English version of this License and the original versions of those notices and disclaimers. In case of a disagreement between the translation and the original version of this License or a notice or disclaimer, the original version will prevail.

If a section in the Document is Entitled "Acknowledgements", "Dedications", or "History", the requirement (section 4) to Preserve its Title (section 1) will typically require changing the actual title.

## 9. TERMINATION

You may not copy, modify, sublicense, or distribute the Document except as expressly provided for under this License. Any other attempt to copy, modify, sublicense or distribute the Document is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

## 10. FUTURE REVISIONS OF THIS LICENSE

The Free Software Foundation may publish new, revised versions of the GNU Free Documentation License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. See https://www.gnu.org/copyleft/.

Each version of the License is given a distinguishing version number. If the Document specifies that a particular numbered version of this License "or any later version" applies to it, you have the option of following the terms and conditions either of that specified version or of any later version that has been

published (not as a draft) by the Free Software Foundation. If the Document does not specify a version number of this License, you may choose any version ever published (not as a draft) by the Free Software Foundation.

## ADDENDUM: How to use this License for your documents

```
Copyright (c) YEAR YOUR NAME.
Permission is granted to copy, distribute and/or modify this document
under the terms of the GNU Free Documentation License, Version 1.2
or any later version published by the Free Software Foundation;
with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts.
A copy of the license is included in the section entitled “GNU
Free Documentation License”.
```

If you have Invariant Sections, Front-Cover Texts and Back-Cover Texts, replace the “with...Texts.” line with this:

```
with the Invariant Sections being LIST THEIR TITLES, with the
Front-Cover Texts being LIST, and with the Back-Cover Texts being LIST.
```

If you have Invariant Sections without Cover Texts, or some other combination of the three, merge those two alternatives to suit the situation.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.