

# SIEMENS

## SIMATIC

### S7 S7-1200 Programmable controller

#### System Manual

|                                               |    |
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## Legal information

### Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

#### **DANGER**

indicates that death or severe personal injury **will** result if proper precautions are not taken.

#### **WARNING**

indicates that death or severe personal injury **may** result if proper precautions are not taken.

#### **CAUTION**

indicates that minor personal injury can result if proper precautions are not taken.

#### **NOTICE**

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

### Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

### Proper use of Siemens products

Note the following:

#### **WARNING**

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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### Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

## 5.5 Using a memory card

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### Note

The CPU supports only the pre-formatted SIMATIC memory cards (Page 1546).

Before you copy any program to the formatted memory card, delete any previously saved program from the memory card.

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Use the memory card either as a transfer card or as a program card. Any program that you copy to the memory card contains all of the code blocks and data blocks, any technology objects, and the device configuration. A copied program does **not** contain force values. The force values are not part of the program, but are stored in the load memory, whether the internal load memory of the CPU, or the external load memory (a program card). If you insert a program card in the CPU, STEP 7 then applies the force values only to the external load memory on the program card.

- Use a transfer card (Page 142) to copy a program to the internal load memory of the CPU without using STEP 7. After you insert the transfer card, the CPU first erases the user program and any force values from the internal load memory, and then copies the program from the transfer card to the internal load memory. When the transfer process is complete, you must remove the transfer card.

You can use an empty transfer card to access a password-protected CPU when the password has been lost or forgotten (Page 151). Inserting the empty transfer card deletes the password-protected program in the internal load memory of the CPU. You can then download a new program to the CPU.

- Use a program card (Page 145) as external load memory for the CPU. Inserting a program card in the CPU erases all of the CPU internal load memory (the user program and any force values). The CPU then executes the program in external load memory (the program card). Downloading to a CPU that has a program card updates only the external load memory (the program card).

Because the internal load memory of the CPU was erased when you inserted the program card, the program card **must** remain in the CPU. If you remove the program card, the CPU goes to STOP mode. (The error LED flashes to indicate that program card has been removed.)

You also use a memory card when downloading firmware updates (Page 148).

### 5.5.1 Inserting a memory card in the CPU

#### NOTICE

##### Protect memory card and receptacle from electrostatic discharge

Electrostatic discharge can damage the memory card or the receptacle on the CPU.

Make contact with a grounded conductive pad and/or wear a grounded wrist strap when you handle the memory card. Store the memory card in a conductive container.



Check that the memory card is not write-protected. Slide the protection switch away from the "Lock" position.

Note that if you do insert a write-protected memory card into the CPU, STEP 7 will display a diagnostic message on the next power up alerting you to that fact. The CPU will power up without failure, but instructions involving recipes or data logs, for example, will return errors if the card is write-protected.

#### WARNING

##### Verify that the CPU is not running a process before inserting the memory card.

If you insert a memory card (whether configured as a program card, transfer card, or firmware update card) into a running CPU, the CPU goes immediately to STOP mode, which might cause process disruption that could result in death or severe personal injury.

Before inserting or removing a memory card, always ensure that the CPU is not actively controlling a machine or process. Always install an emergency stop circuit for your application or process.

#### Note

##### Do not insert V3.0 program transfer cards into S7-1200 V4.0 CPUs.

Version 3.0 program transfer cards are not compatible with version S7-1200 V4.0 CPUs. Inserting a memory card that contains a V3.0 program causes a CPU error.

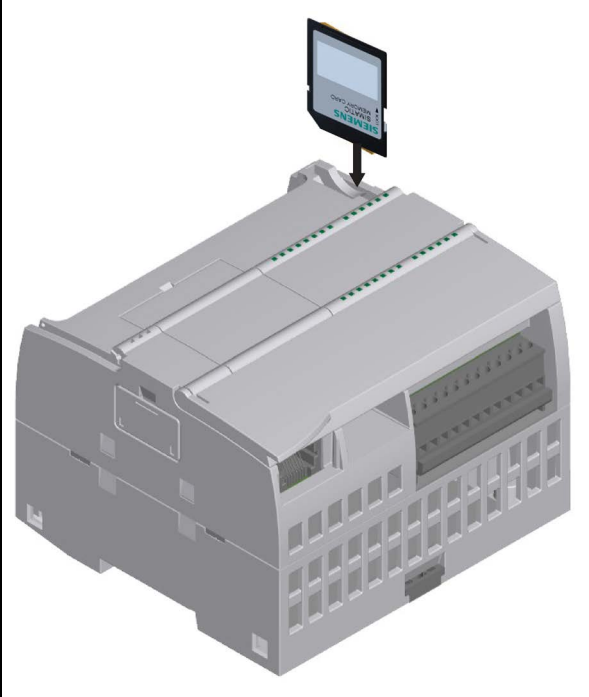
If you do insert an invalid version program transfer card (Page 142), you should remove the card, and perform a STOP to RUN transition, a memory reset (MRES), or cycle power. After you recover the CPU from the error condition, you can download a valid V4.0 CPU program.

To transfer a V3.0 program to a V4.0 program, you must use the TIA Portal to Change Device in the Hardware Configuration.

#### Note

If you insert a memory card with the CPU in STOP mode, the diagnostic buffer displays a message that the memory card evaluation has been initiated. The CPU will evaluate the memory card the next time you either change the CPU to RUN mode, reset the CPU memory with an MRES, or power-cycle the CPU.

Table 5- 41 Inserting a memory card

|                                                                                    |                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>To insert a memory card, open the top CPU door and insert the memory card in the slot. A push-push type connector allows for easy insertion and removal.</p> <p>The memory card is keyed for proper installation.</p> |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### CPU behavior when you insert a memory card

When you insert a memory card in the CPU, the CPU performs the following steps:

1. Transitions to STOP mode (if not already in STOP mode)
2. Prompts for one of the following choices:
  - Power cycle
  - Transition to RUN mode
  - Perform a memory reset
3. Evaluates the card

## How the CPU evaluates the memory card

If you do not configure the CPU to "Disable copy from internal load memory to external load memory" in the Protection properties of the device configuration (Page 212), the CPU determines what type of memory card you inserted:

- **Empty memory card:** A blank memory card does not have a job file (S7\_JOB.S7S). If you insert a blank memory card, the CPU adds a program job file. It then copies internal load memory to external load memory (the program file on the memory card) and erases internal load memory.
- **Blank program card:** A blank program card has a program job file that is empty. In this case, the CPU copies internal load memory to external load memory (the program file on the memory card) and erases internal load memory.

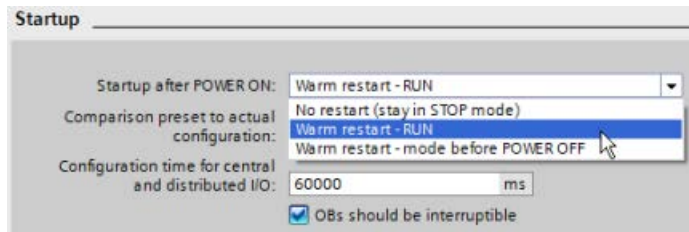
If you configured the CPU to "Disable copy from internal load memory to external load memory" in the Protection properties of the device configuration, the CPU behaves as follows:

- **Empty memory card:** A blank memory card does not have a job file (S7\_JOB.S7S). If you insert a blank memory card, the CPU does nothing. It does not create a program job file and it does not copy internal load memory to external load memory (the program file on the memory card). It does not erase internal load memory.
- **Blank program card:** A blank program card has a program job file that is empty. In this case, the CPU performs no action. It does not copy internal load memory to external load memory (the program file on the memory card). It does not erase internal load memory.

If you insert a program card (Page 145), transfer card (Page 142), or card that contains a firmware update (Page 148) into the CPU, the configuration setting for "Disable copy from internal load memory to external load memory" has no effect on how the CPU evaluates the memory card.

### 5.5.2 Configuring the startup parameter of the CPU before copying the project to the memory card

When you copy a program to a transfer card or a program card, the program includes the startup parameter for the CPU. Before copying the program to the memory card, always ensure that you have configured the operating mode for the CPU following a power-cycle. Select whether the CPU starts in STOP mode, RUN mode, or in the previous mode (prior to the power cycle).



### 5.5.3 Transfer card

#### NOTICE

##### Protect memory card and receptacle from electrostatic discharge

Electrostatic discharge can damage the memory card or the receptacle on the CPU.

Make contact with a grounded conductive pad and/or wear a grounded wrist strap whenever you handle the memory card. Store the memory card in a conductive container.

## Creating a transfer card

Always remember to configure the startup parameter of the CPU (Page 142) before copying a program to the transfer card. To create a transfer card, follow these steps:

1. Insert a blank SIMATIC memory card that is not write-protected into an SD card reader/writer attached to your computer. (If the card is write-protected, slide the protection switch away from the "Lock" position.)

If you are reusing a SIMATIC memory card that contains a user program, data logs, recipes, or a firmware update, you **must** delete the files before reusing the card. Use Windows Explorer to display the contents of the memory card and delete the "S7\_JOB.S7S" file and also delete any existing folders (such as "SIMATIC.S7S", "FWUPDATE.S7S", "DataLogs", and "Recipes").

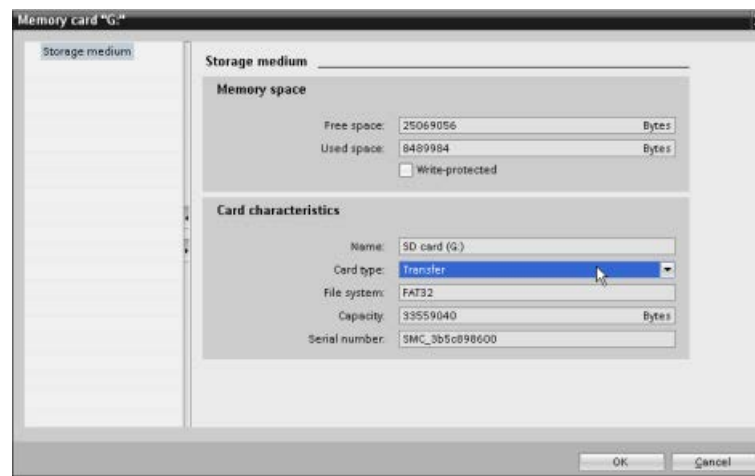
### NOTICE

**Do NOT delete the hidden files "\_\_LOG\_\_" and "crdinfo.bin" from the memory card.**

The "\_\_LOG\_\_" and "crdinfo.bin" files are required for the memory card. If you delete these files, you cannot use the memory card with the CPU.

2. In the Project tree (Project view), expand the "SIMATIC Card Reader" folder and select your card reader.
3. Display the "Memory card" dialog by right-clicking the drive letter corresponding to the memory card in the card reader and selecting "Properties" from the context menu.
4. In the "Memory card" dialog, select "Transfer" from the "Card type" drop-down menu.

At this point, STEP 7 creates the empty transfer card. If you are creating an empty transfer card, such as to recover from a lost CPU password (Page 151), remove the transfer card from the card reader.



5. Add the program by selecting the CPU device (such as PLC\_1 [CPU 1214C DC/DC/DC]) in the Project tree and dragging the CPU device to the memory card. (Another method is to copy the CPU device and paste it to the memory card.) Copying the CPU device to the memory card opens the "Load preview" dialog.

6. In the "Load preview" dialog, click the "Load" button to copy the CPU device to the memory card.
7. When the dialog displays a message that the CPU device (program) has been loaded without errors, click the "Finish" button.

### Using a transfer card

|                                                                                                  |
|--------------------------------------------------------------------------------------------------|
|  <b>WARNING</b> |
|--------------------------------------------------------------------------------------------------|

**Verify that the CPU is not actively running a process before inserting the memory card.**

Inserting a memory card will cause the CPU to go to STOP mode, which could affect the operation of an online process or machine. Unexpected operation of a process or machine could result in death or injury to personnel and/or property damage.

Before inserting a transfer card, always ensure that the CPU is in STOP mode and your process is in a safe state.

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#### Note

**Do not insert V3.0 program transfer cards into later model CPUs.**

Version 3.0 program transfer cards are not compatible with later model S7-1200 CPUs. Inserting a memory card that contains a V3.0 program causes a CPU error.

If you do insert an invalid version program transfer card, then remove the card, perform a STOP to RUN transition, a memory reset (MRES), or cycle power. After you recover the CPU from the error condition, you can download a valid CPU program

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To transfer the program to a CPU, follow these steps:

1. Insert the transfer card into the CPU (Page 139). If the CPU is in RUN, the CPU will go to STOP mode. The maintenance (MAINT) LED flashes to indicate that the memory card needs to be evaluated.
2. Power-cycle the CPU to evaluate the memory card. Alternative methods for rebooting the CPU are to perform either a STOP-to-RUN transition or a memory reset (MRES) from STEP 7.
3. After the rebooting and evaluating the memory card, the CPU copies the program to the internal load memory of the CPU.

The RUN/STOP LED alternately flashes green and yellow to indicate that the program is being copied. When the RUN/STOP LED turns on (solid yellow) and the MAINT LED flashes, the copy process has finished. You can then remove the memory card.

4. Reboot the CPU (either by restoring power or by the alternative methods for rebooting) to evaluate the new program that was transferred to internal load memory.

The CPU then goes to the start-up mode (RUN or STOP) that you configured for the project.

---

#### Note

You must remove the transfer card before setting the CPU to RUN mode.

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### 5.5.4 Program card

**NOTICE**

**Electrostatic discharge can damage the memory card or the receptacle on the CPU.**

Make contact with a grounded conductive pad and/or wear a grounded wrist strap when you handle the memory card. Store the memory card in a conductive container.



Check that the memory card is not write-protected. Slide the protection switch away from the "Lock" position.

Before you copy any program elements to the program card, delete any previously saved programs from the memory card.

### Creating a program card

When used as a program card, the memory card is the external load memory of the CPU. If you remove the program card, the internal load memory of the CPU is empty.

**Note**

If you insert a blank memory card into the CPU and perform a memory card evaluation by either power cycling the CPU, performing a STOP to RUN transition, or performing a memory reset (MRES), the program and force values in internal load memory of the CPU are copied to the memory card. (The memory card is now a program card.) After the copy has been completed, the program in internal load memory of the CPU is then erased. The CPU then goes to the configured startup mode (RUN or STOP).

Always remember to configure the startup parameter of the CPU (Page 142) before copying a project to the program card. To create a program card, follow these steps:

1. Insert a blank SIMATIC memory card that is not write-protected into an SD card reader/writer attached to your computer. (If the card is write-protected, slide the protection switch away from the "Lock" position.)

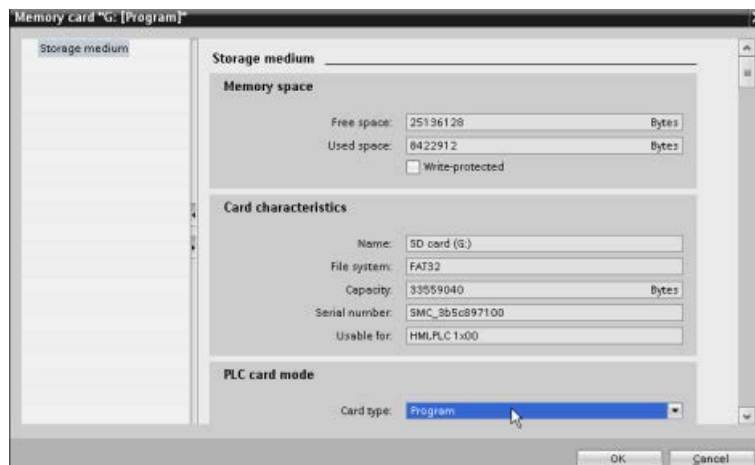
If you are reusing a SIMATIC memory card that contains a user program, data logs, recipes, or a firmware update, you **must** delete the files before reusing the card. Use Windows Explorer to display the contents of the memory card and delete the "S7\_JOB.S7S" file and also delete any existing folders (such as "SIMATIC.S7S", "FWUPDATE.S7S", "DataLogs", and "Recipes").

#### NOTICE

**Do NOT delete the hidden files "\_\_LOG\_\_" and "crdinfo.bin" from the memory card.**

The "\_\_LOG\_\_" and "crdinfo.bin" files are required for the memory card. If you delete these files, you cannot use the memory card with the CPU.

2. In the Project tree (Project view), expand the "SIMATIC Card Reader" folder and select your card reader.
3. Display the "Memory card" dialog by right-clicking the drive letter corresponding to the memory card in the card reader and selecting "Properties" from the context menu.
4. In the "Memory card" dialog, select "Program" from the drop-down menu.



5. Add the program by selecting the CPU device (such as PLC\_1 [CPU 1214C DC/DC/DC]) in the Project tree and dragging the CPU device to the memory card. (Another method is to copy the CPU device and paste it to the memory card.) Copying the CPU device to the memory card opens the "Load preview" dialog.
6. In the "Load preview" dialog, click the "Load" button to copy the CPU device to the memory card.
7. When the dialog displays a message that the CPU device (program) has been loaded without errors, click the "Finish" button.

## Using a program card as the load memory for your CPU

### WARNING

#### Risks associated with inserting a program card

Verify that the CPU is not actively running a process before inserting the memory card.

Inserting a memory card will cause the CPU to go to STOP mode, which could affect the operation of an online process or machine. Unexpected operation of a process or machine could result in death or injury to personnel and/or property damage.

Before inserting a memory card, always ensure that the CPU is offline and in a safe state.

To use a program card with your CPU, follow these steps:

1. Insert the program card into the CPU. If the CPU is in RUN mode, the CPU goes to STOP mode. The maintenance (MAINT) LED flashes to indicate that the memory card needs to be evaluated.
2. Power-cycle the CPU to evaluate the memory card. Alternative methods for rebooting the CPU are to perform either a STOP-to-RUN transition or a memory reset (MRES) from STEP 7.
3. After the CPU reboots and evaluates the program card, the CPU erases the internal load memory of the CPU.

The CPU then goes to the start-up mode (RUN or STOP) that you configured for the CPU.

The program card must remain in the CPU. Removing the program card leaves the CPU with no program in internal load memory.

### WARNING

#### Risks associated with removing a program card

If you remove the program card, the CPU loses its external load memory and generates an error. The CPU goes to STOP mode and flashes the error LED.

Control devices can fail in an unsafe condition, resulting in unexpected operation of controlled equipment. Such unexpected operations could result in death or serious injury to personnel, and/or damage to equipment.

Do not remove the program card without understanding that you are removing the program from CPU.

### 5.5.5 Firmware update

You can use a SIMATIC memory card for performing a firmware update.

|                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NOTICE</b>                                                                                                                                                                                                                                                                                                                      |
| <b>Protect memory card and receptacle from electrostatic discharge</b><br>Electrostatic discharge can damage the memory card or the receptacle on the CPU.<br>Make contact with a grounded conductive pad and/or wear a grounded wrist strap whenever you handle the memory card. Store the memory card in a conductive container. |

You use a SIMATIC memory card when downloading firmware updates from Siemens Industry Online Support (<http://support.industry.siemens.com>). From this Web site, navigate to "Downloads". From there search for the specific type of module that you need to update.

Alternatively, you can access the S7-1200 downloads Web page (<https://support.industry.siemens.com/cs/ww/en/ps/13683/dl>) directly.

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**Note**

You cannot update an S7-1200 CPU V3.0 or earlier to S7-1200 V4.0 or V4.1 by firmware update.

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You can also perform a firmware update by one of these methods:

- Using the online and diagnostic tools of STEP 7 (Page 1318)
- Using the Web server "Module Information" standard Web page (Page 1023)
- Using the SIMATIC Automation Tool  
(<https://support.industry.siemens.com/cs/ww/en/view/98161300>)

|                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NOTICE</b>                                                                                                                                                                                                                                                          |
| <b>Do not use the Windows formatter utility or any other formatting utility to reformat the memory card.</b><br>If a Siemens memory card is reformatted using the Microsoft Windows formatter utility, then the memory card will no longer be usable by a S7-1200 CPU. |

To download the firmware update to your memory card, follow these steps:

1. Insert a blank SIMATIC memory card that is not write-protected into an SD card reader/writer attached to your computer. (If the card is write-protected, slide the protection switch away from the "Lock" position.)

You can reuse a SIMATIC memory card that contains a user program or another firmware update, but you must delete some of the files on the memory card.

To reuse a memory card, you **must** delete the "S7\_JOB.S7S" file and any existing "Data Logs" folders or any folder (such as "SIMATIC.S7S" or "FWUPDATE.S7S") before downloading the firmware update. Use Windows Explorer to display the contents of the memory card and to delete the file and folders.

#### NOTICE

**Do NOT delete the hidden files "\_\_LOG\_\_" and "crdinfo.bin" from the memory card.**

The "\_\_LOG\_\_" and "crdinfo.bin" files are required for the memory card. If you delete these files, you cannot use the memory card with the CPU.

2. Select the zip file for the firmware update that corresponds to your module, and download it to your computer. Double-click the file, set the file destination path to be the root directory of the SIMATIC memory card, and start the extraction process. After the extraction is complete, the root directory (folder) of the memory card will contain a "FWUPDATE.S7S" directory and the "S7\_JOB.S7S" file.

3. Safely eject the card from the card reader/writer.

To install the firmware update, follow these steps:

#### WARNING

**Verify that the CPU is not actively running a process before installing the firmware update.**

Installing the firmware update will cause the CPU to go to STOP mode, which could affect the operation of an online process or machine. Unexpected operation of a process or machine could result in death or injury to personnel and/or property damage.

Before inserting the memory card, always ensure that the CPU is offline and in a safe state.

1. Insert the memory card into the CPU. If the CPU is in RUN mode, the CPU then goes to STOP mode. The maintenance (MAINT) LED flashes to indicate that the memory card needs to be evaluated.
2. Power-cycle the CPU to start the firmware update. Alternative methods for rebooting the CPU are to perform either a STOP-to-RUN transition or a memory reset (MRES) from STEP 7.

#### Note

To complete the firmware upgrade for the module, you must ensure that the external 24 V DC power to the module remains on.

After the CPU reboots, the firmware update starts. The RUN/STOP LED alternately flashes green and yellow to indicate that the update is being copied. When the RUN/STOP LED turns on (solid yellow) and the MAINT LED flashes, the copy process has finished. You must then remove the memory card.

3. After removing the memory card, reboot the CPU again (either by restoring power or by the alternative methods for rebooting) to load the new firmware.

The user program and hardware configuration are not affected by the firmware update. When the CPU is powered up, the CPU enters the configured start-up state. (If the startup mode for your CPU was configured to "Warm restart - mode before POWER OFF", the CPU will be in STOP mode because the last state of the CPU was STOP.)

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#### **Note**

##### **Updating multiple modules connected to CPU**

If your hardware configuration contains multiple modules that correspond to a single firmware update file on the memory card, the CPU applies the updates to all applicable modules (CM, SM, and SB) in configuration order, that is, by increasing order of the module position in Device Configuration in STEP 7.

If you have downloaded multiple firmware updates to the memory card for multiple modules, the CPU applies the updates in the order in which you downloaded them to the memory card.

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## A.17 TeleService (TS Adapter and TS Adapter modular)

The following manuals contain the technical specification for the TS Adapter IE Basic and the TS Adapter modular:

- Industrial Software Engineering Tools  
Modular TS Adapter
- Industrial Software Engineering Tools  
TS Adapter IE Basic

For more information about this product and for the product documentation, refer to the product catalog web site for the TS Adapter

(<https://eb.automation.siemens.com/mall/en/de/Catalog/Search?searchTerm=TS%20Adapter%20IE%20basic&tab=>).

## A.18 SIMATIC memory cards

| Capacity | Article Number     |
|----------|--------------------|
| 32 GB    | 6ES7954-8LT02-0AA0 |
| 2 GB     | 6ES7954-8LP01-0AA0 |
| 256 MB   | 6ES7954-8LL02-0AA0 |
| 24 MB    | 6ES7954-8LF02-0AA0 |
| 12 MB    | 6ES7954-8LE02-0AA0 |
| 4 MB     | 6ES7954-8LC02-0AA0 |

## C.4 Fail-Safe CPUs and signal modules

Table C- 10 Fail-Safe CPUs

| Fail-Safe CPU models |                        | Article number     |
|----------------------|------------------------|--------------------|
| CPU 1212FC           | CPU 1212FC DC/DC/DC    | 6ES7212-1AF40-0XB0 |
|                      | CPU 1212FC DC/DC/Relay | 6ES7212-1HF40-0XB0 |
| CPU 1214FC           | CPU 1214FC DC/DC/DC    | 6ES7214-1AF40-0XB0 |
|                      | CPU 1214FC DC/DC/Relay | 6ES7214-1HF40-0XB0 |
| CPU 1215FC           | CPU 1215FC DC/DC/DC    | 6ES7215-1AF40-0XB0 |
|                      | CPU 1215FC DC/DC/Relay | 6ES7215-1HF40-0XB0 |

Table C- 11 Fail-Safe signal modules

| Functional Safety signal modules |                           | Article number     |
|----------------------------------|---------------------------|--------------------|
| Digital input                    | SM 1226 F-DI 16 x 24 V DC | 6ES7226-6BA32-0XB0 |
| Digital output                   | SM 1226 F-DQ 4 x 24 V DC  | 6ES7226-6DA32-0XB0 |
|                                  | SM 1226 F-DQ 2 x Relay    | 6ES7226-6RA32-0XB0 |

## C.5 Other modules

Table C- 12 Companion products

| Item            |                                          | Article number     |
|-----------------|------------------------------------------|--------------------|
| Power supply    | PM 1207 power supply                     | 6EP1332-1SH71      |
| Ethernet switch | CSM 1277 Ethernet switch - 4 ports       | 6GK7277-1AA10-0AA0 |
| CM CANopen      | CANopen for SIMATIC S7-1200              | 021620-B           |
|                 | CANopen (Ruggedized) for SIMATIC S7-1200 | 021730-B           |
| RF120C          | RF120C communications module             | 6GT2002-0LA00      |

## C.6 Memory cards

Table C- 13 Memory cards

| SIMATIC memory cards | Article number     |
|----------------------|--------------------|
| SIMATIC MC 32 GB     | 6ES7954-8LT02-0AA0 |
| SIMATIC MC 2 GB      | 6ES7954-8LP01-0AA0 |
| SIMATIC MC 256 MB    | 6ES7954-8LL02-0AA0 |
| SIMATIC MC 24 MB     | 6ES7954-8LF02-0AA0 |
| SIMATIC MC 12 MB     | 6ES7954-8LE02-0AA0 |
| SIMATIC MC 4 MB      | 6ES7954-8LC02-0AA0 |