
S7-1200 vs S7-1500: when should you choose each family?

A practical comparison of performance, communication, diagnostics, and cost in real projects.

Summary. Both the S7-1200 and the S7-1500 are programmed in TIA Portal with the same engineering framework, and both are common in Romanian plants. The choice is rarely about which controller is 'better'. It is about matching the controller to the machine's performance, communication, diagnostic and lifecycle requirements, and then documenting that choice so the next engineer understands it.

1. Why this decision matters more than it looks

A controller choice is usually made once and then lived with for ten to fifteen years. Changing families later is expensive: the program may need to be reworked, HMI tags re-linked, spare parts stocked twice, and technicians retrained. The purchase price of the CPU is only one line in that cost picture. Engineering hours, commissioning time, spares strategy and future expansion usually matter more over the life of the machine.

2. Positioning of the two families

The S7-1200 is a compact, all-in-one controller. The CPU carries onboard digital and analog I/O, and expansion is done with signal boards, signal modules and communication modules that clip onto the side of the CPU. It is designed for standalone machines and small automation tasks where footprint and hardware cost are important.

The S7-1500 is a modular, higher-performance controller. Its CPU has no onboard I/O, so every input and output is a separate module on a backplane. It targets demanding machine and process applications, with more execution performance, richer diagnostics, technology functions and more communication resources. It is the family normally chosen for multi-axis motion, larger lines and systems that must be integrated into plant-wide data structures.

3. Performance and memory

Execution speed and memory are the first technical differences most engineers check. The S7-1500 generally offers higher instruction performance and larger program and data memory, which matters when a single controller runs several machine sequences, data handling and communication tasks at the same time. For a typical standalone machine with a few hundred I/O points and straightforward sequencing, the S7-1200 is usually sufficient.

Do not decide from the catalogue alone. Estimate the program size of your application, add the data blocks and recipe storage, and then compare against the memory figures in the current CPU data sheet. Measure the real cycle time during commissioning with the program runtime tools in TIA Portal. A useful rule is to keep a clear margin for future changes, because a machine that fills its memory on day one will be expensive to extend later.

4. Communication and connectivity

Both families support PROFINET for device communication, and both can be connected to SCADA and higher-level systems. Differences appear in the detail. Motion control with PROFINET IRT and isochronous operation is generally the domain of the S7-1500. Additional fieldbus and serial connections are added through communication modules on both families, with a wider option list on the

S7-1500. Recent firmware on both families supports OPC UA server functions, but the exact features differ, so check the firmware release notes for the specific CPU order number.

Count your network segments early. If the plant needs separate control and office networks, multiple PROFINET lines, or a redundant ring, confirm that the chosen CPU and its communication modules support the topology you intend to build.

5. Diagnostics and maintenance

Diagnostics often decide the outcome on machines that have intermittent faults or demanding commissioning schedules. The S7-1500 provides more detailed diagnostic information, trace functions for recording signal behaviour over time, and a more extensive diagnostic buffer. These features reduce the time needed to find a fault that happens once a shift. The S7-1200 offers solid diagnostics for most machines, but it is worth testing the diagnostic workflow your maintenance team will actually use before committing to a family.

6. Total cost of ownership

Compare total cost, not hardware price alone. The main elements are:

- CPU, I/O, communication module and power supply prices for your actual configuration
- Engineering hours to build, test and document the program
- Spare parts: how many different order numbers must be kept in stock
- Training of technicians and the HMI licence model
- Expected expansion of the machine or line over the next several years

The S7-1200 often wins for a single small machine. The S7-1500 can win on a multi-machine line where a standardised library, a common CPU family and one spares list reduce engineering and maintenance effort across all stations.

7. Decision table

Criterion	Points toward S7-1200	Points toward S7-1500
Machine size	Standalone, modest I/O count	Multi-station line, large I/O count
Motion control	Simple drives, no coordinated axes	Several coordinated servo axes
Diagnostics need	Basic fault finding acceptable	Trace and detailed diagnostics required
Communication	Standard PROFINET, few links	Redundancy, many segments, rich integration
Footprint	Tight panel space	Space available for modular rack
Hardware budget	Strict limit on CPU and I/O cost	Budget allows higher-performance CPU
Standardisation	Isolated machine, no shared spares	Plant standard, shared spares and library

8. Worked scenarios

Scenario A: labelling machine

A standalone labelling machine with about 40 digital inputs, 24 digital outputs, four analog signals, one HMI and no coordinated motion. The S7-1200 fits the footprint and budget, and the machine will not need trace functions or complex networking. Choose the S7-1200 and document the expansion limit so

the next change request is evaluated against it.

Scenario B: four-station packaging line

A packaging line with servo axes, traceability data sent to a manufacturing execution system, several PROFINET segments and frequent commissioning changes. The S7-1500 is the appropriate choice. Standardising on this family also lets the plant reuse function blocks across lines.

Scenario C: hybrid architecture

A line controlled by an S7-1500 with a stand-alone auxiliary machine, such as a bagging unit, controlled by an S7-1200 and connected through PROFINET. This is often the best answer when a single machine in the line has different needs. Make sure the data exchange between the two controllers is defined clearly, and that the diagnostic view for both is available to maintenance.

9. Common mistakes

- Choosing by price alone and discovering the memory or communication limit after the machine is built
- Ignoring future expansion and leaving no margin in I/O or program memory
- Forgetting that a remote I/O station is itself a design decision with its own cost and diagnostics
- Checking the CPU for functional safety only after the program is written
- Underestimating how much time a diagnostic-poor controller costs during commissioning

10. Standardisation as a strategy

Plants that run one controller family across most machines reduce spares, training and engineering effort. A reasonable policy is to choose a default family for new machines and allow an exception only when a documented criterion requires it. Record the decision in the project file, including the requirements that drove it. Six months later, that record is often the most valuable document in the project.

Practical exercise

Take a machine you know well and complete the following steps:

1. List the number of digital inputs, digital outputs, analog signals and special I/O.
2. List every communication link: HMI, SCADA, other controllers, drives, MES or ERP.
3. State whether the machine has coordinated motion, and if so, how many axes.
4. Estimate the program size in working days of engineering and the memory it will require.
5. Fill in the decision table above and recommend a family in one paragraph.
6. Name the single requirement that would change your recommendation if it turned out to be false.

Reading material and checklist

- Read the current CPU data sheets for the exact order numbers under consideration.
- Check the TIA Portal version required for each CPU and the firmware release notes.
- Confirm the functional safety requirements with the safety engineer before the CPU is fixed.
- Keep a written selection record in the project folder.

Note: this guide is a decision framework. Product features, memory sizes and firmware capabilities change over time. Always verify the details against the current Siemens documentation for the exact CPU order number you intend to buy.