USB-C becomes mandatory: a look at the future of charging

The European Union is obliging its member states to standardize the charging of certain electronic devices and is also setting deadlines for this. In future, many things should be more standardized and therefore easier for the customer. But what can USB-C do better?

If you enter the term "USB-C EU law" in the search engine, the following text appears:

USB-C becomes mandatory charging standard in the EU. The EU is making USB-C connectors and the USB Power Delivery standard (USB-PD) mandatory. ***From December 28, 2024, all cell phones, tablets and cameras sold in the EU must have a USB-C charging port.*** *This will also apply to laptops from spring 2026.*

When looking at a standard USB-A to USB-C charging cable, at first glance the functionality appears to be the same as before. The USB-A plug is obviously connected to an old mains adaptor, the laptop or the charging socket in the car. The USB-C plug goes into the newly purchased device. Thanks to its symmetrical design, it is at least torsion-proof. The size is roughly the same as a micro USB plug. So almost everything remains the same and it's just a different plug format? No, because this use case only describes compatibility with an outdated technology! USB-C can do much more!

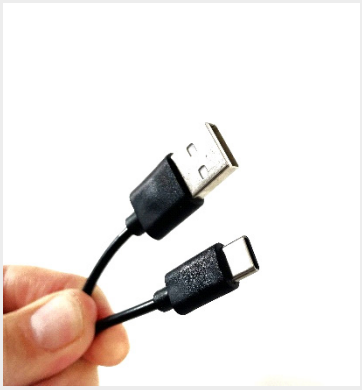


Figure 1: USB-A to USB-C charging cable

What you need to know about USB-C

Today we would like to give you an insight into the topic of charging with USB-C and explain why we have opted for the USB-C interface for our new ARGUS® F200 development, even though measuring devices are exempt from the above-mentioned EU regulation.

The USB Type C with USB-PD controller used in the ARGUS® F200 is compliant with the specifications of USB Type-C version 3.1 and USB-PD 3.0. What does this mean? First, let's take a look at the terms: The version standards describe the charging capacities and data transfer speeds defined by the relevant USB forum.

Very fast data transmission at gigabit speed

The USB 3.1 version is an alias for 3.0 with a speed of 5 Gbit/s. In Gen2, the so-called SuperSpeed Plus version even reaches 10 Gbit/s. The widely used USB 2.0 only supports up to 480 Mbit/s, whereas the newer version 3.2 Gen 2x2 already supports up to 20 Gbit/s.

Further developments beyond this offer up to 40 Gbit/s under the name USB 4, and in future even 80 Gbit/s with USB 4 2.0.

It goes without saying that as speeds increase, so do the demands on the cables to keep signal quality high.

High charging capacities shorten the charging time

The version number after the letters PD (Power Delivery) describes the charging capacity. And this is where things get exciting in everyday use. While the data transfer standards for USB only describe low power levels of 2.5 watts (USB 2.0) or 4.5 watts (USB 3.0, 3.1 and 3.2), the charging standards have been significantly expanded. Starting from a USB battery charging standard with 7.5 watts of power (these are usually specially labeled USB-A sockets), USB-C was designed for 15 watts (5V/3A). Incidentally, all these standards use a voltage of 5V. This has, of course, now become established among consumers. For the first time with the USB-PD standard, voltages higher than 5V with a simultaneous increase in current to 5A are also permitted for USB-C plugs. Voltages of 5, 9, 15 or 20 volts are now available as charging voltages. This means that a maximum output of 100 watts can be called up. And it goes even further: the next standard USB Power Delivery EPR with Extended Power Range even allows additional voltages of 28, 36 and 48V. This leads to charging capacities of up to 240 watts. That is a tenfold increase compared to USB 2.0.

USB-C to USB-C instead of mixed operation

This means that the high charging power results in a further quality requirement for the connection cable used. However, this only applies if both ends of the cable are designed as USB-C plugs.

And this is exactly where a new era begins: Instead of limiting yourself to a 5V power source with USB-A in mixed operation, you should always make sure to establish connections from USB-C to USB-C.

This higher performance allows not only smartphones and tablets, but also laptops, monitors and other devices, such as the

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ARGUS® F200, to be charged and operated via USB. In addition, USB-PD makes it possible to connect multiple devices simultaneously to a USB PD-compatible hub and ensure that each device receives optimal power. The hub can intelligently distribute and prioritize power. For example, first charge the ARGUS® and then a smartphone.

How is USB-C implemented in the ARGUS® F200?

For mains operation, the power supply via USB-C PD in the ARGUS® F200 is permanently set to 15V. The power supply unit used offers an output power of 45W and can flexibly provide voltages between 5V and 20V - adapted to the respective load.
The power management of the ARGUS® F200 controls the power distribution precisely. While the system is supplied with the required power, the surplus energy is used to charge the integrated battery. At maximum charging capacity, the output is around 45 watts at 3A.
If you connect the appropriate ARGUS® power supply unit, it would take approx. 1 hour to charge a fully discharged battery.
However, if you want to use a different source, you can also use all other devices that are equipped with a USB-C port. This could be your laptop, the docking station, the charging socket in your car or a modern power bank.
As a measuring device, the ARGUS® F200 also displays details of the negotiated charging voltage and charging current. This is also helpful because the symbols printed next to the USB plugs are usually quite small. The technical data printed on the power banks is barely legible even with a magnifying glass.
In the following table, we have recorded the values negotiated with the ARGUS® F200 for some USB-C ports that are usually available at a workstation:

Source	USB Type (Source)	Voltage / Current	Performance
Docking Station	USB-C socket at the front	5V / 1.5A	7.5 watts
	USB-C socket at the back	5V / 3A	15 watts
Laptop	USB-C socket at the side	5V / 3A	15 watts
	USB-A at the side	5V / 0.5A	2.5 watts
Powerbank (65 Wh)	USB-C	15V / 3A	45 watts
	USB-A	5V / 1.5A	7.5 watts
Magnetic Powerbank (38.5 Wh)	USB-C	9V / 2.22A	20 watts
	USB-A	5V / 1.5A	7.5 watts
Car (rear seat)	USB-C	5V / 1.5A	7.5 watts
Car (rear seat bench)	USB-C	5V / 3A	15 watts

Figure 2: Values of typical USB-C ports negotiated with the ARGUS® F200

The favorite among the tested sources is clearly the power bank with 45 watts of charging power! Otherwise, it is worth noting that the charging capacities vary considerably depending on the source.



Figure 3: ARGUS® F200; top panel with USB-A and USB-C

Bi-directional is also possible

One of the most innovative features of USB-PD is the bidirectional communication. The charger and the device to be charged exchange information in order to select the appropriate voltage and current. Communication takes place via the USB cable and ensures that the power requirements of each device are correctly recognized. It should be noted that the selected USB cable can also influence communication.

Unlike older USB versions, which usually only transfer power in one direction (from the charger to the device), USB-PD can also charge in the other direction. This is particularly useful for devices such as power banks or laptops that can both draw and release power.

In addition to the features mentioned, USB-PD also offers the following advantages:

- **Fast charging:**
The higher power and flexible voltages mean that devices can be charged more quickly.

- **Simplification:**
A single charger for many different devices.

- **Security:**
Intelligent communication and adjustment of voltage and current minimize the risk of overheating and damage.

USB Power Delivery is now a widely used standard, especially for USB-C ports, and is supported by many smartphones, tablets, laptops and other electronics as it shortens charging times and offers more flexibility.

Symbols help to (hopefully) keep track of the chaos

As mentioned above, there are symbols next to the USB ports to help you recognize the underlying technology and performance:
The so-called trident dates back to the time of USB 2.0 and indicates a transfer speed of 480 Mbit/s. An extension is the SS symbol (SuperSpeed). It indicates that up to 5 Gbit/s are supported. A superscript 10 indicates an increase to 10 Gbit/s (Super Speed Plus). A battery symbol indicates that Power Delivery is also supported. The interface for a compatible display is represented by a white P in a black D. The lightning bolts are still missing: a white lightning bolt with an arrow means that the device is Thunderbolt 3-capable and can transfer 40 Gbit/s; a black lightning bolt indicates the port's fast charging function. If you know your way around, you'll be fine.

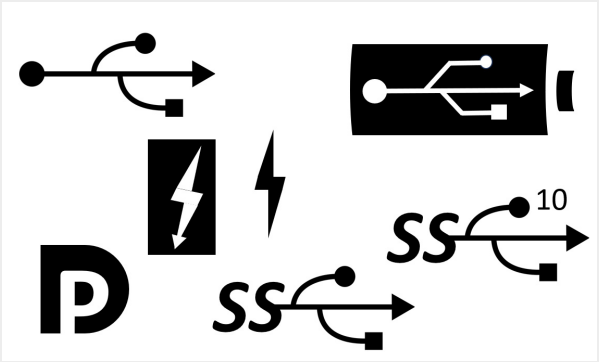


Figure 4: USB symbols: Trident (top left), battery symbol (top right), SuperSpeed (bottom right), display symbol (bottom left), lightning bolts (center)

Conclusion

USB-C with Power Delivery is fascinating and fun! The advances in terms of transfer speeds and charging performance are enormous. With the ARGUS® F200, we have deliberately opted for the pioneering USB-C technology, which is increasingly becoming the standard not only in measuring devices, but also in laptops, smartphones, power banks and cars, for example. In addition to compatibility with a wide range of sources, the quick-charging function saves a considerable amount of time and makes the device particularly flexible to use. It will be interesting to see what innovations and product developments can be expected in the future across the entire spectrum of telecommunications, industry and the consumer market.