

X20EM061x and X20EM161x

1 Other applicable documents

For additional and supplementary information, see the following documents.

Other applicable documents

| Document name | Title |
|---------------|--|
| MAX20 | X20 system user's manual |
| MAEMV | Installation / EMC guide |

2 General information

This compact yet powerful controller series is based on Intel Atom processor technology. The fanless, battery-free design of these controllers means they are completely maintenance-free.

The basic configuration includes USB, Ethernet, POWERLINK V2, RS485 and a flash drive. A controller with a flexibly usable slot for X20 interface modules is available for each processor variant.

- Intel Atom processor with 400 MHz (compatible) to 1.3 GHz with integrated I/O processor
- Ethernet, POWERLINK V2 with poll-response chaining, onboard USB and RS485
- Scalable: 0 or 1 slot for modular interface expansion
- 512 MB to 1 GB LPDDR4 SDRAM
- 1 to 2 GB onboard flash drive
- Fanless
- No battery

3 Order data


|  | |
|--|--|
| X20EM061x | X20EM161x |
| Order number | Short description |
| Embedded PLC | |
| X20EM0611 | X20 Embedded PLC, Atom 0.4 GHz (compatible), 512 MB DDR4 RAM, 64 kB FRAM, 1 GB onboard flash drive, 2 USB interfaces, 1 RS485 interface, 1 POWERLINK interface, 1 Ethernet interface 10/100BASE-T |
| X20EM1611 | X20 Embedded PLC, Atom 0.4 GHz (compatible), 512 MB DDR4 RAM, 64 kB FRAM, 1 GB onboard flash drive, 1 insert slot for X20 interface modules, 2 USB interfaces, 1 RS485 interface, 1 POWERLINK interface, 1 Ethernet interface 10/100BASE-T |
| X20EM0612 | X20 Embedded PLC, Atom 0.8 GHz, 768 MB DDR4 RAM, 64 kB FRAM, 1 GB onboard flash drive, 2 USB interfaces, 1 RS485 interface, 1 POWERLINK interface, 1 Ethernet interface 10/100BASE-T |
| X20EM1612 | X20 Embedded PLC, Atom 0.8 GHz, 768 MB DDR4 RAM, 64 kB FRAM, 1 GB onboard flash drive, 1 insert slot for X20 interface modules, 2 USB interfaces, 1 RS485 interface, 1 POWERLINK interface, 1 Ethernet interface 10/100BASE-T |
| X20EM0613 | X20 Embedded PLC, Atom 1.3 GHz, 1 GB DDR4 RAM, 64 kB FRAM, 2 GB onboard flash drive, 2 USB interfaces, 1 RS485 interface, 1 POWERLINK interface, 1 Ethernet interface 10/100BASE-T |
| X20EM1613 | X20 Embedded PLC, Atom 1.3 GHz, 1 GB DDR4 RAM, 64 kB FRAM, 2 GB onboard flash drive, 1 insert slot for X20 interface modules, 2 USB interfaces, 1 RS485 interface, 1 POWERLINK interface, 1 Ethernet interface 10/100BASE-T |
| Included in delivery | |
| Accessory package for X20 Embedded PLC | |
| X20ACEMTB1 | Accessories X20 Embedded PLCs: 2-pin terminal block for I/O power supply, 6-pin terminal block for RS485 interface and PLC power supply, X20 end cover plate, right (X20AC0SR1) |

Table 1: X20EMx61x - Order data

Included in delivery

| Order number | Short description |
|--------------|---|
| - | Interface module slot cover ¹⁾ |
| X20ACEMTB1 | Accessory package for X20 Embedded PLCs: <ul style="list-style-type: none"> 2-pin terminal block for I/O power supply 6-pin terminal block for RS485 interface and controller power supply X20 end cover plate, right (order number X20AC0SR1) |

1) For controllers with a slot for X20 interface modules.

4 X20EM061x - Technical data

| Order number | X20EM0611 | | X20EM0612 | X20EM0613 |
|--|---|---------------------|-------------------|------------------------|
| Short description | | | | |
| Interfaces | 1x RS485, 1x Ethernet (2-port switch), 1x POWERLINK (V2), 2x USB, 1x X2X Link | | | |
| System module | Controller | | | |
| General information | | | | |
| B&R ID code | 0x289B | 0x289A | 0x288F | |
| Cooling | Fanless | | | |
| Status indicators | CPU function, Ethernet, POWERLINK, RS485, I/O power supply | | | |
| Diagnostics | | | | |
| CPU function | Yes, using LED status indicator | | | |
| Ethernet | Yes, using LED status indicator | | | |
| I/O power supply | Yes, using software and LED status indicator | | | |
| POWERLINK | Yes, using LED status indicator | | | |
| Temperature | Yes, using software register | | | |
| Support | | | | |
| Controller redundancy | No | | | |
| Storage health data support ¹⁾ | Yes | | | |
| ACOPOS support | Yes | | | |
| Visual Components support | Yes | | | |
| Power consumption | 4.6 W ²⁾ | 4.7 W ²⁾ | | |
| Power consumption for X2X Link power supply ³⁾ | 0.6 W | | | |
| Power consumption ³⁾ | | | | |
| Internal I/O | 0.56 W | | | |
| Additional power dissipation caused by actuators (resistive) [W] | - | | | |
| Certifications | | | | |
| CE | Yes | | | |
| UKCA | Yes | | | |
| CPU and X2X Link power supply | | | | |
| Input voltage | 24 VDC -20% / +25% | | | |
| Input current | Max. 1.4 A | | | |
| Fuse | Integrated, cannot be replaced | | | |
| Reverse polarity protection | Yes | | | |
| X2X Link power supply output | | | | |
| Nominal output power | 3.5 W | | | |
| Parallel connection | Yes ⁴⁾ | | | |
| Redundant operation | Yes | | | |
| Input I/O power supply | | | | |
| Input voltage | 24 VDC -15% / +20% | | | |
| Fuse | Required line fuse: Max. 10 A, slow-blow | | | |
| Output I/O power supply | | | | |
| Nominal output voltage | 24 VDC | | | |
| Permissible contact load | 10 A | | | |
| Controller | | | | |
| Real-time clock | Retention for at least 300 hours, typ. 1000 hours at 25°C, 1 s resolution, <30 s/month accuracy at 25°C | | | |
| FPU | Yes | | | |
| Processor | | | | |
| Type | Atom E3915 | | | |
| Clock frequency | 400 MHz (compatible). | 800 MHz | 1.3 GHz | |
| L1 cache | | | | |
| Data code | 24 kB | | | |
| Program code | 32 kB | | | |
| L2 cache | 1 MB | | | |
| Integrated I/O processor | Processes I/O data points in the background | | | |
| Modular interface slots | 0 | | | |
| Remanent variables | Max. 64 kB, retention >10 years ⁵⁾ | | | |
| Shortest task class cycle time | 400 µs | 200 µs | 100 µs | |
| Typical instruction cycle time | 0.0044 µs | 0.0028 µs | 0.0015 µs | |
| Standard memory | | | | |
| RAM | 512 MB LPDDR4 SDRAM | 768 MB LPDDR4 SDRAM | 1 GB LPDDR4 SDRAM | |
| Application memory | | | | |
| Type | 1 GB eMMC flash memory | | | 2 GB eMMC flash memory |
| Data retention | 10 years | | | |
| Writable data amount | | | | |
| Guaranteed | 40 TB | | | |
| Results for 5 years | 21.9 GB/day | | | |
| Guaranteed erase/write cycles | 20,000 | | | |
| Error-correcting code (ECC) | Yes | | | |

Table 2: X20EM061x - Technical data

| Order number | X20EM0611 | X20EM0612 | X20EM0613 |
|--|-----------|---|-----------|
| Interfaces | | | |
| Interface IF2 | | | |
| Signal | | Ethernet | |
| Variant | | 2x shielded RJ45 (switch) | |
| Line length | | Max. 100 m between 2 stations (segment length) | |
| Transfer rate | | 10/100 Mbit/s | |
| Transfer | | | |
| Physical layer | | 10BASE-T/100BASE-TX | |
| Half-duplex | | Yes | |
| Full-duplex | | Yes | |
| Autonegotiation | | Yes | |
| Auto-MDI/MDIX | | Yes | |
| Interface IF3 | | | |
| Fieldbus | | POWERLINK (V2) managing or controlled node | |
| Type | | Type 4 ⁶⁾ | |
| Variant | | 1x RJ45 shielded | |
| Line length | | Max. 100 m between 2 stations (segment length) | |
| Transfer rate | | 100 Mbit/s | |
| Transfer | | | |
| Physical layer | | 100BASE-TX | |
| Half-duplex | | Yes | |
| Full-duplex | | POWERLINK mode: No / Ethernet mode: Yes | |
| Autonegotiation | | Yes | |
| Auto-MDI/MDIX | | Yes | |
| Interface IF4 | | | |
| Type | | USB 1.1/2.0 | |
| Variant | | Type A | |
| Max. output current | | 0.5 A | |
| Interface IF5 | | | |
| Type | | USB 1.1/2.0 | |
| Variant | | Type A | |
| Max. output current | | 0.5 A | |
| Interface IF6 | | | |
| Fieldbus | | X2X Link master | |
| Interface IF7 | | | |
| Signal | | RS485 | |
| Variant | | Connection via 6-pin terminal block | |
| Max. distance | | 1000 m | |
| Transfer rate | | Max. 115.2 kbit/s | |
| Terminating resistor | | Integrated in PLC, not switchable | |
| Electrical properties | | | |
| Electrical isolation | | Ethernet (IF2), POWERLINK (IF3), X2X (IF6) and RS485 (IF7) isolated from each other, from other interfaces and from PLC I/O to PLC isolated from all interfaces USB (IF4 and IF5) not isolated from PLC ⁷⁾ | |
| Operating conditions | | | |
| Mounting orientation | | | |
| Horizontal | | Yes | |
| Vertical | | Yes | |
| Installation elevation above sea level | | | |
| 0 to 2000 m | | No limitation | |
| >2000 m | | Reduction of ambient temperature by 0.6°C per 100 m | |
| Degree of protection per EN 60529 | | IP20 | |
| Ambient conditions | | | |
| Temperature | | | |
| Operation | | | |
| Horizontal mounting orientation | | -25 to 60°C | |
| Vertical mounting orientation | | -25 to 50°C | |
| Derating | | - | |
| Storage | | -40 to 70°C | |
| Transport | | -40 to 70°C | |
| Relative humidity | | | |
| Operation | | 5 to 95%, non-condensing | |
| Storage | | 5 to 95%, non-condensing | |
| Transport | | 5 to 95%, non-condensing | |
| Mechanical properties | | | |
| Note | | X20 end cover plate (right) included in delivery 2- and 6-pin terminal block included in delivery | |

Table 2: X20EM061x - Technical data

| Order number | X20EM0611 | X20EM0612 | X20EM0613 |
|--------------|-----------|---------------------|-----------|
| Dimensions | | | |
| Width | | 55 mm | |
| Height | | 124 mm | |
| Depth | | 92 mm | |
| Weight | | 475 g ⁸⁾ | |

Table 2: X20EM061x - Technical data

- 1) For details about *storage health data*, see Automation Help.
- 2) Without USB interface.
- 3) The specified values are maximum values. For examples of the exact calculation, see section "Mechanical and electrical configuration" in the X20 system user's manual.
- 4) In parallel operation, it is only permitted to expect 75% of the nominal power. It is important to make sure that all power supply units operated in parallel are switched on and off at the same time.
- 5) The memory size for remanent variables is configurable in Automation Studio.
- 6) For additional information, see section "Communication / POWERLINK / General information / Hardware - IF/LS" in Automation Help.
- 7) The PLC power supply and USB interfaces have the same GND contact.
- 8) The PLC was weighed with the two terminal blocks. The X20 end cover plate (right) was not included in the weighing.

5 X20EM161x - Technical data

| Order number | X20EM1611 | | X20EM1612 | X20EM1613 |
|--|---|---------------------|------------------------|-----------|
| Short description | | | | |
| Interfaces | 1x RS485, 1x Ethernet (2-port switch), 1x POWERLINK (V2), 2x USB, 1x X2X Link | | | |
| System module | Controller | | | |
| General information | | | | |
| B&R ID code | 0x289E | 0x289D | 0x289C | |
| Cooling | Fanless | | | |
| Status indicators | CPU function, Ethernet, POWERLINK, RS485, I/O power supply | | | |
| Diagnostics | | | | |
| CPU function | Yes, using LED status indicator | | | |
| Ethernet | Yes, using LED status indicator | | | |
| I/O power supply | Yes, using software and LED status indicator | | | |
| POWERLINK | Yes, using LED status indicator | | | |
| Temperature | Yes, using software register | | | |
| Support | | | | |
| Controller redundancy | No | | | |
| Storage health data support ¹⁾ | Yes | | | |
| ACOPOS support | Yes | | | |
| Visual Components support | Yes | | | |
| Power consumption | 5.3 W ²⁾ | 5.4 W ²⁾ | 5.5 W ²⁾ | |
| Power consumption for X2X Link power supply ³⁾ | 0.6 W | | | |
| Power consumption ³⁾ | | | | |
| Internal I/O | 0.56 W | | | |
| Additional power dissipation caused by actuators (resistive) [W] | - | | | |
| Certifications | | | | |
| CE | Yes | | | |
| UKCA | Yes | | | |
| CPU and X2X Link power supply | | | | |
| Input voltage | 24 VDC -20% / +25% | | | |
| Input current | Max. 1.4 A | | | |
| Fuse | Integrated, cannot be replaced | | | |
| Reverse polarity protection | Yes | | | |
| X2X Link power supply output | | | | |
| Nominal output power | 3.5 W | | | |
| Parallel connection | Yes ⁴⁾ | | | |
| Redundant operation | Yes | | | |
| Input I/O power supply | | | | |
| Input voltage | 24 VDC -15% / +20% | | | |
| Fuse | Required line fuse: Max. 10 A, slow-blow | | | |
| Output I/O power supply | | | | |
| Nominal output voltage | 24 VDC | | | |
| Permissible contact load | 10 A | | | |
| Controller | | | | |
| Real-time clock | Retention for at least 300 hours, typ. 1000 hours at 25°C, 1 s resolution, <30 s/month accuracy at 25°C | | | |
| FPU | Yes | | | |
| Processor | | | | |
| Type | Atom E3915 | | | |
| Clock frequency | 400 MHz (compatible). | 800 MHz | 1.3 GHz | |
| L1 cache | | | | |
| Data code | 24 kB | | | |
| Program code | 32 kB | | | |
| L2 cache | 1 MB | | | |
| Integrated I/O processor | Processes I/O data points in the background | | | |
| Modular interface slots | 1 | | | |
| Remanent variables | Max. 64 kB, retention >10 years ⁵⁾ | | | |
| Shortest task class cycle time | 400 µs | 200 µs | 100 µs | |
| Typical instruction cycle time | 0.0044 µs | 0.0028 µs | 0.0015 µs | |
| Standard memory | | | | |
| RAM | 512 MB LPDDR4 SDRAM | 768 MB LPDDR4 SDRAM | 1 GB LPDDR4 SDRAM | |
| Application memory | | | | |
| Type | 1 GB eMMC flash memory | | 2 GB eMMC flash memory | |
| Data retention | 10 years | | | |
| Writable data amount | | | | |
| Guaranteed | 40 TB | | | |
| Results for 5 years | 21.9 GB/day | | | |
| Guaranteed erase/write cycles | 20,000 | | | |
| Error-correcting code (ECC) | Yes | | | |

Table 3: X20EM161x - Technical data

| Order number | X20EM1611 | X20EM1612 | X20EM1613 |
|--|---|---|-----------|
| Interfaces | | | |
| Interface IF2 | | | |
| Signal | | Ethernet | |
| Variant | | 2x shielded RJ45 (switch) | |
| Line length | | Max. 100 m between 2 stations (segment length) | |
| Transfer rate | | 10/100 Mbit/s | |
| Transfer | | | |
| Physical layer | | 10BASE-T/100BASE-TX | |
| Half-duplex | | Yes | |
| Full-duplex | | Yes | |
| Autonegotiation | | Yes | |
| Auto-MDI/MDIX | | Yes | |
| Interface IF3 | | | |
| Fieldbus | | POWERLINK (V2) managing or controlled node | |
| Type | | Type 4 ⁶⁾ | |
| Variant | | 1x RJ45 shielded | |
| Line length | | Max. 100 m between 2 stations (segment length) | |
| Transfer rate | | 100 Mbit/s | |
| Transfer | | | |
| Physical layer | | 100BASE-TX | |
| Half-duplex | | Yes | |
| Full-duplex | | POWERLINK mode: No / Ethernet mode: Yes | |
| Autonegotiation | | Yes | |
| Auto-MDI/MDIX | | Yes | |
| Interface IF4 | | | |
| Type | | USB 1.1/2.0 | |
| Variant | | Type A | |
| Max. output current | | 0.5 A | |
| Interface IF5 | | | |
| Type | | USB 1.1/2.0 | |
| Variant | | Type A | |
| Max. output current | | 0.5 A | |
| Interface IF6 | | | |
| Fieldbus | | X2X Link master | |
| Interface IF7 | | | |
| Signal | | RS485 | |
| Variant | | Connection via 6-pin terminal block | |
| Max. distance | | 1000 m | |
| Transfer rate | | Max. 115.2 kbit/s | |
| Terminating resistor | | Integrated in PLC, not switchable | |
| Electrical properties | | | |
| Electrical isolation | Ethernet (IF2), POWERLINK (IF3), X2X (IF6) and RS485 (IF7) isolated from each other, from other interfaces and from PLC I/O to PLC isolated from all interfaces USB (IF4 and IF5) and slot for X20 interface modules not isolated from PLC ⁷⁾ | | |
| Operating conditions | | | |
| Mounting orientation | | | |
| Horizontal | | Yes | |
| Vertical | | Yes | |
| Installation elevation above sea level | | | |
| 0 to 2000 m | | No limitation | |
| >2000 m | | Reduction of ambient temperature by 0.6°C per 100 m | |
| Degree of protection per EN 60529 | | IP20 | |
| Ambient conditions | | | |
| Temperature | | | |
| Operation | | | |
| Horizontal mounting orientation | | -25 to 60°C | |
| Vertical mounting orientation | | -25 to 50°C | |
| Derating | | - | |
| Storage | | -40 to 70°C | |
| Transport | | -40 to 70°C | |
| Relative humidity | | | |
| Operation | | 5 to 95%, non-condensing | |
| Storage | | 5 to 95%, non-condensing | |
| Transport | | 5 to 95%, non-condensing | |
| Mechanical properties | | | |
| Note | X20 end cover plate (right) included in delivery 2- and 6-pin terminal block included in delivery Interface module slot cover included in delivery | | |

Table 3: X20EM161x - Technical data

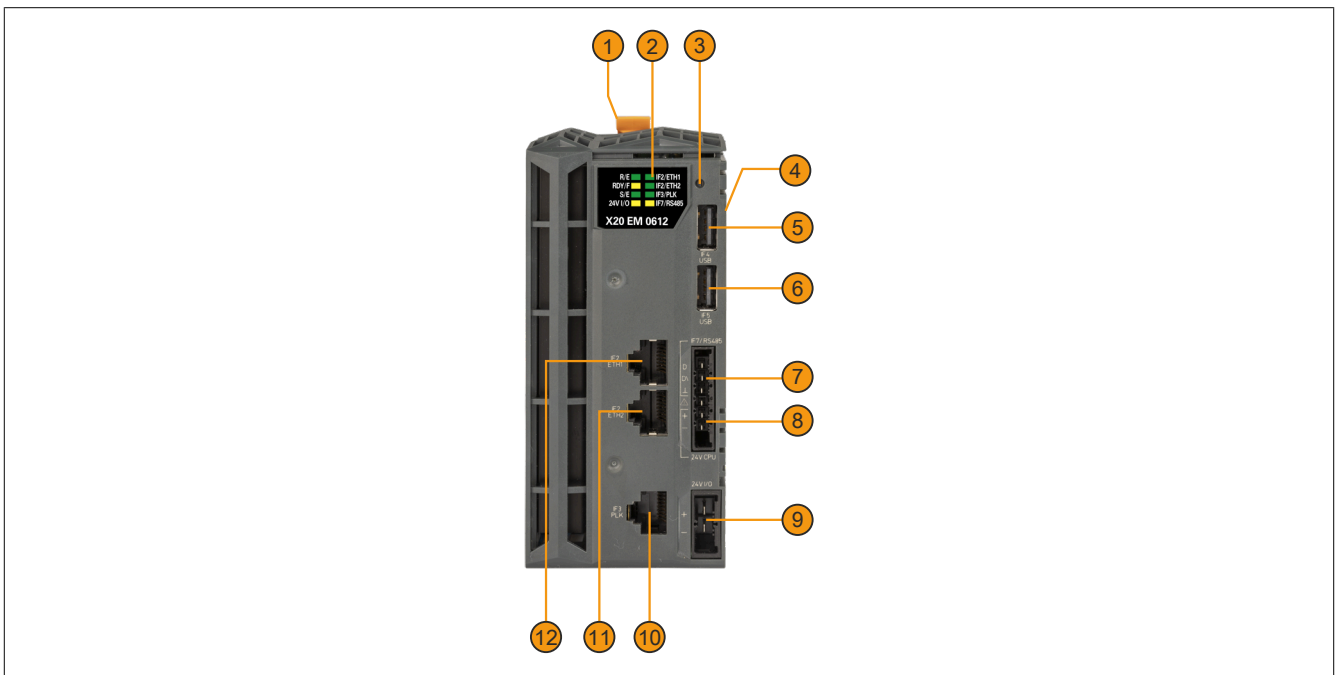
| Order number | X20EM1611 | X20EM1612 | X20EM1613 |
|--------------|-----------|---------------------|-----------|
| Dimensions | | | |
| Width | | 82.5 mm | |
| Height | | 124 mm | |
| Depth | | 92 mm | |
| Weight | | 530 g ⁸⁾ | |

Table 3: X20EM161x - Technical data

- 1) For details about *storage health data*, see Automation Help.
- 2) Without interface module and without USB interface.
- 3) The specified values are maximum values. For examples of the exact calculation, see section "Mechanical and electrical configuration" in the X20 system user's manual.
- 4) In parallel operation, it is only permitted to expect 75% of the nominal power. It is important to make sure that all power supply units operated in parallel are switched on and off at the same time.
- 5) The memory size for remanent variables is configurable in Automation Studio.
- 6) For additional information, see section "Communication / POWERLINK / General information / Hardware - IF/LS" in Automation Help.
- 7) The PLC power supply and USB interfaces have the same GND contact.
- 8) The PLC was weighed with the two terminal blocks. The interface module slot cover and X20 end cover plate (right) were not included in the weighing.

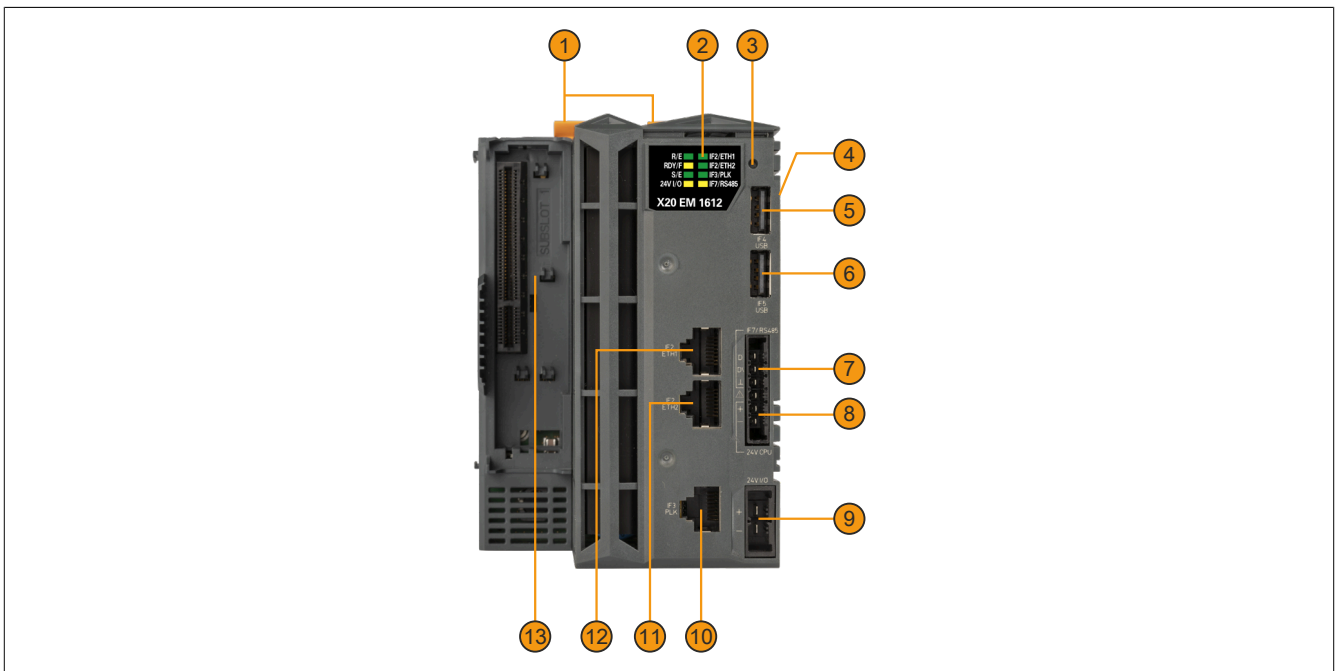
6 Operating and connection elements

X20EM061x



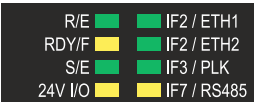
| | | | |
|----|-------------------------------------|----|--------------------------------------|
| 1 | Top-hat rail latch | 2 | LED status indicators |
| 3 | Button for reset and operating mode | 4 | IF6 - X2X Link |
| 5 | IF4 - USB | 6 | IF5 - USB |
| 7 | IF7 - RS485 | 8 | Controller and X2X Link power supply |
| 9 | I/O power supply | 10 | IF3 - POWERLINK |
| 11 | IF2/ETH2 - Ethernet | 12 | IF2/ETH1 - Ethernet |

X20EM161x



| | | | |
|----|-------------------------------------|----|--------------------------------------|
| 1 | Top-hat rail latch | 2 | LED status indicators |
| 3 | Button for reset and operating mode | 4 | IF6 - X2X Link |
| 5 | IF4 - USB | 6 | IF5 - USB |
| 7 | IF7 - RS485 | 8 | Controller and X2X Link power supply |
| 9 | I/O power supply | 10 | IF3 - POWERLINK |
| 11 | IF2/ETH2 - Ethernet | 12 | IF2/ETH1 - Ethernet |
| 13 | Slot for interface modules | - | - |

6.1 LED status indicators

| Figure | LED | Color | Status | Description |
|---|---------------------------|-----------|--------------|--|
|  | R/E | Green/Red | Off | Controller not supplied |
| | | Green | On | Application running |
| | | | Blinking | System startup: The controller is initializing the application, all bus systems and I/O modules. ¹⁾ |
| | | | Double flash | System startup during firmware update ¹⁾ |
| | | Red | On | The controller is in mode SERVICE ²⁾ or BOOT ²⁾ , or one of the following errors is present: <ul style="list-style-type: none"> Controller and X2X Link supply voltage too low The controller has switched off due to one of the following reasons: <ul style="list-style-type: none"> Overtemperature Overload on the X2X bus power supply There is an internal defect. |
| | | | Blinking | If LED "R/E" blinks red and LED "RDY/F" blinks yellow, a license violation has occurred. |
| | | | Double flash | System startup: Installation error ³⁾ |
| | RDY/F | Yellow | On | Mode SERVICE ²⁾ or BOOT ²⁾ |
| | | | Blinking | If LED "RDY/F" blinks yellow and LED "R/E" blinks red, a license violation has occurred. |
| | S/E | Green/Red | | Status/Error LED. LED states are described in section "LED "S/E" (status/error LED)" on page 10. |
| | 24 V / IO | Yellow | On | I/O power supply voltage within the valid range |
| | | Red | Double flash | I/O supply voltage too low |
| | IF2 / ETH1, IF2 / ETH2 | Green | On | The link to the Ethernet remote station is established. |
| | | | Blinking | The link to the Ethernet remote station is established. The LED blinks if Ethernet activity is taking place on the bus. |
| | IF3 / PLK | Green | On | The link to the POWERLINK remote station is established. |
| | | | Blinking | The link to the POWERLINK remote station is established. The LED blinks if Ethernet activity is taking place on the bus. |
| | IF7 / RS485 | Yellow | On/Blinking | The module is transmitting/receiving data via the RS485 interface. |

1) This process can take several minutes depending on the configuration.

2) The operating states are described in "Real-time operating system - Method of operation - Operating states" in Automation Help.

3) AR 4.93 and later: The project installation (initial installation or update) via USB flash drive was aborted with an error.

6.1.1 LED "S/E" (status/error LED)

This LED is a green/red dual LED and indicates the state of the POWERLINK interface. The LED states have a different meaning depending on the operating mode of the POWERLINK interface.

6.1.1.1 Ethernet mode

In this mode, the interface is operated as an Ethernet interface.

| LED "S/E" | | Description |
|-----------|-----|---|
| Green | Red | |
| On | Off | The interface is operated as an Ethernet interface. |

Table: LED "S/E": Interface in Ethernet mode

6.1.1.2 POWERLINK V2 mode

Error message

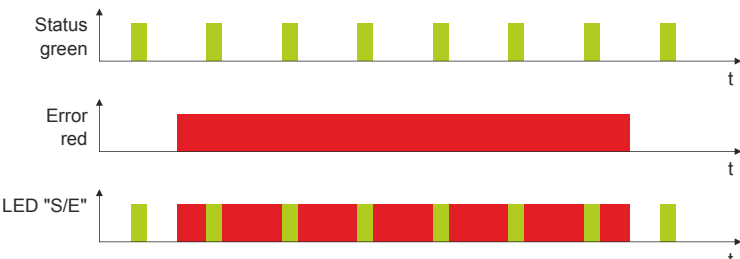
| LED "S/E" | | Description |
|-----------|-----|---|
| Green | Red | |
| Off | On | The interface is in error mode (failed Ethernet frames, increased number of collisions on the network, etc.). Note: Several red blinking signals are displayed immediately after the device is switched on. These are not errors, however. |
| Blinking | On | <p>If an error occurs in the following modes, then the green LED blinks over the red LED:</p> <ul style="list-style-type: none"> PRE_OPERATIONAL_1 PRE_OPERATIONAL_2 READY_TO_OPERATE  |

Table: LED "S/E" - Error message (interface in POWERLINK mode)

Interface status

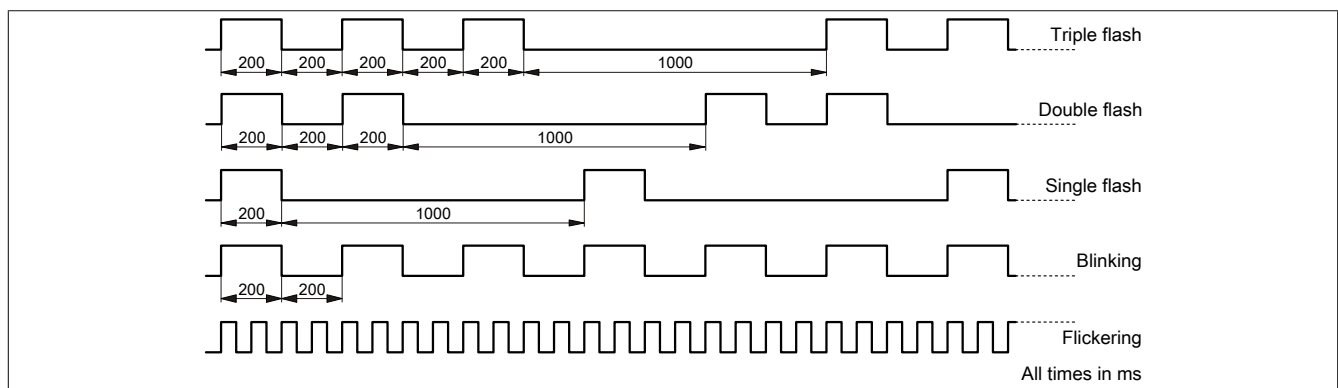
| LED "S/E" | | Description |
|--------------------------------|-----|--|
| Green | Red | |
| Off | Off | <p>Mode: NOT_ACTIVE The interface is either in mode NOT_ACTIVE or one of the following modes or errors is present:</p> <ul style="list-style-type: none"> The device is switched off. The device is in the startup phase. The interface or device is not configured correctly in Automation Studio. The interface or device is defective. <p>Managing node (MN) The network is monitored for POWERLINK frames. If a frame is not received within the configured time window (timeout), the interface immediately enters mode PRE_OPERATIONAL_1. If POWERLINK communication is detected before the time has elapsed, however, the MN is not started.</p> <p>Controlled node (CN) The network is monitored for POWERLINK frames. If a frame is not received within the configured time window (timeout), the interface immediately enters mode BASIC_ETHERNET. If POWERLINK communication is detected before this time expires, however, the interface immediately enters mode PRE_OPERATIONAL_1.</p> |
| Flickering (approx. 10 Hz) | Off | <p>Mode: BASIC_ETHERNET The interface is in mode BASIC_ETHERNET. The interface is operated in Ethernet mode.</p> <p>Managing node (MN) This mode can only be exited by resetting the controller.</p> <p>Controlled node (CN) If POWERLINK communication is detected during this mode, the interface enters mode PRE_OPERATIONAL_1.</p> |
| Single flash (approx. 1 Hz) | Off | <p>Mode: PRE_OPERATIONAL_1 The interface is in mode PRE_OPERATIONAL_1.</p> <p>Managing node (MN) The MN is in "reduced cycle" mode. The CNs are configured in this mode. Cyclic communication is not yet taking place.</p> <p>Controlled node (CN) The CN can be configured by the MN in this mode. The CN waits until it receives an SoC frame and then switches to mode PRE_OPERATIONAL_2.</p> |
| | On | <p>Controlled node (CN) If the red LED lights up in this mode, this means that the MN has failed.</p> |
| Double flash (approx. 1 Hz) | Off | <p>Mode: PRE_OPERATIONAL_2 The interface is in mode PRE_OPERATIONAL_2.</p> <p>Managing node (MN) The MN starts cyclic communication (cyclic input data is not yet evaluated). The CNs are configured in this mode.</p> <p>Controlled node (CN) The CN can be configured by the MN in this mode. A command then switches the mode to READY_TO_OPERATE.</p> |
| | On | <p>Controlled node (CN) If the red LED lights up in this mode, this means that the MN has failed.</p> |

Table: LED "S/E" - Interface state (interface in POWERLINK mode)

| LED "S/E" | | Description |
|--------------------------------|-----|--|
| Green | Red | |
| Triple flash (approx. 1 Hz) | Off | Mode: READY_TO_OPERATE The interface is in mode READY_TO_OPERATE. Managing node (MN) Cyclic and asynchronous communication. Received PDO data is ignored. Controlled node (CN) The configuration of the CN is completed. Normal cyclic and asynchronous communication. The transmitted PDO data corresponds to the PDO mapping. However, cyclic data is not yet evaluated. |
| | On | Controlled node (CN) If the red LED lights up in this mode, this means that the MN has failed. |
| On | Off | Mode: OPERATIONAL The interface is in mode OPERATIONAL. PDO mapping is active and cyclic data is evaluated. |
| Blinking (approx. 2.5 Hz) | Off | Mode: STOPPED The interface is in mode STOPPED. Managing node (MN) This mode does not occur for the MN. Controlled node (CN) Output data is not being output, and no input data is being provided. This mode can only be reached and exited by a corresponding command from the MN. |

Table: LED "S/E" - Interface state (interface in POWERLINK mode)

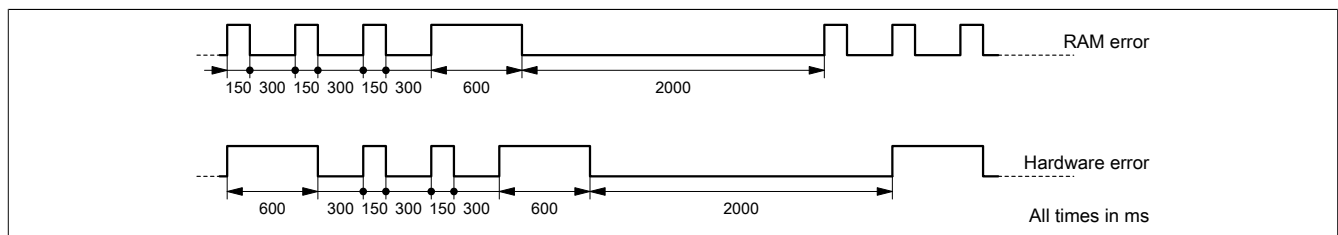
Blink times



6.1.2 System stop error codes

A system stop error can occur due to incorrect configuration or defective hardware.

The error code is indicated by LED "S/E" blinking red. The blinking signal of the error code consists of 4 switch-on phases with short (150 ms) or long (600 ms) duration. The error code is repeated every 2 seconds.



| Error | Error description |
|-----------------------|---|
| RAM error | The device is defective and must be replaced. |
| Hardware error | The device or a system component is defective and must be replaced. |

6.2 Button for reset and operating mode

The button can be pressed with a suitable object (e.g. paper clip or ballpoint pen).

6.2.1 Reset

The button must be pressed for less than 2 seconds to trigger a reset. This triggers a hardware reset on the controller, which means that:

- All application programs are stopped.
- All outputs are set to zero.

The controller then boots into service mode by default. The startup mode after pressing the reset button can be set in Automation Studio:

- Service mode (default)
- Warm restart
- Cold restart
- Diagnostic mode

6.2.2 Operating mode

3 operating modes can be set using different button sequences:

| Operating mode | Button sequence | Description |
|---------------------------|--|--|
| BOOT ¹⁾ | Boot mode is enabled by the following button sequence: <ul style="list-style-type: none"> • Press the button for less than 2 s. As soon as LED "Error" lights RED, the button can be released. • Then press the button within 2 s for longer than 2 s. As soon as LED "Error" goes out, the button can be released. | Boot AR is started, and the runtime system can be installed via the online interface (Automation Studio). User flash memory is erased only when the download begins. |
| SERVICE/RUN ¹⁾ | Press the button for less than 2 s. As soon as LED "Error" lights RED , the button can be released. | Mode SERVICE/RUN: Triggering and startup behavior correspond to triggering a hardware reset (see "Reset" on page 13). |
| DIAGNOSE ¹⁾ | Press the button for more than 2 s. LED "Error" lights RED and then goes out. As soon as LED "Error" goes out, the button can be released. | The controller is starting up in diagnostic mode. Program sections in User RAM and User FlashPROM are not initialized. After diagnostic mode, the controller always boots with a warm restart. |

1) The operating states are described in "Real-time operating system - Method of operation - Operating states" in Automation Help.

6.3 Flash drive

This application memory is implemented as an integrated flash drive.

6.4 Project installation

Project installation is described in "Project management - Project installation" in Automation Help.

6.5 Ethernet interface (IF2)

General information

IF2 is a 10BASE-T/100BASE-TX Ethernet interface.

The INA2000 station number is set using the B&R Automation Studio software.

For information about wiring X20 modules with an Ethernet interface, see section "Mechanical and electrical configuration - Wiring guidelines for X20 modules with Ethernet cables" in the X20 user's manual.

Information:

The Ethernet interface is not suitable for POWERLINK.

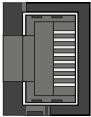
When using the POWERLINK interface, the Ethernet interface is not permitted to be operated with an IP address from the POWERLINK address range.

POWERLINK address range: 192.168.100.x

The interface is equipped with 2 female RJ45 connections. Both connections result in an integrated switch. This makes daisy-chain wiring easy.

The controller supports half-duplex and full-duplex communication. Mixed operation is not possible. Both connections must be operated in either half-duplex or full-duplex communication mode.

Pinout

| Interface | Pinout | | |
|--|--------|-------------|----------------|
| | Pin | Ethernet | |
|  Shielded RJ45 | 1 | RXD | Receive data |
| | 2 | RXD\ | Receive data\ |
| | 3 | TXD | Transmit data |
| | 4 | Termination | |
| | 5 | Termination | |
| | 6 | TXD\ | Transmit data\ |
| | 7 | Termination | |
| | 8 | Termination | |

6.6 POWERLINK interface (IF3)

The controller are equipped with a POWERLINK V2 interface.

POWERLINK

By default, the POWERLINK interface is operated as a managing node (MN). In the managing node, the node number is set to a fixed value of 240.

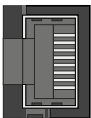
If the POWERLINK node is operated as a controlled node (CN), a node number from 1 to 239 can be set in the POWERLINK configuration in Automation Studio.

Ethernet mode

In this mode, the interface is operated as an Ethernet interface. The INA2000 station number is set using the Automation Studio software.

Pinout

For information about wiring X20 modules with an Ethernet interface, see section "Mechanical and electrical configuration - Wiring guidelines for X20 modules with Ethernet cables" in the X20 user's manual.

| Interface | Pinout | | |
|--|--------|-------------|----------------|
| | Pin | Ethernet | |
|  Shielded RJ45 | 1 | RXD | Receive data |
| | 2 | RXD\ | Receive data\ |
| | 3 | TXD | Transmit data |
| | 4 | Termination | |
| | 5 | Termination | |
| | 6 | TXD\ | Transmit data\ |
| | 7 | Termination | |
| | 8 | Termination | |

6.7 USB interfaces (IF4 and IF5)

IF4 and IF5 are non-galvanically isolated USB interfaces. The abbreviation USB stands for "Universal Serial Bus". Both USB interfaces support the USB 1.1 and 2.0 standards.

Information:

USB peripheral devices can be connected to the USB interfaces. Automation Runtime supports a selection of USB peripheral devices. For the supported USB classes, see the AR help documentation.

Information:


The following must be taken into account when using a USB peripheral device and grounded controller power supply (PELV):

- Only USB peripheral devices with no connection between GND and ground are permitted to be connected. This is the case, e.g. with the USB dongle from B&R.

6.8 RS485 interface (IF7)

Complex devices can be connected to the X20 system with this serial, galvanically isolated RS485 interface. The terminals of the signals are connected to the 6-pin terminal block.

A terminating resistor is integrated in the controller and not switchable.

| Interface | | Pinout | |
|--|----------|--------|---------------------------|
|  6-pin male multipoint connector | Terminal | RS485 | |
| | 1 | D | Data |
| | 2 | D\ | Data\ |
| | 3 | ⊥ | GND |
| | 4 | NC | Not permitted to be used! |

6.9 Slot for interface modules

A variant with a flexibly usable slot for X20 interface modules is available for each performance class.

Different bus or network systems can be flexibly integrated into the X20 system by selecting the appropriate interface module.

6.10 Data and real-time clock retention

The controllers do not use a battery. This makes them completely maintenance-free. Eliminating the backup battery was made possible by the following measures:


| Data and real-time clock retention | Backup type | Note |
|------------------------------------|---------------------|--|
| Remanent variables | FRAM | This FRAM stores its contents ferroelectrically. Unlike normal SRAM, this does not require a battery. |
| Real-time clock | Gold foil capacitor | The real-time clock is backed up for approx. 1000 hours by a gold foil capacitor. The gold foil capacitor is completely charged after 3 continuous hours of operation. |

7 Controller power supply

A power supply unit is already integrated in the controller. It is equipped with a supply for the controller, X2X Link and the internal I/O power supply. The bus power supply and internal I/O power supply are galvanically isolated from each other.


Controller and X2X Link power supply - Pinout

The terminals of the controller and X2X Link power supply are connected to the 6-pin terminal block.

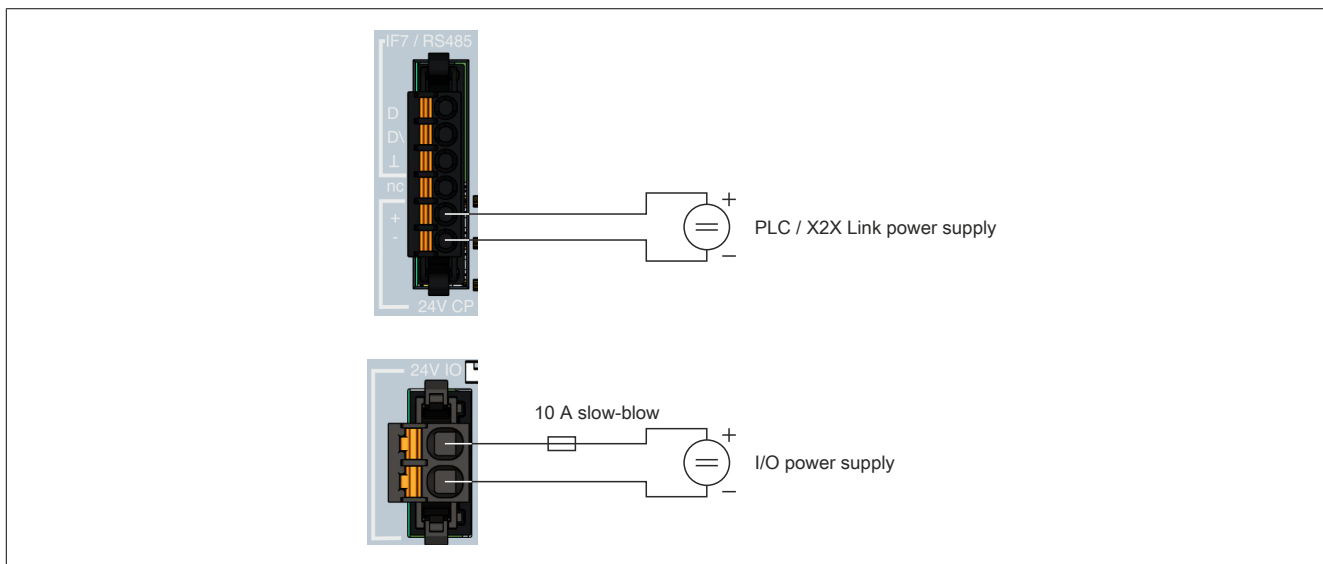
| Controller and X2X Link power supply | | Pinout | |
|--|----------|-------------|---------|
|  6-pin male multipoint connector | Terminal | Description | |
| | 5 | + | +24 VDC |
| | 6 | - | GND |

I/O power supply - Pinout

The terminals of the I/O power supply are connected to the 2-pin terminal block.

| I/O power supply | | Pinout | |
|--|----------|-------------|---------|
|  2-pin male multipoint connector | Terminal | Description | |
| | 1 | + | +24 VDC |
| | 2 | - | GND |

Connection example



8 Overtemperature shutdown

To prevent damage, a shutdown – reset state – of the controller takes place at 110°C processor temperature or 90°C board temperature.

The following errors are entered in the logbook in the event of shutdown:

| Error number | Short error text |
|--------------|--|
| 9204 | PLC restart triggered by the PLC CPU's temperature monitoring. |
| 9210 | Warning: Halt/Service after watchdog or manual reset. |

9 System requirements

The following minimum versions are recommended to generally be able to use all functions:

- Automation Studio 4.11
- Automation Runtime 4.92

10 Notes for operating certain modules with the embedded PLC

The minimum hardware upgrade versions listed in the table are required to operate the following modules with embedded PLCs. The upgrade can be installed from Automation Studio by selecting **Tools / Upgrades** from the menu.

| Order number | Minimum hardware upgrade version |
|--------------|----------------------------------|
| X20IF1041-1 | 1.3.1.0 |
| X20IF1043-1 | 1.4.1.0 |
| X20IF1051-1 | 1.2.4.0 |
| X20IF1053-1 | 1.3.1.0 |
| X20IF1061-1 | 1.8.0.0 |
| X20IF1063-1 | 1.3.1.0 |
| X20IF10A1-1 | 1.2.1.0 |
| X20IF10D1-1 | 1.6.1.0 |
| X20IF10D3-1 | 1.5.1.0 |
| X20IF10E1-1 | 1.3.1.0 |
| X20IF10E3-1 | 1.8.0.0 |
| X20IF10G3-1 | 1.7.1.0 |
| X20SLXyyy | 1.10.10.4 |

11 General data points

This controller is equipped with general data points. These are not controller-specific; instead, they contain general information such as system time and heat sink temperature.

General data points are described in section "Additional information - General controller data points" in the X20 system user's manual.