

# X20(c)BC0087

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## 1 General information

Established in 1979, the Modbus protocol has approved the use of Ethernet with both Modbus TCP and Modbus/UDP. Today, Modbus TCP is an open Internet draft standard introduced by Schneider Automation to the Internet Engineering Task Force (IETF), the organization responsible for Internet standardization. The Modbus services and object model have been preserved since the original version and left unchanged for use with the TCP/IP transmission medium.

Modbus/UDP differs from Modbus TCP in that it uses connectionless communication via UDP/IP. The advantages of faster and easier communication with UDP/IP also brings with it the disadvantage of requiring error detection and correction in the application layer.

This bus controller makes it possible to connect X2X Link I/O nodes to Modbus via Ethernet. The bus controller can be operated on B&R controllers through the use of Automation Studio or on third-party systems with Modbus TCP or -UDP master functionality.

- Fieldbus: Modbus/TCP, Modbus/UDP
- I/O configuration via the fieldbus
- DHCP-capable
- Bootp-capable
- Integrated double switch for efficient cabling
- Configurable I/O cycle (0.5 to 4 ms)
- Response time: <1 to 8 ms (depending on the load on the integrated switch)
- Validity check for command sequences before execution

### Information:

**Only the standard function model (see the respective module description) is supported when the bus controller is used together with multi-function modules it has automatically configured itself.**

**All other function models are supported when configured accordingly in Automation Studio V4.3 or later.**

**Automation Studio can be downloaded at no cost from the B&R website ([www.br-automation.com](http://www.br-automation.com)). The evaluation license is permitted to be used to create complete configurations for fieldbus bus controllers at no cost.**

## 2 Coated modules

Coated modules are X20 modules with a protective coating for the electronics component. This coating protects X20c modules from condensation and corrosive gases.

The modules' electronics are fully compatible with the corresponding X20 modules.

**For simplification purposes, only images and module IDs of uncoated modules are used in this data sheet.**

The coating has been certified according to the following standards:

- Condensation: BMW GS 95011-4, 2x 1 cycle
- Corrosive gas: EN 60068-2-60, method 4, exposure 21 days



### 2.1 Starting temperature

The starting temperature describes the minimum permissible ambient temperature when the power is switched off at the time the coated module is switched on. This is permitted to be as low as -40°C. During operation, the conditions as specified in the technical data continue to apply.

#### Information:

**It is important to absolutely ensure that there is no forced cooling by air currents in a closed control cabinet, for example using a fan or ventilation slots.**

## 3 Order data


Model number	Short description	Figure
	<b>Bus controllers</b>	
X20BC0087	X20 bus controller, 1 Modbus TCP or Modbus UDP interface, integrated 2-port switch, 2x RJ45, order bus base, power supply module and terminal block separately.	
X20cBC0087	X20 bus controller, coated, Modbus/TCP or Modbus/UDP interface, integrated 2-port switch, 2x RJ45, order bus base, power supply module and terminal block separately	
	<b>Required accessories</b>	
	<b>System modules for bus controllers</b>	
X20BB80	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, X20 end plates (left and right) X20AC0SL1/ X20AC0SR1 included	
X20PS9400	X20 power supply module, for bus controller and internal I/O power supply, X2X Link power supply	
X20PS9402	X20 power supply module, for bus controller and internal I/O power supply, X2X Link power supply, supply not electrically isolated	
X20cBB80	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, X20 end plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cPS9400	X20 power supply module, coated, for bus controller and internal I/O power supply, X2X Link power supply	
	<b>Terminal blocks</b>	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	

Table 1: X20BC0087, X20cBC0087 - Order data

## 4 Technical data

Model number	X20BC0087	X20cBC0087
Short description		
Bus controller	Modbus TCP/UDP slave	
General information		
B&R ID code	0x227C	0xD577
Status indicators	Module status, bus function	
Diagnostics		
Module status	Yes, using status LED and software	
Bus function	Yes, using status LED and software	
Power consumption		
Bus	2 W	
Additional power dissipation caused by actuators (resistive) [W]	-	
Certifications		
CE	Yes	
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÜ 09 ATEX 0083X	
UL	cULus E115267 Industrial control equipment	
HazLoc	cCSAus 244665 Process control equipment for hazardous locations Class I, Division 2, Groups ABCD, T5	
DNV GL	Temperature: <b>B</b> (0 - 55°C) Humidity: <b>B</b> (up to 100%) Vibration: <b>B</b> (4 g) EMC: <b>B</b> (bridge and open deck)	
LR	ENV1	
KR	Yes	
EAC	Yes	
KC	Yes	-
Interfaces		
Fieldbus	Modbus TCP/UDP slave	
Variant	2x shielded RJ45 (switch)	
Cable 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	
Min. cycle time <sup>1)</sup>		
Fieldbus	1 ms	
X2X Link	500 µs	
Synchronization between bus systems possible	No	
Electrical properties		
Electrical isolation	Modbus isolated from bus and I/O	
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 0.5°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	-	
Starting temperature	-	Yes, -40°C
Storage	-40 to 85°C	
Transport	-40 to 85°C	

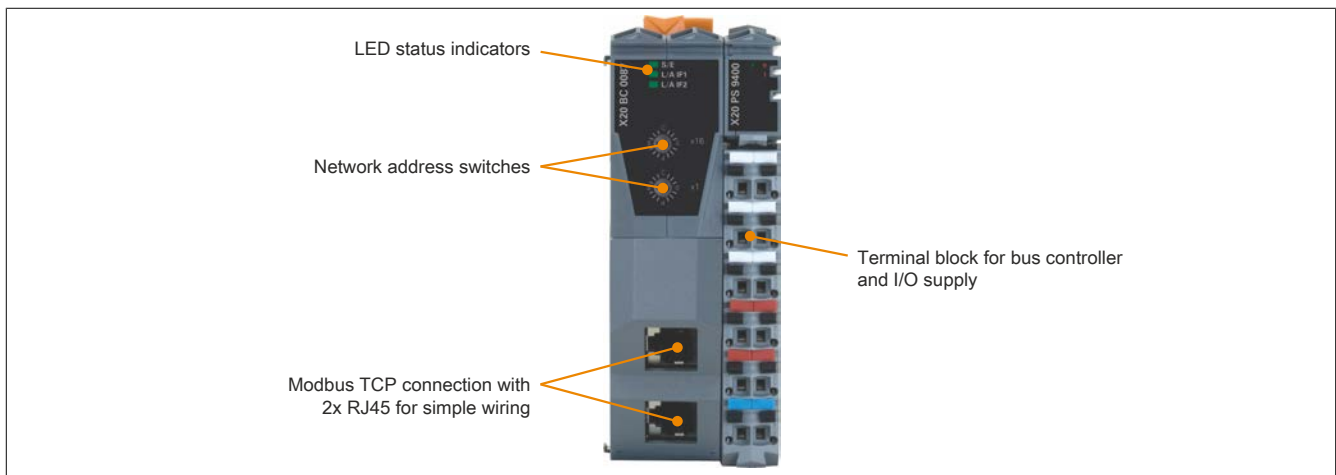
Table 2: X20BC0087, X20cBC0087 - Technical data

Model number	X20BC0087	X20cBC0087
Relative humidity		
Operation	5 to 95%, non-condensing	Up to 100%, condensing
Storage	5 to 95%, non-condensing	
Transport	5 to 95%, non-condensing	
Mechanical properties		
Note	Order terminal block 1x X20TB12 separately Order 1x power supply module X20PS9400 or X20PS9402 separately Order 1x bus base X20BB80 separately	Order 1x X20TB12 terminal block separately Order 1x X20cPS9400 power supply module separately Order 1x X20cBB80 bus base separately
Pitch 2)	37.5 +0.2 mm	

Table 2: X20BC0087, X20cBC0087 - Technical data

- 1) The minimum cycle time defines how far the bus cycle can be reduced without communication errors occurring.  
2) Spacing is based on the width of bus base X20BB80. In addition, power supply module X20PS9400 or X20PS9402 is always required for the bus controller.

## 5 Operating and connection elements

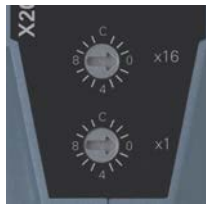


### 5.1 LED status indicators

Figure	LED	Color	Status	Description
	S/E <sup>1)</sup>	Green	On	Indicates that there is at least one client connection
			2 pulses	Indicates that there are no client connections
			4 pulses	Indicates that the controller is waiting for an address from the DHCP server
			Blinking	Initialization of connected I/O modules
		Red	2 pulses	Watchdog timeout
			3 pulses	Faulty I/O module configuration data
			4 pulses	Indicates that the controller has detected an IP address being used twice
			5 pulses	Indicates a missing, defective or incorrect I/O module
			6 pulses	Error reading flash memory. Last write operation was incomplete or contained errors. <sup>2)</sup>
		L/A IFx	On	Indicates a major unrecoverable fault
			Blinking	Ethernet activity taking place on the RJ45 port (IF1, IF2) indicated by the respective LED
			On	Indicates an established connection (link), but no communication is taking place
			Off	Indicates that no physical Ethernet connection exists

- 1) The Status/Error LED "S/E" is a green/red dual LED. The LED blinks red several times immediately after startup. This is a boot message, however, and not an error.  
2) Possible cause: The bus controller received a command to save, but was switched off before saving was complete. In this case, the bus controller continues to use the old configuration and indicates the failed write operation with a blink code.

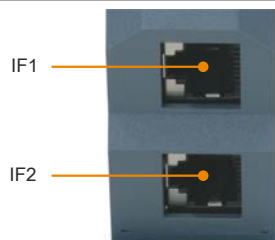
## 5.2 Modbus/TCP network address switch

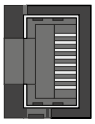


Switch position	Description
0x00	This switch position is the factory default setting. In this position, the address switches have no effect on system parameters. The bus controller parameters in flash memory are used (IP address or interface number). The bus controller is started with factory default values if valid flash data is not present.
0x01 - 0x7F	The last position of the IP address saved in flash memory is changed to the address switch value. The IP address saved in flash memory is not changed. The interface number is read from flash memory.
0x80 - 0xEF	Sets the bus controller to DHCP mode for this range. The DNS server is informed of the current hostname. A hostname is generated according to the setting of the address switch.  <b>Example</b> The generated hostname is made up of 3 elements: "br" + "mb" + Address switch value (3 decimal places) This means, for example, that the following hostname is generated for address switch setting 0xD7 (dec. 215): "brmb215".
0xF0	Auto-store mode: The IP settings are obtained from the DHCP or BOOTP server. If the IP settings are different than the values stored in flash memory, then the current IP parameters are saved. This function is available in firmware version 1.39 and later.
0xF1 - 0xFD	Reserved (same function as position 0xFF).
0xFE	Initializes all bus controller parameters with default values during booting. No values are read from flash memory. The communication parameters correspond to the values assigned with switch setting 0xFF.
0xFF	Initializes all communication parameters with default values. All other bus controller parameters are read from flash memory. Default parameters: <ul style="list-style-type: none"> <li>IP address: 192.168.100.1</li> <li>Subnet mask: 255.255.255.0</li> <li>Gateway: 192.168.100.254</li> <li>Primary NetBIOS name: "br" + MAC address</li> <li>Secondary NetBIOS name: "br" + "mb" + address switch value (decimal)</li> <li>Interface number: 502</li> <li>X2X Link configuration: 4 ms cycle time</li> <li>X2X Link cable length: 0 m</li> </ul>

## 5.3 Ethernet interface

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



Interface	Pinout	
	Pin	Ethernet
 Shielded RJ45	1	RXD
	2	RXD\
	3	TXD
	4	Termination
	5	Termination
	6	TXD\
	7	Termination
	8	Termination

## 6 Setting the IP address (default value)

Changes to the network address switches are only applied after a restart. If the bus controller is restarted with the address switch value 0xFF, it is initialized with the IP address 192.168.100.1. This address is also the factory default setting. The interface number is set to 502 (reserved for Modbus).

This IP address can be used to establish a connection to the bus controller. The internationally unique MAC address is listed on the housing side of the bus controller. The combination of "br" and the MAC address results in a unique name (primary NetBIOS name) that also makes it possible to access the bus controller.

Example of the primary NetBIOS name:

MAC address:	00-60-65-00-49-02
Resulting NetBIOS name:	br006065004902

This means that, without additional parameter changes, either the default IP address 192.168.100.1 or the NetBIOS name "br+MAC" can be used to communicate with the bus controller.

Since NetBIOS is being used, the bus controller can only be accessed via this name if there are no intermediary routers or gateways in the way.

## 7 Automatic IP assignment by a DHCP server

If a network address switch setting between 0x80 and 0xEF is configured, the bus controller will attempt to request an IP address from the DHCP server. The assigned IP address can be queried with command "ping" together with the hostname. The bus controller registers this hostname on the DHCP server, which should forward it to a DNS server.

**Example**      The hostname (DNS name) is made up of 3 elements:  
                     "br" + "mb" + Address switch value (3 decimal places)  
                     This means, for example, that the following hostname is generated for address switch setting 0xD7 (dec. 215): "brmb215".

If DNS service is not available on the network, the bus controller's two NetBIOS names can also be used for access. The secondary NetBIOS name is identical to the hostname. If the address switches are set to 0x00, it is identical to the primary NetBIOS name. The bus controller can only be reached via its NetBIOS name if no other routers or gateways are in the way.

## 8 Changing the IP address with the network address switches

The address switches can be used to change the last byte in the IP address configured on the bus controller. The IP address saved in flash memory is not changed. If the address switches are set to 0x00, the bus controller applies the IP address last saved to flash memory. Switch positions between 0x01 and 0x7F cause the last position of the IP address (the lowest byte) to be overwritten by the value of the address switch. This provides the user a quick and easy way to address a large number of bus controllers. In short, an IP address between 192.168.100.1 and 192.168.100.127 can be selected for a bus controller using the address switches without requiring any additional software configuration.

## 9 Information about NetBIOS names

In addition to the hostname used to register on the DHCP server, the bus controller also has so-called NetBIOS names. These are used to access the bus controller from a PC using its name (as opposed to its IP address). This is only possible if no routers or gateways are in the way, however.

The primary NetBIOS name is always composed of the prefix "br" and the MAC address from the bus controller (see ["Automatic IP assignment by a DHCP server" on page 6](#)).

The secondary NetBIOS name corresponds to the primary NetBIOS name at address switch position 0x00. This is necessary because several bus controllers with address switch value 0x00 are permitted to be located in one network segment. In this case, the IP address from flash memory is used.

For all other address switch positions, the secondary NetBIOS name is generated from the network address switch value (as in DHCP mode): "br" + "mb" + Address switch value (3 decimal places).

A hostname defined explicitly by the user will be used for the secondary NetBIOS name regardless of the address switch value.

This makes it possible to access the bus controller with the NetBIOS name configured using the address switches. This is also possible if the controller was not configured for use with a DHCP server (address switch setting between 0x01 and 0x7F).

## 10 Saving an IP address to flash memory

The IP parameters in flash memory can be changed via the Modbus protocol, the ModbusTCP Toolbox or the Telnet interface. The ModbusTCP Toolbox can be downloaded from the B&R website.

The IP address, subnet and gateway are all defined in the address range 0x1003 to 0x100E. Each has a length of 4 words. The data is applied by writing constant 0xC1 to address 0x1140 ("Write single register" fc6, addr. 0x1140, data 0xC1). The new settings are applied after the bus controller is restarted.