X20BC0053

1 General information

DeviceNet was developed by Allen-Bradley as a CAN bus based automation network. It is based on a produc-er/consumer protocol. From the user's point of view, all data is handled completely separately from the features of the CAN bus (e.g. longer data packets are fragmented automatically by DeviceNet). I/O messages with defined characteristics are used for access.

This bus controller makes it possible to connect X2X Link I/O nodes to DeviceNet. It has automatic transfer rate detection, auto scan, automatic mapping and automatic configuration of the I/O modules. Explicit messaging, change of state, cyclic, polled and bit strobe are supported as transfer modes.

In addition to the standard communication objects, there are vendor-specific objects to represent the modular X20 System in the best manner possible. X20 and other modules based on X2X Link can be connected to the bus controller.

The entire configuration of this type of modular system is supported by the DeviceNet standard. Allen Bradley developed the modular I/O configuration to simplify the necessary configuration steps. The DeviceNet bus controllers from B&R also support this type of configuration.

- Fieldbus: DeviceNet
- I/O configuration via the fieldbus
- Support of both linear and modular (Allen Bradley) configuration systems
- Auto scan, automatic I/O mapping of the I/Os
- Automatic I/O configuration
- Integrated terminating resistor

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.

2 Order data

Model number	Short description	Figure
	Bus controllers	
X20BC0053	X20 bus controller, 1 DeviceNet interface, order 1x TB2105 terminal block separately Order bus base, power supply module and terminal separately	
	Required accessories	
	System modules for bus controllers	
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	
	Terminal blocks	
0TB2105.9010	Accessory terminal block, 5-pin, screw clamps 2.5 mm²	
0TB2105.9110	Accessory terminal block, 5-pin, push-in terminal block 2.5 mm²	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	

Table 1: X20BC0053 - Order data

3 Technical data

Model number	X20BC0053
Short description	
Bus controller	DeviceNet adapter (slave)
General information	
B&R ID code	0x1F1B
Status indicators	Module status, bus function, 24V DeviceNet voltage, data transfer, terminating resistor.
Diagnostics	
24 V DeviceNet voltage	Yes, with LED status indicators (MOD and NET)
Module status	Yes, using status LED and software
Bus function	Yes, using status LED
Data transfer	Yes, using status LED
Terminating resistor	Yes, using status LED
Power consumption	
Bus	1.5 W
Additional power dissipation caused by actuators (resistive) [W]	-
Certifications	
CE	Yes
KC	Yes
EAC	Yes
UL	cULus E115267 Industrial control equipment
HazLoc	cCSAus 244665 Process control equipment for hazardous locations Class I, Division 2, Groups ABCD, T5
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÚ 09 ATEX 0083X
DNV GL	Temperature: **B** (0 - 55°C) Humidity: **B** (up to 100%) Vibration: **B** (4 g) EMC: **B** (bridge and open deck)
LR	ENV1
KR	Yes
Interfaces	
Fieldbus	DeviceNet adapter (slave)
Variant	5-pin male multipoint connector
Max. distance	500 m
Transfer rate	Max. 500 kbit/s
Default transfer rate	Automatic transfer rate detection
Min. cycle time [1]	
Fieldbus	No limitations
X2X Link	400 µs
Synchronization between bus systems possible	No
Terminating resistor	Integrated in the module
Electrical properties	
Electrical isolation	DeviceNet isolated from I/O DeviceNet not isolated from bus
Operating conditions	
Mounting orientation	
Horizontal	Yes
Vertical	Yes
Installation elevation above sea level	
0 to 2000 m	No limitations
>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	-
Storage	-40 to 85°C
Transport	-40 to 85°C

Table 2: X20BC0053 - Technical data

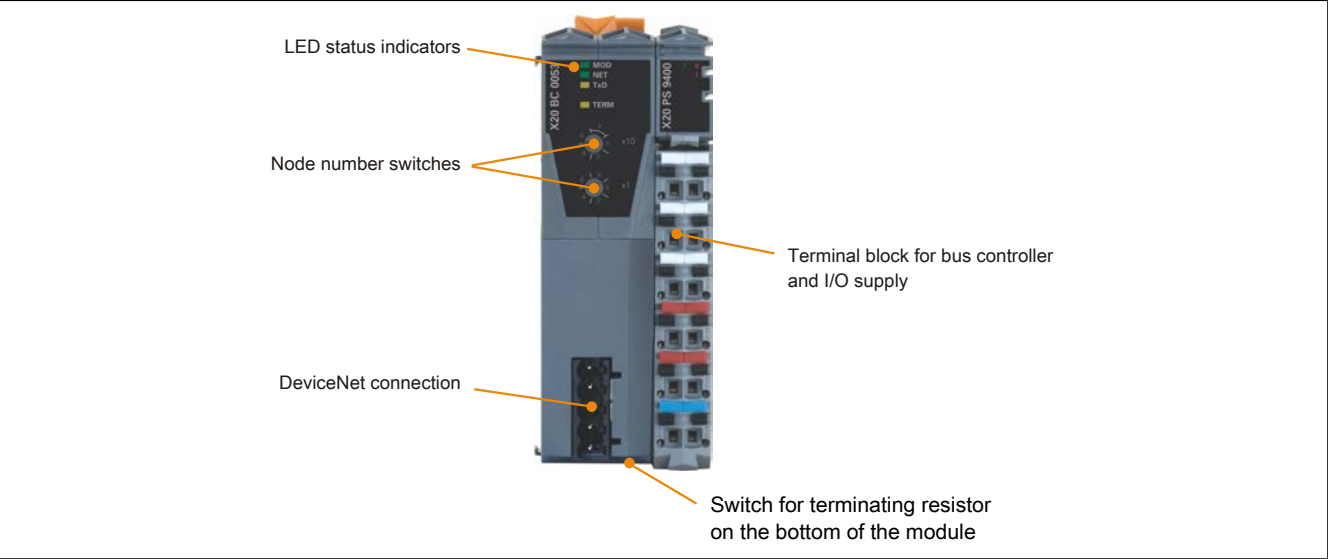| Model number	X20BC0053
Relative humidity	
Operation	5 to 95%, non-condensing
Storage	5 to 95%, non-condensing
Transport	5 to 95%, non-condensing
Mechanical properties	
Note	Order 1x TB2105 terminal block separately Order 1x X20TB12 terminal block separately Order 1x X20PS9400 or X20PS9402 power supply module separately Order 1x X20BB80 bus base separately
Spacing [2]	37.5 $^{+0.2}$ mm

Table 2: X20BC0053 - 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 the X20BB80 bus base. In addition, an X20PS9400 or X20PS9402 supply module is always required for the bus controller.

4 LED status indicators

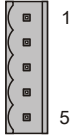| Figure	LED	Color	Status	Description
	MOD[1]	Green	Off	Bus sense error: If the "NET" LED is also "off", there is no 24 V DeviceNet voltage. No transfer rate: If the PS9400's "RUN" LED is active (PREOPERATIONAL or RUN mode), the automatic transfer rate detection is still running or no transfer rate could be detected.
			On	RUN mode: The 24 V DeviceNet voltage is OK and the module is operating under normal conditions.
			Blinking	Standby mode: Configuration is missing, incomplete, or incorrect.
		Red	Blinking	Recoverable Fault mode:
		Green/red	Blinking	Module is performing a self test.
	NET[1]	Green	Off	No power, offline: • Bus sense error: If the "MOD" LED is also off, there is no 24 V DeviceNet voltage. • No transfer rate: If the PS9400's "RUN" LED is active (PREOPERATIONAL or RUN mode), the automatic transfer rate detection is still running or no transfer rate could be detected. • Module has not yet completed a duplicate MAC-ID test.
			Blinking	Online, not connected: • The module has carried out the duplicate MAC-ID test and is online. • There is no established connection to a master/scanner.
			On	Everything is OK: A connection to the master/scanner (explicit or I/O) is set up.
		Red	Blinking	Connection timeout: The time for an I/O connection has expired.
			On	Critical connection error - fieldbus communication no longer possible: • Duplicate MAC ID error • Bus off • Receive/transmit overrun
	TxD	Yellow	Off	The bus controller is not transmitting any data via the DeviceNet fieldbus
			On	The bus controller is transmitting data via the DeviceNet fieldbus
	TERM	Yellow	Off	The terminating resistor integrated in the bus controller is turned off
			On	The terminating resistor integrated in the bus controller is turned on

1) The "MOD" and "NET" LEDs are green/red dual LEDs.

5 Operating and connection elements

LED status indicators

Node number switches

Terminal block for bus controller and I/O supply

DeviceNet connection

Switch for terminating resistor on the bottom of the module

6 DeviceNet interface

The interface is a 5-pin multipoint connector. Terminal block 0TB2105 must be ordered separately.

Interface	Pinout		
	Terminal	**DeviceNet**	
1 5 5-pin male multipoint connector	1	CAN⊥ (V-)	CAN ground
	2	CAN_L	CAN low
	3	SHLD	Shield
	4	CAN_H	CAN high
	5	V+	Supply voltage[1]

1) The 24 VDC in the DeviceNet network must be fed in externally in order to guarantee correct operation and data exchange. 24 VDC is not made available by the device.

7 Terminating resistor

Switch for terminating resistor

On   Off
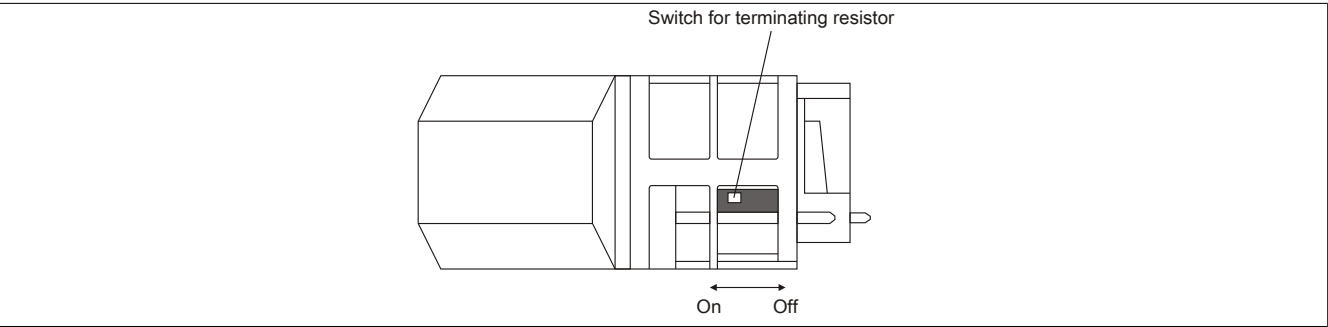
A terminating resistor is already integrated on the bus controller. It can be turned on and off with a switch on the bottom of the housing. An active terminating resistor is indicated by the "TERM" LED.

8 Node number

The MAC ID is configured using the two address switches on the bus controller.

The configurable range lies between 0 and 63. This value range is required in the DeviceNet specifications for a DeviceNet device.

Switch position	MAC ID
00 - 63	0 to 63
64	The MAC ID can be configured by setting the address switch using the master/scanner software.
65 - 89	Not permitted
90	See "Clearing parameters" on page 6
91 - 94	Not permitted
95	See "Automatic configuration" on page 6
96 - 99	Not permitted

Number position in switch position "P"

9 Automatic transfer rate detection

After booting, the bus controller goes into "Listen only" mode. This means the bus controller behaves passively on the bus and only listens.

The bus controller attempts to receive valid objects. If receive errors occur, the controller switches to the next transfer rate in the lookup table.

If no objects are received, all transfer rates are tested cyclically. This procedure is repeated until valid objects are received, indicating that the correct transfer rate has been determined. Only transfer rates permitted by the DeviceNet specification are tested.

Lookup table

The controller tests the transfer rate according to this table. Beginning with the starting transfer rate (500 kbit/s), the controller switches to the next lower transfer rate. At the end of the table, the bus controller restarts the search from the beginning.

Transfer rate
500 kbit/s
250 kbit/s
125 kbit/s

> **Information:**
>
> **While automatic transfer rate recognition is running, both DeviceNet LEDs are switched off (because there is no LED status definition in the DeviceNet specifications for this status).**
>
> **To ensure that the module has been supplied and booted, this manufacturer specific status definition requires the X20PS9400 RUN LED to be active.**

10 Clearing parameters

Various parameters can be stored in the bus controller's flash memory. Deleting these parameters using switch position 90 returns the bus controller to its factory settings.

Deleting the parameters

1. Turn off the power supply to the bus controller.

2. Set the node number to 90

3. Turn on the power supply to the bus controller.

4. Wait until the "MOD" LED flashes green for 5 s (3 ms on / 500 ms off). The node number switch "x10" must be set to 0 and then back to 9 within this time window.

5. Wait until the "MOD" LED blinks with a red double-flash (parameters have been cleared).

6. Turn off the power supply to the bus controller.

7. Set the desired node number (00 to 63).

8. Turn on the power supply to the bus controller.

9. The bus controller boots with the set node number and automatic transfer rate detection.

11 Automatic configuration of the I/O modules

The automatic configuration of the connected I/O modules by the bus controller is supported starting with Rev. D0 (firmware ≥V1.23) of the bus controller.

To prevent the configuration data from being accidentally overwritten on the bus controller, the procedure described below must be followed when creating the configuration data. When doing this, it is important that all required I/O modules are also started when booting the bus controller (i.e. supplied with power). This is especially important when using potential groups (E-stop switches).

The automatic configuration sets the following attributes of class 0x65 on the individual I/O modules:

- Module type (0x01)
- Input length (0x03)
- Output length (0x05)

Additional parameters are not set. That means that the connected modules are configured with their standard settings and standard I/O lengths. This can be changed by editing the parameters in the respective master engineering tool.

Automatic configuration

1. Turn off the power supply to the bus controller.

2. Set node number switch to 95 (this is done by turning switch "x10" to position 9 and switch "x1" to 5).

3. Turn on the power supply to the bus controller.

4. Wait until the "MOD" LED starts blinking green (3 ms on / 500 ms off). This phase of green blinking lasts 5 s. The node number "x10" switch must be set to 0 within this time frame and then set back to 9.

5. Wait until the "MOD" LED blinks (4 red flashes). The old configuration data is now deleted completely and overwritten with the new values from the connected I/O modules.

6. Turn off the power supply to the bus controller.

7. Set the desired node number (00 to 63).

8. Turn on the power supply to the bus controller.

9. The bus controller boots using the set node number, automatic transfer rate recognition and standard settings from the connected I/O modules.

12 Additional documentation and import files (EDS)

Additional documentation about bus controller functions as well as the necessary import files for the master engineering tool are available for download from the Downloads section of the B&R website (www.br-automation.com).