Chapter 2 • Embedded controller

The Embedded Controller is a stand-alone CPU for switching cabinet installation.

The **EC2x** module offers interchangeable application memory in the form of a CompactFlash card¹⁾ as well as a separate backup battery for the module.

It is equipped with five application interfaces:

- One RS232 interface (IF1) for programming and configuring using B&R AutomationStudio[™]
- One CAN interface (IF2) for connecting to a CAN network
- One Profibus DP interface (IF3) for connecting to a Profibus network (only EC21)
- One X2X Link interface (IF4)
- One Ethernet interface (IF6) for connecting to an Ethernet network.

In addition, a maximum of three digital inputs / outputs are provided.

The digital inputs and outputs can be configured individually as input or output. Additional functions such as a counter function with direction switching (stepper motor) or period and gate measurement are integrated.

The **EC20** module is also available as version with ARNC0 software.

¹⁾ Application memory must be ordered separately.

1. The compact system on the DIN rail

Standalone CPUs have to be compact, highly efficient, and able to communicate with other devices. The embedded controller does all this and more. Its wide range of interfaces means all communication requirements can be met. Outstanding performance with its compact size and integrated digital I/O mean the embedded controller can be used in a wide range of applications.

2. The most important data

	EC20 EC21		
Description	7EC020.60-2	7EC020.61-2	7EC021.60-1
Module type		Standalone CPU	
Installation	Dire	ectly or on standard mounting rail T	S35
Processor		x86 Intel-compatible	
ARNC0	\checkmark	-	-
Clock speed		100 MHz	
DRAM	32 MB	32 MB	16 MB
SRAM		32 KByte (battery-buffered)	
Fastest task class	1 ms		
Communication interfaces Ethernet 10/100 Mbps RS232 CAN X2X Link Profibus DP	* * * * * * * * * * * * * * * * * * * * * * * * * * *		
Integrated I/O	3 digital mixed channels at 24 VDC, 0.5 A, can be individually selected as input or output		
Special functions for dig. inputs	Event counter, ABR incremental encoder, gate measurement, period measurement		

Tabelle 1: Embedded Controller - The most important data

Ethernet is increasingly becoming the standard communication medium used in automation. B&R provides all System Generation 4 CPUs with 10/100 Mbps Ethernet onboard.

3. EC20

3.1 Order data

Model number	Short description	Image
7EC020.60-2	Embedded Controller, x86 100 MHz Intel compatible, 32 MB DRAM, 32 KB SRAM, removable application memory (CompactFlash), 1 CAN interface, 1 X2X Link Master interface, 1 Ethernet interface 100 Base-T, 1 RS232 interface, 3 DM, 24 VDC, 0.5 A. Application memory must be ordered separately! Terminal blocks 0TB708 and 0TB704 must be ordered separately!	
7EC020.61-2	Embedded Controller, ARNC0, x86 100 MHz Intel compatible, 32 MB DRAM, 32 KB SRAM, removable application memory (CompactFlash), 1 CAN interface, 1 X2X Link Master interface, 1 Ethernet interface 100 Base-T, 1 RS232 interface, 3 DM, 24 VDC, 0.5 A. Application memory must be ordered separately! Terminal blocks 0TB708 and 0TB704 must be ordered separately!	
	Application memory	viii 🌘
5CFCRD.0032-02	CompactFlash 32 MB ATA/IDE SanDisk	. 6
5CFCRD.0064-03	CompactFlash 64 MB ATA/IDE SiliconSystems	
5CFCRD.0128-03	CompactFlash 128 MB ATA/IDE SiliconSystems	
5CFCRD.0256-03	CompactFlash 256 MB ATA/IDE SiliconSystems	
5CFCRD.0512-03	CompactFlash 512 MB ATA/IDE SiliconSystems	
5CFCRD.1024-03	CompactFlash 1024 MB ATA/IDE SiliconSystems	
5CFCRD.2048-03	CompactFlash 2048 MB ATA/IDE SiliconSystems	CAN PARTY
	Terminal blocks	
0TB708.91	Accessory terminal block, 8-pin, cage clamps 1.5 mm ²	
0TB708:92-01	Accessory terminal block, 20 pcs. 8-pin cage clamps 1.5 mm ²	
0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm ²	
0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm ²	
	Terminal blocks	
0G0001.00-090	Cable PC <-> PLC/PW, RS232, online cable	
7AC911.9	Bus connector, CAN	
0AC912.9	Bus adapter, CAN, 1 CAN interface	
0AC913.92	Bus adapter, CAN, 2 CAN interfaces, including 30 cm connection cable (DSUB connector)	
	Notes	
Application memory	and TB704 / TB708 terminal blocks must be ordered separately!	

Tabelle 2: 7EC021.60-1 - Order data

3.2 Technical data

Product ID	EC20
General information	
C-UL-US listed	Yes
Module type	Embedded controller
Dimensions in mm (W x H x D)	43 x 122 x 110
Power consumption	<6 W
CPU	
Processor clock	100 MHz
SRAM	32 KB
DRAM	32 MB
Operating system	AC140 (Version E2.82 or higher)
Application interface IF1	
Interface type	R\$232
Electrical isolation	No
Design	9-pin DSUB plug
Max. distance	15m / 19200 Baud
Max. baud rate	115.2 kBaud
Display	232 LED
Application interface IF2	
Interface type	CAN
Electrical isolation	Yes
Design	9-pin DSUB plug
Max. distance	1,000 m
Max. baud rate Bus lengths up to 60 m Bus lengths up to 200 m Bus lengths up to 1,000 m	500 kBit/s 250 kBit/s 50 kBit/s
Display	CAN LED
Network-capable	Yes
Bus termination resistor	Externally wired
Application interface IF4	
Interface type	X2X Link master
Electrical isolation	Yes
Design	4-pin connector
Max. distance	100 m
Internal bus supply	No
Display	X2X LED
Network-capable	Yes, network topology: Line

Tabelle 3: 7EC021.60-1 - Technical data

Product ID	EC20
Application interface IF6	
Interface type	Ethernet
Electrical isolation	Yes
Design	RJ45 socket
Max. distance	100 m
Baud rate	10/100 MBaud
Display	ACT LED
Network-capable	Yes
Inputs / outputs	
Connection, module-side	8-pin connector
Configuration of the digital inputs/outputs	Can be configured individually as input or output
Digital inputs ¹⁾	
Number of inputs	Max. 3
Wiring	Sink
Electrical isolation Input - ACOPOS Input - Input	Yes No
Input voltage (nom./max.)	24 VDC / 30 VDC
Switching threshold LOW HIGH	< 5 V > 15 V
Input current at rated voltage	Approx. 4.2 mA
Input delay	<5 µs
Modulation compared to ground potential	Max. ±30 V
Event counter	
Signal form	Square wave pulse
Input frequency	Max. 100 kHz
Pulse length	Min. 5 µs
Counter size	32-bit
Inputs Input 1 Input 2 Input 3	Counter 1

Tabelle 3: 7EC021.60-1 - Technical data (cont.)

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Product ID	EC20
Incremental encoder	
Signal form	Square wave pulse
Evaluation	4-fold
Encoder monitoring	No
Input frequency	Max. 20 kHz
Count frequency	Max. 80 kHz
Reference frequency	Max. 20 kHz
Distance between edges	Min. 5 µs
Counter size	16-bit
Inputs Input 1 Input 2 Input 3	Channel A Channel B Reference pulse R
Gate measurement	
Signal form	Square wave pulse
Gate frequency	Max. 100 kHz
Pulse length	Min. 5 µs
Count frequency Internal External	31.25 kHz or 4 MHz Max. 100 kHz
Period measurement	
Signal form	Square wave pulse
Input frequency	Max. 100 kHz
Pulse length	Min. 5 µs
Count frequency Internal External	31.25 kHz or 4 MHz Max. 100 kHz
Digital outputs	
Number of outputs	Max. 3
Туре	High-side transistor outputs
Electrical isolation Output - PLC Output - Output	Yes No
Switching voltage (min. /nom. /max.)	18 VDC / 24 VDC / 30 VDC
Continuous current	Max. 500 mA
Switching Delay 0 -> 1 and 1 -> 0	Max. 500 µs (typ. 250 µs)
Switching frequency (resistive load)	Max. 100 Hz
Protection Short circuit protection Overload protection	Yes Yes
Continuous short circuit current at 24 V	Тур. 4 А
Readable outputs	Yes

Tabelle 3: 7EC021.60-1 - Technical data (cont.)

Product ID	EC20
Operational conditions	
Environmental temperature during operation	0 to +45 °C
Relative humidity during operation	5 to 95 %, non-condensing
Operational conditions	
Storage temperature	-25 to +55 °C
Relative humidity during storage	5 to 95 %, non-condensing
Transport temperature	-25 to +70 °C
Relative humidity during transport	95 % at +40 °C

Tabelle 3: 7EC021.60-1 - Technical data (cont.)

1) Shielded cables must be used for inputs 1 - 3.

3.3 Indications

Image	LED	Name	Color	Description
	0	Status (RUN)	Red Red with orange blinking Red/green blinking (1 Hz) Orange Green Green with orange blinking	ERROR/RESET Load/unload and start BOOT AR Startup of BOOT or CF - AR SERVICE/DIAG/BOOT mode RUN RUN - BATTERY LOW
	0	RS232 (232)	Orange blinking	Data transfer to application interface IF1 (RS232)
RUN 0 2122	6	Ethernet (ACT)	Orange Orange blinking	Ethernet LINK (IF6) Ethernet ACTIVE (IF6)
	0	CAN1 (CAN1)	Orange	Data transfer on application interface IF2 (CAN)
	6	X2X (X2X)	Orange	Data transfer on application interface IF4 (X2X)

Tabelle 4: 7EC021.60-1 - Indicators

3.4 Sets CAN node number (IF2) and operating mode

The CAN node number and the operating mode of the EC20 can be set using two HEX code switches:

Image	Code switch	Description
	0	CAN node number 16s position (high)
CAN CAN	0	CAN node number 1s position (low)
10 ()		

Tabelle 5: 7EC021.60-1 - Sets CAN node number (IF2) and operating mode

Switch position	Operating mode	Description
\$00	Boot	In this switch position the default B&R Automation Runtime ^{TY} (AR) is started, and the runtime system can be installed using the online interface (B&R Automation Studio ^T)! User Flash is deleted after the download begins.
\$01-\$FE	Run	RUN mode, valid CAN node number.
\$FF	Diagnostics	The CPU boots in Diagnostics mode. Program sections in User RAM and User FlashPROM are not initialized. After Diagnostics mode, the CPU always boots with a warm restart.

Tabelle 6: 7EC021.60-1 - Operating modes

The CAN node number change takes effect the next time the EC20 is switched on.

There must be a terminating resistor (120 Ω , 0.25 W) between CAN_H and CAN_L at the beginning and end of the CAN bus.

3.5 Ethernet station number setting (IF6)

The Ethernet station number can be set with software (B&R Automation Studio™).

3.6 Reset button

Image	Description
Reset button	 The reset button can be pressed with any small pointed object (e.g. paper clip). Pressing the reset button triggers a hardware reset, which means: All application programs are stopped. All outputs are set to zero. The EC20 then goes into SERVICE mode.

Tabelle 7: 7EC021.60-1 - Reset button

3.7 Application memory slot (CompactFlash)



Tabelle 8: 7EC021.60-1 - Reset button

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3.8 Backup battery

Image	Code switch	Description
Battery cover	The EC20 is equippe on the bottom of the	ed with a lithium battery. The lithium battery is placed in a separate compartment module and protected by a cover.
	Backup battery dat	a
	Lithium battery	3 V / 950 mAh
	Model number	0AC201.9
	Short description	Lithium batteries, 5 pcs., 3 V / 950 mAh, button cell
	Storage temperature	-20 to +60 °C
	Storage time	Max. 3 years at 30°C
View from below	Relative humidity	0 to 95% (non-condensing)

Tabelle 9: 7EC021.60-1 - Backup battery

3.8.1 Data / real-time buffering

The following areas are buffered:

- Remanent variables
- User RAM
- System RAM
- Real-time clock

3.8.2 Battery monitoring

The battery voltage is checked cyclically. The cyclic load test of the battery does not considerably shorten the battery life, instead it gives an early warning of weakened buffer capacity.

The status information, "BatteryOK" is available from the system library function "BatteryInfo."

3.8.3 Battery change interval

The battery should be changed every 4 years. The change interval refers to the average life span and operating conditions and is recommended by B&R. It is not the maximum buffer duration.

Information:

Data stored in the EC20 RAM will be lost if the battery is changed with the PLC switched off! The battery can be changed with power applied, but this is not allowed in all countries!

3.9 Input / output register

3.9.1 Digital in r/- (16 Bit)

Bit	Value	Description
0		Logical status of digital I/O 1
1		Logical status of digital I/O 2
2		Logical status of digital I/O 3
3 - 15		Reserved

3.9.2 Digital out r/w (16 Bit)

All reserved bits must be written with 0.

Bit	Value	Description
0	0	Digital output 1 is inactive
	1	Digital output 1 is active
1	0	Digital output 2 is inactive
	1	Digital output 2 is active
2	0	Digital output 3 is inactive
	1	Digital output 3 is active
3 - 15		Reserved

3.9.3 Counter (32 Bit) r/(w)

In addition to the typical counter modes, this counter has a "Stepper motor counter mode" (see Configuration register bits 4-6).

In stepper motor counter mode, the count direction is set using digital I/O 2 (0...increment, 1...decrement), and the counter clock is on digital I/O 1. Only one clock edge is used for counting (can be configured with bit 3 of the counter configuration register).

3.9.4 Counter configuration (16 bit) r/w

All reserved bits must be written with 0.

Bit	Value	Description
0		Reserved
1	0	AB(R) counter mode: R input disabled
	1	AB(R) counter mode: R input enabled
2		Reserved
3	0	Measurement starts at increasing edge
	1	Measurement starts at decreasing edge
4 - 6	000	No counter operation
	001	AB(R) counter mode
	010	Event counter mode
	011	Period measurement mode
	100	Stepper motor counter mode
	101	Gate measurement mode
	110	Not allowed
	111	Not allowed
7 - 8	00	Counter frequency 4MHz
	01	External counter frequency
	10	Counter frequency 31.25 kHz
	11	Not allowed
9	0	Counter overflow recognition disabled / Reset counter overflow bit
	1	Overflow recognition of the continuous counter is enabled (value limited to \$FFFF)
10 - 14		Reserved
15	0	Time / counter reset
	1	Time / counter enabled (ATTENTION: Only set bit after counter configuration is complete)

3.9.5 Status (16 Bit) r/-

Bit	Value	Description
0 - 8		Reserved
9	0	Period or gate measurement within the counter range 0 - \$FFFF (only valid if bit 9 is set in the counter configuration word).
	1	Counter overflow during period or gate measurement. Acknowledge by resetting bit 9 of the counter configuration word.
10 - 14		Reserved
15	0	Output supply voltage monitoring 24VDC is ok
	1	Output supply voltage monitoring 24VDC error

3.10 Wiring

3.10.1 Overview

AT CAN BE AT CAN

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Figure 3: 7EC021.60-1 - Overview of connections (view from front)



Figure 4: 7EC021.60-1 - Overview of connections (view from below)

3.10.2 Application interface IF1 (RS232)

X1	Pin	Name	Function
	1	DCD	Data Carrier Detect
	2	RXD	Receive signal
1	3	TXD	Transmit signal
6 0	4	DTR	Data Terminal Ready
° °	5	GND	Ground
	6	DSR	Data Set Ready
	7	RTS	Request To Send
9-piri DSOB piug	8	CTS	Clear To Send
	9	RIN	Ring Indicator

Tabelle 10: 7EC021.60-1 - Pin assignments for X1 (RS232)

3.10.3 Application interface IF2 (CAN)

X2	Pin	Name	Function
	1		
	2	CAN_L	CAN low
1	3	CAN_GND	CAN 0 V
6 0	4		
	5		
	6		
9 5 0 pip DSLIP plug	7	CAN_H	CAN high
a-bill DOOR bind	8		
	9		

Tabelle 11: 7EC021.60-1 - Pin assignments for X2 (CAN)

3.10.4 X4 connector (inputs/outputs)

				Function in the mode:	
X4	Pin	Name	Incremental counter	Period/gate measurement	Stepper motor counter
	1	GND		GND (Digital I/O)	
	2	+24 VDC		Supply +24V (Digital I/O)	
	3	Digital I/O 1	A	Counter	input
	4	Digital I/O 2	В		Counting Direction
	5	Digital I/O 3	R	External Clock	
	6	Shield		Shield	
	7	+24 VDC		+24V supply (module)	
/18708	8	GND		GND (module)	

Tabelle 12: 7EC021.60-1 - Pin assignments X4 (inputs/outputs)

3.10.5 Application interface IF4 (X2X)

IF4	Pin	Name	Function
	1	X2X	X2X data
	2	X2X⊥	X2X ground
2	3	X2X\	X2X data inverted
	4	SHLD	Shield
4			

Tabelle 13: 7EC021.60-1 - Pin assignments X5 (X2X)

3.10.6 Application interface IF6 (Ethernet)

IF6	Pin	Name	Function
	1	RXD	Receive signal
	2	RXD\	Receive signal inverted
	3	TXD	Transmit signal
1	4	Termination	Termination
	5	Termination	Termination
	6	TXD\	Transmit signal inverted
	7	Termination	Termination
	8	Termination	Termination

Tabelle 14: 7EC021.60-1 - Pin assignments for X6 (Ethernet)

4. EC21

4.1 Order data

Model number	Short description	Image
7EC021.60-1	Embedded Controller, x86 100 MHz Intel compatible, 16 MB DRAM, 32 KB SRAM, removable application memory (CompactFlash), 1 CAN interface, 1 Profibus DP slave interface, 1 X2X Link Master interface, 1 Ethernet interface 100 Base-T, 1 RS232 interface, 3 DM, 24 VDC, 0.5 A. Application memory must be ordered separately! Terminal blocks 0TB708 and 0TB704 must be ordered separately!	
	Application memory	Contraction of the Party of the
5CFCRD.0032-02	CompactFlash 32 MB ATA/IDE SanDisk	Letter
5CFCRD.0064-03	CompactFlash 64 MB ATA/IDE SiliconSystems	
5CFCRD.0128-03	CompactFlash 128 MB ATA/IDE SiliconSystems	
5CFCRD.0256-03	CompactFlash 256 MB ATA/IDE SiliconSystems	(6 (6
5CFCRD.0512-03	CompactFlash 512 MB ATA/IDE SiliconSystems	10.10
5CFCRD.1024-03	CompactFlash 1024 MB ATA/IDE SiliconSystems	6.6
5CFCRD.2048-03	CompactFlash 2048 MB ATA/IDE SiliconSystems	22
	Terminal blocks	
0TB708.91	Accessory terminal block, 8-pin, cage clamps 1.5 mm ²	
0TB708:92-01	Accessory terminal block, 20 pcs. 8-pin cage clamps 1.5 mm ²	D D
0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm ²	PEDS CAN
0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm ²	
	Terminal blocks	
0G0001.00-090	Cable PC <-> PLC/PW, RS232, online cable	
7AC911.9	Bus connector, CAN	
0AC912.9	Bus adapter, CAN, 1 CAN interface	
0AC913.92	Bus adapter, CAN, 2 CAN interfaces, including 30 cm connection cable (DSUB connector)	
	Notes	
Application memory	and TB704 / TB708 terminal blocks must be ordered separately!	

Tabelle 15: 7EC021.60-1 - Order data

4.2 Technical data

Product ID	EC21			
General information				
C-UL-US listed	Yes			
Module type	Embedded controller			
Dimensions in mm (W x H x D)	43 x 122 x 110			
Power consumption	<6 W			
CPU				
Processor clock	100 MHz			
SRAM	32 KB			
DRAM	16 MB			
Operating system	AC140 (Version E2.82 or higher)			
Application interface IF1				
Interface type	RS232			
Electrical isolation	No			
Design	9-pin DSUB plug			
Max. distance	15m / 19200 Baud			
Max. baud rate	115.2 kBaud			
Display	232 LED			
Application interface IF2				
Interface type	CAN			
Electrical isolation	Yes			
Design	9-pin DSUB plug			
Max. distance	1,000 m			
Max. baud rate Bus lengths up to 60 m Bus lengths up to 200 m Bus lengths up to 1,000 m	500 kBit/s 250 kBit/s 50 kBit/s			
Display	CAN LED			
Network-capable	Yes			
Bus termination resistor	Externally wired			

Tabelle 16: 7EC021.60-1 - Technical data

Product ID	EC21		
Application interface IF3			
Interface type	RS485		
Transfer protocol	Profibus DP		
Electrical isolation	Yes		
Design	9-pin DSUB socket		
Controller	ASIC SPC3		
RAM	1.5 kByte		
Max. distance	1,000 m		
Max. baud rate Bus lengths up to 100 m Bus lengths up to 200 m Bus lengths up to 400 m Bus lengths up to 1,000 m	12 MBit/s 1.5 MBit/s 500 kBit/s 187.5 kBit/s		
Indicators	PB LED		
Network-capable	Yes		
Bus termination resistor	External T-connector		
Application interface IF4			
Interface type	X2X Link master		
Electrical isolation	Yes		
Design	4-pin connector		
Max. distance	100 m		
Internal bus supply	No		
Display	X2X LED		
Network-capable	Yes, network topology: Line		
Application interface IF6			
Interface type	Ethernet		
Electrical isolation	Yes		
Design	RJ45 socket		
Max. distance	100 m		
Baud rate	10/100 MBaud		
Display	ACT LED		
Network-capable	Yes		
Inputs / outputs			
Connection, module-side	8-pin connector		
Configuration of the digital inputs/outputs	Can be configured individually as input or output		

Tabelle 16: 7EC021.60-1 - Technical data (cont.)

Product ID	EC21			
Digital inputs ¹⁾				
Number of inputs	Max. 3			
Wiring	Sink			
Electrical isolation Input - ACOPOS Input - Input	Yes No			
Input voltage (nom./max.)	24 VDC / 30 VDC			
Switching threshold LOW HIGH	< 5 V > 15 V			
Input current at rated voltage	Approx. 4.2 mA			
Input delay	<5 µs			
Modulation compared to ground potential	Max. ±30 V			
Event counter				
Signal form	Square wave pulse			
Input frequency	Max. 100 kHz			
Pulse length	Min. 5 µs			
Counter size	32-bit			
Inputs Input 1 Input 2 Input 3	Counter 1			
Incremental encoder				
Signal form	Square wave pulse			
Evaluation	4-fold			
Encoder monitoring	No			
Input frequency	Max. 20 kHz			
Count frequency	Max. 80 kHz			
Reference frequency	Max. 20 kHz			
Distance between edges	Min. 5 µs			
Counter size	16-bit			
Inputs Input 1 Input 2 Input 3	Channel A Channel B Reference pulse R			
Gate measurement				
Signal form	Square wave pulse			
Gate frequency	Max. 100 kHz			
Pulse length	Min. 5 µs			
Count frequency Internal External	31.25 kHz or 4 MHz Max. 100 kHz			

Tabelle 16: 7EC021.60-1 - Technical data (cont.)

Product ID	EC21
Period measurement	
Signal form	Square wave pulse
Input frequency	Max. 100 kHz
Pulse length	Min. 5 µs
Count frequency Internal External	31.25 kHz or 4 MHz Max. 100 kHz
Digital outputs	
Number of outputs	Max. 3
Туре	High-side transistor outputs
Electrical isolation Output - PLC Output - Output	Yes No
Switching voltage (min. /nom. /max.)	18 VDC / 24 VDC / 30 VDC
Continuous current	Max. 500 mA
Switching Delay 0 -> 1 and 1 -> 0	Max. 500 µs (typ. 250 µs)
Switching frequency (resistive load)	Max. 100 Hz
Protection Short circuit protection Overload protection	Yes Yes
Continuous short circuit current at 24 V	Тур. 4 А
Readable outputs	Yes
Operational conditions	
Environmental temperature during operation	0 to +45 °C
Relative humidity during operation	5 to 95 %, non-condensing
Operational conditions	·
Storage temperature	-25 to +55 °C
Relative humidity during storage	5 to 95 %, non-condensing
Transport temperature	-25 to +70 °C
Relative humidity during transport	95 % at +40 °C

Tabelle 16: 7EC021.60-1 - Technical data (cont.)

1) Shielded cables must be used for inputs 1 - 3.

4.3 Indications

Image	LED	Name	Color	Description
	0	Status (RUN)	Red Red with orange blinking Red/green blinking (1 Hz) Orange Green Green with orange blinking	ERROR/RESET Load/unload and start BOOT AR Startup of BOOT or CF - AR SERVICE/DIAG/BOOT mode RUN RUN - BATTERY LOW
	0	RS232 (232)	Orange blinking	Data transfer to application interface IF1 (RS232)
RUN 0 020	€	Profibus (PB)	Orange	Data transfer on application interface IF3 (Profibus)
00 00	Ø	Ethernet (ACT)	Orange Orange blinking	Ethernet LINK (IF6) Ethernet ACTIVE (IF6)
	6	CAN1 (CAN1)	Orange	Data transfer on application interface IF2 (CAN)
	6	X2X (X2X)	Orange	Data transfer on application interface IF4 (X2X)

Tabelle 17: 7EC021.60-1 - Indicators

4.4 Sets CAN node number (IF2) and operating mode

The CAN node number and the operating mode of the EC21 can be set using two HEX code switches:

Image	Code switch	Description
	0	CAN node number 16s position (high)
CAN O STA	0	CAN node number 1s position (low)

Tabelle 18: 7EC021.60-1 - Sets CAN node number (IF2) and operating mode

Switch position	Operating mode	Description
\$00	Boot	In this switch position the default B&R Automation Runtime ^{TI} (AR) is started, and the runtime system can be installed using the online interface (B&R Automation Studio ^T)! User Flash is deleted after the download begins.
\$01-\$FE	Run	RUN mode, valid CAN node number.
\$FF	Diagnostics	The CPU boots in Diagnostics mode. Program sections in User RAM and User FlashPROM are not initialized. After Diagnostics mode, the CPU always boots with a warm restart.

Tabelle 19: 7EC021.60-1 - Operating modes

The CAN node number change takes effect the next time the EC21 is switched on.

There must be a terminating resistor (120 Ω , 0.25 W) between CAN_H and CAN_L at the beginning and end of the CAN bus.

4.5 Profibus station number setting (IF3)

The Profibus station number can be set using two HEX code switches:

Image	Code switch	Description
	0	Profibus station number 16s position (high)
	0	Profibus station number 1s position (low)

Tabelle 20: 7EC021.60-1 - Setting the Profibus station number

The Profibus station number change takes effect the next time the EC21 is switched on.

The AsL2Dp library is used for communication between the master and slave.

4.6 Ethernet station number setting (IF6)

The Ethernet station number can be set with software (B&R Automation Studio™).

4.7 Reset button

Image	Description
Reset button	 The reset button can be pressed with any small pointed object (e.g. paper clip). Pressing the reset button triggers a hardware reset, which means: All application programs are stopped. All outputs are set to zero. The EC21 then goes into SERVICE mode.
view from below	

Tabelle 21: 7EC021.60-1 - Reset button

4.8 Application memory slot (CompactFlash)

Image	Description
Ejector for CompactFlash CompactFlash	Program memory is required to operate the EC21. The application memory is CompactFlash. It is not included with the delivery of the EC21, instead it must be ordered as an accessory. The CompactFlash memory card is inserted in the slot underneath the EC21 and is removed by pressing the ejector. The CompactFlash memory card can be secured using a safety clip.
View from below	
	Tabelle 22: 7EC021.60-1 - Reset button

4.9 Backup battery

Image	Code switch	Description
Battery cover	The EC21 is equippe on the bottom of the	ed with a lithium battery. The lithium battery is placed in a separate compartment module and protected by a cover.
	Backup battery data	a
	Lithium battery	3 V / 950 mAh
	Model number	0AC201.9
	Short description	Lithium batteries, 5 pcs., 3 V / 950 mAh, button cell
	Storage temperature	-20 to +60 °C
	Storage time	Max. 3 years at 30°C
View from below	Relative humidity	0 to 95% (non-condensing)

Tabelle 23: 7EC021.60-1 - Backup battery

4.9.1 Data / real-time buffering

The following areas are buffered:

- Remanent variables
- User RAM
- System RAM
- Real-time clock

4.9.2 Battery monitoring

The battery voltage is checked cyclically. The cyclic load test of the battery does not considerably shorten the battery life, instead it gives an early warning of weakened buffer capacity.

The status information, "BatteryOK" is available from the system library function "BatteryInfo."

4.9.3 Battery change interval

The battery should be changed every 4 years. The change interval refers to the average life span and operating conditions and is recommended by B&R. It is not the maximum buffer duration.

Information:

Data stored in the EC21 RAM will be lost if the battery is changed with the PLC switched off! The battery can be changed with power applied, but this is not allowed in all countries!

4.10 Input / output register

4.10.1 Digital in r/- (16 Bit)

Bit	Value	Description
0		Logical status of digital I/O 1
1		Logical status of digital I/O 2
2		Logical status of digital I/O 3
3 - 15		Reserved

4.10.2 Digital out r/w (16 Bit)

All reserved bits must be written with 0.

Bit	Value	Description
0	0	Digital output 1 is inactive
	1	Digital output 1 is active
1	0	Digital output 2 is inactive
	1	Digital output 2 is active
2	0	Digital output 3 is inactive
	1	Digital output 3 is active
3 - 15		Reserved

4.10.3 Counter (32 Bit) r/(w)

In addition to the typical counter modes, this counter has a "Stepper motor counter mode" (see Configuration register bits 4-6).

In stepper motor counter mode, the count direction is set using digital I/O 2 (0...increment, 1...decrement), and the counter clock is on digital I/O 1. Only one clock edge is used for counting (can be configured with bit 3 of the counter configuration register).

4.10.4 Counter configuration (16 bit) r/w

Bit	Value	Description
0		Reserved
1	0	AB(R) counter mode: R input disabled
	1	AB(R) counter mode: R input enabled
2		Reserved
3	0	Measurement starts at increasing edge
	1	Measurement starts at decreasing edge
4 - 6	000	No counter operation
	001	AB(R) counter mode
	010	Event counter mode
	011	Period measurement mode
	100	Stepper motor counter mode
	101	Gate measurement mode
	110	Not allowed
	111	Not allowed
7 - 8	00	Counter frequency 4MHz
	01	External counter frequency
	10	Counter frequency 31.25 kHz
	11	Not allowed
9	0	Counter overflow recognition disabled / Reset counter overflow bit
	1	Overflow recognition of the continuous counter is enabled (value limited to \$FFFF)
10 - 14		Reserved
15	0	Time / counter reset
	1	Time / counter enabled (ATTENTION: Only set bit after counter configuration is complete)

All reserved bits must be written with 0.

4.10.5 Status (16 Bit) r/-

Bit	Value	Description
0 - 8		Reserved
9	0	Period or gate measurement within the counter range 0 - \$FFFF (only valid if bit 9 is set in the counter configuration word).
	1	Counter overflow during period or gate measurement. Acknowledge by resetting bit 9 of the counter configuration word.
10 - 14		Reserved
15	0	Output supply voltage monitoring 24VDC is ok
	1	Output supply voltage monitoring 24VDC error

4.11 Wiring

4.11.1 Overview

Figure 5: 7EC021.60-1 - Overview of connections (view from front)



Figure 6: 7EC021.60-1 - Overview of connections (view from below)

4.11.2 Application interface IF1 (RS232)

X1	Pin	Name	Function
6 0 0 0 0 0 0 0 0 5 9-pin DSUB plug	1	DCD	Data Carrier Detect
	2	RXD	Receive signal
	3	TXD	Transmit signal
	4	DTR	Data Terminal Ready
	5	GND	Ground
	6	DSR	Data Set Ready
	7	RTS	Request To Send
	8	CTS	Clear To Send
	9	RIN	Ring Indicator

Tabelle 24: 7EC021.60-1 - Pin assignments for X1 (RS232)

4.11.3 Application interface IF2 (CAN)

X2	Pin	Name	Function
6 0 0 0 0 0 0 0 0 0 5 9-pin DSUB plug	1		
	2	CAN_L	CAN low
	3	CAN_GND	CAN 0 V
	4		
	5		
	6		
	7	CAN_H	CAN high
	8		
	9		

Tabelle 25: 7EC021.60-1 - Pin assignments for X2 (CAN)

4.11.4 Application interface IF3 (Profibus)

Х3	Pin	Name	Function
9 6 9 1 9-pin DSUB plug	1		
	2		
	3	DATA	Data
	4	CNTRL	Transmit enable
	5	Profibus_GND	Profibus GND (electrically isolated)
	6	+5V / 50mA	+5 V supply / 50 mA (electrically isolated)
	7		
	8	DATA\	Data
	9	CNTRL\	Transmit enable\

Tabelle 26: 7EC021.60-1 - Pin assignment for X3 (Profibus)

4.11.5 X4 connector (inputs/outputs)

			Function in the mode:		
Х4	Pin	Name	Incremental counter	Period/gate measurement	Stepper motor counter
	1	GND	GND (Digital I/O)		
	2	+24 VDC	Supply +24V (Digital I/O)		
	3	Digital I/O 1	A Counter input		put
	4	Digital I/O 2	В		Counting direction
	5	Digital I/O 3	R	External clock	
	6	Shield	Shield		
	7	+24 VDC	+24V supply (module)		
718708	8	GND		GND (module)	

Tabelle 27: 7EC021.60-1 - Pin assignments X4 (inputs/outputs)

4.11.6 Application interface IF4 (X2X)

IF4	Pin	Name	Function
	1	X2X	X2X data
	2	X2X⊥	X2X ground
	3	X2X\	X2X data inverted
	4	SHLD	Shield

Tabelle 28: 7EC021.60-1 - Pin assignments X5 (X2X)

4.11.7 Application interface IF6 (Ethernet)

IF6	Pin	Name	Function
	1	RXD	Receive signal
	2	RXD\	Receive signal inverted
	3	TXD	Transmit signal
	4	Termination	Termination
	5	Termination	Termination
	6	TXD\	Transmit signal inverted
	7	Termination	Termination
	8	Termination	Termination

Tabelle 29: 7EC021.60-1 - Pin assignments for X6 (Ethernet)