INTERBUS

User Manual

Description and Installation of the TP 420 IB

Designation: TP 420 IB UM E

Revision: A

Order No.:

This manual is valid for:

TSwin	Version 2.2
TP 420 IB	Order No.: 27 12 02 4

6470A

PHOENIX CONTACT

Please Observe the Following Notes:

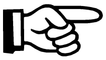
In order to guarantee the safe use of your device, we recommend that you read this manual carefully. The following notes give you information on how to use this manual.

Qualifications of the User Group

The products described in this manual should be installed/operated/maintained only by electricians or persons instructed by them, who are familiar with applicable national standards. Phoenix Contact assumes no liability for damage to any products resulting from disregard of information contained in this manual.

Explanation of Symbols Used

The *attention* symbol refers to an operating procedure which, if not carefully followed, could result in damage to equipment or personal injury.



The *note* symbol informs you of conditions that must strictly be observed to achieve error-free operation. It also gives you tips and advice on hardware and software optimization to save you extra work.

The *text* symbol refers you to detailed sources of information (manuals, data sheets, literature, etc.) on the subject matter, product, etc. This text also provides helpful information for the orientation in the manual.

Danger through electric shock.

Danger through corrosiveness.

Danger through toxic.

Danger through explosion.

Component destruction through electrostatic discharge!

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Table of Contents

Section 1

This section informs you about

- keyboard
- dimensions
- installation
- connector pin assignments
- display settings
- character sets
- battery
- fuse
- application memory

1 Description of the TP 420 IB

The TP 420 IB is a compact operator panel for the connection to the INTERBUS.

It has

– Two INTERBUS remote bus interfaces
– One serial RS-232 interface
– One LCD with 4 lines of 20 characters
– Six function keys with insert strips
– Realtime clock

The TP 420 IB is configured with TSwin from Version 2.2.

1.1 Front View

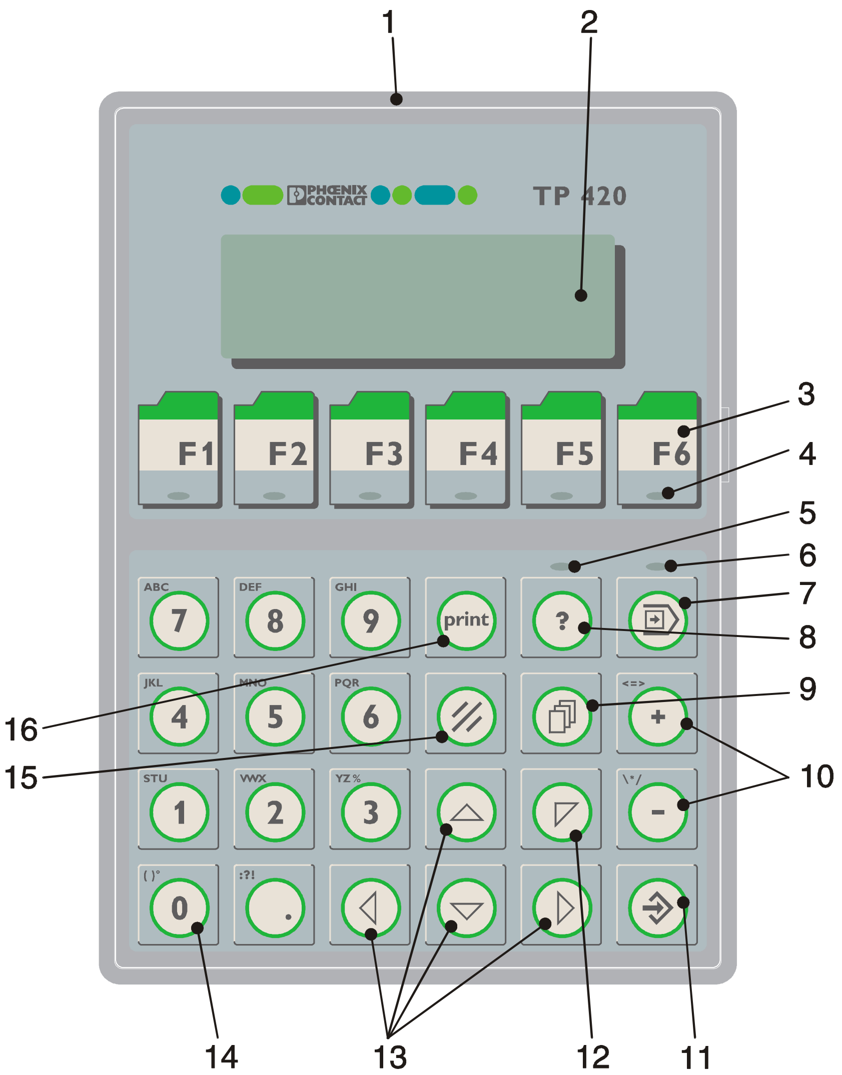


Figure 1-1 Front view

Key:

1 Front plate
2 LCD
3 Function keys F1 to F6
4 Status LED, function keys
5 Status LED, help
6 Status LED, data release
7 Special key, data release
8 Special key, help
9 Control key, page down
10 Edit key, plus and minus
11 Special key, enter
12 Cursor key, home
13 Cursor key, right, left, up, down
14 Edit key 0 to 9, alphabetical
15 Special key, delete
16 Special key, print

1.2 Keyboard

The operator panel offers all the important key functions. The keys are positioned under an environmental proof polyester foil.

The keyboard has the following basic features:

– Membrane keyboard
– Actuator travel approximately 0.3 mm (0.012 in.)
– Key area 15 mm x 15 mm (0.591 in. x 0.591 in.)
– Function keys with status LED (green)

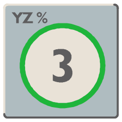
The function of the keys depends on the user description.

1.2.1 Edit Keys

Key: **0 and ( )** ° is used for changing data in the editor. The (and) and ° characters can be entered when configuring the **Shift** or **ShiftCase** system variables.

Key: **1 and STU** is used for changing data in the editor. The characters S, T and U can be entered when configuring the **Shift** or **ShiftCase** system variables.

Key: **2 and VWX** is used for changing data in the editor. The characters V, W and X can be entered when configuring the **Shift** or **ShiftCase** system variables.



Key: **3 and YZ%** is used for changing data in the editor. The characters Y, Z and % can be entered when configuring the **Shift** or **ShiftCase** system variables.

Key: **4 and JKL** is used for changing data in the editor. The characters J, K and L can be entered when configuring the **Shift** or **ShiftCase** system variables.

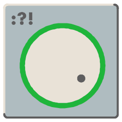
Key: **5 and MNO** is used for changing data in the editor. The characters M, N and O can be entered when configuring the **Shift** or **ShiftCase** system variables.

Key: **6 and PQR** is used for changing data in the editor. The characters P, Q and R can be entered when configuring the **Shift** or **ShiftCase** system variables.

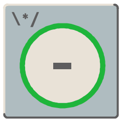
Key: **7 and ABC** is used for changing data in the editor. The characters A, B and C can be entered when configuring the **Shift** or **ShiftCase** system variables.

Key: **8 and DEF** is used for changing data in the editor. The characters D, E and F can be entered when configuring the **Shift** or **ShiftCase** system variables.

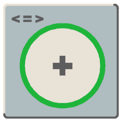
Key: **9 and GHI** is used for changing data in the editor. The characters G, H and I can be entered when configuring the **Shift** or **ShiftCase** system variables.



Key: **Decimal point and :?!** is used to change data in the editor. The characters ? and ! can be entered when configuring the **Shift** or **ShiftCase** system variables.

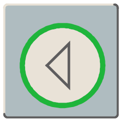


Key: **Minus and */** is used to change data in the editor. The characters \, * and / can be entered when configuring the **Shift** or **ShiftCase** system variables.

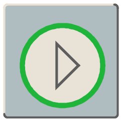


Key: **Plus and <=>** is used to change data in the editor. The characters <, = and > can be entered when configuring the **Shift** or **ShiftCase** system variables.

1.2.2 Control Keys



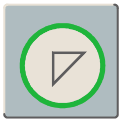
Key: **Left cursor** can be programmed to directly select adjacent nodes and I/O masks. In the editor, it moves the cursor one character to the left (character selection).



Key: **Right cursor** can be programmed to directly select adjacent nodes and I/O masks. In the editor, it moves the cursor one character to the right (character selection).

Key: **Up cursor** can be programmed to directly select adjacent I/O masks. In the editor, it moves the cursor up one variable (variable selection).

Key: **Down cursor** can be programmed to directly select adjacent I/O masks. In the editor, it moves the cursor down one variable (variable selection).



Key: **Home cursor** can be programmed to directly select higher-level nodes and I/O masks. In the editor, it returns the cursor to the first input variable position.

Key: **Page down** is used to scroll page by page through tables, receptors and messages. This function corresponds to the **TabPgDn** system variable. The key displays the data content down to the end of the table.

1.2.3 Special Keys

Key: **Help** always shows the current help text (online help). A flashing help key LED indicates that there is a system message. The system message is always shown in plain text.

Key: **Data release** changes from the menu to the editor. The integrated LED is lit during edit mode. Pressing Data release in edit mode exits the editor.

Key: **Enter** is used to end the data entry. Pressing it during the startup mask opens the setup mask.

Key: **Delete** deletes the character beneath the cursor in the editor. Removes the selected messages from the data memory.

Key: **Print** can be used as a soft key to activate various print processes.

1.2.4 Function Keys

Keys **F1 to F6** with integrated LEDs are used for function confirmation. The function of the keys can be freely assigned (with soft key functions). The function keys can be used either as direct keys for menu control or for triggering a function in the control system.

1.2.4.1 Assigning the Function Keys

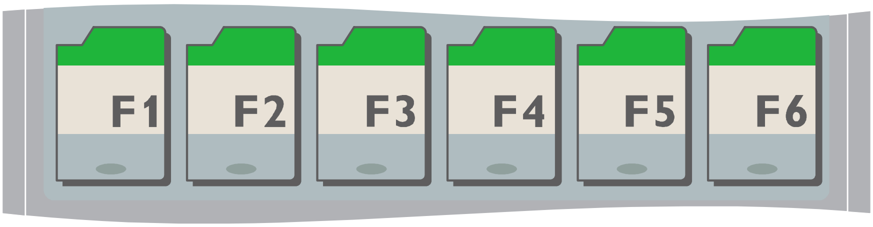


Figure 1-2 Assigning the function keys

1.2.4.2 Insert Strip for the Function Keys

Insert strips can also be replaced when the TP 420 IB is built in. A strip labeled with F1 to F6 and an unlabeled strip is supplied with the device.

For the labeling, use:

- Single pieces, prototypes: Label with water-resistant pen
- Small series: Copying foil with laser print
- Large series: Customer-specific labeled insert strips

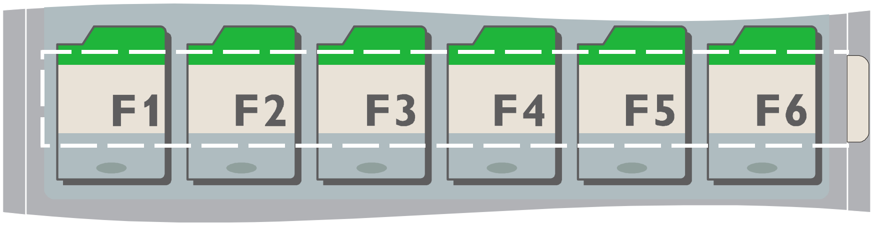


Figure 1-3 Position of the insert strip in the TP 420 IB

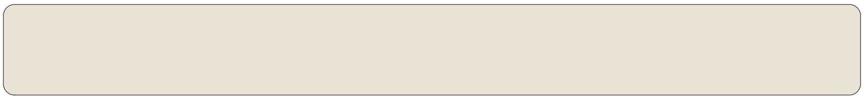


Figure 1-4 Unlabeled insert strip

Figure 1-5 Labeled insert strip (standard)

1.3 Rear View

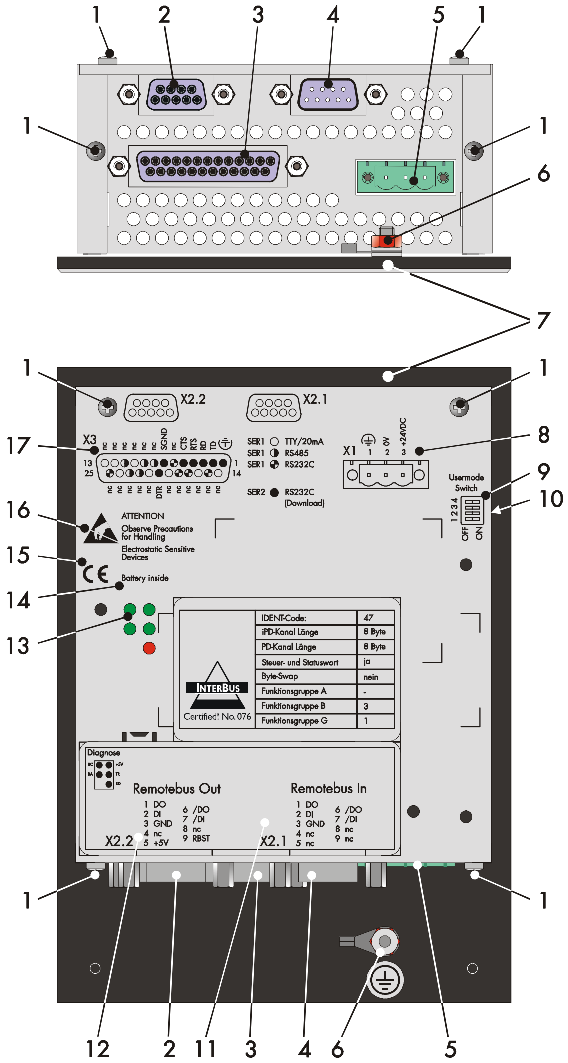


Figure 1-6 Rear view

Key:

1 Mounting screws
2 Female connector X2.2 (remotebus out)
3 Female connector X3 (SER2 RS-232)
4 Male connector X2.1 (remotebus in)
5 Male connector X1 (supply voltage)
6 Threaded bolt for grounding
7 Front plate
8 Pin assignment male connector X1 (supply voltage)
9 Assignment of the user mode switch
10 User mode switch on the side
11 Pin assignment male connector X2.1 (remotebus in)
12 Pin assignment female connector X2.2 (remotebus out)
13 Diagnostic LEDs
14 Battery note
15 CE mark
16 Warning
17 Pin assignment female connector X3 (SER2 RS-232)

1.4 Device Installation

Installation and maintenance should only be carried out by authorized and trained experts.

When installing, take care to leave a gap of at least 30 mm (1.181 in.) to ensure sufficient air circulation.

The seal between the front plate and the mounting surface depends on the installation.

Device installation is suitable when the device can be accessed from the rear. It is recommended that a plate approximately 1 mm to 14 mm (0.039 in. to 0.551 in.) thick be used for installation in switchboards.

- Push the device from in front through the mounting hole.
- Plug the mounting clamps into the notches on the rear side of the device. The clamps are supplied with the TP 420 IB.
- Screw the device uniformly against the mounting wall.

1.4.1 Dimensions of the Front Plate

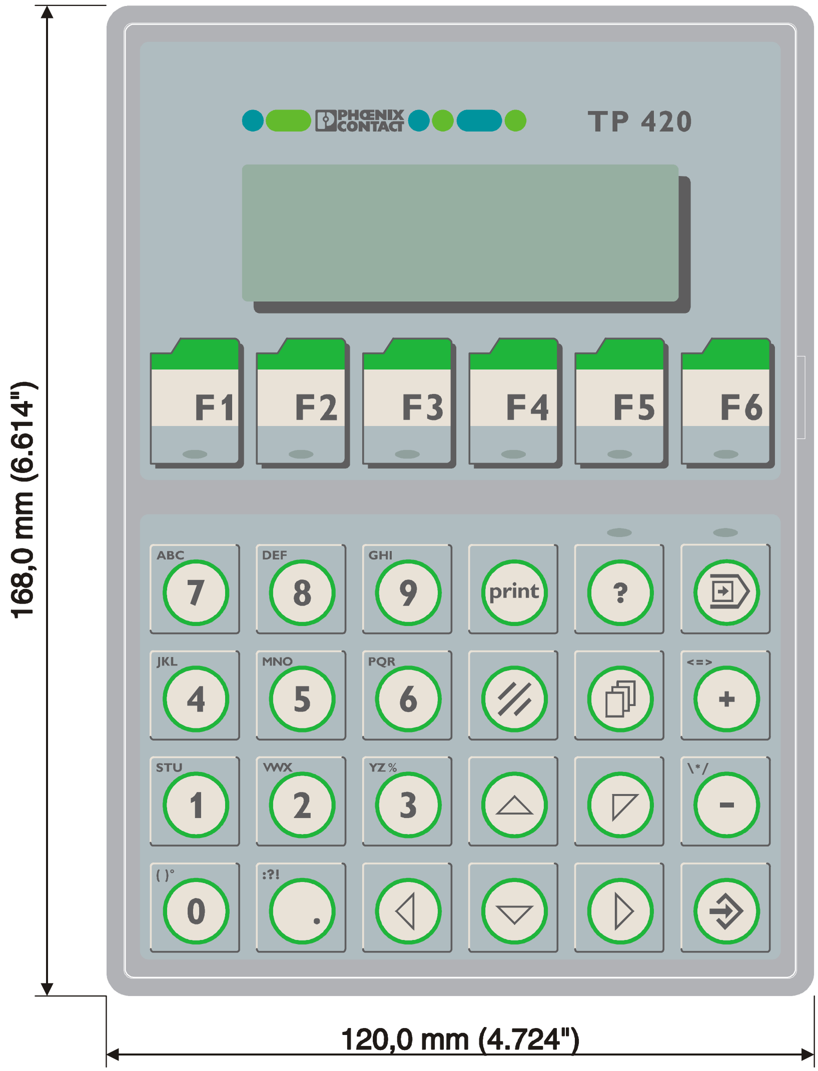


Figure 1-7 Dimensions of the front plate

1.4.2 Side View, Installation Depth

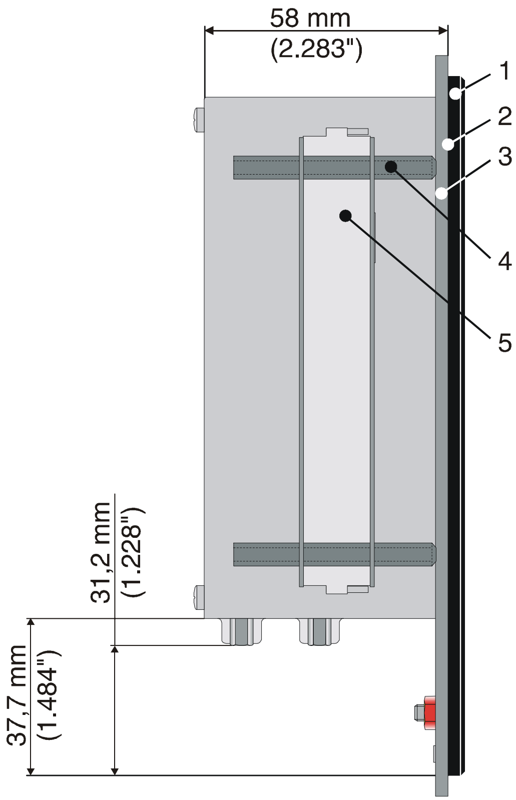


Figure 1-8 Side view, installation depth

Key:

1 Front plate

2 Foam rubber seal

3 Mounting surface (1 mm to 14 mm [0.039 in. to 0.551 in.] thick)

4 Threaded pin DIN 914 M4 x 35 mm (1.378 in.)

5 Mounting clamp

1.4.3 Mounting Segment

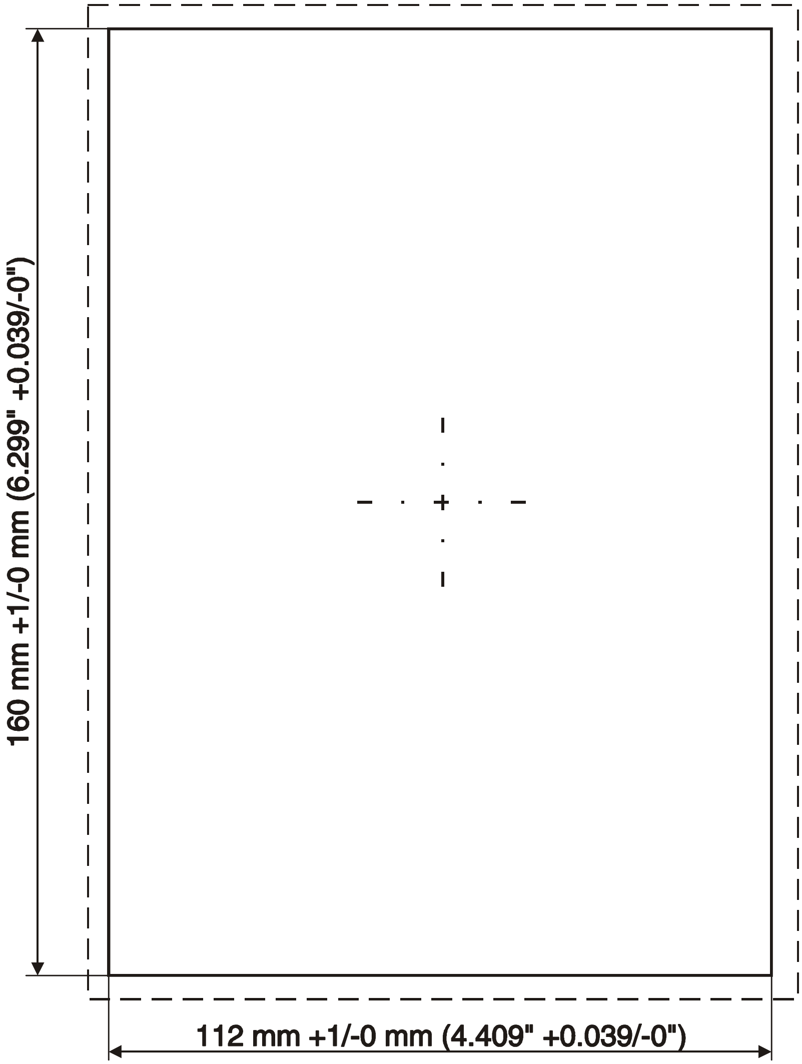


Figure 1-9 Mounting segment

1.5 Connector Pin Assignments

The TP 420 IB is equipped with the following interfaces as standard.

Table 1-1 Overview of the interfaces

Interface	Designation	Meaning
X1 male connector		Supply voltage
X2.1 male connector	Remotebus in	INTERBUS remote bus connection
X2.2 female connector	Remotebus out	INTERBUS remote bus connection
X3 female connector	SER2 RS-232	Download/upload/ protocol printer/scan-ner

1.5.1 Connector X1 (Supply Voltage)

The supply voltage is supplied via connector X1.

The device has protection against polarity reversal. If the polarity is wrong, the device cannot be started.

This device has protection class I. For safe operation, a SELV corresponding to IEC 61131 must be used for the supply voltage.

A shielded, finely stranded cable with a diameter up to 2.5 mm² (14 AWG) must be used.

If shielded connection cables are used in the supply voltage area, the shielding must be connected to Pin 1.

A separate cable must always be provided for the grounding. The cable must have a minimum diameter of 1.5 mm² (16 AWG) and be as short as possible. Complying with this recommendation will increase operational safety.

- Connect the supply voltage via the plug-in 3-pos. female connector. The COMBICON female connector MSTB 2.5/3-STF (Order No. 17 86 84 4) is provided.
- Use the screw locking system of the female connector to prevent it from coming loose.

Connector in the TP 420 IB:

3-pos. COMBICON connector MSTBV 2.5/3-GF (Order No. 17 76 89 6)

Table 1-2 Assignment of connector X1

Pin	Designation	Function
1	⏚	Noiseless ground
2	0 V	Supply voltage 0 V
3	24 V DC	Supply voltage 24 V DC

1.5.2 Connector X2.1/X2.2 INTERBUS

The INTERBUS is connected via the remote bus (remotebus in and remotebus out) interface X2.1 and X2.2.

INTERBUS uses a 6-wire cable that is available by the meter (IBS RBC METER-T, Art.-No. 28 06 28 6).

The shielding of the cable should be connected in a flat position to the solid metal covers of the connectors. See page A-6.

Connector in the TP 420 IB:

9-pos. D-SUB male connector remotebus in

Table 1-3 Assignment of the interface X2.1 remotebus in

Pin	Designation	Function	Color coding
1	DO	Data output	Yellow
2	DI	Data input	Grey
3	GND	Functional earth ground	Brown
4	nc	Not connected	
5	nc	Not connected	
6	/DO	Data output inverted	Green
7	/DI	Data input inverted	Pink
8	nc	Not connected	
9	nc	Not connected	

Connector in the TP 420 IB

9-pos. D-SUB female connector remotebus out

Table 1-4 Assignment of the interface X2.2 remotebus out

Pin	Designation	Function	Color coding
1	DO	Data output	Yellow
2	DI	Data input	Grey
3	GND	Functional earth ground	Brown
4	nc	Not connected	
5	+5 V	Supply Voltage +5 V DC	
6	/DO	Data output inverted	Green
7	/DI	Data input inverted	Pink
8	nc	Not connected	
9	RBST	Remote bus status	

The listed core colors refer to the cores in the INTERBUS standard cable (IBS RBC METER-T, Art.-No. 28 06 28 6).

1.5.3 Connector X3 SER2 RS-232

At interface X3 SER2 you can connect a scanner or a protocol printer. During the configuring you use this interface for the download and upload of the application file.

A shielded, concentrically stranded cable (cable type LiYCY) with a minimum diameter of 0.25 mm² (24 AWG) must be used. The maximum permitted length of the cable is 15 m (49.213 ft.).

The shielding of the cable should be connected in a flat position to the solid metal covers of the connectors. See page A-6.

Connector in the TP 420 IB:

25-pos. D-SUB female connector

Table 1-5 Assignment of the interface X3 SER2 RS-232

Pin	Designation	Function
1	⏚	Low-noise earth
2	TD	Transmit data
3	RD	Receive data
4	RTS	Ready to send
5	CTS	Clear to send
7	SGND	Signal ground
20	DTR	Data transfer request

1.6 Shielding

The shielding must be linked on both sides in a flat position to the solid metal covers of the connector housing. Please note that an equipotential bonding line, which is at least 10 times the diameter of the shield, is required when grounding both sides.

1.7 LCD

Toxic/Corrosive
If the display is damaged, avoid touching, swallowing or breathing in the liquids or gases which may leak out.

An overview of the LCD of the TP 420 IB:

Table 1-6 LCD overview

Designation	Value
Type	LCD
Resolution	4 x 20 characters
Background illumination	LED
Viewing angle	90°
Basic contrast setting	Via user mode switch
Contrast setting	Via software, temperature compensated
Lifetime LCD	100,000 h
Lifetime background illumination	100,000 h
Lines	4
Characters/line	20
Normal character	5 x 7 pixels + cursor
Character height	4.3 mm (0.169 in.)
Character color	Black
Background color	Yellowish-green
Visible front cutout (height x width)	23 mm x 74 mm (0.906 in. x 2.913 in.)

1.7.1 Contrast Setting

The contrast of the LCD can be set using software. To do this, the **LCDContrast** system variable must be set up in the user description in an I/O mask.

Every editor, which permits the entry and modification of integers, can be used to change the variables. The range limits for the editor should be set as follows:

Lower limit	-25
Upper limit	+70

If the variable is missing, a basic setting (value 25) is made during initialization.

1.7.2 Basic Contrast Setting

If the contrast in the display is such that it is impossible to read the masks, the user mode switch (See page 1-27) can be used to set the basic contrast.

Table 1-7 Switch position for basic contrast

Switch	Setting
S1	ON
S2	OFF
S3	OFF
S4	ON

The switch position is identical to the “Activate download via hardware” position. The contrast is reset before a corresponding warning message is shown. The warning can be read as normal. The application description will not be lost.

To set the basic contrast:

- Switch the device off
- Set the user mode switch according to the above pattern.
- Switch the device on again.

- When the warning appears, switch the device off again.
- Set switch 4 to the OFF position.
- Switch the device on again.

1.7.3 Character Attributes

The following character attributes can be displayed:

– Normal

– Flashing

1.7.4 "Normal" Character Set

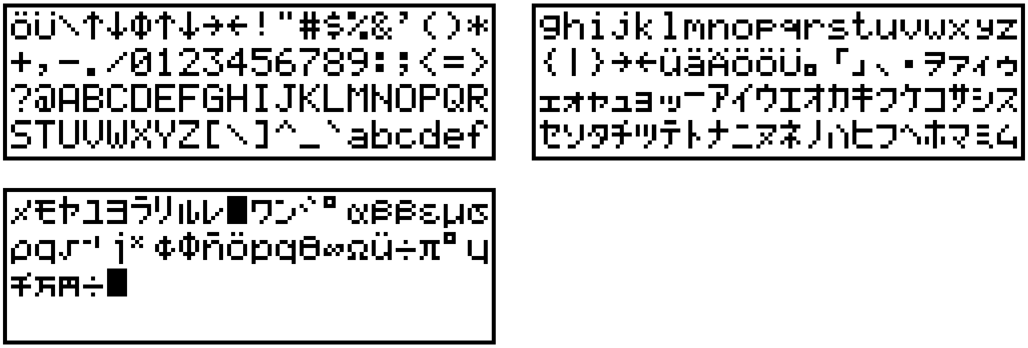


Figure 1-10 "Normal" character set

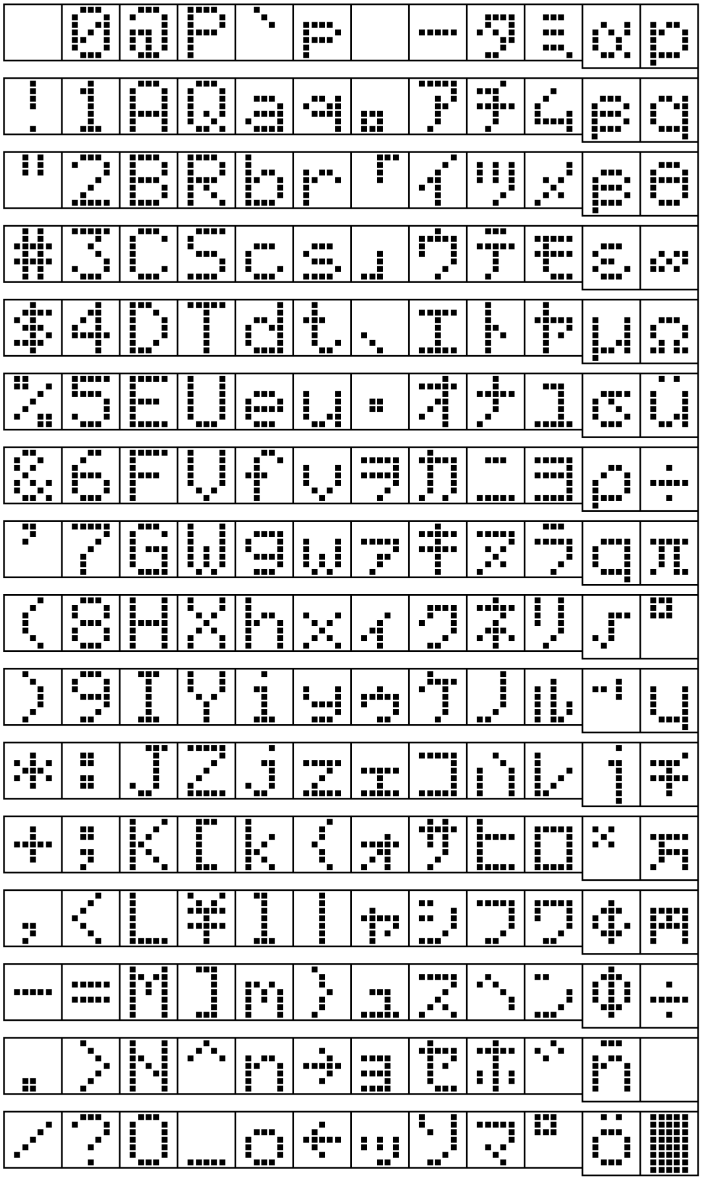
1.7.5 ASCII Character Set

0		32		64	@	96	`	128		160		192		224	
1		33	!	65	A	97	a	129	ü	161		193		225	ß
2		34	"	66	B	98	b	130		162		194		226	
3		35	#	67	C	99	c	131		163		195		227	
4		36	$	68	D	100	d	132	ä	164		196		228	
5		37	%	69	E	101	e	133		165		197		229	
6		38	&	70	F	102	f	134		166		198		230	
7		39	'	71	G	103	g	135		167		199		231	
8		40	(	72	H	104	h	136		168		200		232	
9		41	)	73	I	105	i	137		169		201		233	
10		42	*	74	J	106	j	138		170		202		234	
11		43	+	75	K	107	k	139		171		203		235	
12		44	,	76	L	108	l	140		172		204		236	
13		45	–	77	M	109	m	141		173		205		237	ø
14		46	.	78	N	110	n	142	Ä	174		206		238	
15		47	/	79	O	111	o	143		175		207		239	
16		48	0	80	P	112	p	144		176		208		240	
17		49	1	81	Q	113	q	145		177		209		241	
18		50	2	82	R	114	r	146		178		210		242	
19		51	3	83	S	115	s	147		179		211		243	
20		52	4	84	T	116	t	148	ö	180		212		244	
21		53	5	85	U	117	u	149		181		213		245	
22		54	6	86	V	118	v	150		182		214		246	÷
23		55	7	87	W	119	w	151		183		215		247	
24	↑	56	8	88	X	120	x	152		184		216		248	°
25	↓	57	9	89	Y	121	y	153	Ö	185		217		249	
26	→	58	:	90	Z	122	z	154	Ü	186		218		250	
27	←	59	;	91	[	123	{	155		187		219		251	
28		60	<	92	\	124	|	156		188		220		252	
29		61	=	93	]	125	}	157		189		221		253	
30		62	>	94	^	126		158		190		222		254	
31		63	?	95	_	127		159		191		223		255	

Figure 1-11 ASCII character set

1.7.6 Loadable „Katakana“ Character Set

032 048 064 080 096 112 160 176 192 208 224 240



047 063 079 095 111 127 175 191 207 223 239 255

Figure 1-12 Loadable „Katakana“ character set

1.8 User Mode Switch

The user mode switch is positioned at the side of the device. The switches can be operated there.

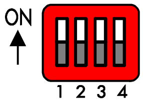


Figure 1-13 User mode switch

Table 1-8 User mode switch

S1	S2	S3	S4	Function
I	X	–	–	Standard mode (default upon delivery)
I	X	I	–	Standard mode without SPS
–	I	–	–	Transparent mode with start and stop code of the keys
–	–	–	I	Transparent mode without stop code of the keys
I	–	–	I	Activate download (deletes application memory) and default contrast setting
I	–	I	I	Activate upload

Key for table:

I = Switch ON

– = Switch OFF

X = Any switch position

1.9 Battery

The built-in lithium battery preserves the data in the CMOS-RAM and supplies the realtime clock. The battery has a minimum life of 5 years even in unfavorable operating conditions. When the battery runs down, the “Change battery” message is generated automatically.

We recommend that you change the battery approximately every 4 years as part of the regular maintenance work. New batteries can be obtained directly from Phoenix Contact.

If the “Change battery” message is detected too late, e.g., the realtime clock stops or shows the wrong date, data in the CMOS-RAM may have already been lost. For this reason, after changing a battery, always check data such as passwords that can be modified, parameters in the system variables, recipe data sets and entries in the message system.

1.9.1 Changing the Battery

Batteries must only be changed by authorized and trained experts.

So that message data and time survive, the battery must be changed under operating voltage. Please note the safety notes on the rear of the device.

- Remove the screws on the rear side of the device and detach the enclosure.
- Remove the cable tie, which secures the battery.
- Disconnect the battery connector and remove the dead battery.
- Plug in the cable for the new battery.
- Use a cable tie to attach the new battery to the plastic support on the printed circuit board.
- Reattach the rear panel of the device.
- Carefully screw the screws tightly into the rear panel.
- Check data such as passwords that can be modified, parameters in the system variables, recipe data sets and entries in the message system.

1.9.2 Battery Waste Disposal

According to § 7 of the Batterieverordnung (German Battery Ordinance) of 1/9/1998, end users must always return old batteries to a dealer or to a returns depot set up for this purpose by the public waste disposal body. Only dispose of dead batteries in public or commercial collection boxes.

To prevent short circuitry in the collection boxes insulate the poles of each battery with insulation tape or put each single battery into a plastic bag.

Explosive
Lithium batteries must not be thrown on to fires, exposed to temperatures above 100°C (212°F) or recharged.

Toxic
Do not open lithium batteries.

Components can be damaged by electrostatic discharge
Electrostatic discharge can damage electronic components. Observe the ESD protective measures.

1.10 Fuse

A semiconductor fuse is used to protect the device.

The semiconductor fuse cannot be replaced!

Once the fuse has been tripped, the device must be isolated from the supply voltage to allow the semiconductor fuse to regenerate. At an ambient temperature of 20°C (68°F) the regeneration lasts approximately 20 seconds. The higher the ambient temperature, the longer the regeneration takes.

1.11 Application Memory

The unit is equipped with 256 KByte flash memory as application memory. This memory area is available to store the user application, the loadable protocol driver, the fonts and the recipe data.

1.12 Diagnostic LEDs

On the rear of the TP 420 IB are the diagnostic LEDs, which display the states of the bus system.

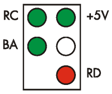


Figure 1-14 Arrangement of the diagnostic LEDs

Table 1-9 Functions of the diagnostic LEDs

Designation	Color	Status	Function
+5 V	Green	On	Voltage monitor
RC	Green	On	Remote bus check
BA	Green	On	Bus active
RD	Red	On	Remote bus disabled

A Technical Appendix

A 1 Technical Data

Keyboard	
30 keys in total, membrane keyboard	
Including	6 control keys
	6 function keys with LEDs and insert strips
	2 special keys with LEDs
	3 special keys without LEDs
	13 edit keys

LCD	
Resolution	4 lines with 20 characters
Display area	23 mm x 74 mm (H x W) (0.906 in. x 2.913 in.)
Background illumination	LED
Lifetime LCD	100,000 h
Lifetime background illumination	100,000 h

Electrical Data	
Supply voltage	24 V DC (SELV)
Residual ripple	10 % maximum
Minimum voltage	19.2 V
Maximum voltage	30.2 V
Current consumption	< 0.3 A
Peak current	< 0.5 A

Electrical Data	
Connection value	~ 10 W
Fuse	Semiconductor fuse
Protection against polarity reversal	Protective diode

Interfaces	
Variable baud rates and data formats	
X2.1 INTERBUS incoming remote bus (remotebus in)	Electrically isolated
X2.2 INTERBUS outgoing remote bus (remotebus out)	Electrically isolated
X3 SER2 RS-232 download/upload/scanner/ protocol printer	Not electrically isolated

Central Unit	
Central unit	Z80-CPU
Clock-pulse rate	10 MHz
Watchdog timer	Available
Realtime clock	Available
Battery monitoring	Available
Temperature compensation for LCD	Available

Memory	
Application memory	256 KByte flash
Firmware memory	256 KByte flash
RAM	128 KByte static CMOS RAM, battery backed

Connection Method
D-SUB female and male connectors, 9-pos. and 25-pos.
COMBICON MSTBV 2,5/3-GF inclusive COMBICON MSTB 2,5/3-STF

Ambient Conditions	
Temperatures	
Operating	0 °C to 50 °C (32°F to 122°F)
Storage	-20 °C to 70 °C (-4°F to 158°F)
Relative humidity	
Operation	30 % to 75 %, no condensation
Storage and transport	30 % to 75 %, no condensation

Standards and Guidelines	
Immunity to interference	EN 50082-2 EN 55011 limit value class B EN 55022 EN 61000-4-2 EN 61000-4-3 EN 61000-4-4 EN 61000-4-5 EN 61000-4-6
Equipment requirements	IEC 61131
Electromagnetic compatibility	89/336/EWG
Degree of protection	EN 60529
Impact load, shocks	EN 60068-2-27
Sinusoidal vibrations	EN 60068-2-6

Approvals
CE, UL, C-UL

Housing Data	
Total weight	500 g approximately
Housing	Steel sheet, galvanized
Front plate	Anodized aluminium, 168 mm x 120 mm x 4 mm (H x W x D) (6.614 in. x 4.724 in. x 0.157 in.)
Front foil	Polyester foil
Seal on the rear	Polyethylene foam
Mounting segment	160 mm x 112 mm (H x W) (6.299 in. x 4.409 in.)
Installation depth	58 mm (2.283 in.) without connector
Degree of protection	On the front: IP 65 On the back: IP 20

A 2 Ordering Data

Description	Order Designation	Order No.
Operator panel	TP 420 IB	27 12 02 4
COMBICON female connector	MSTB 2,5/3-STF	17 86 84 4
COMBICON male connector	MSTBV 2,5/3-GF	17 76 89 6
Remote bus cable, standard, 3 x 2 x 0.22 mm^2 (24 AWG), by the meter	IBS RBC METER-T	28 06 28 6

A 3 Shielding D-SUB Connectors

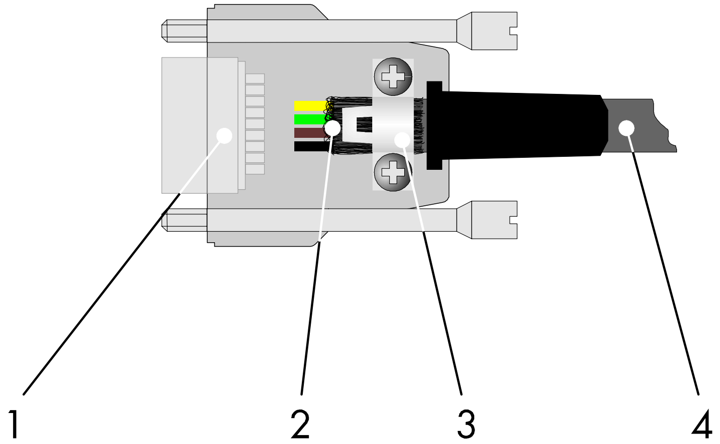


Figure A-1 Shielding D-SUB connectors

1 D-SUB connector

2 Shield

3 Cable clamp

4 Cable

The shield must be folded back into a flat position above the cable sheath.

When fixing the cable clamps, as much of the shielding as possible must be in contact with the housing and sufficient strain relief must also be ensured.

B 1 List of Figures

Section 1

Appendix A

B 2 List of Tables

Section 1

B 3 Index

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