Operating instructions

Series SX402

Alphanumeric digital displays with Profibus DP interface

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Validity

The model designation of the units is:

SX402-220/05/0G-001/0B-K0	SX402-420/05/0G-001/0B-K0
SX402-240/05/0G-001/0B-K0	SX402-220/09/0G-001/0B-K0

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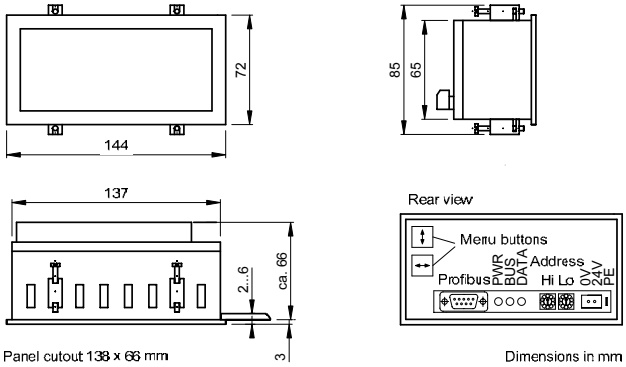
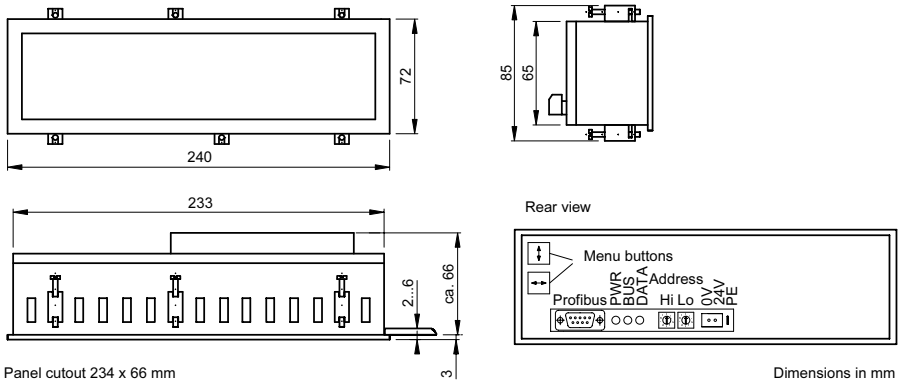
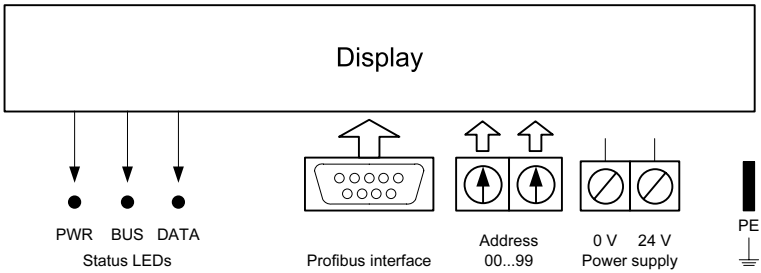
SX402-220/05/0G-001/0B-K0 (2 x 20 characters, character height 5 mm)
SX402-420/05/0G-001/0B-K0 (4 x 20 characters, character height 5 mm)



SX402-240/05/0G-001/0B-K0 (2 x 40 characters, character height 4,7 mm)
SX402-220/09/0G-001/0B-K0 (2 x 20 characters, character height 9 mm)



Principle circuit diagram



Parameterization | The parameterization of the unit is done by means of a menu in the menu display (see chapter 5).

Profibus interface | The Profibus interface is located on the 9-pin D Sub socket. It has the following assignment:

Pin	1	2	3	4	5	6	7	8	9
Signal	–	–	B	RTS	GND	+ 5V	–	A	–

The units are Profibus DP slaves according EN 50 170.

The baud rate is automatically recognized. It can reach up to 12 Mbaud.

The GSD file 'SIEB0AD7.GSD' on disc is included in the delivery.

The address is set with the rotary switches (00...99).

An error message will appear on the display if there has been a bus error. (see chapter 6).

Status indicators | The status indicators (LEDs) are located on the back side of the display. They have the following function:

PWR The Profibus interface is supplied with power.

BUS The unit is parameterized and identified as a Profibus user.

DATA The information to be represented is updated (short light-up).

Bus errors in Profibus systems may result in personal injury or material damage. Therefore it is to observe that a bus error at the Profibus may occur if you reset the display with the command $0 and activate the menu (see chapter 5) while the display is in operation.

Data transmission | The system requires the data transmission in the Profibus to take place cyclically. Data located in the input and output areas of the master are exchanged cyclically between master and slave. This is why new data must be marked by the handshake as 'new'. The transfer of the new data will take place only once; the cyclical repeat, however, is ignored.

Handshake | The handshake marks new data for the display (send handshake) and checks the receiving readiness of the display (busy check).

For the send handshake, bit 0 (TxHS bit) has been reserved in the first byte of the output data area (TxHS byte. Bits 7...1 must be set to 0 by the master.

Output data area

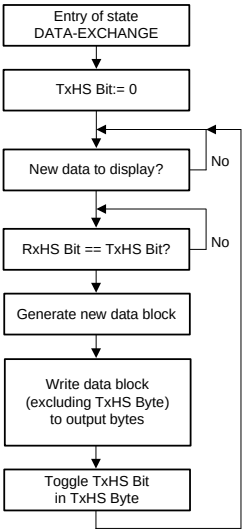
	Byte 0 (TxHS-Byte)							Byte 1	Byte 2		Byte (n – 1)
7	6	5	4	3	2	1	0	7 ---------- 0	7 ---------- 0		7 ---------- 0
:	:	:	:	:	:	:	:	——————— useful data ———————			
:	:	:	:	:	:	:	:				
:	:	:	:	:	:	:	↕	TxHS bit (toggled by the master)			
:	:	:	:	:	:	:	:				
0	0	0	0	0	0	0		Bits 7…1 must be set to 0 by the master			

For the busy check, bit 7 (RxHS bit) has been reserved in the only byte of the input data area (RxHS byte). Bits 6…0 are read by the master as 0.

Input data area

Byte 0 (RxHS-Byte)								
7	6	5	4	3	2	1	0	
:	:	:	:	:	:	:	:	
:	0	0	0	0	0	0	0	Bits 6…0 are read by the master as 0
:								
↕								RxHS bit (toggled by the slave)

Flow chart | After the transfer to DATA-EXCHANGE (display has been parameterized and Profibus has been recognized) the display will set the RxHS bite to the starting value of 0. The master will also set the TxHS bite to 0 during the transfer to the DATA-EXCHANGE.



The display is ready to receive as soon as the RxHS bit has the same value as the TxHS bit sent last. Now the master can send new data to the display. The master marks new data by inverting the TxHS bit (toggle). The new data is written in the user data if the TxHS byte is unchanged. The TxHS bit will be toggled into TxHS-Byte only after this has been done. After a short time, the display signals again readiness to receive by setting the RxHS bit equal to the TxHS bit received last.

Data segmentation The system requires the number of output bytes to be limited. This may require the division of a new data telegram into several segments. In accordance with the handshake method described above, each individual segment contains a send handshake byte (TxHS byte), and the maximum number of bytes it can contain is that configured in the output data area.

The segments are sent in succession to the display in accordance with the handshake. The display evaluates the data after receipt of a message termination.

Caution! Surplus output bytes have to be filled with 00_h if less data than that that has been configured in the output data area is being sent to the display. It does not matter whether the data is being segmented or not. Data bytes containing 00h are ignored by the display.

Functional building block | We will send you a sample program for Siemens S7-300 as a data medium for the control of one or more displays and a functional building block for the implementation of the handshake.

Data evaluation | The data is evaluated according to the command table shown below. In the description, the numbers in [ ] refer to the corresponding lines in the command table.

Commands | Some of the commands require a telegram ending (↵). It can be inserted by means of a single CR ($0D_h$) or LF ($0A_h$) character or a CR/LF character combination.

Commands for text manipulation

Display text	**cc...↵**	send any character (**cc…** = characterband with any content)	[1]
Deleting text	**$E↵**	Clearing text in the display	[2]

Commands for text formatting

Line break	**$C**	Forced line break	[3]
Flashing	**$F1**	Flashing of following characters on	[4]
	$F0	Flashing of following characters off	[5]
Bar graph	**$Gnnn**	Bar graph display (nnn = number of columns, always enter in three numeric digits, e. g. $G040)	[6]
$ character	**$$**	Display of the '$' character in the text	[7]

Commands for display options

Flashing	**$F1↵**	Flashing of the entire display on	[8]
	$↵F0	Flashing of the entire display off	[9]
Reset	**$0↵**	Restarting the display **(see Safety precautions)**	[10]

Display text | To display a text, its characters (**cc**…) are sent to the display as a data telegram [1]. Any text in the display is cleared when a fixed text is called up.

Deleting text | Any text in the display is cleared with the **$E↵** command [2]. Afterwards the following will appear on the display.

Line break | If a text contains more characters than can be displayed in one line, a line break is inserted automatically at the end of the line, and the text is continued in the next line.

A line break can also be forced at a certain place in the text, for example for correct hyphenation [3] using the command **$**C.

Flashing | Including **$F1** in the data string causes the following characters to flash [4]. **$F0** command in the data telegram deactivates the flashing of the following characters [5].

The **$F1↵** command activates the flashing of the entire display [8]. The **$F0↵** command deactivates the flashing of the entire display [9].

Bar graph | The **$Gnnn** command activates the bar graph display [31]. **nnn** stands for the number of illuminating columns, i.e. the length of the bar graph and must always be three digits, e. g. $G040 [6].

Character $** | The command for displaying the '$' character is **$$ [7].

Reset | The **$0↵** command restarts the unit [10].

Bus errors in Profibus systems may result in personal injury or material damage. Therefore it is to observe that a bus error at the Profibus may occur if you reset the display with the command $0 while the display is in operation.

Paging | If a text contains more characters than can be shown in the display, it is automatically displayed in paging mode. The page change interval can be set between 2, 5 or 10 seconds in menu item P (see chapter 5).

Chapter 4 | Individual line selection

Application | The activation of the devices as described in chapter 4 is optimized for applications in which individual texts are shown in the display. Longer texts are written in several lines of the display due to the automatic line break. When the text contains more characters than can be displayed, it will be automatically displayed in paging mode.

The individual line selection is optimized for applications in which several texts independent of one another should be shown in different lines and each line should be considered as an individual display. The lines can be selected individually. The control commands only refer to the activated line. The automatic line break and paging functions are not active.

Commands | The activation of the individual lines is carried out according to the following command table.

The commands beginning with **$Lx** select an individual line. **x** is the line number (1…4).

The commands require a telegram ending (↵). It can be inserted by means of a single CR ($0D_h$) or LF ($0A_h$) character or a CR/LF character combination.

Commands

Display text	**$Lxcc...↵**	Send any character to line x (**cc...** = characterband with any content)	[11]
Deleting text	**LxE↵**	Delete the text in the line x	[12]
Flashing	**LxF1↵**	Flashing of the whole line x on	[13]
	LxF0↵	Flashing of the whole line x off	[14]

Bus errors in Profibus systems may result in personal injury or material damage. Therefore it is to observe that activating the menu during the operation of the units may cause a bus error at the Profibus.

Menu display | The parameterization of the devices is carried out in a menu of the display. To reach the menu, press both menu buttons simultaneously (approx. 1 sec.) until an audible signal is heard and menu item 01 appears in the display. Now, you can navigate in the menu as follows:

Next menu item:	Shortly press key [↕]
Page menu items forward:	Press key [↕] long
Previous menu item:	Double click on key [↕]
Page menu items backward:	Double click on [↕] and keep it pressed

Next setting	Shortly press key [↔]
Page settings forward:	Press key [↔] long
Previous setting	Double click on key [↔]
Page setting backward:	Double click on [↔] and keep it pressed

The menu ends in menu item U with the button [↕]. The settings made are either saved (set), not saved (escape) or the factory settings, except for menu item 1, are reset, depending on the setting selected in menu item U.

Cancelling the menu without saving the settings made is possible by pressing both menu buttons longer (approx. 1 sec.) or will occur automatically if 60 seconds pass without a menu button being pressed.

Once the menu is closed, the unit behaves in the same manner as when the operating voltage was applied.

Control of the displays is not possible in menu mode.

Menu table | The menu items are displayed in the following menu table. The factory settings are marked with an *. Individual menu items or settings can be suppressed in another menu item, depending on the unit version or setting.

Menu item		Settings	Display	
P	Paging interval	2 seconds *	P	2
		5 seconds *	P	5
		10 seconds *	P	10
T	Time-out	No time-out *	T	0
		Time-out after 2 s	T	2
		Time-out after 4 s	T	4
		Time-out after 8 s	T	8
		Time-out after 16 s	T	16
		Time-out after 32 s	T	32
		Time-out after 64 s	T	64
		Time-out after 128 s	T	128
U	Saving	Saving parameters* (Set)	U	Set
		Not saving parameters (Escape)	U	Esc
		Resetting to the default settings (Default)	U	Def

Time-out | In menu item T, it is possible to set whether a time-out occurs, and if so, after what time. Time-out means that the display is cleared if it has not received a data telegram after a defined time period. The following symbol appears then on the display >.

Paging-Interval | If the text contains more characters than can be shown in the display, it is automatically displayed in paging mode. The page change interval can be set between 2, 5 or 10 seconds in menu item P.

Serious faults due to improper operation or faulty operating conditions are indicated in the display. The following messages are possible:

Fault message	Cause	Elimination
OFFLINE	The display is not connected to the bus or the bus stopped	Check the connections, start bus
SYNTAX_ERROR	A faulty command was sent to the display	The command must be corrected (see command table chapter 7)
OVER_FLOW	Too many characters have been sent to the display	Correct the data telegram
BAD_CONFIG	Faulty CONFIG data from the master	Adjust the hardware declaration in the master
BAD_PARAM	Faulty parameter from the master	Adjust the parameter

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2		!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{	!	}	~	⌂
8	€	ü	é	â	ä	à	å	ç	ê	ë	è	ï	î	ì	Ä	Å
9	É	æ	Æ	ô	ö	ò	û	ù	ÿ	Ö	Ü	ø	£	Ø	×	ƒ
A	á	í	ó	ú	ñ	Ñ	ª	º	▒	⌐	¬	½	¼	¡	«	»
B	⁞	▒	▒	¦	¦	▒	▒	▒	▒	▒	▒	▒	₧	≡	¢	¥	ä
C	А	Б	В	Г	Д	Е	Ж	З	И	Й	К	Л	М	Н	О	П
D	Р	С	Т	У	Ф	Х	Ц	Ч	Ш	Щ	Ъ	Ы	Ь	Э	Ю	Я
E	α	ß	Γ	π	Σ	σ	µ	τ	Φ	Θ	Ω	δ	∞	φ	∈	∩
F	≡	±	≥	≤	▒	▒	÷	≈	°	∙	·	√	ⁿ	²	▒	▒

The characters 00_h to $1F_h$ are replaced by blanks.

Display range	SX402-220/xx/0G-001/0B-K0	2 x 20 characters
	SX402-420/xx/0G-001/0B-K0	4 x 20 characters
	SX402-240/xx/0G-001/0B-K0	2 x 40 characters
Character height	SX402-220/05/0G-001/0B-K0	approx. 5 mm
	SX402-420/05/0G-001/0B-K0	approx. 5 mm
	SX402-240/05/0G-001/0B-K0	approx. 4,7 mm
	SX402-220/09/0G-001/0B-K0	approx. 9 mm
Display color	green	
Protection type	IP65 (front)	
Operating voltage reversed polarity	24 V DC ±15 %, galvanically isolated, protected against	
Power consumption	approx. 7 VA	
Connection technology	Profibus: D Sub socket	
	Power supply: pluggable screw-type terminal, clamping range 0,08…2,5 mm²	
Operating temperature	0...50 °C	
Storage temperature	-20...70 °C	
Relative humidity max. 95 % (non-condensing)		
Weight	SX402-220/05/0G-001/0B-K0	approx. 450 g
	SX402-420/05/0G-001/0B-K0	approx. 450 g
	SX402-240/05/0G-001/0B-K0	approx. 600 g
	SX402-220/09/0G-001/0B-K0	approx. 600 g
Length of texts	max. 200 characters including formatting	