APT1000G

Industrial terminal

Operation manual

Version 1.00

AMiT

Contents

History of revisions

Document name: apt1000g_g_en_100.pdf

Author: Jiří Mlejnek

Revision	Date	Changes
100	27. 2. 2010	New document

Related documentation

1. DetStudio development environment help

2. Application Note AP0016 – Principles of RS485 interface usage
   file: ap0016_en_xx.pdf

1 Introduction

APT1000G is an industrial terminal with serial interface.

Basic features
- Keyboard with 27 keys
- Backlighted LCD display, (4 × 20) characters
- RS232 serial interface
- RS485 serial interface with galvanic isolation
- RS422 serial interface with galvanic isolation
- Mounting into switchboard front panel

2 Technical parameters

Display		
Display	Display	Backlighted LCD, (4 × 20) characters, cursor, character (5 × 8) pixels
	Character height	4 mm

Keyboard		
Keyboard	Keyboard	27 buttons
	Mechanical durability	Min. 1.5×10^5

Connection		
Connection	Interface	RS232 including RTS, CTS RS485 with galvanic isolation RS422 with galvanic isolation
	Data transmission rate	150 Bd to 19200 Bd

RS232		
RS232	Galvanic isolation	No
	Logical level 0 (input)	Min. +3 V, max. +30 V
	Logical level 1 (input)	Min. -30 V, max. -3 V
	Logical level 0 (output)	Min. +5 V, max. +10 V
	Logical level 1 (output)	Min. -10 V, max. -5 V
	Maximum cable length	10 m
	Operation indication	No
	Connection points	CANON 9 plug or WAGO 256 terminals

RS485		
RS485	Overvoltage protection	Transil 600 W
	Galvanic isolation	Yes
	Isolation strength	300 V AC / 1 minute *)
	Terminating resistor **)	120 Ω on the terminal

	Idle state definition **)
	    up to +5 V
	    up to 0 V
		
		1 kΩ on the terminal
		1 kΩ on the terminal

	Maximum wire length	1200 m / 19200 Bd
	Maximum stations count	1
	Operation indication	No
	Connection points	WAGO 256 terminals

Note *) Isolation must not be used for dangerous voltage separation.
**) Terminating resistor and idle state definition are connected concurrently.

RS422		
RS422	Overvoltage protection	Transil 600 W
	Galvanic isolation	Yes
	Isolation strength	300 V AC / 1 minute *)
	Terminating resistor	120 Ω on the terminal

	Idle state definition
	    up to +5 V
	    up to 0 V
		
		1 kΩ on the terminal
		1 kΩ on the terminal

	Maximum wire length	1200 m / 19200 Bd
	Maximum stations count	1
	Operation indication	No
	Connection points	WAGO 256 terminals

Note *) Isolation must not be used for dangerous voltage separation.

Mechanics	Mechanical design	Metal cover, foil-covered front panel
	Mounting	Into switchboard front panel
	Ingress protection rate 　　– front panel 　　– rear panel	 IP55 IP20
	Signal connection	WAGO 256 terminals
	Maximum wire cross section	2.5 mm^2
	Weight	700 g
	Dimensions (w × h × d)	(146 × 166 × 52) mm

Power supply	Power supply	24 V DC ±20 %
	Power consumption	Max. 200 mA at 24 V DC

Temperatures	Operating temperature	0 °C to 50 °C
	Storage temperature	-20 °C to 70 °C

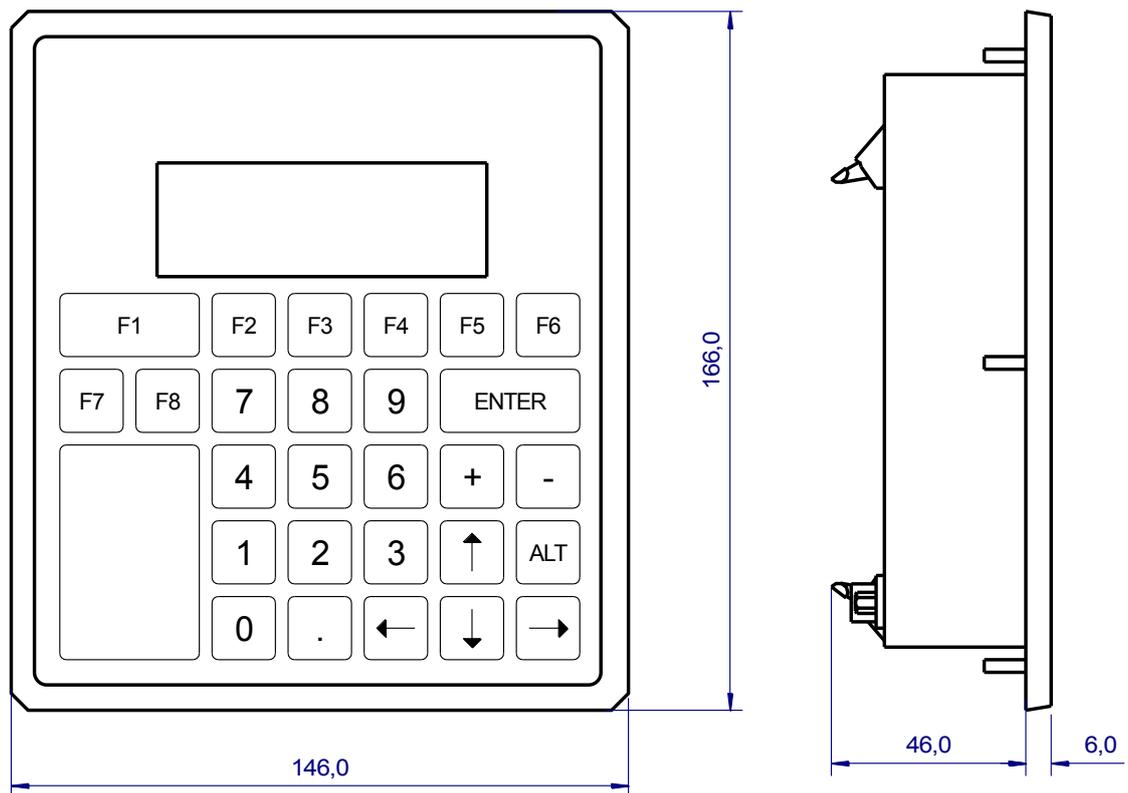|		
Others	Maximum ambient humidity	< 95 % non-condensing

2.1　Dimensions

Fig. 1 – **APT1000G** dimensions

2.2   Conformity assessment

The equipment meets the requirements of NV616/2006. The compliance assessment has been performed in accordance with harmonized standard EN°61326.

Tested in accordance with standard	Type of test	Class
EN 55022:2010	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement	A *)
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test, air discharge	15 kV
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test, contact discharge	8 kV
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test, power supply	2 kV
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test, RS232	2 kV
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test, RS485	2 kV
EN 61000-4-11:2004	Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests	complies

*)   This is a product of class A. In the internal environment, this product can cause radio disturbances. In such case the user can be requested to take the appropriate measures.

2.3 Recommended drawing symbol

Following drawing symbol is recommended for terminal **APT1000G**.
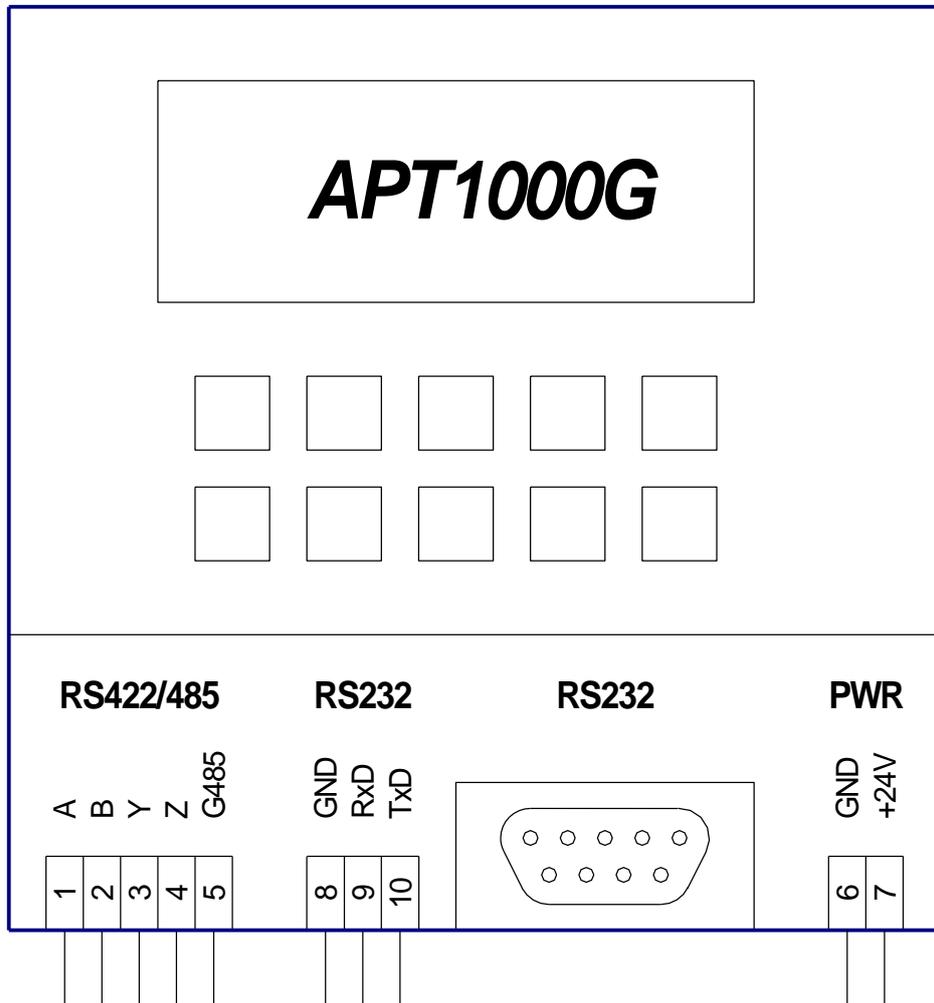
Fig. 2 – Recommended drawing symbol for **APT1000G**

3   Power supply

Terminal **APT1000G** can be powered only by DC power supply.

Power supply 24 V DC   Terminal **APT1000G** can be power supplied by standard DC power supplies from AMiT production.

Wiring example
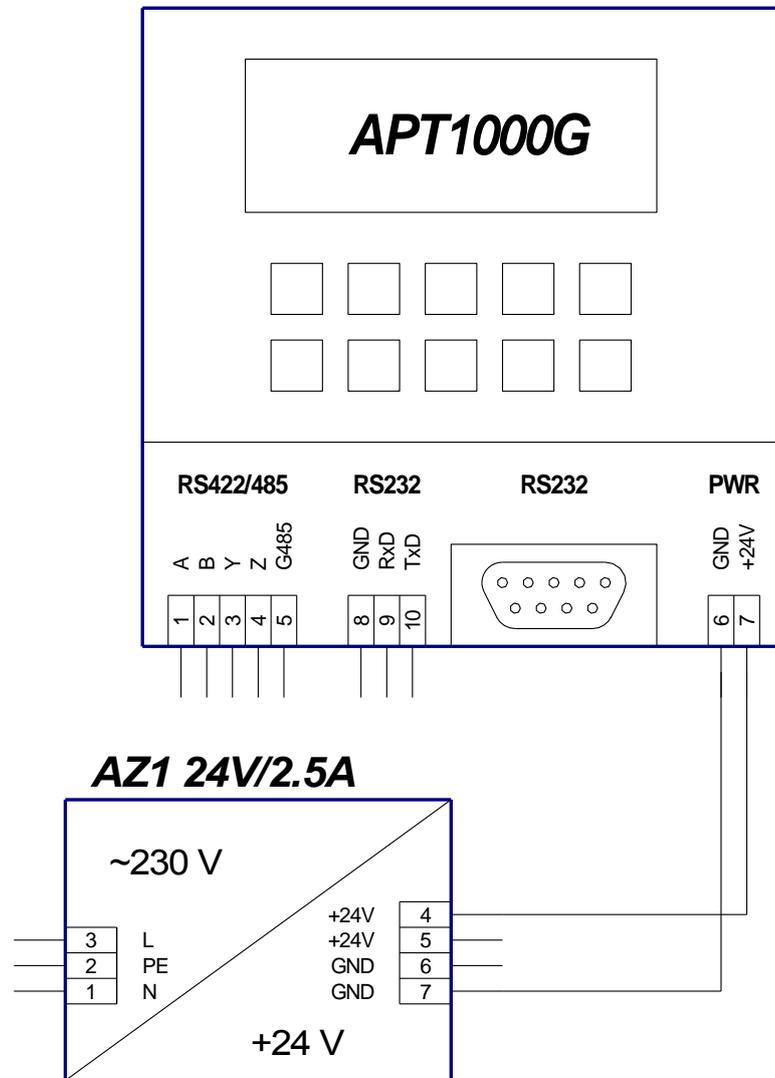
Fig. 3 – Wiring example of single control system

Note   Terminal metal cover is connected through 2.2 nF capacitors on GND. It is recommended to connect GND terminals with switchboard's PE terminal during installation.

4 Controlling

4.1 Keyboard

Pressed characters are transmitted immediately in **RS232** and **RS422** modes. Pressed characters are transmitted according to CTS signal status in **RS232RTS** mode. Pressed characters are transmitted on ESC sequence request in **RS485** mode.

Keycode

Key	Decimal code	Hexadecimal code	Character
0	48	30h	0
1	49	31h	1
2	50	32h	2
3	51	33h	3
4	52	34h	4
5	53	35h	5
6	54	36h	6
7	55	37h	7
8	56	38h	8
9	57	39h	9
F1	65	41h	A
F2	66	42h	B
F3	67	43h	C
F4	68	44h	D
F5	69	45h	E
F6	70	46h	F
F7	71	47h	G
F8	72	48h	H
Up arrow	11	0Bh	
Right arrow	6	06h	
Left arrow	8	08h	
Down arrow	5	05h	
.	46	2Eh	.
Enter	13	0Dh	
+	43	2Bh	+
-	45	2Dh	-

[ALT] *+ key* If any key is pressed together with [ALT] key, the keycode is increased by 128 in decimal (80h in hexadecimal).

4.2 Brightness, contrast

Contrast control Combinations of [ALT] + [↑] or [↓] keys do not generate any code but have direct impact on display contrast.

[ALT] + [↑]   increases display contrast

[ALT] + [↓]   decreases display contrast

4.3   DIP switch

Switches 1 to 3 are used for RS485 (RS422) interface setting.

Switch 4 is used for configuration mode activation. This switch is tested only during power-on. If this switch is turned on during the terminal run, it will not cause mode change.

Switch	Function	ON	OFF
1	Signal A idle state	Connected	Not connected
2	Signal B idle state	Connected	Not connected
3	RS485 wires termination	Connected	Not connected
4	Configuration	Config	Normal

Configuration mode is described in individual chapter.

Note   Terminating resistor can be connected through DIP switch only to AB signals (used for RS485 and RS422). Possible wires termination of YZ signals (used as RS422 transmitter) must be realised through 120 Ω external resistor.

4.4   Reset

Terminal transmits **0xEE (238 DEC, 0EE HEX)** character after the power supply voltage is connected. This function indicates terminal dropout and RESET to the system.

The terminal transmits the character immediately after power-on in RS232 and RS422 interface mode, the character is saved in buffer and transmitted on the ESC sequence request in RS485 interface mode.

5 Character set

Received characters are displayed on the screen according to the table below. ESC sequence is used for setting.

Program. characters CG1 to CG8 characters represent eight characters. Their displaying on the display is programmable. Control function "character shape setting" is used for this purpose.

Character BB represents a "black block" that is displayed on the terminal display after the **0xFF** character is received, or after the wrong parity character is received.

SP character stands for space.

Another characters that have their codes listed as **bold** in the table, are control functions; see chapter Firmware.

The terminal ignores the rest of the characters (empty fields in the table) and receiving of these characters will have no effect on the display and terminal functionality.

	0x	**1x**	**2x**	**3x**	**4x**	**5x**	**6x**	**7x**	**8x**	**9x**
x0		**Goto**	SP	0	@	P	`	p	CG1	
x1			!	1	A	Q	a	q	CG2	
x2			"	2	B	R	b	r	CG3	
x3			#	3	C	S	c	s	CG4	
x4			$	4	D	T	d	t	CG5	
x5	↓		%	5	E	U	e	u	CG6	
x6	→		&	6	F	V	f	in	CG7	
x7			'	7	G	W	g	w	CG8	
x8	←		(	8	H	X	h	x	**BB**	
x9			)	9	I	Y	i	y		
xA	**LF**	**Hm**	*	:	J	Z	j	z		
xB	↑	**ESC**	+	;	K	]	k	10		
xC	**CLR**		,	<	L	¢	l	12		
xD	**CR**		-	=	M	]	m	15		
xE	**BS**		.	>	N	^	n	↵		
xF	**DEL**		/	?	O	_	o	**ER**		

6 Communication interfaces

6.1 RS232

This interface is intended for connection between two devices according to RS232 standard. RS232 interface of terminal **APT1000G** is always without galvanic isolation, i.e. is galvanically connected with power supply.

Terminal **APT1000G** has its RS232 interface led-out on two types of connectors (CANON 9 and WAGO 256). CANON 9 connector terminals are connected to WAGO 256 connector terminals with the same name.

Connector location
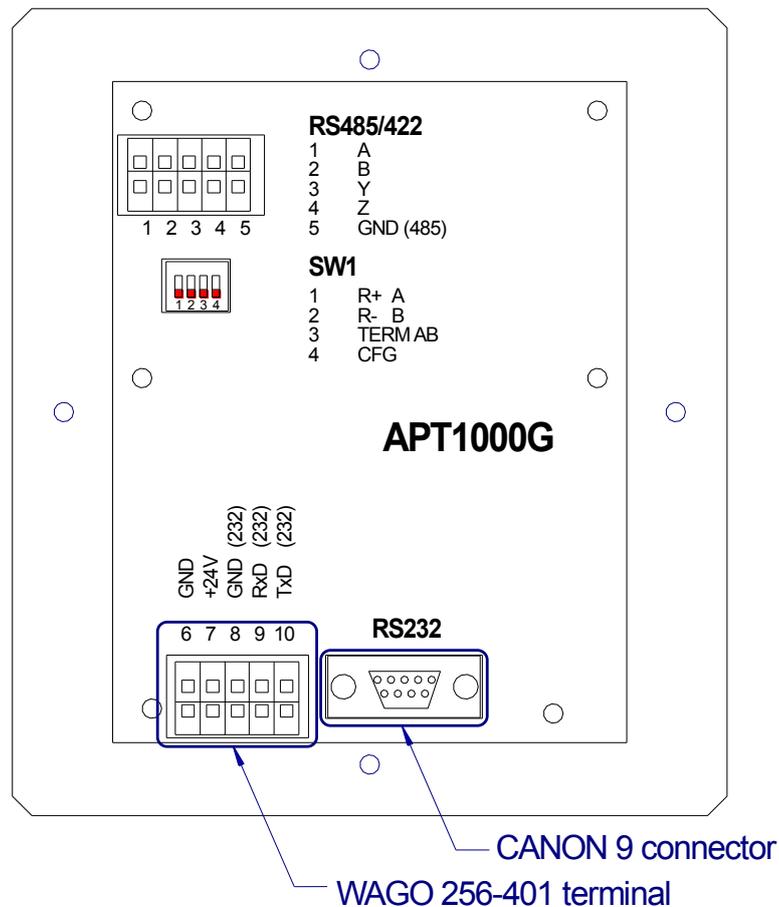
Fig. 4 – RS232 connectors location

CANON 9 connector wiring

CANON 9 on terminal **APT1000G**.

PIN	SIGNIFICATION	TYPE
2	RxD	Input
3	TxD	Output
5	GND	-
7	RTS	Output
8	CTS	Input

Note **SIGNIFICATION** item corresponds with terminal **APT1000G** signal. **TYPE** item is a type of signal on terminal **APT1000G**. **KABEL 232P** is used for connection to the control system (with CANON 9 connector).

Protection circuits wiring
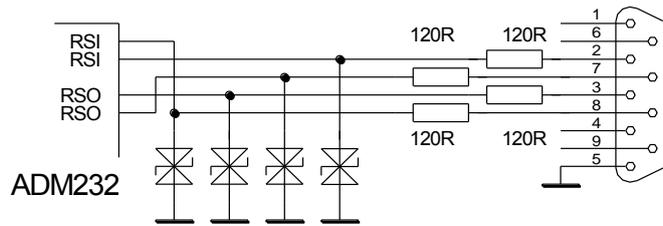
Fig. 5 – Protection circuits wiring on RS232

Wiring example Terminal connection with control system **AMiRiS99** through RS232 interface.
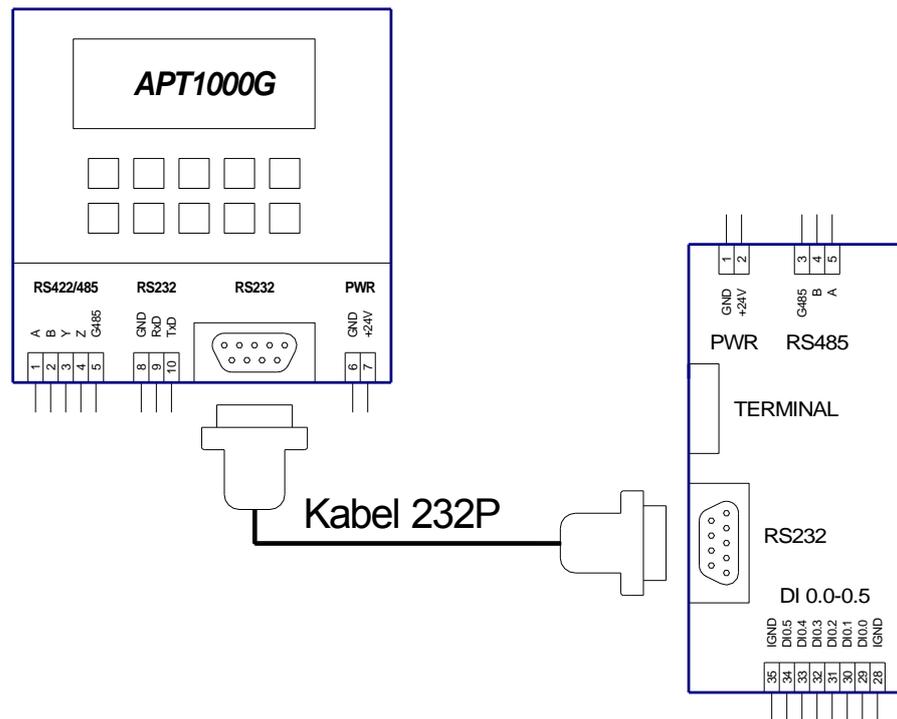
Fig. 6 – Terminal connection with control system through cable **KABEL 232P**

WAGO 256 terminals wiring WAGO 256 on **APT1000G** terminal.

PIN	SIGNIFICATION	TYPE
8	GND	-
9	RxD	Input
10	TxD	Output

Note **SIGNIFICATION** item corresponds with terminal **APT1000G** signals. **TYPE** item is a type of terminal **APT1000G** signal.

6.2   RS485

RS485 interface of the terminal **APT1000G** is galvanically isolated from the terminal power supply.

Only one terminal **APT1000G** can be connected through RS485 interface.

Maximum cable length is 1200 m for 19200 Bd communication speed. A repeater has to be used for longer distances, for example **DM-485TO485** from AMiT production.

Connector location
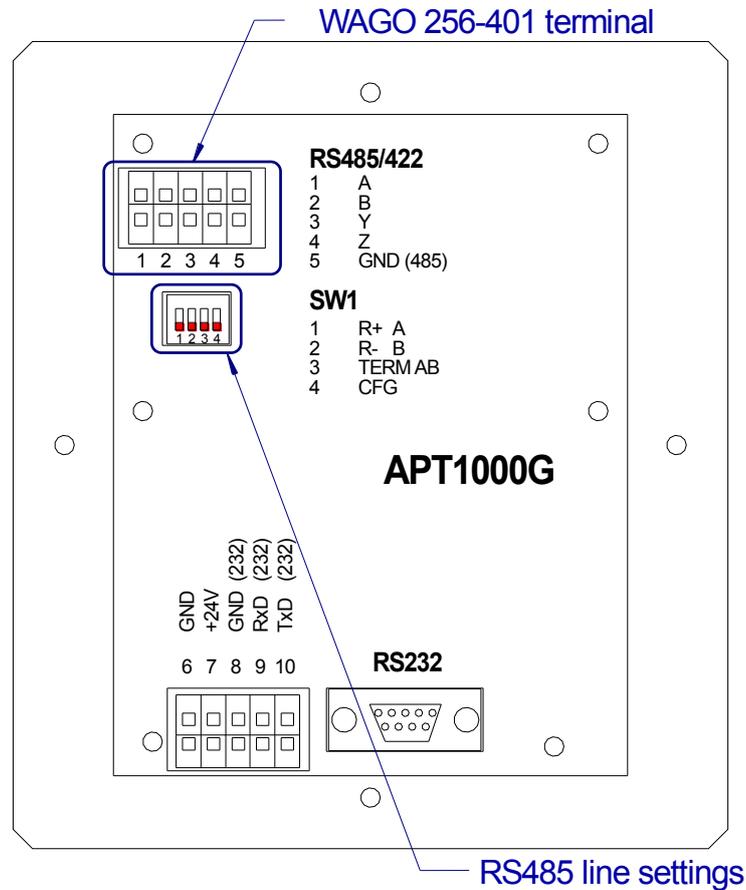
Fig. 7 – RS485 connector and DIP switch location for interface setting

Connector numbering

Terminal	Label	Signification
1	A	RS485 interface, signal A
2	B	RS485 interface, signal B
5	GND	RS485 interface ground

DIP switch setting

Switch	Signification
1	Signal A idle state (ON connected)
2	Signal B idle state (ON connected)
3	RS485 wires termination (ON connected)

RS485 is half-duplex interface; therefore station does not transmit pressed buttons directly but it stores them into buffer. Data are transmitted only after receiving the ESC S sequence.

Wiring scheme
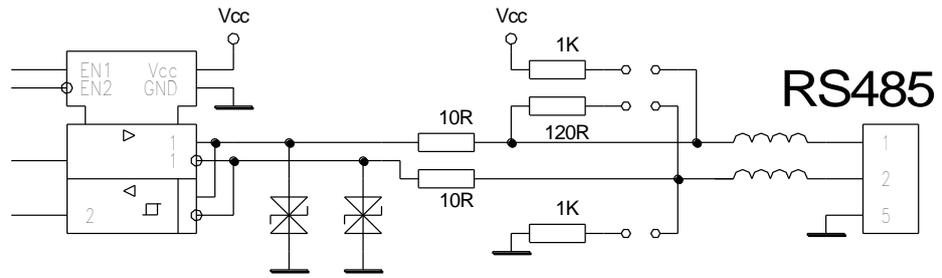
Fig. 8 – Wiring scheme of protective circuits, terminating resistor connection and idle state resistors connection

Wiring example   Terminal connection with control system through RS485 interface.
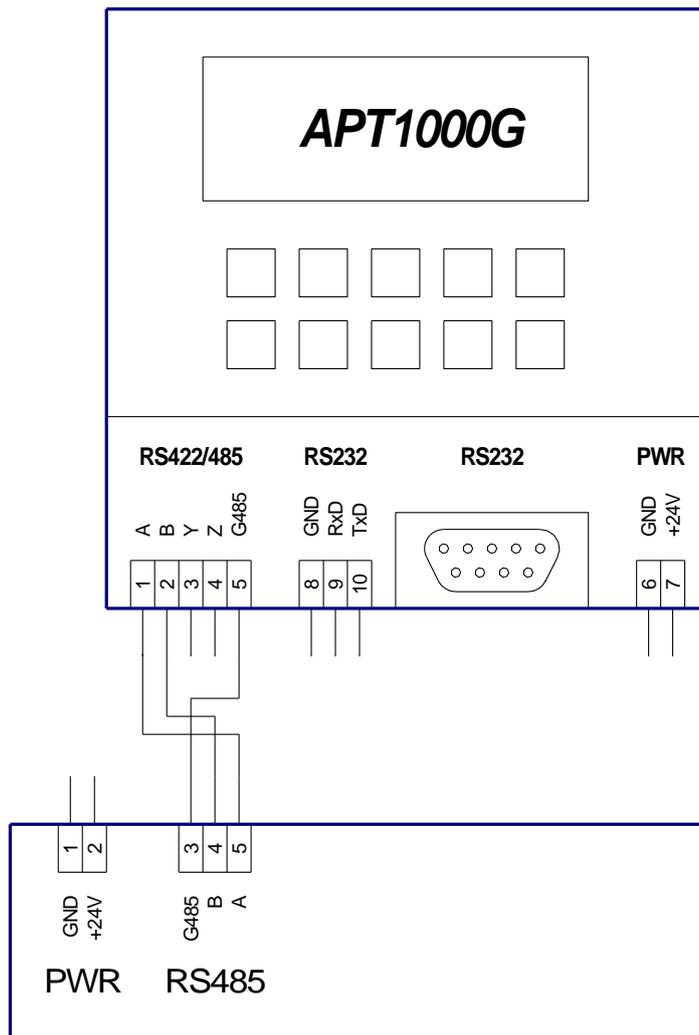
Fig. 9 – Terminal connection with control system through RS485 interface

6.3   RS422

RS422 interface of the terminal **APT1000G** is galvanically isolated from terminal power supply.

Only one terminal **APT1000G** can be connected through RS422 interface.

Maximum cable length is 1200 m for 19200 Bd communication speed.

Connector location
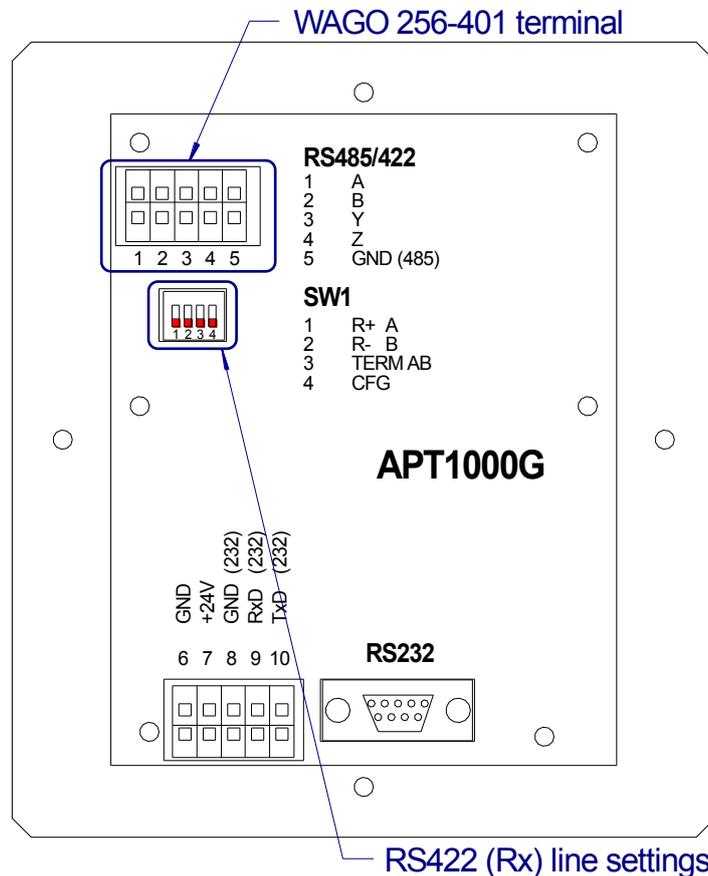
Fig. 10 – RS422 connector and DIP switch connection for interface setting

Connector numbering

Terminal	Label	Signification
1	A	RS422 interface, signal Rx+
2	B	RS422 interface, signal Rx-
3	Y	RS422 interface, signal Tx+
4	Z	RS422 interface, signal Tx-
5	GND	RS422 interface ground

DIP switch setting

Switch	Signification
1	Signal Rx+ idle state (ON connected)
2	Signal Rx- idle state (ON connected)
3	RS422 wires termination – Rx (ON connected)

Note Terminating resistor can be connected through DIP switch only for AB signals. Possible termination of YZ signals (used as RS422 transmitter) must be realised through 120 Ω external resistor.

Wiring Terminal connection with control system through RS422 interface.
example
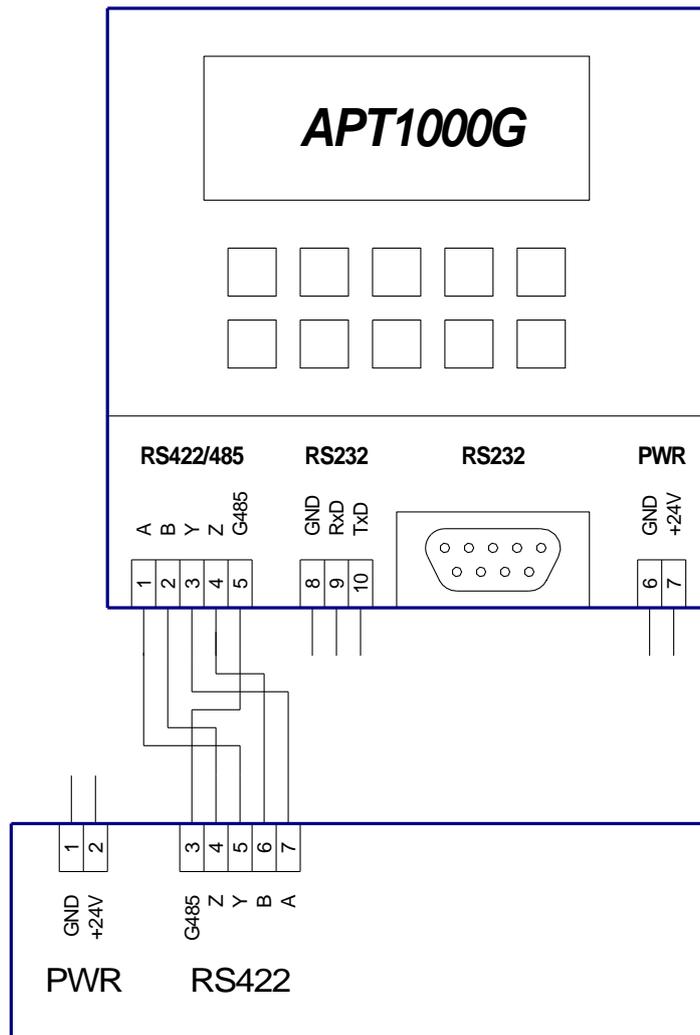
Fig. 11 – Terminal connection with control system through RS422 interface

7 Connectors and terminals layout
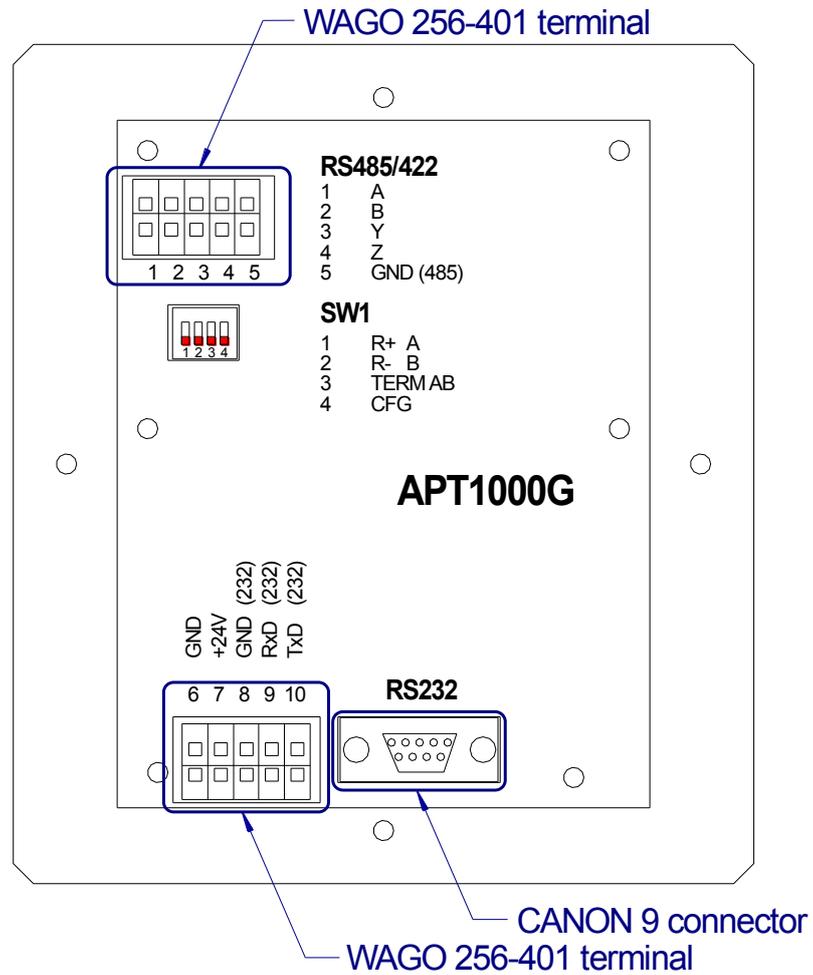
Fig. 12 – Connectors and terminals location

Terminal	Label	Signification
1	A	RS485 interface, signal A / RS422 interface, signal Rx+
2	B	RS485 interface, signal B / RS422 interface, signal Rx-
3	Y	RS422 interface, signal Tx+
4	Z	RS422 interface, signal Tx-
5	G485	RS485 / RS422 interface ground
6	GND	Ground terminal
7	+24V	+24 V DC terminal power supply
8	GND	RS232 interface ground
9	RxD	RS232 interface, signal RxD
10	TxD	RS232 interface, signal TxD

Caution Terminals GND (6, 8) are internally connected.

RS485/422
1   A
2   B
3   Y
4   Z
5   GND (485)

SW1
1   R+ A
2   R- B
3   TERM AB
4   CFG

APT1000G

GND
+24V
GND (232)
RxD (232)
TxD (232)

6 7 8 9 10

RS232

RS485/422 line settings
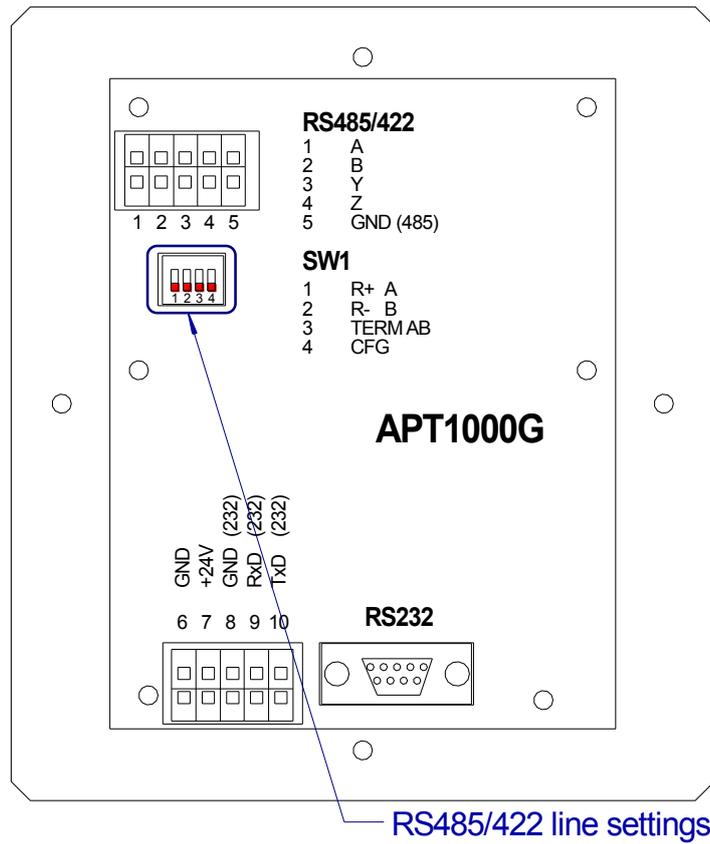
Fig. 13 – Switch location

8 Mounting

Terminal **APT1000G** is intended to be mounted into switchboard front panel.
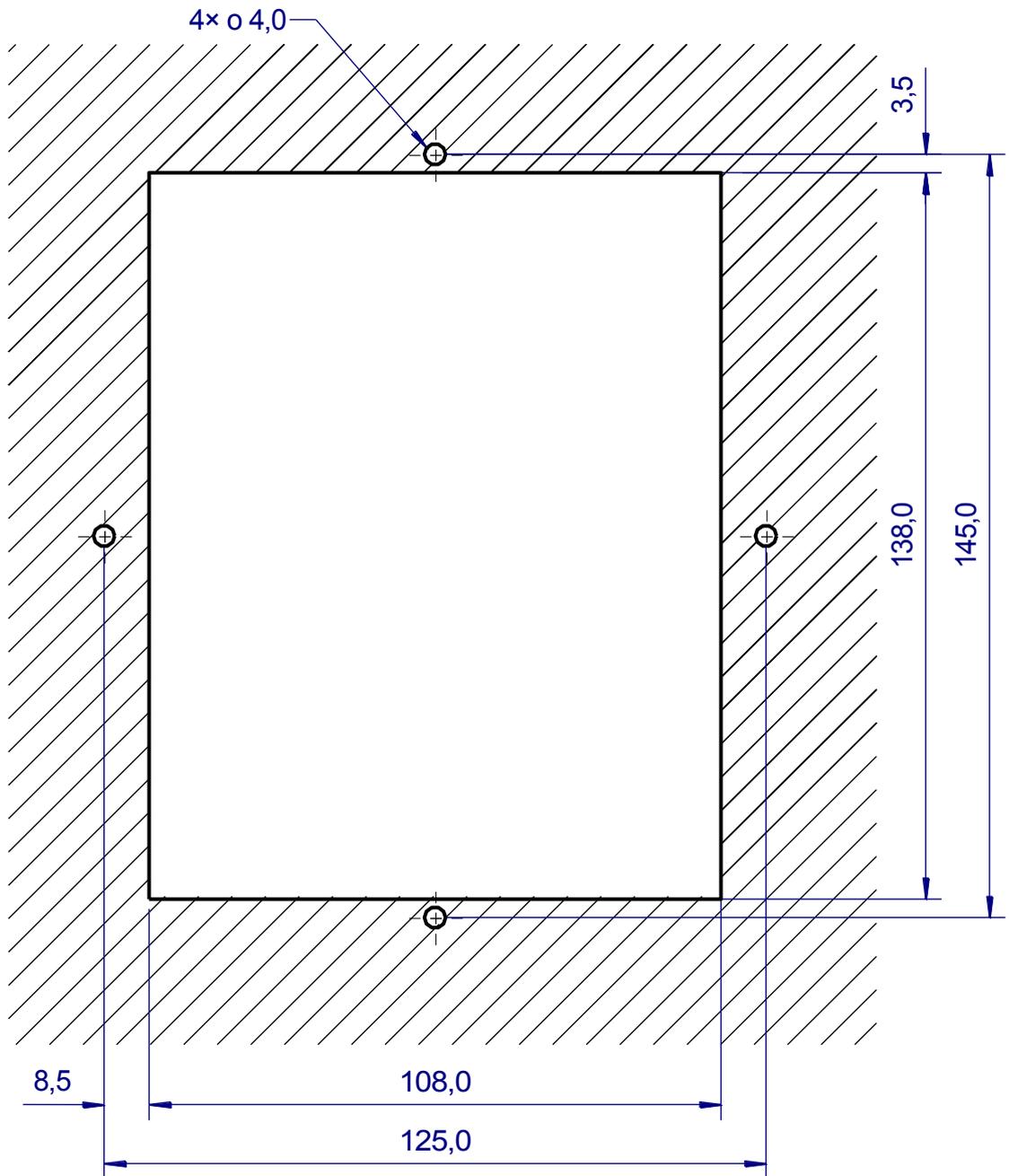
Fig. 14 – Mounting hole

8.1   Installation rules

RS485 channel   Use the shielded signal cables for wiring. Connect the cable shielding to the PE terminal immediately on switchboard input.

RS232 channel   Communication cable without shielding is sufficient if interface is used within switchbox.

Use the shielded cables for permanent use outside the switchboard frame. Connect the shielding to the PE terminal immediately on switchboard frame input.

Note   All PE terminal connections must be realized with the lowest impedance as possible. Technical parameters of terminal are guaranteed only when these wiring rules are applied.

9 Terminal configuration

Configuration menu is shown when DIP switch 4 is set ON before turning power-on.

Terminal does not receive any characters and does not transmit any pressed keys in configuration mode. A menu is displayed where individual terminal parameters are set:

```
Configuration menu:
Serial parameters
Environment params
Save&Exit           v
```

Parameters are stored in EEPROM memory when changing a particular item; therefore they will stay valid even after the terminal is turned off and on again.

9.1 Menu controlling

Terminal has hierarchical structure of individual menus in configuration mode.

Current menu title is displayed on the terminal top line.

Individual menu items are displayed on other lines. ↑ and ↓ keys allow to scroll through menu items. Entering next submenu level is performed by selecting particular item and pressing Enter key – see below. Returning back from lower level of submenu is performed by pressing F1 key or selecting item "Back" and pressing Enter key.

There are several types of menu items:

Submenu type item Selecting this item and pressing Enter key causes entering into next level of submenu.

Item type selection Placing a cursor on this item and pressing Enter causes that the cursor shifts to the right where the value can be selected by pressing ↑ and ↓ keys.

Selected option is confirmed by pressing Enter key, the cursor returns back to menu items selection.

Pressing F1 key causes leaving the selection, edited option will return to original value before the beginning of editing.

9.2 "Serial parameters" menu

Item can be activated also by pressing F2 key.

Speed Values: 150 / 300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200

It sets transmission speed of communication interface in Bd.

| *Parity* | **Even** | Even parity. |
| | **Odd** | Odd parity. |

Interface   It defines what type of communication interface will be used for communication with terminal.

	RS232	Only Rx, Tx communication through RS232 interface.
	RS232/RTS	Communication through RS232 interface, key codes transmission can be blocked by CTS signal.
	RS485	Communication through RS485 interface.
	RS422	Communication through RS422 interface.

If CTS signal is in logical state 0 in 232RTS mode – the terminal transmits normally; in logical state 1 the transmission is paused. Characters are stored in terminal buffer. Data are transferred after the CTS signal is changed. This signal is usually controlled with RTS signal from superior control system. Buffer depth is 255 characters. If this buffer is filled, RTS signal state on terminal is changed from logical 0 to 1. This signal is usually monitored with CTS signal from superior control system.

Back   It calls up returning back to main configuration menu.

9.3   "Environment params" menu

Item can be activated also by pressing F3 key.

| *Echo* | **On** | Pressed key is simultaneously displayed on the screen. |
| | **Off** | Pressed key is only transmitted through serial interface. |

| *CR -> CR LF* | **On** | When receiving CR character, LF character will be added automatically. |
| | **Off** | When receiving CR character, LF character will not be added automatically. |

| *Display* | **Scroll** | Display is "scrolled". |
| | **Overwr** | Display is overwritten. |

| *Autorepeat* | **On** | Keyboard autorepeat is on. |
| | **Off** | Keyboard autorepeat is off. |

Autorepeat time constants are predefined and cannot be changed.

Contrast   Values: 0 to 9

It sets display contrast. This value affects displaying only for LCD display terminals.

Brightness   Values: 0 to 3

It sets display brightness. This value only affects displaying on vacuum fluorescent display terminals (VFD).

Note *Brightness and Contrast values are also changed concurrently when changing display brightness or contrast through key combinations of* ⟨ALT⟩ + ⟨↑⟩ *or* ⟨ALT⟩ + ⟨↓⟩. *Only one value affects displaying on the screen (according to display type).*

Cursor type **Block** Cursor in blinking field form.
Line   Cursor in horizontal line form is below the character level.
None   Cursor is off.

It sets implicit cursor type – type that will be set on terminal immediately after turning the power supply on. Cursor can be changed anytime by Escape sequences Esc-I, Esc-W, Esc-U independently on this setting.

Clear menu config This item has no effect on standard terminal. If this item is used, "FLASH not present" error is displayed.

Back It causes returning back to main configuration menu.

9.4 "Save&Exit" menu

Item can be activated also by pressing ⟨F8⟩ key.

Performed configuration changes are stored to EEPROM after confirmation of this option, and after the DIP switch number 4 is switched to OFF position, the terminal is reset.

9.5 "Exit" menu

Item can be activated also by pressing ⟨F7⟩ key.

After confirmation of this option and switching the DIP switch number 4 to OFF position, the terminal is reset without storing of performed configuration changes.

10 Firmware

Copyright and firmware version is displayed on terminal display after turning power supply on. Screen is erased after a first character receiving.

10.1 Terminal modes

Terminal always operates in one of two modes:

Configuration mode Configuration mode is activated by switching DIP switch 4 to ON position before turning power supply on.

Terminal does not receive any characters and does not transmit any pressed keys. A configuration menu is displayed where individual terminal parameters are set. Terminal configuration is described in previous chapter.

ASCII-terminal mode Terminal displays received characters in this mode, processes control codes, transmits codes of pressed keys through serial line.

10.2 Control functions

Next chapter describes different control functions that can be entered through serial interface.
If a function (including parameters, see below) is consisted of characters set (e.g. set LED <27> <'l'> <'1'> <'0'> <'0'>), each byte must be received within 300 ms period after the previous one, otherwise the whole sequence is considered as invalid one and will be ignored.

10.3 Control functions format

Some control sequences have parameters that are transmitted immediately after the sequence mentioned in second column of control functions table.
Parameters are labelled in control functions table with short identifier according to their signification. It is usually described closer in the column **Control Functions**.

Parameter type

Prefix	Type	Range	Signification
a	ASCII	character	Parameter is understood as a single ASCII character.
c	char	-128 to 127	Parameter is a single byte that is understood as a value with a plus or minus sign in defined range. Value is equal to ASCII code of received character.
b	byte	0 to 255	Parameter is a single byte that is understood as a value without plus or minus sign in defined range.

Cursor settings

Control functions	Sequence	Parameters
	Code (decimal)	
	Code (hexa)	
"v" – Cursor down It moves the cursor one line down. If the cursor is on the lowest line and command "Cursor down" is received, the cursor is moved to the same position on the first line.	*Ctrl+E*	
	5	
	05h	
">" – Cursor right It moves the cursor one character to the right. If the cursor is on the last column of the line and command "Cursor right" is received, the cursor is moved to the first position on the same line.	*Ctrl+F*	
	6	
	06h	
"<" – Cursor left It moves the cursor one character to the left. If the cursor is on the first column of the line and command "Cursor left" is received, the cursor is moved to the last position on the same line.	*Ctrl+H*	
	8	
	08h	
"^" – Cursor up It moves the cursor one line up. If the cursor is on the first line and command "Cursor up" is received, the cursor is moved to the same position on the last line.	*Ctrl+K*	
	11	
	0Bh	
"CR" – Carriage return It returns cursor to the first column of current line. If automatic transition to next line is activated in configuration menu, the cursor is moved to the next line. If needed – scrolling down or moving the cursor to the first line is performed (setting in configuration menu).	*Ctrl+M*	
	13	
	0Dh	
	26	
	1Ah	
"LF" – Line feed Cursor is moved to the next line. If the cursor is on the last line – scrolling down, or moving the cursor to the first line is performed (according to setting in configuration menu).	*Ctrl+J*	
	10	
	0Ah	
"Goto" – Cursor position It sets cursor to position **aX**-32, **aY**-32. Coordinates must be in the range 32 to 51 and 32 to 35.	*Ctrl+P*	aX, aY
	16	
	10h	
"Hm" – Cursor home Cursor will be moved to its **"**home**"** position, i.e. on the first column of the first line. Displayed data stay intact.	*Ctrl+Z*	
	26	
	1Ah	

Fig. 15 – Display coordinate system

Left top corner has coordinates [0,0], right bottom [19,3].

Example of Goto function Setting cursor to position [15,1]

10h, 2Fh, 21h	hexadecimally
16, 47, 33	decimally
Ctrl+P / !	characters sequence

Deleting a character

Control functions	Sequence	Parameters
	Code (decimal)	
	Code (hexa)	
"CLR" – Clear text screen The whole contents of the display is erased. Cursor returns to the default position.	*Ctrl+L*	
	10	
	0Ch	
"DEL" – Delete a character It deletes a character on a cursor position, character on the right will be moved one position to the left.	*Ctrl+O*	
	15	
	0Fh	
"BS" – Backspace It deletes a character on the left side from the cursor. Cursor is moved one position to the left, character on the right side will be moved one position to the left.	*Ctrl+N*	
	14	
	0Eh	
"ER" – Rewrite a character It moves a cursor one position to the left and deletes a character on this new position (without shifting the rest of the characters on the line).	**ER**	
	127	
	7Fh	

Text cursor – turning off, turning on, shape

Control functions	Sequence	Parameters
	Code (decimal)	
	Code (hexa)	
Turn off cursor This command will cancel cursor displaying.	*Esc T*	
	27 84	
	1Bh 54h	
Cursor line This command will set cursor shape to a form of a line.	*Esc W*	
	27 87	
	1Bh 57h	
Cursor block This command will set cursor as a blinking field.	*Esc U*	
	27 85	
	1Bh 55h	

Reading and operating the keyboard

Control functions	Sequence	Parameters
	Code (decimal)	
	Code (hexa)	
Transmit key cache memory This command operates only for RS485 interface. Terminal does not transmit a code of pressed key in this mode but key presses are stored into cache memory. After the command is received, it transmits all keycodes gathered since last Esc S command. This will prevent collisions on Half-duplex RS485 interface.	*Esc S*	
	27 83	
	1Bh 53h	
Blocking keyboard It blocks terminal keyboard, key presses are ignored.	*Esc N*	
	27 78	
	1Bh 4Eh	
Unblocking keyboard It unblocks terminal keyboard, keyboard operates normally.	*Esc Q*	
	27 81	
	1Bh 51h	

Alarms

Maximum of 16 alarms can be defined. Alarms are indicated by selected character blinking on a selected terminal position, regardless to other displayed screen data – alarm character overlaps any other character displayed on this position. If there are active multiple alarms with different characters defined on one position – characters of all alarms are blinking in a sequence.

Control functions	Sequence	Parameters
	Code (decimal)	
	Code (hexa)	
Alarm activation Activates alarm number aNum ('0' to 'F') indicated by character aChar blinking on a position bX, bY on the display.	*Esc a 1*	aNum, aChar, bX, bY
	27 97 49	
	1Bh 61h 31h	
Alarm deactivation Deactivates alarm number aNum ('0' to 'F').	*Esc a 0*	aNum
	27 97 48	
	1Bh 61h 30h	

Coordinates are entered in the same way as for Goto function.

Example of Alarm function Setting alarm 3, character '#' to position [4,1]

1Bh, 61h, 31h, 33h, 23h, 24h, 21h	hexadecimally
27, 97, 49, 51, 35, 36, 33	decimally
Esc a 1 3 # $!	characters sequence

Cancelling Alarm 3

1Bh, 61h, 30h, 33h	hexadecimally
27, 97, 48, 51	decimally
Esc a 0 3	characters sequence

Service and testing functions

Control functions	Sequence	Parameters
	Code (decimal)	
	Code (hexa)	
Display connection test Terminal returns character 0AAh and erase pressed keys cache memory after this command, i.e. if there were any characters in cache memory and this command is used – all characters in cache memory will be cancelled. This can be circumvented by using a ESC S sequence followed by ESC K sequence (in case of RS485 interface usage).	*Esc K*	
	27 75	
	1Bh 4Bh	
Display test This function fills display with characters "E". This is used for optimal manual brightness adjustment.	*Esc I*	
	27 73	
	1Bh 49h	
Copyright This function will show copyright and SW version on the display.	*Esc J*	
	27 74	
	1Bh 4Ah	
Set contrast It sets display contrast to value bContrast (0 to 9).	*Esc J*	bContrast
	27 74	
	1Bh 4Ah	

Programmable characters

Control functions	Sequence	Parameters
	Code (decimal)	
	Code (hexa)	
Setting character shape This function sets shape of one of eight characters CG1 to CG8. Their ASCII codes are <128> to <135> decimal, therefore 80h to 87h.	*Esc X*	bChar, 8x bData
	27 88	
	1Bh 58h	

Decimal code <88>, therefore 58h must be followed by number of character being set (1 to 8 for CG1 to CG8) followed by eight bytes defining character shape according to following figure.

```
1. byte ->      x x x 1 1 1 1 0      1Eh
2. byte ->      x x x 1 0 0 0 1      11h
3. byte ->      x x x 1 0 0 0 1      11h
4. byte ->      x x x 1 1 1 1 0      1Eh
5. byte ->      x x x 1 0 1 0 0      14h
6. byte ->      x x x 1 0 0 1 0      12h
7. byte ->      x x x 1 0 0 0 1      11h
8. byte ->      x x x 0 0 0 0 0      00h
```

Bits marked with "x" are meaningless. Following character sequence sets shape of character CG3 (it's ASCII is <130> therefore 82h) into shape of capital letter R (as shown on figure):

1Bh, 58h, 03h, 1Eh, 11h, 11h, 1Eh, 14h, 12h, 11h, 00h   hexadecimally

27, 88, 3, 30, 17, 17, 30, 20, 18, 17, 0   decimally

10.4 List of control characters

Control function name	Decimal	Hexadecimal	ASCII
Cursor down	05	05h	*CTRL/E*
Cursor right	06	06h	*CTRL/F*
Cursor left	08	08h	*CTRL/H*
Cursor up	11	0Bh	*CTRL/K*
Beginning of the line	13	0Dh	ENTER
Next line	10	0Ah	*CTRL/J*
Cursor position	16, xx, xx	10h, XXh, XXh	*CTRL/P, .., ..*
Cursor home	26	1Ah	*CTRL/E*
Clear screen	12	0Ch	*CTRL/L*
DEL	15	0Fh	*CTRL/O*
BACKSPACE	14	0Eh	*CTRL/N*
Rewrite a character	127	7Fh	DEL

Escape sequence	Decimal	Hexadecimal	ASCII
Communication test	27, 15	1Bh, 4Bh	*ESC,* K
Transmitting keys	27, 83	1Bh, 53h	*ESC,* S
Cursor off	27, 84	1Bh, 54h	*ESC,* T
Cursor line	27, 87	1Bh, 57h	*ESC,* W
Cursor block	27, 85	1Bh, 55h	*ESC,* U
Display test	27, 73	1Bh, 49h	*ESC,* I
Copyright, version	27, 74	1Bh, 4Ah	*ESC,* J
Set contrast	27, 74, xx	1Bh, 4Ah, XXh	*ESC,* J, …
Blocking keyboard	27, 78	1Bh, 4Eh	*ESC,* N
Unblocking the keyboard	27, 81	1Bh, 51h	*ESC,* Q
Alarm activation	27, 97, 49, xx, xx, xx, xx	1Bh, 61h, 31h, …	*ESC,* a, 1, …
Alarm deactivation	27, 97, 48, xx	1Bh, 61h, 30h, …	*ESC,* a, 0, …
Setting character shape	27, 88, …	1Bh, 58h, …	*ESC,* X, …

11 Ordering information and completion

Terminal	**APT1000G**	Industrial LCD terminal, operation manual, warranty certificate, cutting template

Connection to control system	**KABEL 232P**	RS232 connection cable, control system (CANON 9) – **APT1000G**
	KABEL 232RP	RS232 connection cable, control system (RJ45) – **APT1000G**

11.1 Factory settings

Terminal configuration

Serial parameters	**Set value**
Speed	**19200**
Parity	**Even**
Interface	**232**

Environment params	**Set value**
Echo	**Off**
CR -> CR LF	**Off**
Display	**Ovewr**
Autorepeat	**On**
Contrast	
Brightness	
Cursor type	**Line**

12 Maintenance

Terminal does not require any periodic checking nor maintenance.

Cleaning Time after time with regard to way of device usage, it is necessary to remove dust from the terminal. The device can be cleaned by dry soft brush or vacuum cleaner, only when switched-off and disassembled.

Note **The maintenance mentioned above can be performed by manufacturer or authorized service only!**

13 Waste disposal

Electronics disposal The disposal of electronic equipment is subject to the regulations on handling electrical waste. The equipment must not be disposed in common public waste. It must be delivered to places specified for that purpose and recycled.