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Preface

This manual covers the following text display systems:

- **PX 30 PGS5**
- **PX 120 PGS5**
- **PXT 5 PGS5**
- **PXT 6 PGS5**
- **PXT 20 PGS5**
- **PXT 90 PGS5**
- **PXT 132 PGS5**
- **PXT 208 PGS5**
- **PXT 216 PGS5**
- **PXT 305 COM-LC**
- **TIP 132 PGS5**

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October 1994

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Addendum
PX(T) PGS5 and PXT 305 COM-LC

Notes on Operation

- After power-up, a valid value (text number of an available text) must be entered under the PLC address for which parameters have been set.
  This is necessary if LED-data and function key information is to be transmitted accurately.

- The information below is important when using the following S5-CPUs:

S5-115U with CPU 945

a) The connection between the PLC and PX(T)-unit must not be broken during operation.

b) Supply voltages to the PLC and PX(T)-unit must be switched on and off simultaneously.

c) If you are operating a PX(T) on one of the interfaces on the CPU 945, you will only be able to use the other interface for transmitting blocks in a limited capacity.

d) Inputs that are not available cannot have parameters set as PLC-addresses, as they will be overwritten with zero by the input process I/O-image.

S5-135U with CPU 928 and 928B

a) On these CPUs, it is not normally possible to drive data byte addresses (DL, DR) from the PG. This means that the whole data word will always be written, even through the PX(T). The byte that isn't required (DL or DR) will be lost to the user. It is set at zero.

b) On the CPU 928B, if both interfaces are being used (with a PX(T) and a PG, or with two PX(T)s), both interfaces will crash if you try to display block status. This can also occur when displaying the status of variables. This happens because the PLC interfaces are overloaded and the PLC crashes.

Remedy: Reset the CPU and reload the program.

Important: Make sure the CPU is not connected to the PX(T) while the program is being loaded.

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PX(T) PGS5 and PXT 305 COM-LC

Operating Manual

Item No. 18 526

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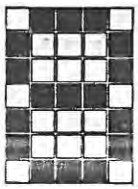
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General Guidelines

- Electrical connections should be undertaken by someone who is properly qualified and who is familiar with the relevant regulations concerning health and safety at work.
- Units should be operated within the permitted operating temperature range.
- The guarantee on these units will be rendered invalid if the unit has been opened. Any units needing repair must be sent back to Pilz.
- These units are only guaranteed to function correctly if used in accordance with the guidelines given in this manual. Please ensure that the units are connected up correctly, otherwise the display and/or your machine could be damaged irreparably.

Unit-Specific

- When selecting where to mount your display, please remember to keep as large a distance as possible between the unit and any electromagnetic fields. This is especially important when frequency converters are nearby. We also recommend you use a bulkhead to separate the display from the source of the interference.
- Inductive components built into the surrounding fields (eg. contactor, relay and solenoid valve coils), must be wired with an RC-network, especially if they are fed from the same source.
- Data and power lines should be installed separately to avoid capacitive and inductive transmission (recommended minimum distance = 10 cm)!
- To avoid the build-up of heat, a distance of 10 cm should be maintained all round the unit.
- Interference voltages accessing the unit via supply and signal lines, and electrostatic voltages passed on through contact, are diverted to the earth point (spade terminal on the rear of the unit).
  Connect the earth point (⏚) to the earth conductor PE using as short a copper conductor as possible (≥ 6mm² diameter)!
- The earth conductor (1.5 mm² diameter) should be connected to the terminal marked ⏚ on the supply voltage connector.
- Before applying voltage always check that the voltage information given on the unit matches your supply.
- Shielded, twisted pair cable must be used for connections to the interfaces.
- Always use metallic or metallised synthetic connectors with the connection cable.
- The shielding on the S5-PG/TTY cable must be connected on both sides.
- The shielded connection on the RS 232 (V24) cable must be used on one side of the connector housing [PX(T)-side].

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- Please ensure that the mounting screws on the connector are firmly attached.
- The power supply for the display system must be designed for a peak switching current of 15 x I_N.
- Do not change the memory chip while power is applied to the unit.
- On a SIMATIC S5-CPU with 2 PG-connections:
  - If the PX(T) and PG are operated simultaneously **AND**
  - DB-addresses were entered when parameters were set for the key utilities (APART menu "Edit ... Key Code or Function Keys"), please remember the following:

  If the S5 user memory is being compressed on-line, no key on the PX(T) should be operated during this time, otherwise values could be written into invalid addresses.

Before installation you should also check the safety requirements laid down by the manufacturer of the controller.

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The Application of Display Systems

Display systems (text displays and operator terminals) are used wherever the speedy identification of machine status and the display of current process data is required. Operator terminals also offer the user a simple interface to the Siemens S5 range of PLCs. All units in the Pilz range are designed for use in industrial applications, for on-the-spot operator guidance.

Display System Components

PILZ Display Systems are based on the following components:

A
Display

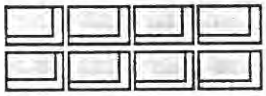


B
Operator Field

B1 Function Keys



B2 Alphanumeric Keys



B3 Additional external 24 V inputs (eg. keys or switches)



C
LEDs

C1 LEDs on the function keys (individually driven)

C2 LEDs on SHIFT, ALPHA or 2nd F-key (driven internally)

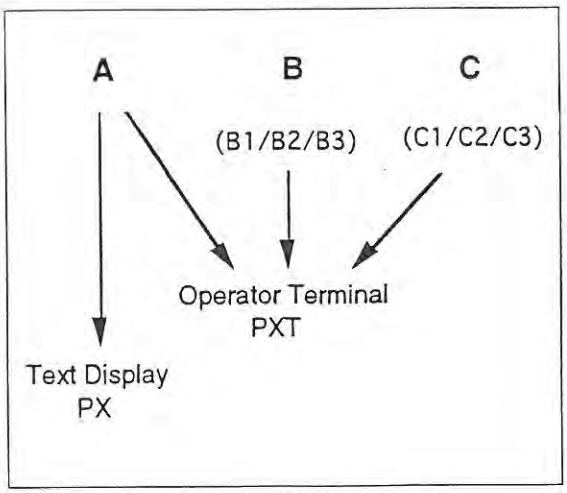
C3 24 V keyboard outputs

Text displays consist of component A alone:

- PX 30 PGS5
- PX 120 PGS5

Operator terminals consist of components A, B and C:

- **PXT 5 PGS5** (without B2, B3 and C)
- **PXT 6 PGS5** (without B2, B3 and C)
- **PXT 20 PGS5** (without B2 and C2)
- **PXT 90 PGS5**
- **PXT 132 PGS5/TIP 132 PGS5** (without C2)
- **PXT 208 PGS5** (without C2)
- **PXT 216 PGS5** (without C2)
- **PXT 305 COM-LC** (without B3 and C3)



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General Operation of the Display Systems

The display systems are driven serially through the PG-interface of a Siemens SIMATIC S5 PLC.

Texts stored in the text memory are selected and displayed using the relevant text number.

Texts may include variables (eg. true and set values). Variables are selected by number and are displayed with particular attributes (eg. right justification). The allocation of attributes and the positioning of variables are managed by means of control characters and flags, which are edited within the text.

The variable value sent from the PLC can be scaled before being displayed. This means it can be converted by using a multiplying factor and then adding an offset.

Additional display functions (eg. scrolling and segment test) are available via control commands from the PLC.

Configuration instructions stored in the text memory enable the display to adapt to certain user requirements (eg. scroll function and character set).

Operator terminals can also use their LEDs to display information, which can be sent to the PLC via the keyboard.

Some operator terminals enable you to enter set values and monitor the value range. The permitted set value range is defined by entering minimum and maximum values (MIN / MAX).

Text

Text Memory

The text memory is fitted with a Flash-EPROM with a 32 KByte capacity; **from version 2.00 and on the PXT 305 COM-LC, this is only available with 64 KByte.**
However, EPROMs with a 32/64 KByte memory capacity and an access time of ≤ 150 ns may also be used.
Its address range consists of text numbers 1 ... 9,999.

Creating Text

The software required for creating text and programming the text memory is called ADIT DOS (from version 5.02/2.05) and is described in detail in the ADIT DOS Manual.

Character Sets

Bothe the IBM (No. 437) and Cyrillic character sets can be used (see page 77). You can select the character set you require throught the ADIT DOS default settings (see section entitled "Configuration" on pages 32-33).

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Exception: PXT 305 COM-LC:
The PXT 305 COM-LC has a limited IBM character set (see page 78) and has no Cyrillic characters.

Characters from the IBM set which can be represented are from 32_D to 254_D, or 20_H to FE_H (exception: 35_D / 23_H).

Characters $1B_H$ and 23_H are used for special functions.

Character	Function
$1B_H$	Used as a start character for an ESC-Code; ESC-Sequences determine the attributes of text and variables (eg. flashing characters) and also clear the display before showing new text (see section entitled "Control Characters")
23_H	Text mask for variables (#)

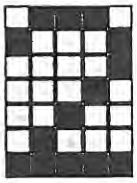
Control Characters (ESCAPE-Codes)

Using ADIT DOS Software, these control characters are selected through the function keys. The corresponding ESCAPE-Codes are generated automatically and are entered in the text at the cursor position.

The following control characters are supported:

Control Command	ESC-Code	Explanation
Clear display	ESC 40	Displayed text is cleared. Text attributes (variables etc.) are also lost.
Hardcopy	ESC 48	The displayed text is outputted to a printer via the RS 232 interface (see also page 33)
Auto-Scroll	ESC 49	Text is scrolled automatically at a rate of every 2 seconds. Depending on the default settings, you can scroll either one or two lines at a time (see pages 10 and 35).
Flasher on	ESC 06	From this point on, text will flash. This does not affect the variables.
Flasher off	ESC 07	From this point on, text will no longer flash.
Line Break	ESC 45	Corresponds to the ASCII: CR-LF
Right Justification *	ESC 56	Refer to page 15, "Variable Layout"
Left Justification	ESC 57	Refer to page 15, "Variable Layout"
Show leading zeros	ESC 58	Refer to page 15, "Variable Layout"
Suppress leading zeros*	ESC 59	Refer to page 15, "Variable Layout"

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Control Command	ESC-Code	Explanation
Variable No. 0	ESC 60	
Variable No. 1	ESC 61	
• •	• •	
Variable No. 7	ESC 67	

* Default Setting: This function has priority. Even if the relevant control character is not present, this function will remain in effect until the opposite function is set.

Layout

When a text is called up, control characters contained in the text are evaluated and then converted into the corresponding text and variable layout (see "Control Characters").

The layout of text is line-oriented, ie. if a text is to carry over on to the next line, the corresponding control character must be edited as such.

In the editor section of "ADIT DOS", line breaks (Carriage Return and Line Feed) occur automatically.

Clear Display

If a text contains the control character "clear display", the previous text and all the corresponding variable positions will be cleared when a new text is displayed.

If the "clear display" command has been deleted in a text in the ADIT DOS Editor, this text can be "stored" in a type of "background file" on top of the previously displayed text. All the edited characters in the "new" text **(incl. spaces)** overwrite the characters they replace in the "old" text. Any characters in the "old" text that are passed over using the arrow keys (in ADIT DOS: **"." character**), will be retained. Variable positions are retained and may also be addressed. If the "old" text is scrolled, the "new" text (also scrolled" will be placed on top.

Scrolling Background Text

It is possible to edit records with more than two lines of text. A record may contain a maximum of 320 characters (without control characters).
On the PX 30 PGS5, PXT 5 PGS5, PXT 208 PGS5 and PXT 305 COM-LC (20 characters per line), 16 lines of text are possible per record. On all the other display systems (40 characters per line), 8 lines of text are possible per record.

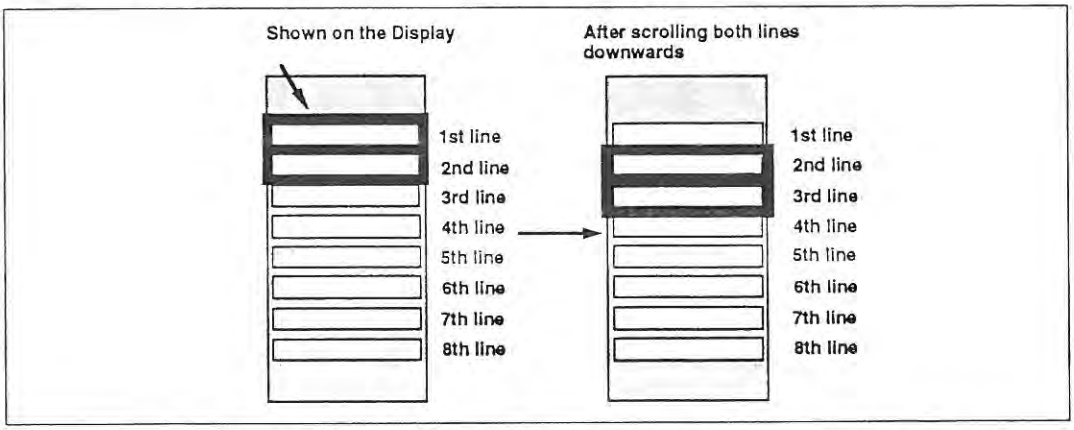
When a record is displayed, the first two lines of the text are shown **(on the PXT 305 COM-LC: the first four lines)**.

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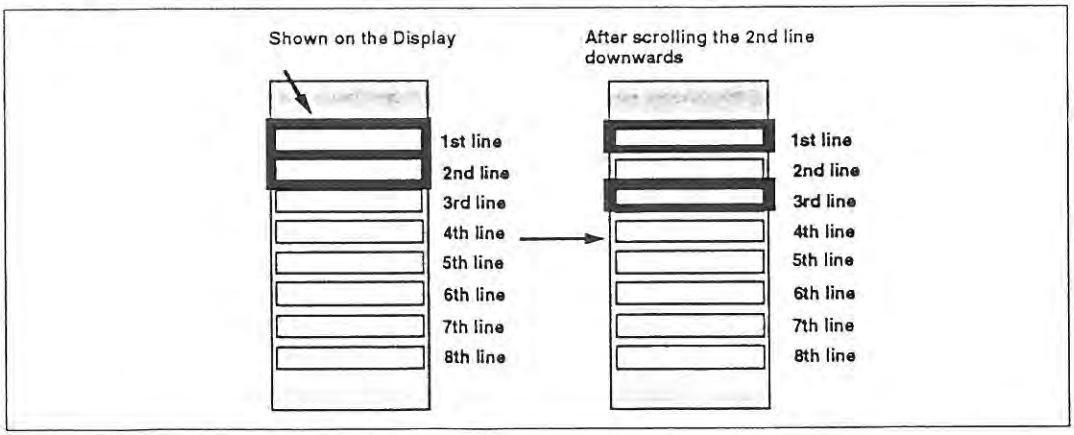
Scrolling of texts is achieved by means of:

- Special scroll inputs:
  (24 V inputs on the back of the unit; **not on the PX 30, PXT 5, PXT 208 PGS5 and PXT 305 COM-LC**):
  - S0 (down)
  - S1 (up)
- Special utility function codes:
  - 08_H (scroll down)
  - 09_H (scroll up)
  - $0A_H$ (go to start of text)
- The front keypad (↓ and ↑), if $H:1 is configured (see page 34).
- Automatically, by entering the primary control character ESC 49 within the text.

Additional lines (background text) can be displayed by pressing the keys connected to the scroll inputs. Each time a key is pressed (positive-going pulse edge at the scroll input), the text is scrolled on one line (ie. when scrolling downwards, for example, the 2nd line will become the 1st line on the display and the 3rd line will become the 2nd).



The default setting in ADIT DOS can be used to change the scroll function so that only the 2nd line of the display is scrolled with background text and the 1st line remains on the display (see the chapter entitled "Configuration" on page 32).



The display will return to the start of the text when both scroll inputs are set simultaneously ie, the first two lines will be displayed.

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Variables

Basics

- 8 variables are available per text, with ID-numbers 0 ... 7.
- A variable can be a maximum of 10 characters in length.
- The negative prefix "-" may be placed in front of the variable as an 11th character. **Please note**: If a variable is composed of numeric values with figures after the decimal point, right justification should be selected, otherwise the variable value could be falsified.
- Text masks (#) must be created in the text for variables. These format the variable output.
- If the transmitted variable is larger than the variable length edited, (number of text masks), only the higher value or lower value part will be displayed, depending on the justification (left/right).
- The display system is line-oriented! This means that a variable cannot extend over the start or end of a line. For this reason it is not possible to insert one and the same variable over several lines.

True and Set Value Variables

True value variables are those whose values are read from the controller and are displayed in the text at the place reserved by the marker.

Set value variables are those whose values are entered via the keypad on the operator terminal and are transmitted to the place allocated in the controller's memory. Once the value has been transmitted, the variable value will be updated on the display, showing the contents of the allocated memory space. This is done as an acknowledgement. Markers are used to position set value variables within the text.

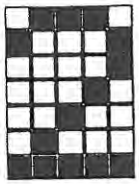
The editing, input and monitoring of set value variables is described in the Chapter entitled "Inputting Set Values", from pages 54-66.

Scaling of Variable Values

A true value variable sent from the PLC can be scaled before being displayed. This means it can be converted by using a multiplying factor and then adding an offset. When inputting set values, this conversion is carried out "backwards", ie. the offset is subtracted first and then divided by the factor.

Scaling may be necessary when converting values with different units of measurement into values shown in the same unit of measurement, for example, if a temperature value measured in °Celcius is to be displayed in °Kelvin or °Fahrenheit.

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"Factor" and "Offset" scaling values are entered using ADIT DOS, at any point within the text containing the variable that is to be scaled. Values should be entered as follows:

ID for Factor or Offset / Variable Number / Value of the Factor or Offset

The set formula for entering this information is:

MULn:(Value)_ or OFFn:(Value)_ ("_" symbolizes a space)

where **n** is variable number (0 ... 7) and **(Value)** is the relevant numeric value.

Example

MUL0:+23_OFF0:2_ means that variable 0 is to be multiplied by factor 23. 2 will then be added to the total.

WARNING:
- The values for MUL and OFF must have the same number of decimal places!
- The number of decimal places for the MUL factor must be equal to or greater than the number of decimal places on the variable (→ variable formatting in ADIT DOS).

Please note: The scaling values MUL and OFF, entered using the above formula, are visible characters, ie. when the relevant lines are displayed, these characters will also be represented.

This scaling process does have consequences, which are explained in the following examples:

Example 1: A set value can be entered which is greater than that permitted within the PLC parameters.

PLC memory space: 2 Bytes, BCD-coded
This results in **4 BCD-digits** and a value range of 0 ... 9,999 for the variable.
Factor: MULn:100
This means that the permitted set value range for the display is 0 ... 999,900
Therefore, **6** (instead of 4) places must be reserved for the set value input, using markers within the text!

Example 2: When entering set values, some integer values may be falsified when they are updated with the contents of the PLC-memory.

If the value 250 is entered, in accordance with example 1, before it is stored it will be divided by 100 and only the **integer part** of the ratio, 2, will be transmitted to the PLC. For each set value between 200 ... 299, only the value 2 will be transmitted to the PLC. When the variable value is then updated on the display with the contents of the allocated memory range, the value 2 will again be multiplied by 100, and as a result, 200 will be displayed!

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Example 3: For an accurate display of true value variables, the figure calculated by the multiplication with the scaling factor must not exceed 10 digits on the display.

A variable can be a maximum of 10 characters long. If scaling causes this figure to be exceeded, only the 10 lowest value digits will be displayed, resulting in a false value being shown.

The details given in examples 1 to 3 are also valid for binary-coded variables.

You should always take into account what effect an offset will have, when considering the value range (see page 56).

Variable Layout

The following formatting options are available:

- Formatting with the aid of variable masks (ASCII: 23_H, #)
- Left or right justification **(set value variables are generally right-justified!)**
- Display or suppress leading zeros

Each digit in a variable must have a "#"-character as a text mask so that it can be fully displayed. The control character for the variable number must be placed at the last "#"-position (see ADIT DOS Manual).

Please note: The control character 23_H (#) is only visible in the ADIT DOS Editor.

Text Characters within Variables

The variable only appears in the text at the places marked "#". All other text characters are placed within the variable number.

Examples:

Edited Text	Variable Value	Display
#-#-#-#	1234	1-2-3-4
#,##	156	1,56
####/# (show leading zeros)	00105	0010/5

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Overlapping Variables

Variables may not overlap. For reasons of operational security, it is not possible to edit two or more variables at the same position.

In the following example, variable b is restricted by variable a:

Edited Text	Variable Value	Display
####,##### a b	a 987654 b 111111	9876,54111

Left / Right Justification (true value variables)

If no control character is present the variable will be displayed with right justification.

Example:

Edited Text	Variable Value	Display
####,##	12345678	Right justified: 3456,78 Left justified: 1234,56

Leading Zeros

If no control character is present the variable will be displayed with leading zeros suppressed.

Examples:

Edited Text	Variable Value	Control Character	Display
#####,## (right justified)	-34	Show leading zeros Suppress leading zeros	-0000,34 -0,34
#####,## (left justified)	-34	Show leading zeros Suppress leading zeros	-34 , -34 ,
####_ (left justified)	0	Suppress leading zeros	0
##,##_ (right justified)	1	Suppress leading zeros	0,01
####_ (left justified)	34	Suppress leading zeros	34
###,##_ (right justified)	-1	Suppress leading zeros	-0,01
###.##_ (right justified)	-1	Suppress leading zeros	-0.01
###-##_ (right justified)	-1	Suppress leading zeros	—1

When leading zeros are suppressed, "superfluous" zeros are replaced by spaces and any negative prefix is moved along accordingly.

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Inserting a Cursor or Question Mark

By entering a relevant control code in the attribute-byte of the respective variable (see Page 45), the last character and the question mark ("?") or underline ("_") will flash alternately when the variable value is displayed:

- 20_H Flashing underline at the lowest value part
- 30_H Negative prefix and flashing underline at the lowest value part
- 40_H Flashing question mark at the lowest value part
- 50_H Negative prefix and flashing question mark at the lowest value part.

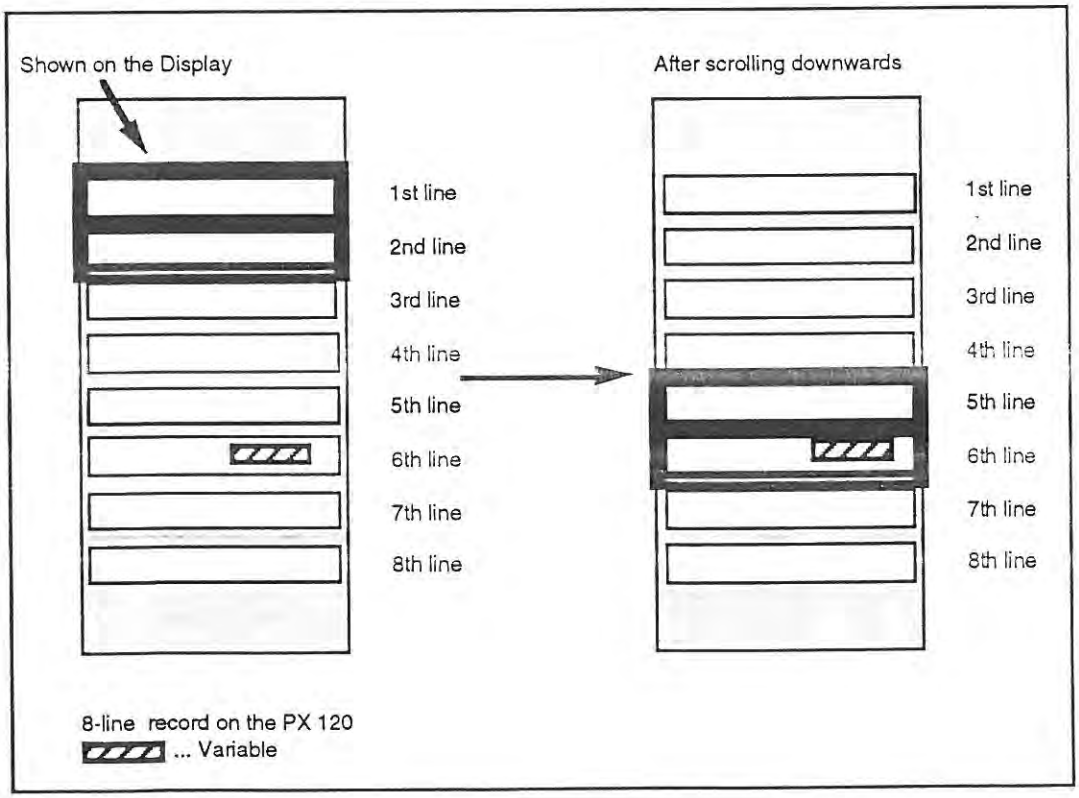
This type of flashing display may be used as an operator prompt, if required.

Example: 12345 alternating with: 1234?

"?" or "_" may be flashed even when there is no variable transmission.

Variables in Background Text

Variables can also be inserted into background text, becoming visible when you scroll to the corresponding line.

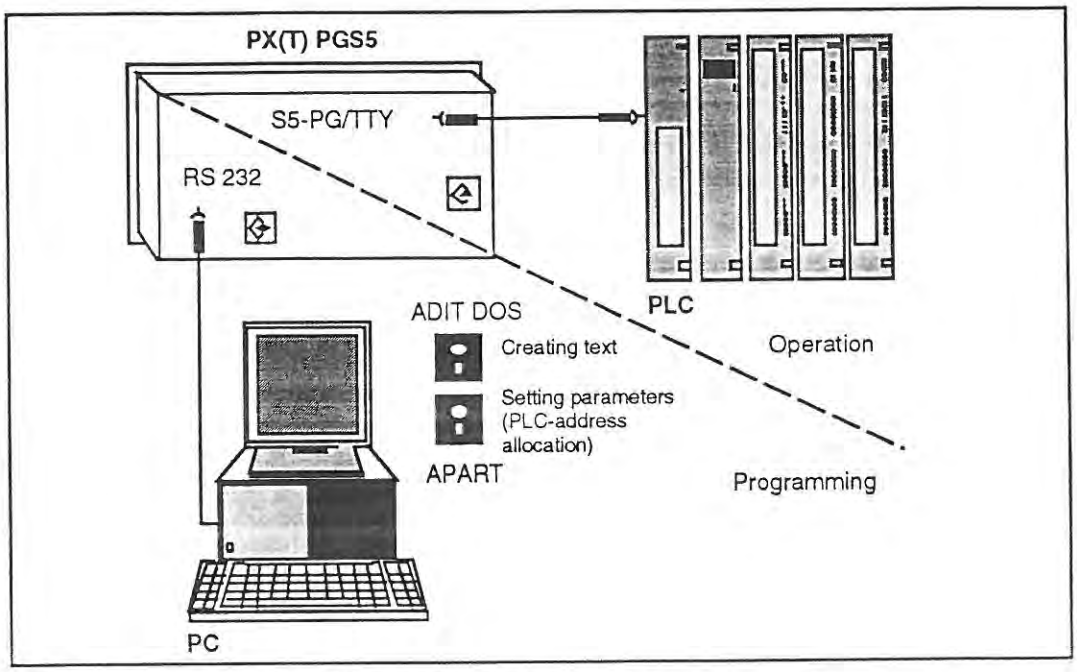


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Display System Features

Display System Interfaces

- S5-PG/TTY interface
- RS 232 programming interface



Details of the connection cable are given on pages 27 and 30.

General Hardware Description

The display has the following features:

PX(T) PGS5	PXT 305 COM-LC
• Vacuum fluorescent display; 2 lines • Automatic brightness control (dimmer function) • IBM character set (extended ASCII character set including special national characters); may be switched to Cyrillic character set • Flash-EPROM text memory (32 KByte; from version 2.00 with 64 KByte), programmable within the unit • Serial interface for S5-connection (S5-PG/TTY; 9-pin) • Serial interface for programming the text memory (RS 232; 9-pin)	• LC-display; 4 lines of 20 characters • Contrast adjustment for LC-display on the back of the unit • Limited IBM character set (see page 78); No Cyrillic character set • 64 KByte Flash-EPROM text memory, programmable within the unit, cannot be exchanged • Serial interface for S5-connection (S5-PG/TTY; 9-pin) • Serial interface for programming the text memory (RS 232; 9-pin)

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In addition to the display, operator terminals also have an operator field with integral LEDs.
Each function key on the operator terminal can be individually designated on a special labelling strip.
Each LED is driven individually.

Exception on the PXT 305 COM-LC: the LED on the 2nd F key is driven internally and lights when the key is pressed, accessing the 2nd level of F-keys. The LED goes out when the next key is pressed, quitting the 2nd level.

The back of the keyboard unit on the operator terminals contains:

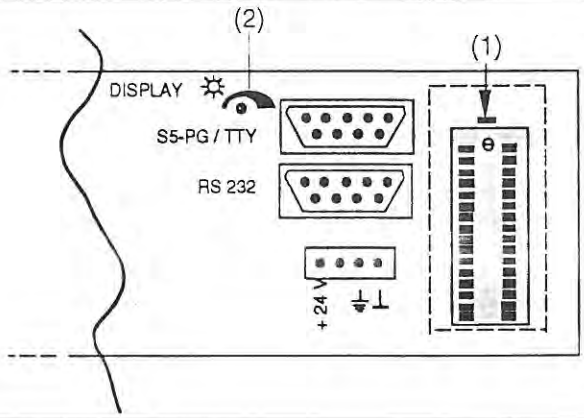
- Eight 24 V inputs (eg. for additional keys and switches) and
- Eight 24 V keyboard outputs

Exception on the PXT 305 COM-LC: the PXT 305 COM-LC has no additional I/Os.

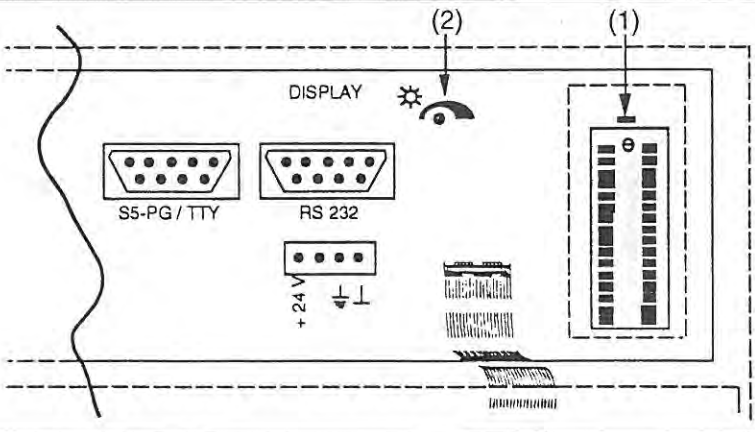
Dimmer Function (not on the PXT 305 COM-LC)

A sensor judges the brightness at the front of the unit and adapts the brightness of the display accordingly.
This dimmer function is activated by setting a jumper (1) on the rear of the unit below the Flash-EPROM.

PX 30 PGS5
PXT 5 PGS5
PXT 208 PGS5



PX 120 PGS5
PXT 6 PGS5
PXT 20 PGS5
PXT 90 PGS5
PXT 132 PGS5
PXT 216 PGS5
TIP 132 PGS5



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The jumper is not inserted ex-works, so the dimmer is switched off. In this case the display will operate at a constant maximum brightness.

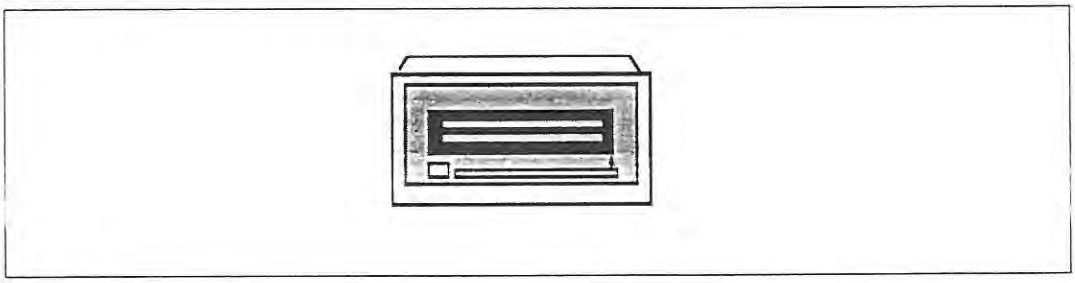
If the dimmer is activated (jumper inserted), we recommend you set the brightness as follows:

1. Totally obscure the sensor on the front of the unit (eg. using your finger).
2. With a screwdriver, adjust the dimmer setting on the rear of the unit to the minimum brightness possible, without the display flickering.

Hardware Description of the Different Display Systems

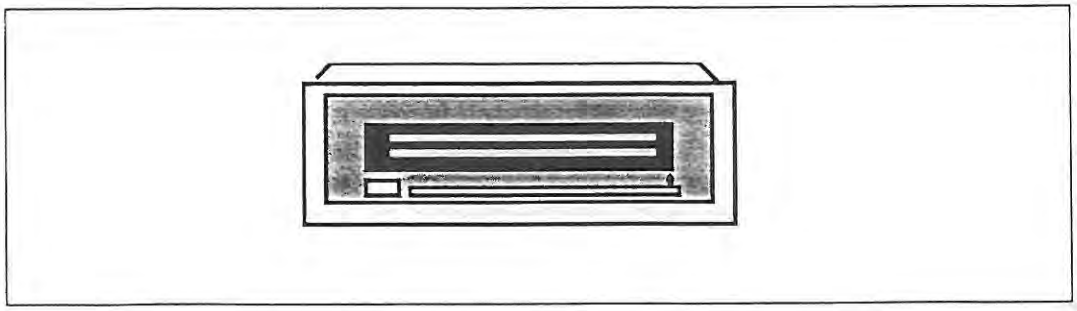
PX 30 PGS5 Text Display

Text Display: Vacuum fluorescent display, 2 lines of 20 characters, 5 mm character height, 5 x 7 dot matrix; S5-PG interface (TTY), RS 232 interface; 32/64 KByte Flash-EPROM text memory, dimmer, supply voltage connection.



PX 120 PGS5 Text Display

Text Display: Vacuum fluorescent display, 2 lines of 40 characters, 9 mm character height, 5 x 12 dot matrix; S5-PG interface (TTY), RS 232 interface, two 24 V inputs (scroll inputs); 32/64 KByte Flash-EPROM text memory, dimmer, supply voltage connection.



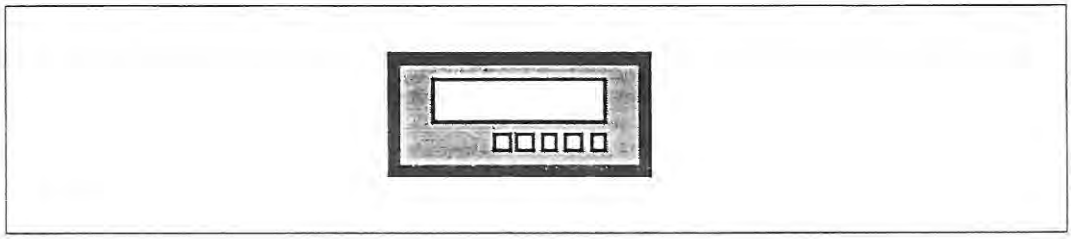
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Display System Features

PXT 5 PGS5 Operator Terminal

Text Display: Vacuum fluorescent display, 2 lines of 20 characters, 5 mm character height, 5 x 7 dot matrix; S5-PG-interface (TTY), RS 232 interface; 32/64 KByte Flash-EPROM text memory, dimmer, supply voltage connection.

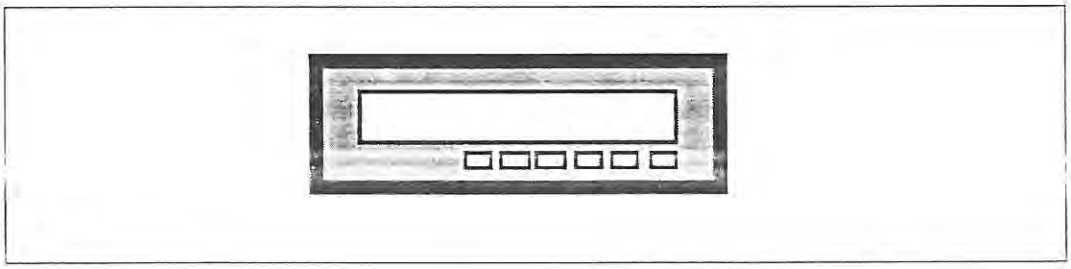
Operator Interface: 5 function keys



PXT 6 PGS5 Operator Terminal

Text Display: Vacuum fluorescent display, 2 lines of 40 characters, 9 mm character height, 5 x 12 dot matrix; S5-PG-interface (TTY), RS 232 interface, two 24 V inputs (scroll inputs); 32/64 KByte Flash-EPROM text memory, dimmer, supply voltage connection.

Operator Interface: 6 function keys



PXT 20 PGS5 Operator Terminal

The PXT 20 PGS5 consists of the following parts:

A) Text Display as PX 120 PGS5: Vacuum fluorescent display, 2 lines of 40 characters, 9 mm character height, 5 x 12 dot matrix; S5-PG-interface (TTY), RS 232 interface, two 24 V inputs (scroll inputs); 32/64 KByte Flash-EPROM text memory, dimmer, supply voltage connection

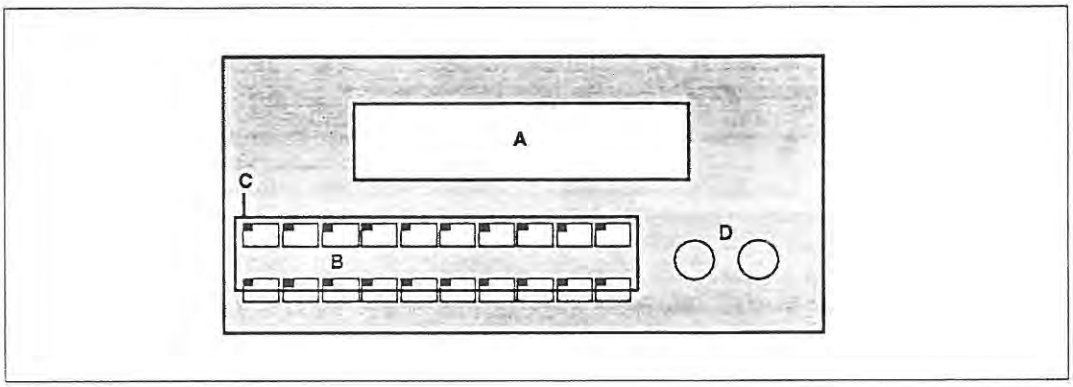
B) Operator Terminal: 20 function keys, eight inputs / eight keyboard outputs (24 V), supply voltage connection

C) LED Indicators: 20 dual-coloured LEDs on the function keys (green/red)

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D) 2 Openings at the Front (ø 22.5 mm): for connecting additional keys and switches; behind the front panel membrane

Please note: If you wish to install additional operator elements you will need to very carefully cut out the membrane which covers the openings. We recommend you use a sharp, tapering knife and that you start from the rear of the unit.



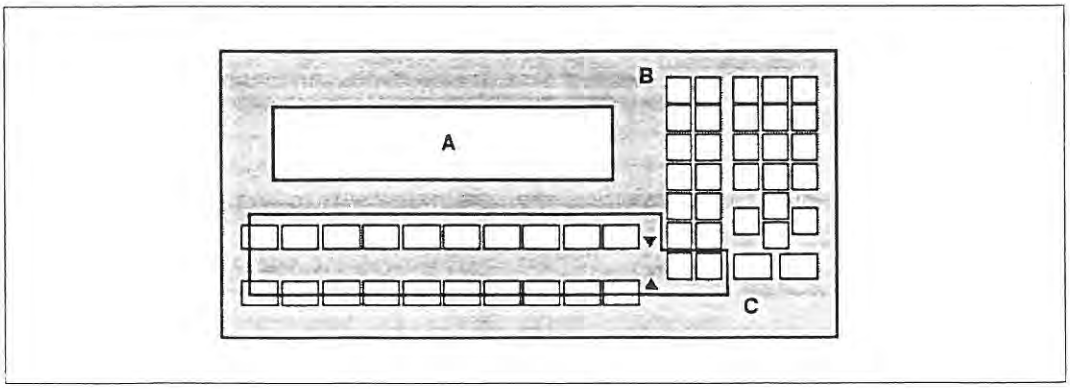
PXT 90 PGS5 Operator Terminal

The PXT 90 PGS5 consists of the following parts:

A) Text Display as PX 120 PGS5: Vacuum fluorescent display, 2 lines of 40 characters, 9 mm character height, 5 x 12 dot matrix; S5-PG-interface (TTY), RS 232 interface, two 24 V inputs (scroll inputs); 32/64 KByte Flash-EPROM text memory, dimmer, supply voltage connection

B) Operator Terminal with 2 key fields: 20 function keys, 32 alphanumeric and special keys; eight inputs / 8 keyboard outputs (24 V), supply voltage connection

C) 24 LED Indicators: 20 (green) LEDs on the function keys, 2 separate LEDs (green and red), two internally driven (green) for SHIFT and ALPHA.



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PXT 132 PGS5 Operator Terminal

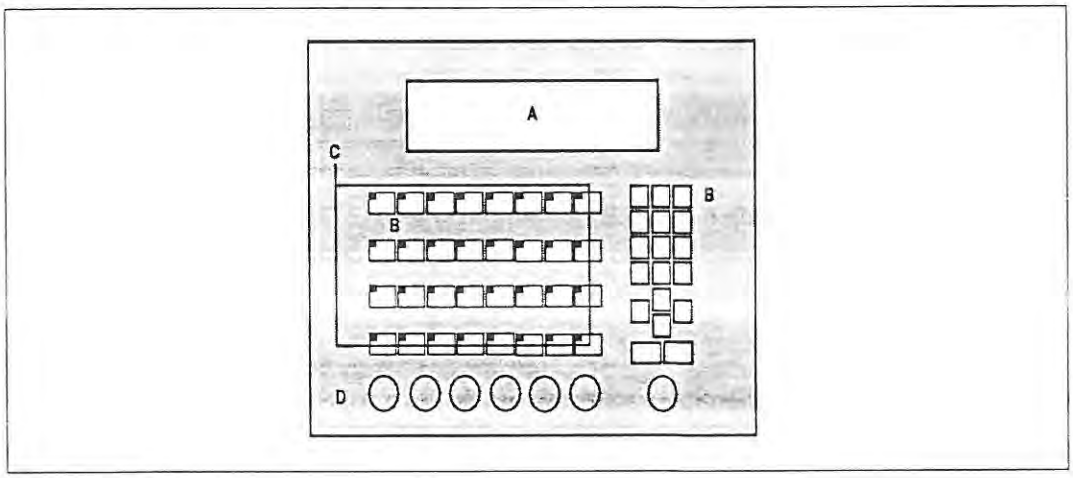
The PXT 132 PGS5 consists of the following parts:

A) Text Display as PX 120 PGS5: Vacuum fluorescent display, 2 lines of 40 characters, 9 mm character height, 5 x 12 dot matrix; S5-PG-interface (TTY), RS 232 interface, two 24 V inputs (scroll inputs); 32/64 KByte Flash-EPROM text memory, dimmer, supply voltage connection

B) Operator Terminal with 2 key fields: 32 function keys, 18 alphanumeric and special keys; eight inputs/8 keyboard outputs (24 V), supply voltage connection

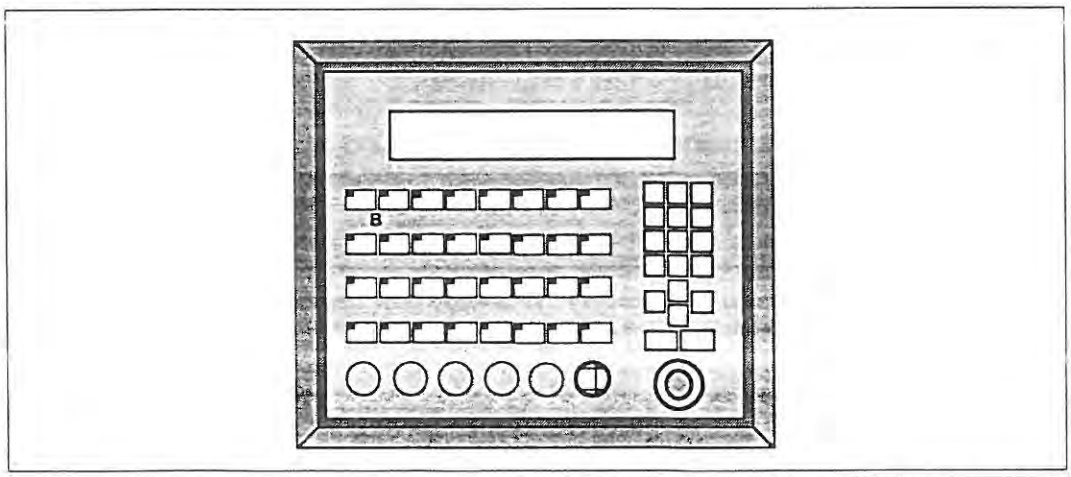
C) LED Indicators: 32 dual-coloured LEDs on the function keys (green/red)

D) 7 Openings at the Front (ø 22.5 mm): for connecting additional keys and switches; behind the front membrane (see note on page 21)



TIP 132 PGS5 Operator Terminal

The TIP 132 PGS5 corresponds to the PXT 132 PGS5, but has an additional signal lamp, plus an emergency stop button, mounted in a control box. For a description of the hardware, please refer to the information given above.



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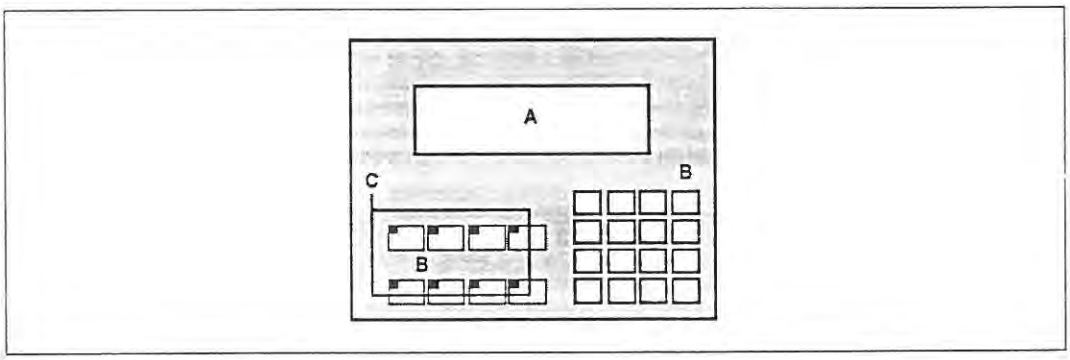
PXT 208 PGS5 Operator Terminal

The PXT 208 PGS5 consists of the following parts:

A) Text Display as PX 30 PGS5: Vacuum fluorescent display, 2 lines of 20 characters, 5 mm character height, 5 x 7 dot matrix; S5-PG-interface (TTY), RS 232 interface; 32/64 KByte Flash-EPROM text memory, dimmer, supply voltage connection

B) Operator Terminal with 2 key fields: 8 function keys, 16 alphanumeric and special keys; eight inputs/8 keyboard outputs (24 V), supply voltage connection

C) LED Indicators: 8 dual/coloured LEDs on the function keys (green/red)



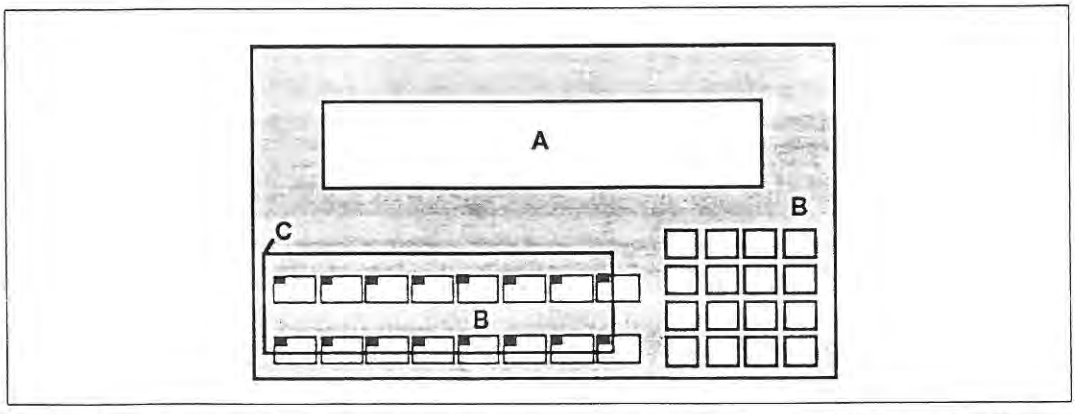
PXT 216 PGS5 Operator Terminal

The PXT 216 PGS5 consists of the following parts:

A) Text Display as PX 120 PGS5: Vacuum fluorescent display, 2 lines of 40 characters, 9 mm character height, 5 x 12 dot matrix; S5-PG-interface (TTY), RS 232 interface, two 24 V inputs (scroll inputs); 32/64 KByte Flash-EPROM text memory, dimmer, supply voltage connection

B) Operator Terminal with 2 Key Fields: 16 function keys, 16 alphanumeric and special keys; eight inputs/8 keyboard outputs (24 V), supply voltage connection

C) LED Indicators: 16 dual-coloured LEDs on the function keys (green/red).



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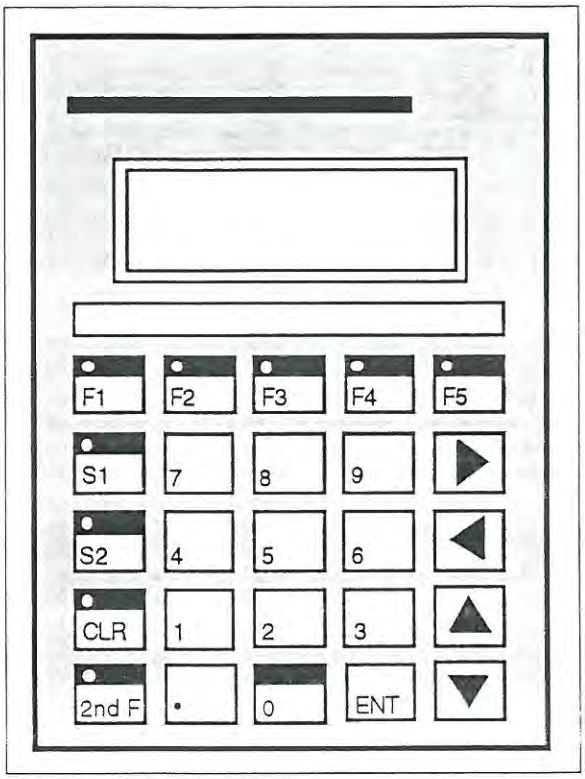
PXT 305 COM-LC Operator Terminal

The PXT 305 COM-LC consists of the following parts:

A) Text Display: LC-Display, 4 lines of 20 characters, 5 mm character height, 5 x 8 dot matrix; S5-PG interface (TTY), RS 232 interface; 64 KByte Flash EPROM text memory (soldered into the unit), contrast adjustment, supply voltage connection.

B) Keypad: 5 function keys with 2 F-key levels (F1 ... F10), 2 special keys, also on two levels (S1 ... S4), 18 numeric and special keys.

C) 8 LEDs: 5 (green) on the function keys, 2 (green) on the special keys, 1 internal LED for the 2nd F-key.



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WARNING!
Display systems should always be installed in accordance with the safety guidelines given in Chapter 1.

Cut-out dimensions can be found in the Appendix.

Please note: The supply voltage connections of the text display and keyboard units must be at the same potential, ie. the earth terminals (⊥ ; 0 V) on both must be connected. Always use cables with a diameter of 1.5 mm² on the terminals marked ⏚ .

The earth conductor (diameter ≥ 6 mm²) should be connected to the back of the unit, at the place marked: ⏚.

Procedure after Power-Up

When the unit is switched on, an address table for the text memory appears, among other things. The greater the number of texts, the longer this process will take. The time delay between power-up and the display being ready is between 0.3 and 3 seconds, during which time the message: "SELFTEST/SYNCHRO" is displayed. You should always take this time delay into account when switching on your machine. The time loss is justified when you consider how much more quickly text can be selected during operation, and how much less memory is taken up in comparison to texts with a fixed start address.

The unit signals that it is ready either:

- By displaying a message containing the following information
  - Unit description
  - Version number

OR

- By displaying a message configured by the user (by entering the corresponding "Replacement Text Number for Base Message" in the **ADIT DOS Default Settings**).

Please note: If you are using your own configured message, the version number can be called up in special mode.

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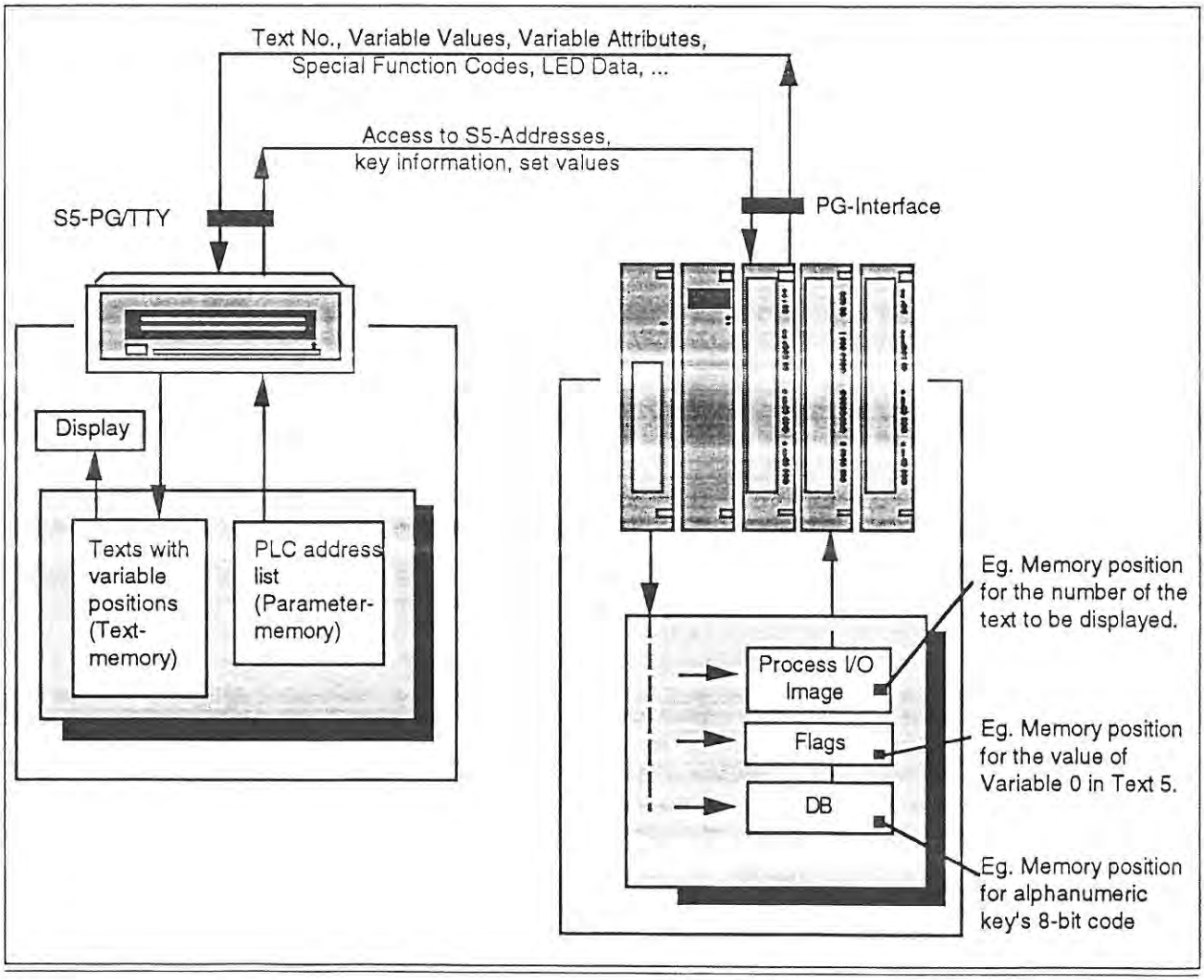
Principles

The PX(T) PGS5 range comprises both text displays (PX PGS5) and operator terminals (PXT PGS5) and has been specially developed to operate through the PG-interface of a Siemens SIMATIC S5 controller. This type of interface is especially economical, reducing the cost of a "Text Display/Operator Terminal - PLC" system to a minimum:

- No additional interface module
- Simple cable connection instead of expensive wiring
- Programming of both display system and PLC is made considerably easier.

Any data required by the display system (eg. text numbers and variable values), or which is to be sent to the PLC (eg. information on keys that are pressed), is stored in the controller under addresses, for which individual parameters may be set. These PLC addresses are stated when programming the display systems.
The display system acts as Master, collecting the data it requires from the controller and writing information to the allocated memory sectors.

The diagram below illustrates this process.



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Controllers that are Supported

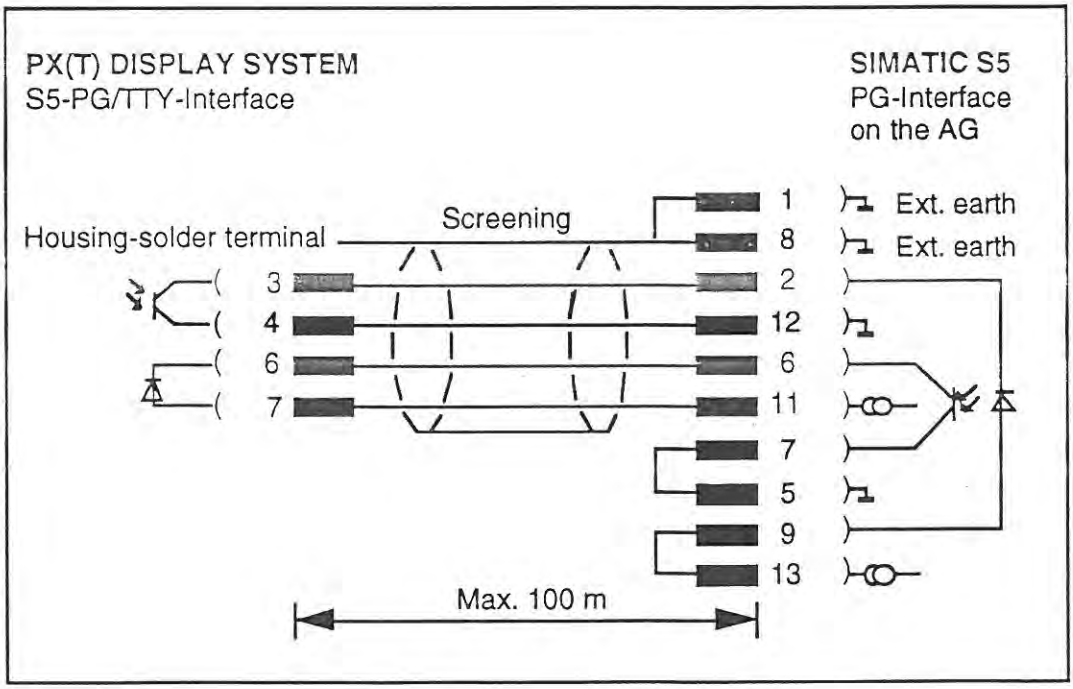
The following types of controller in the S5-range are supported:

Type	CPU
S5-90U	
S5-95U	
S5-100U	103
S5-115U	941, 943 with 2 PG-connections (serial) 943B with two PG-connections (serial)
S5-135U	928

Please note: Other controller types from the S5-range and their CPUs may be used with the PX(T) PGS5 and PXT 305 COM-LC. However, Pilz cannot guarantee their total compatibility.

PLC Connection (S5-PG/TTY Connection Cable)

The connection between the controller and the display system is made using a cable as shown in the diagram below:



This cable is available as an accessory (order reference: 374 143).

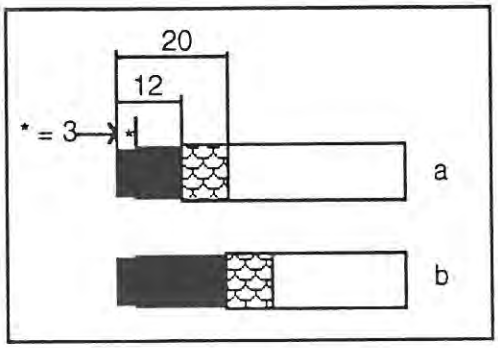
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Remote Bus Cable Connector

a) • Strip the cable sheath back 20 mm
   • Shorten the screening braid by 12 mm
   • Strip the wire ends back 3 mm

b) Lay the screening braid evenly round the cable sheath

c) Attach the protective screen below the strain relief clamp (conductive connection to the housing)



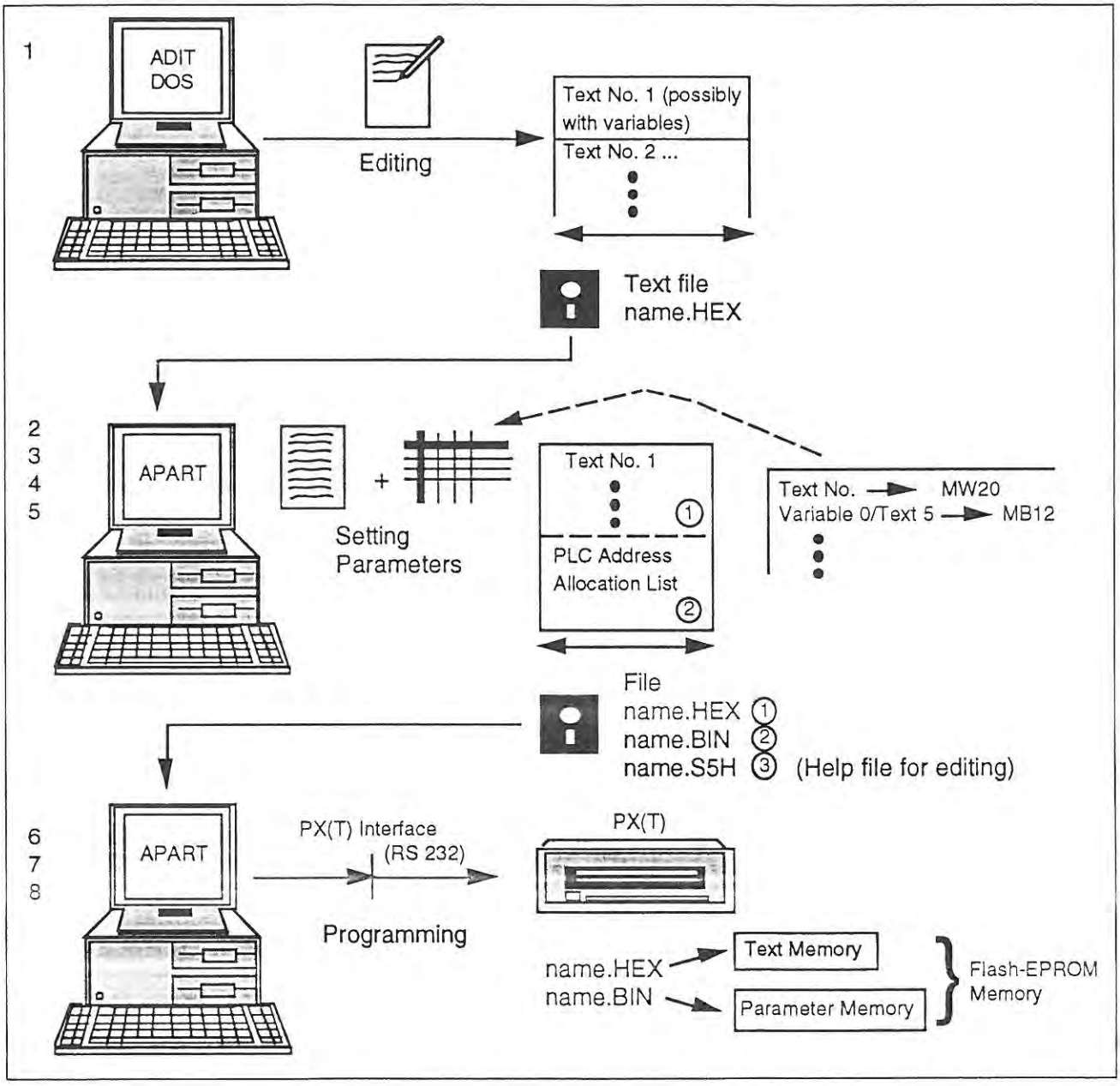
Programming the Display System

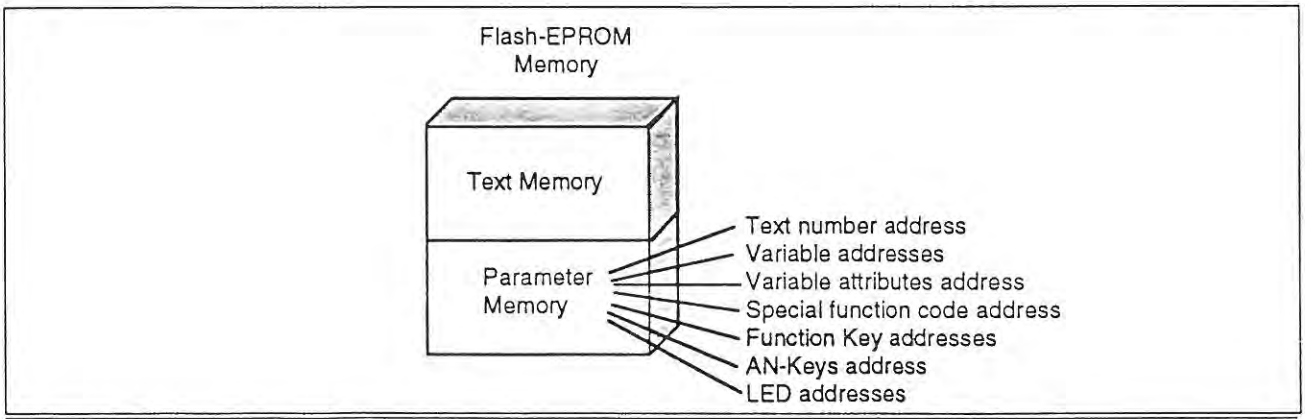
The diagram on the next page shows the standard procedure for programming the display system.

Please note: ADIT DOS and APART are software tools which have been specially designed for Pilz display systems. They are used to create text and set parameters, as well as for programming the memory.

Their operation is described in the relevant manuals.

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	Action	APART Menu
1	Edit text file using ADIT DOS (name.HEX)	
2	Start APART (Input → apart<ENTER>; If using a monochrome screen: → apart/m<ENTER>)	
3	Load text file (name.HEX)	File → Open / F3
4	Edit S5-addresses for the required utilities *	Edit
5	Save data (files name.S5H and name.BIN will be created	File → Save / F2
6	Enter text memory type and PC-interface for programming	Options
7	Clear Flash-EPROM text memory	On-line → Clear text memory
8	Send data	On-line → Write text memory

* The permitted range of values for operands on the S5-135U controller form the basis for entering addresses in APART (see page 87). Any variation from these range limits must be taken into account with the respective controllers.

Programming the Flash-EPROM

Flash-EPROMs are used as text memory. These are currently the quickest memory chips available for text displays. Just like EEPROM-chips, they are programmed and cleared electrically.

The Flash-EPROM is programmed directly inside the display system. When the unit is ready for operation (ie. 24 V supply voltage is applied), just connect the unit to a PC via the RS 232 interface, and the text memory can be programmed quite simply using ADIT DOS software as a text editor and APART software as a parameter tool (both running under MS DOS).

Their operation is described in the relevant manuals.

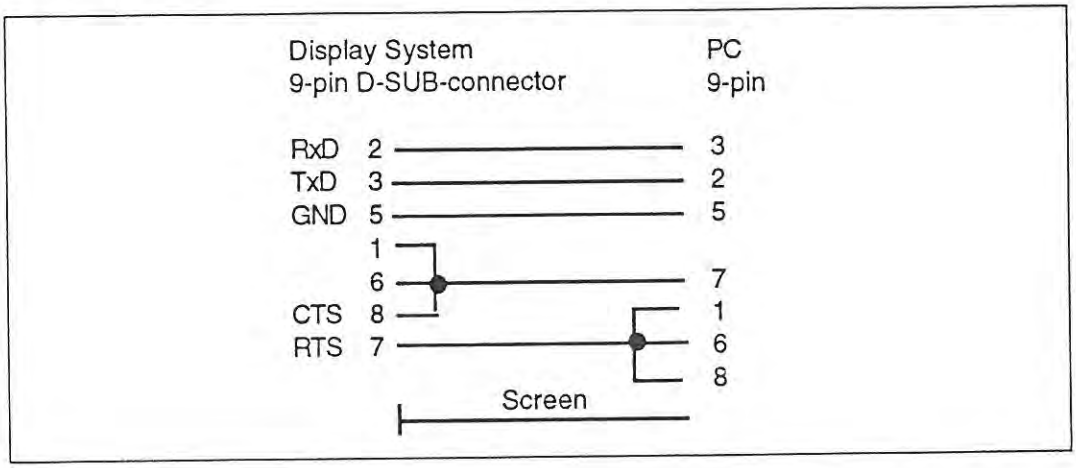
PC Connection (RS 232 Connection Cable)

The RS 232 (V 24) interfaces must be connected in order to program the Flash-EPROM directly within the display system. This connection may be made by:

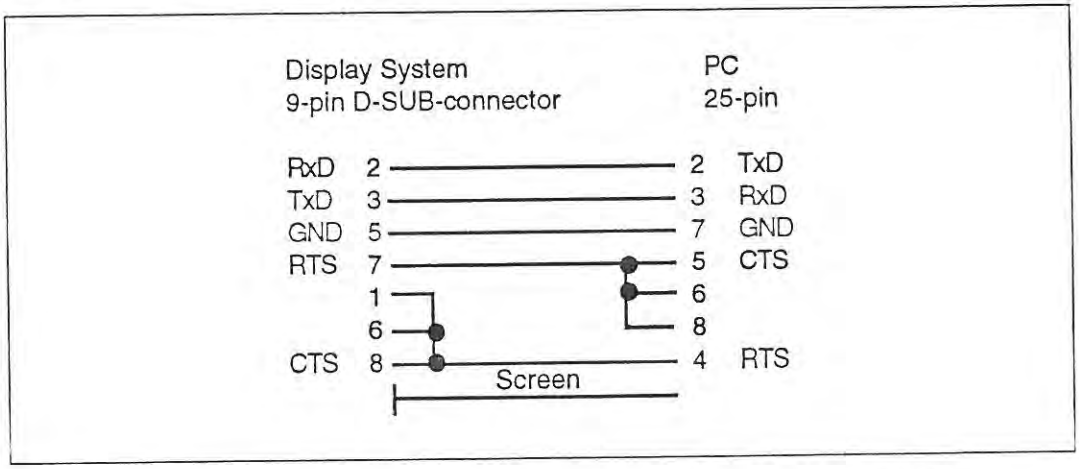
- Ordering the AKSET as an accessory (Order Reference 307 426).
  This consists of a null modem cable (9 to 9-pin) and a mouse adapter (9 to 25-pin) **OR**
- Making up your own cable as shown in either of the two diagrams on the following page.

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RS 232 Connection Cable, 9 to 9-pin

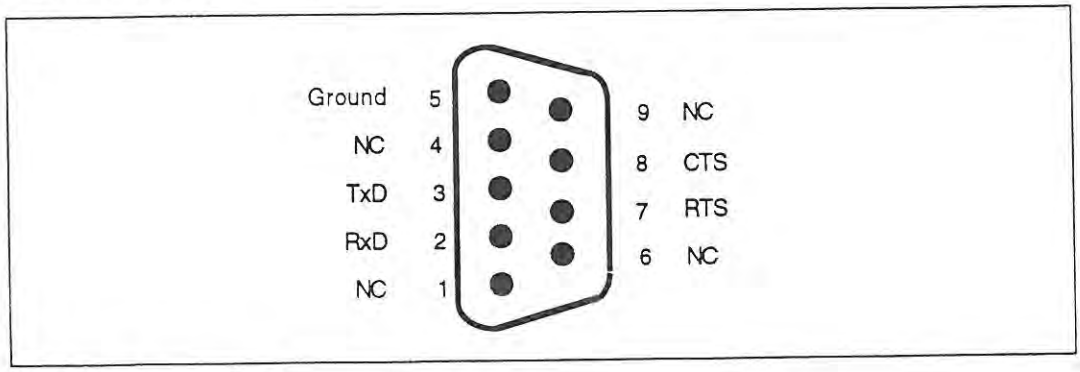


RS 232 Connection Cable, 9 to 25-pin



Please note that the RS 232 interface on the display system uses a 9-pin D-Sub-connector!

Layout of the RS 232 interface



(NC = No Connection)

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Configuration

A variety of settings can be made in respect of:

- Character set
- Default text on power-up
- Scroll function.

Parameter	Explanation	Default Setting
Character Set	You can select either the IBM or the Cyrillic character set. **Exception on the PXT 305 COM-LC:** This unit cannot be switched to the Cyrillic character set. **See also the $C-Instruction on page 34!**	IBM character set
Default Text on power-up	The default message which appears on the display after power-up can be replaced by another message created by the user.	(Base message: Unit description and version number)
Scroll function	You can select between scrolling both lines of the display or just the second line (**on the PXT 305 COM-LC: second, third and fourth line**). You can scroll upwards as far as the first line and downwards as far as the last line. If both scroll inputs are driven simultaneously (24 V inputs on the rear of the unit; **not on the** PX 30/PXT 5/PXT 208 PGS5 and PXT 305 COM-LC) or if the special function code OA_H is entered in the S5 memory sector for special functions, the display will return to the start of the text.	Both lines are scrolled

The settings for the above parameters are polled in ADIT-DOS under the menu item **"Default Settings"** and are automatically stored with the text file (name.HEX). These will then be in effect each time the display system is powered up.

ADIT DOS Default Settings:
The ADIT DOS parameters "Binary-BCD coding", "Number of Inputs" and "Text Display Address" have no meaning on this display system and should be left at their default values (0, 0 and 1).

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Parameter	**Parameter in ADIT DOS**	Setting	Value to Enter
Character Set	**Character Set**	IBM Cyrillic*	99 (default) 98
Default text on power-up	**Text Number for Base Message**	Any text	(Text No.)
Scroll Function	**Scroll Mode**	Both lines scrolled Only 2nd line scrolled**	0 (default) 1

* Not on the PXT 305 COM-LC
** On the PXT 305 COM-LC: 2nd, 3rd and 4th lines are scrolled with background text.

For the output of hardcopy via the RS 232 interface, the printer parameter **must** be configured, and the print format **may** be configured.
Settings for the printer parameter are interrogated in ADIT DOS, under **"Default Settings"**.

Printer Parameter in ADIT DOS	Setting	Value to Enter
Printer baud rate	300 1200 2400 4800 9600	3 12 24 48 96 (default)
Printer data length	7 data bits 8 data bits	7 8 (default)
Printer stop bit	1 stop bit	0 or 1 (PX-internally = 1*)
Printer parity	No parity Odd parity Even parity	0 1 2 (default)

* **Please note:** When sending data, the stop bit is followed by a pause of approx. 0.1 ms. At 9600 baud, this corresponds to one stop bit.

Value combinations valid for these parameters are as follows:

Data Length	**/Stop Bit**	**/Parity**
8	/1	/0
8	/1	/1
8	/1	/2
7	/1	/1
7	/1	/2

Hardcopy-Format ($Q-Instruction)

The print format for hardcopy is set using the $Q-Instruction, which is entered in the ADIT DOS **"Default Settings"** in the line "Max. 40 additional characters".

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$Q:x/y

x = 0 **Multi-line hardcopy** in display format (20/40 characters per line);
All edited lines, including background text, are printed.
(y is not evaluated; its value is insignificant!)

x = 1 **Single line hardcopy**
y = 0 With display format 2 x 20: lines displayed are printed;
With display format 4 x 20: the first two lines are printed;
(40 characters per line)
y = 1 With display format 2 x 40: 1st line of display is printed;
With display format 4 x 20: the first two lines are printed;
(40 characters per line)
y = 2 With display format 2 x 40 or 4 x 20: lines displayed are printed;
(80 characters per line)

WARNING!
The following information is valid for all configuration instructions ($-instructions):
All instructions may be entered one after the other in the line "Max. 40 additional characters" in the ADIT DOS "Default Settings". If required, you can leave a space between the instructions to make them easier to read, but this is not necessary.
However, you must leave a space before the very first $-Instruction!

Loadable Special Character Set ($C-Instruction)

The $C-Instruction can be used to load a special character set, either one available within the display or one created by the user. Further information can be found on page 80.

Exception: The PXT 305 COM-LC does not have the facility to load special character sets.

By-passing the Keypad, 8-Bit Code for Function Keys and Password ($H-Instruction)

The configuration instruction **$H:1/y</zzzzzz>** establishes that the 8-Bit Code of any key that is operated is used internally by the PXT for entering set values, and that the [↓] and [↑] keys are used for scrolling text.
If y = 1, the function keys supply an 8 Bit Code; if y = 0, they don't.

Exception: On the PXT 305 COM-LC, parameter y is not evaluated; the F-Keys on this unit always supply an 8 Bit Code when operated.

zzzzzz represents a password for entering set values, which should be added on to the $H-instruction, preceded by a slash ("/"). The password may consist of between 1 and 6 characters. You must select something that can be inputted via the operator terminal's keypad, so letters, for example, would only be valid on the PXT 90 PGS5.
If your password consists of less than 6 characters, enter spaces for the remainder.

Please note: A password will be recognized as valid, even if just the second slash ("/") has been entered in the $H-instruction. The instruction **$H:1/y/** will block the entry of set values, with no possibility of lifting the block!

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In the unit's default settings (no $H-instruction or $H:0/0), the 8-Bit Codes are not used internally and function keys do not supply an 8-Bit Code (with the exception of the function keys on the PXT 305 COM-LC, as above).

The use of a password is dealt with in the section entitled "Password Protection" on page 59.

F-Keys for [-], [+] and CLEAR-Keys ($J-Instruction)

The [-], [+] and CLEAR-functions are important for entering set values. Their commands can be copied over to function keys, by entering the two digit number of the relevant function key within the $J-instruction:

$J:xx/yy/zz xx = Function key number for [-]-key
yy = Function key number for [+] -key
zz = Function key number for CLEAR-key
(Enter 00 if you do not wish to replace the key)

Example: $J:14/15/16 Function key F14 for "-"
F15 for "+"
F16 for CLEAR

Please note: The $J-instruction is not required on the PXT 305 COM-LC, as the [-], [+] and CLEAR-keys are available directly.

- The [-]-key corresponds to the second function of the [0]-key: [2nd F] + 0 "-"
  This is a toggle key. Entering a second "-" cancels the function of the first "-".
- The CLEAR-key is labelled "CLR".

→

Please note: The CLEAR-key has key code 23_H and corresponds to the quit key on the PXT 90 PGS5 [⏎].

CTS Evaluation ($N-Instruction)

When outputting hardcopy via the RS 232 interface, the CTS (ready to print)-signal will be evaluated on your connected printer, if you set **$N:1**. If there is no CTS-Signal, an error message will be displayed and the hardcopy operation will be aborted after a time-out period of 5 seconds.

In the unit's default settings (no $N-Instruction or $N:0), the CTS-Signal is not evaluated; there is no timeout period for a printer which is not ready to receive data, or which is not connected.

Scroll Speed ($R-Instruction)

The $R-Instruction can be used to change the preset scroll frequency (2 seconds) during auto-scrolling (see page 9).

$R:x x = 1 ... 9 (seconds)

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Display System Utilities

The various functions and options available on the display system are called "Utilities." The table below shows which utilities are supported by which display.

Utility	See Page	Display System	
Display text	38	**Text Display PX PGS5**	**Operator Terminal PXT PGS5 and PXT 305 COM-LC**
Insert variables	38		
Transmit variable attributes	45		
Special utilities (eg. segment test)	46		
Transmit key information on the function keys	47		
Transmit key codes of the alphanumeric keys *	51		
LED control	52		
Input of set values *	54		

* Only on operator terminals with alphanumeric keys.

Basics for Transmitting Key Information

In principle, there are two different ways of transmitting information through the pressing of keys. When a key is pressed, either:

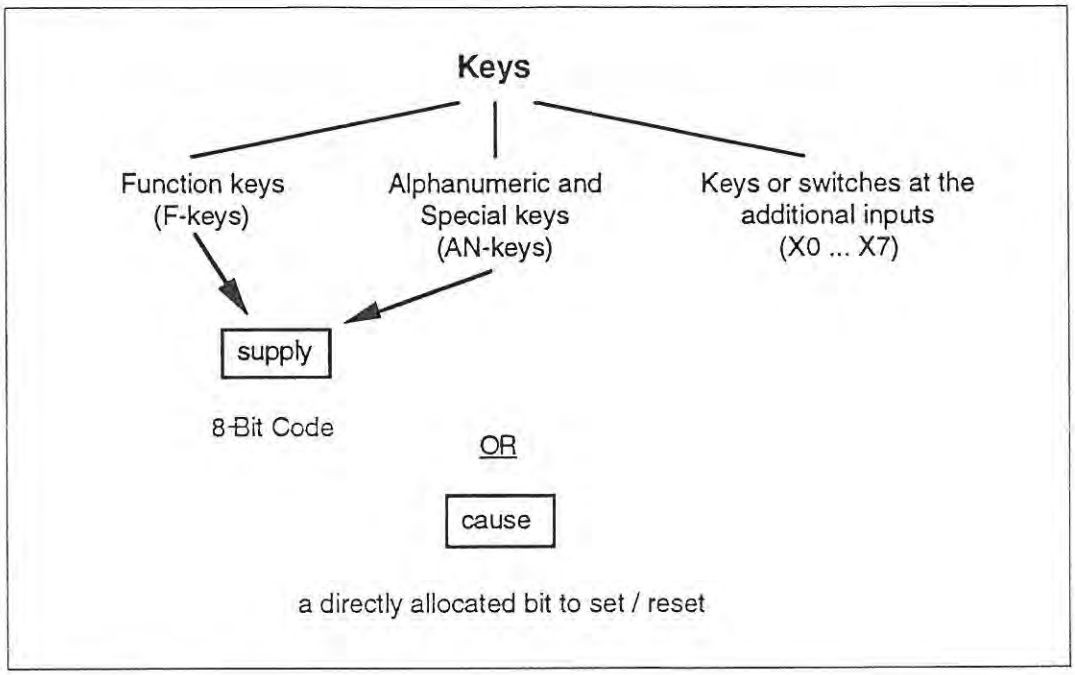
- a directly allocated bit is set **OR**
- the key's 8-bit code is written into an allocated memory sector in the controller.

Valid keys are: function keys, alphanumeric and special keys, as well as keys and switches connected to the additional inputs.

Exception: When keys or switches at additional inputs X0 ... X7 are operated, no 8-bit code is created for transmission to the PLC.

For the function keys to supply an 8-bit code, the display system must be configured with the $H-instruction (see page 34; **NB: this is not necessary on the PXT 305 COM-LC**).

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The way in which parameters are set for the utilities, using the APART parameter tool, determines the type of transmission.

1) The "Function Keys" utility uses the bits directly allocated to the keys. *

2) The "Alphanumeric Key Code" utility sends the 8-bit code of the key that has been pressed to the address set within the parameters. **

* When setting parameters for the "Function Keys" utility, the AN-keys and X0 ... X7 are regarded as additional F-Keys.
Each alphanumeric and special key, plus each additional input, is internally allocated a logic F-key number (see page 48).

** If you set parameters for the "Alphanumeric Key Code" utility by entering an address, the display system will transmit the 8-bit code of every function key, alphanumeric key and special key that is pressed to the controller.

WARNING!
To ensure that key information is transmitted accurately, make sure that no more than 2 keys are pressed simultaneously. This does not apply to any keys or switches connected to X0 ... X7.

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Using APART to Set Parameters for the Utilities



A display system with an S5-PG-interface does not need to be programmed in accordance with any special data communication protocol.
Programming is therefore considerably simpler. All you need to do is establish addresses for the individual utilities (see Chapter 6), under which information will be stored and retrieved within the controller. This process is described under "Setting Parameters for the Utilities".

APART software has been specially developed for Pilz display systems, enabling you to set parameters with ease and to program the PX(T)-memory with the "new" text file (expanded by the PLC-address allocation list), directly within the unit.

The main procedure for programming the display system is described in Chapter 5.

Important: In order for the display system to function, parameters **must** be set for the "Display Text" utility. As far as the other utilities are concerned, you only need to set parameters for those you wish to use.

The permitted range of values for operands on the S5-135U controller form the basis for checking the addresses entered in APART. Any deviation from these range limits must be taken into account with the respective controllers.

Ten seconds after you have finished programming with APART, the display system will automatically switch to PLC-communication.

Display Text

Please note: Texts and their corresponding text numbers are edited with ADIT DOS.

You will need to state the coding of the text number, plus the address under which the PLC enters the number of the text to be displayed.

Valid text number codings:	Binary, BCD
Valid addresses:	EB, EW, AB, AW, MB, MW, DL, DR, DW
	(See page 91 for key)

Inserting Variables

Please note:

- Positions within texts and the formatting of variables (length, number and attributes) are all established using ADIT DOS. Each text may have up to 8 variables (variable numbers 0 ... 7).

  Important: The variable length defined using ADIT DOS can be reduced when setting parameters with APART (see column 5 in the table overleaf). The APART utility "Variable Attributes" (see Page 45) means that additional attributes may also be made available.

- If negative values are permitted for variables, you must remember to leave an additional text mask (#) for the negative prefix.

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- If you are displaying variables, remember to take scaling into account (converting a value with a factor and an offset) when editing variable markers (see page 13).

- If you are displaying bit-coded variables, remember to enter the attribute "Display leading zeros" when editing the variable in ADIT DOS, so that bit state zeros are not suppressed.

The text file (name.HEX) created using ADIT DOS is the basis for setting parameters for the utility "Variable Addresses". From this .HEX-file, APART software determines the numbers of all the edited texts and the variables contained within them.

Set value variables are given an ID, which not only identifies them as such, but also shows which type of set value they are:

ID	Set Value Type
*0	BCD or ASCII (any number of bytes from 1 ... 10)
*1	INT 8 (1 Byte)
*2	INT 16 (2 Bytes = 1 Word)
*4	INT 32 (4 Bytes = 1 Double Word)

This data is prepared in table form and is assigned one PLC-memory address per variable. This address will be used to retrieve the variable value from the PLC. A **maximum of 800 variable addresses** may be edited.

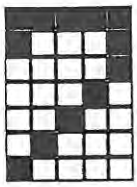
Table header in APART:

Curr. No.	Text No.	Var. No.	Coding	Length	Address	DB-No.	
①	②	③	④	⑤	⑥	⑦	⑧

1 Current numbers for all variables
2 Text ID-number
3 Variable numbers within the text
4 Coding (BIN, BCD, ASC, BIT)
5 Length in characters (with BIN, automatically = 0)
6 PLC-Address
7 Number of the data block (only with data addresses)
8 Set value ID (*0, *1, *2, *4)

Valid codings for true value variables:
Binary (signed), BCD, ASCII, Bit

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Important note on signed binary figures: The conversion of a positive binary integer into a negative binary integer of the same value (taking into account the prefix coding in the highest value bit) is carried out as follows:

1. Positive binary integer
2. Complementing (negation) of binary value
3. Add "1"

Example: "-21" as a signed 8-bit binary figure

1. "+21": 00010101
2. 11101010
3. \+ 00000001
4. 11101011 (store in PLC): "-21"

Please note: The coding of **set value variables** is established when they are edited in ADIT DOS. It is stated in column 4 and cannot then be altered. Bit-coding is not permitted for set value variables.

Valid Variable Length: 1 ... 10 characters

Exception: With binary coding, the length of the variables (number of characters) is established when the PLC address is set:

- Byte address → 3 digit (+ possible prefix)
- Word address → 5 digit (+ possible prefix)
- Double word address → 10 digits (+ possible prefix)

For this reason, the figure 0 is automatically entered in the "Length" column once the abbreviated symbol for binary coding has been entered.

Valid addresses:

Variable	Valid Addresses
True value variables	EB, EW, ED, AB, AW, AD, MB, MW, MD DL, DR, DW, DD *
Set value variables	
*0 (ASCII or BCD)	See true value variables
*1 (Binary, 8 Bit)	EB, AB, MB, DL, DR
*2 (Binary, 16 Bit)	EW, AW, MW, DW
*4 (Binary, 32 Bit)	ED, AD, MD, DD *

* See page 91 for key.

Please note: When setting parameters in APART, double words may be used, even if the controller cannot be addressed via double words.

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The table overleaf illustrates the correlation between the contents of the PLC-memory and the variable value displayed, depending on the information provided when the parameters were set (APART) and during formatting (ADIT DOS).

WARNING!
The coding and length of set and true value variables must match between the PX(T) and PLC, otherwise values could be falsified.

One particular source of danger is the information provided on the length of ASCII and BCD-coded set value variables. If the number of set value digits transmitted is greater than the number reserved in the PLC, important data could be lost within the PLC!

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