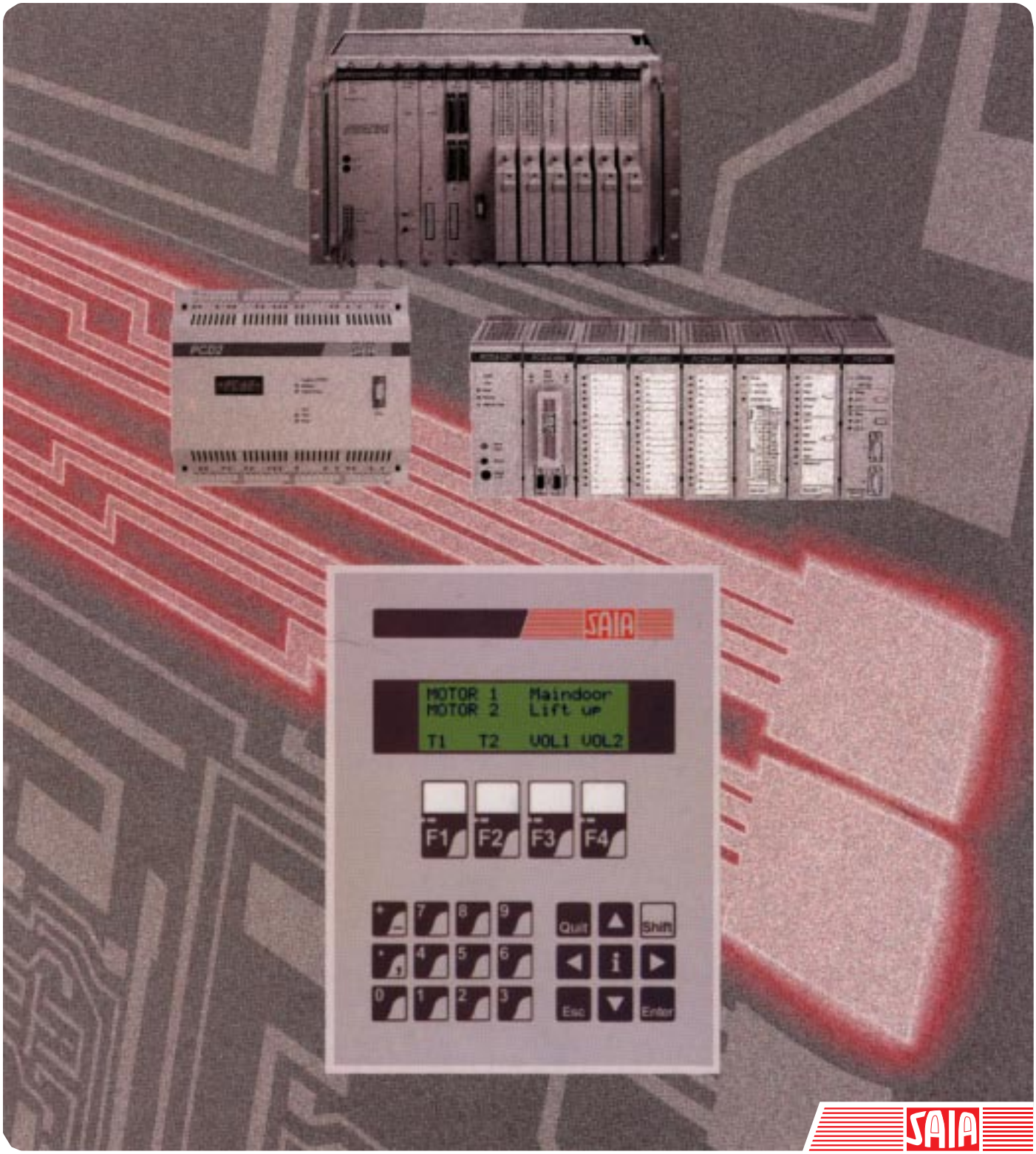
SAIA-Burgess Electronics

SWITCHES • MOTORS • CONTROLLERS

SAIA®PCD

Process Control Devices

PCD7.D202 Industrial Terminal Manual



Edition 26/746 E1

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SAIA® Programmable Control Devices

Manual

Industrial terminal

PCD7.D202

Edition 26/746 E1 - 04.01

Subject to technical changes

Updates

Manual : Industrial terminal PCD7.D202 - Edition E1

Date	Chapter	Page	Description
20.11.2000	---	---	Small updates for the “Support Homepage”
20.11.2000	---	---	Small updates for ..D202 (replaced ..D200)
23.03.2001	10	10-2	Minor corrections
30.04.2001	6	6-9	Correction of commands High/Low contrast

Contents

Notes :

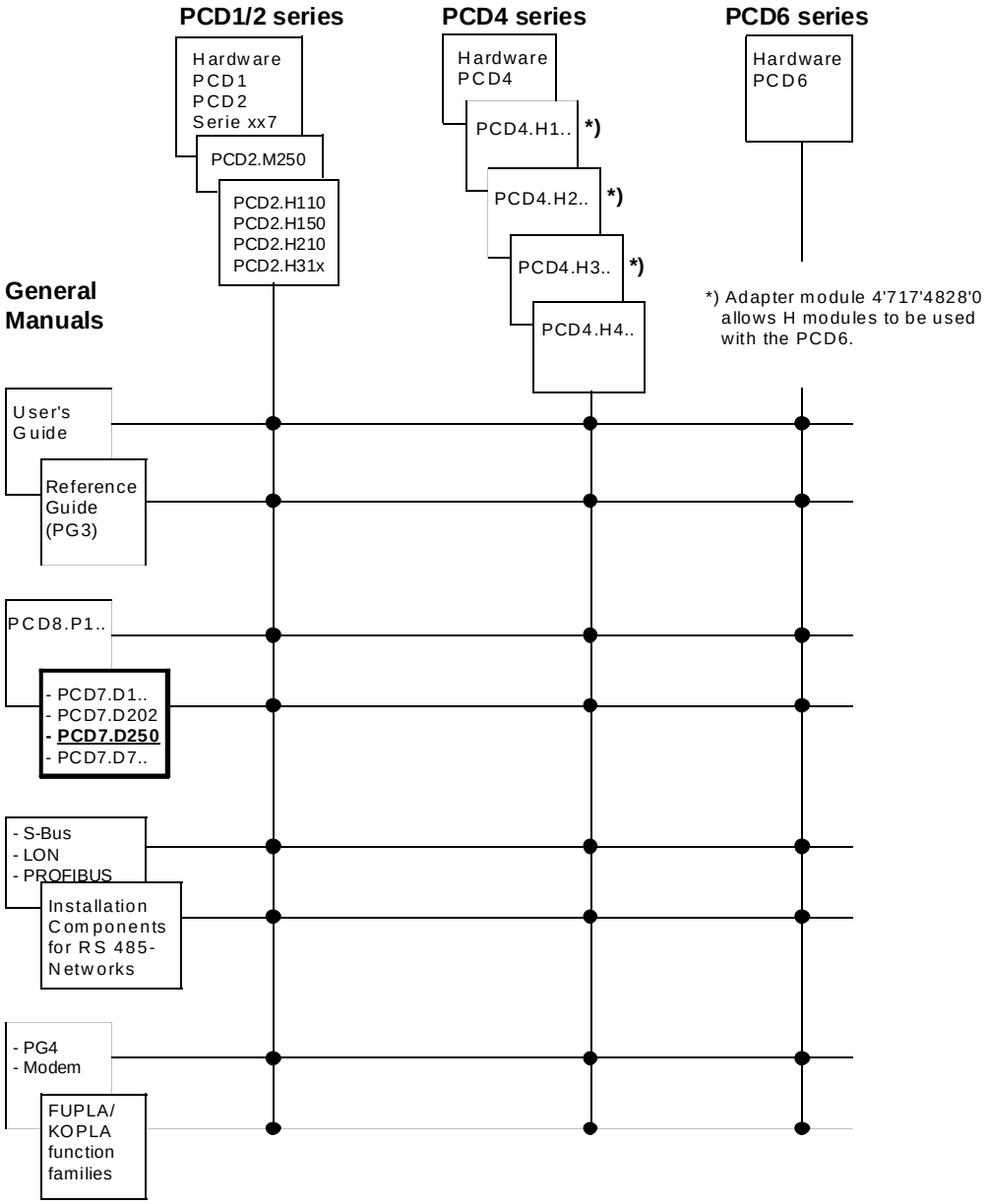
Please note :

A number of detailed manuals are available to aid installation and operation of the SAIA® PCD. These are for use by technically qualified staff, who may also have successfully completed one of our "workshops".

To obtain the best performance from your SAIA® PCD, closely follow the guidelines for assembly, wiring, programming and commissioning given in these manuals. In this way, you will also become one of the many enthusiastic SAIA® PCD users.

If you have any technical suggestions or recommendations for improvements to the manuals, please let us know. A form is provided on the last page of this manual for your comments.

Summary



Reliability and safety of electronic controllers

Saia-Burgess Controls Ltd. is a company which devotes the greatest care to the design, development and manufacture of its products:

- state-of-the-art technology
- compliance with standards
- ISO 9001 certification
- international approvals: e.g. Germanischer Lloyd, UL, Det Norske Veritas, CE mark ...
- choice of high-quality componentry
- quality control checks at various stages of production
- in-circuit tests

Despite every care, the excellent quality which results from this does have its limits. It is therefore necessary, for example, to reckon with the natural failure of components. For this reason Saia-Burgess Controls Ltd. provides a guarantee according to the “General terms and conditions of supply”.

The plant engineer must in turn also contribute his share to the reliable operation of an installation. He is therefore responsible for ensuring that controller use conforms to the technical data and that no excessive stresses are placed on it, e.g. with regard to temperature ranges, overvoltages and noise fields or mechanical stresses.

In addition, the plant engineer is also responsible for ensuring that a faulty product in no case leads to personal injury or even death, nor to the damage or destruction of property. The relevant safety regulations should always be observed. Dangerous faults must be recognized by additional measures and any consequences prevented. For example, outputs which are important for safety should lead back to inputs and be monitored from software. Consistent use should be made of the diagnostic elements of the PCD, such as the watchdog, exception organization blocks (XOB) and test or diagnostic instructions.

If all these points are taken into consideration, the SAIA® PCD will provide you with a modern, safe programmable controller to control, regulate and monitor your installation with reliability for many years.

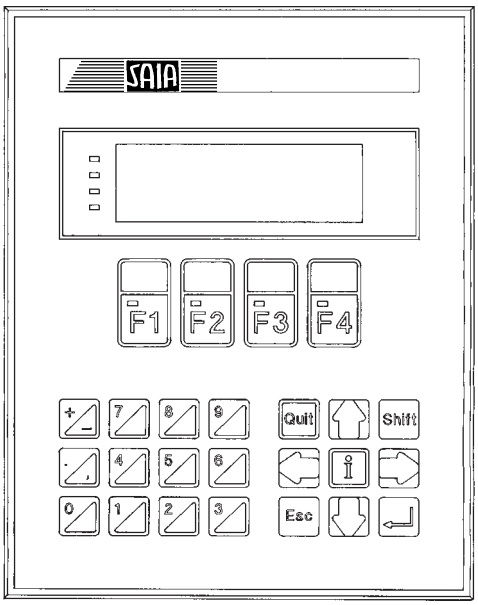
1. Application

The new PCD7.D... control terminals have been developed for tough industrial use, such as occurs in direct contact with production machines. In combination with the intelligent text output of the SAIA° PCD, it provides a simple way of implementing menu-driven user prompting.

With the latest high contrast back-lit LC display, the PCD7.D202 model can display any type of information such a temperature, pressure, unit numbers, date, time, etc., or messages about operating states or alarms.

Under the abrasion-proof polyester foil there are 25 tactile feedback keys, enabling any necessary operating data or processing functions to be entered via the serial data interface, prompted by a menu controlled by the SAIA° PCD.

Labelling strips can be slid beneath the partially transparent front-panel foil: a simple way of enabling the user to create personalized key labels whenever required. Due to the arrangement of the function keys directly below the display, these can also be used as soft keys.



Quick guide to operating the PCD7.D202 terminal

The following chapters supply detailed descriptions of the broad functional possibilities provided by the D202 terminal. In any practical application, probably only a small part of them will be used.

In order to give the beginner a brief guide to simple text output it is advisable, before studying all tests and instructions individually, to do one of the program examples from chapter 8 as a practical exercise. In this way it will be obvious how simple it is in practice to work with the PCD and the D202 terminal.

Notes :

2. Technical data

Function data

Display	LC-display, supertwist with LED back lighting, 4 x 20 characters, height 4.75 mm, with cursor Character set: ASCII characters 16 to 127 and control functions plus special characters depending on language, 4 x LEDs to left of LC-display
Keyboard	Foil keyboard with tactile feedback Numeric keypad with 12 keys, 15 mm spacing Control keypad with 9 keys, 15 mm spacing 4 function keys, 19 mm spacing, with red LEDs and slide-in labelling strip
Data interface	Communications interface (for SAIA°PCD) COM 1: RS 232 (fixed) Transmission speed: 110... 19200 bps

Electrical data

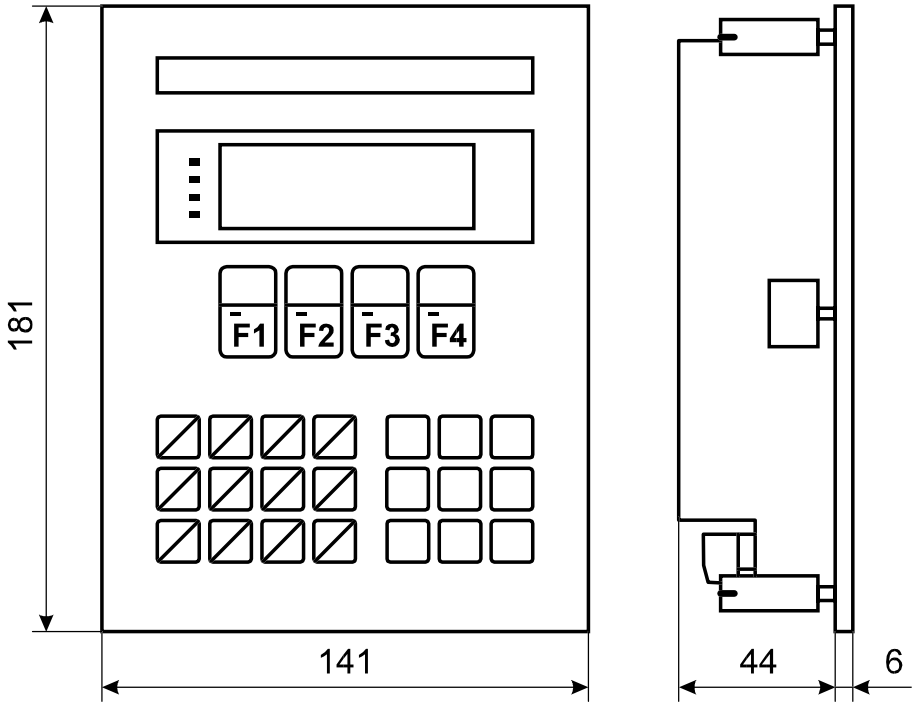
Supply voltage	19... 32 VDC, smoothed, with reserve battery protection, or 19 VAC +/- 15 %, full-wave rectified, with reverse battery protection
Power consumption	max.0.2 A at 24 VDC
Connection	Power supply via plug-in screw terminals for wires of max. 2.5 mm^2 Data interface via 9-pole D-type jack
EMC	ESD complies IEC 801-2: 6 kV (HVR) or 8 kV (discharge) Burst complies IEC 801-4: power supply 4 kV direct, data interfaces 1 kV capacitive Emission complies EN 55022 class B

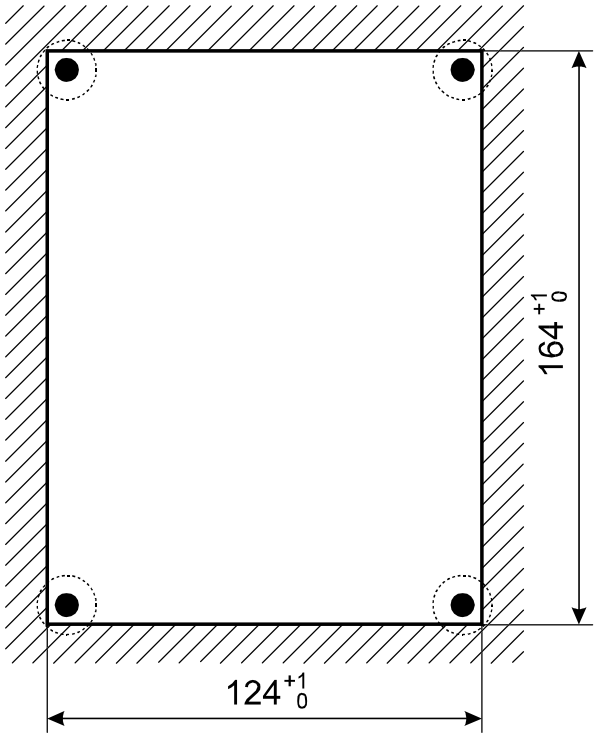
General data

Housing	Plastic frame with polyester foil, front panel protection IP 65 Backplate in aluminium sheet See dimension drawing for measurements and control panel cutout Mounting with stud bolts
Ambient temperature	Operation 0...50 °C (as option -20...+70 °C) Storage -25...+70 °C (as option -30...+80 °C)

Atmospheric humidity	5...95 % relative humidity without condensation, according to IEC 1131-2 and DIN 40 040 class F
Mechanical resistance	Vibration 10...57 Hz, 0.075 mm or 57...150 Hz, 1.0 g according to IEC 68-2-6

3. Dimensions





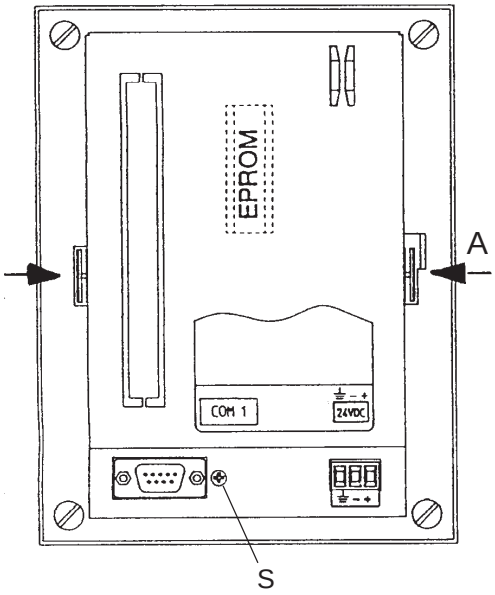
Panel cutout

Mounting with stud bolts

Notes :

4. Hardware

4.1 Power supply / connector



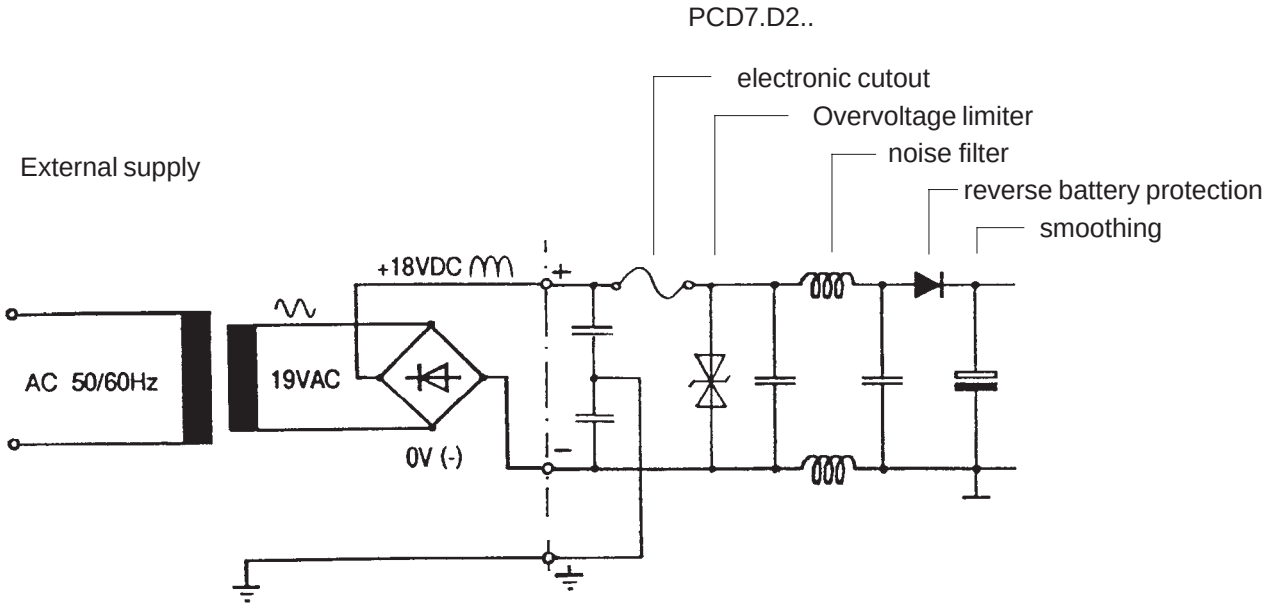
Power supply via plug-in screw terminals for wires of max. 2.5 mm^2 (flexible wires with ferrules max. 1.5 mm^2).

19...32 VDC smoothed or 19 VAC ± 15 % full wave rectified with reverse battery protection.

⚠ A good earth connection is imperative for perfect operation! Moreover, whenever the cover has been removed, cover screw S must be screwed back tightly to restore a good connection to frame ground.

The labelling strip for the 4 function keys is inserted at point A.

Power supply with full wave rectified AC



4.2 Firmware

The Firmware is stored on an EPROM. To update the firmware remove the cover by pressing on the two latches (see part 4.1).

4.3 Serial interface RS232

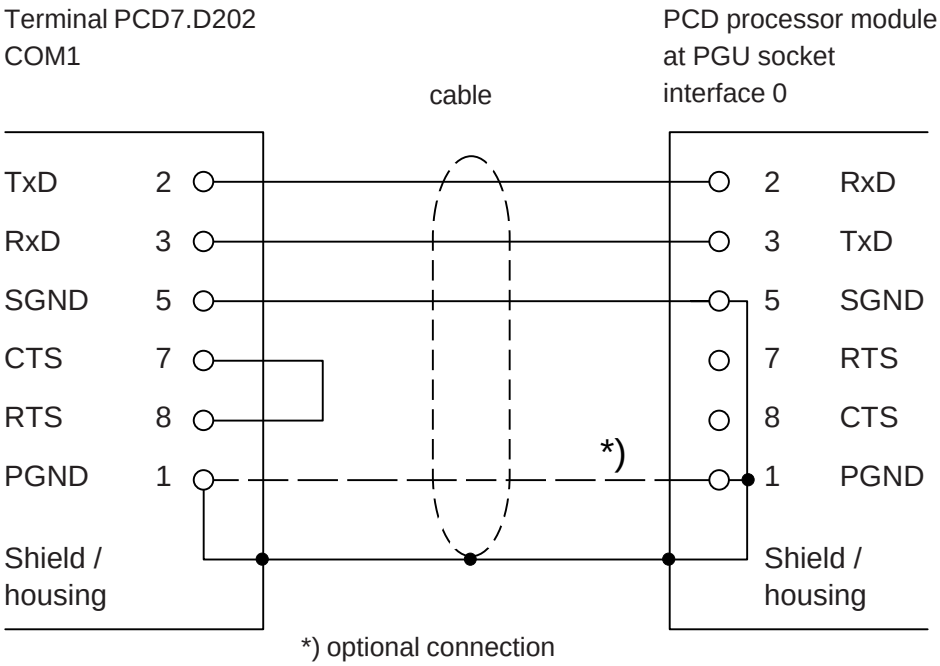
via 9-pole D-type jack (COM 1)

4.3.1 Without RTS/CTS handshaking, or with XON/XOFF

Instructions apply for all PCD communications channels:

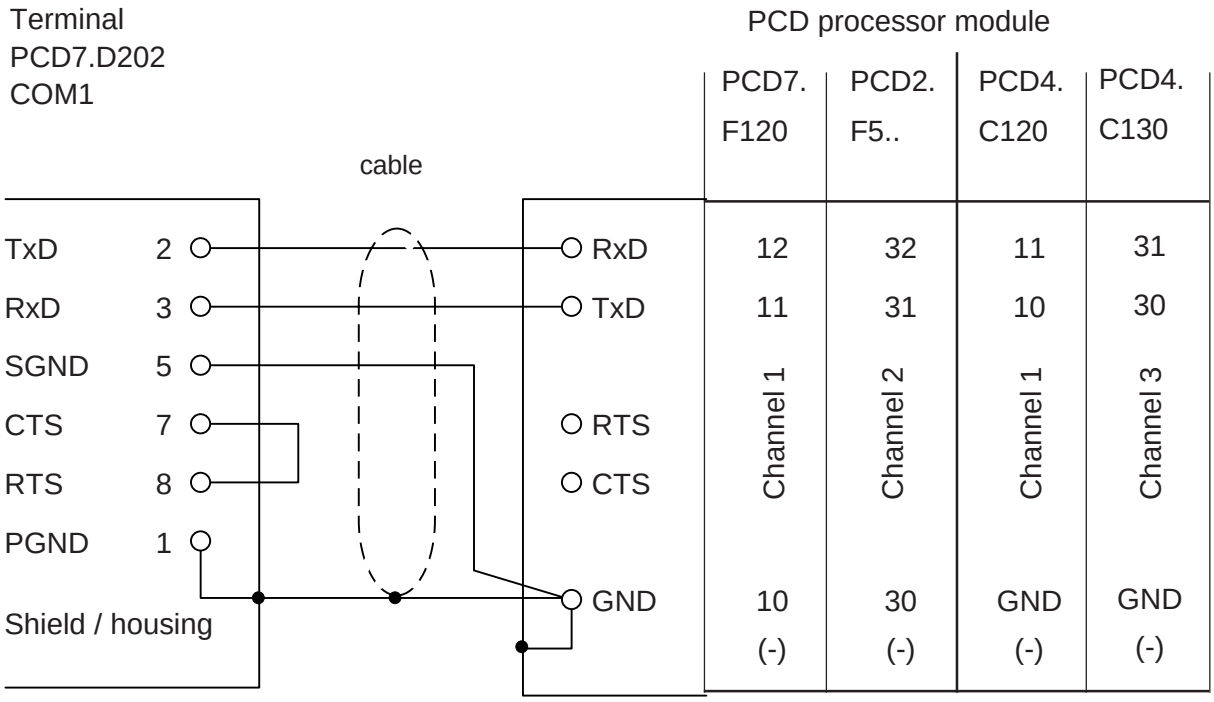
- At the terminal, RTS must be connected with CTS.
- Up to 9600 Baud it is possible to work under PCD communications mode MC0.
- If communication is at 19,200 Baud, handshaking with XON/XOFF is required (PCD communications mode MC2).

a) D202 terminal to PGU connector of PCD



PCD7.K412 cable can be used for this connection (see chapter 10).

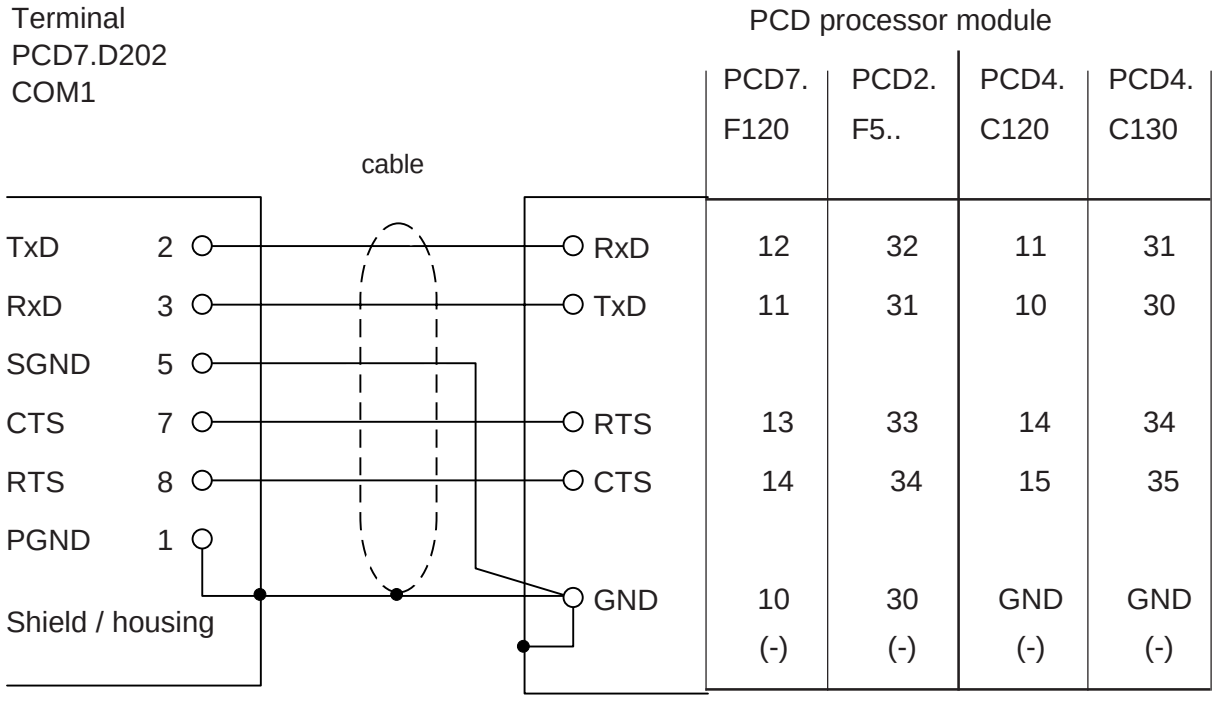
b) D202 terminal to PCD processors, channels 1 to 3



PCD7.K422 cable can be used for this connection (see chapter 10).

4.3.2 With RTS/CTS handshaking

The corresponding PCD communications channel must be assigned with MC1 mode.



Notes :

5. Operation

5.1 Power-up tests

When the D202 starts up, this display is shown:

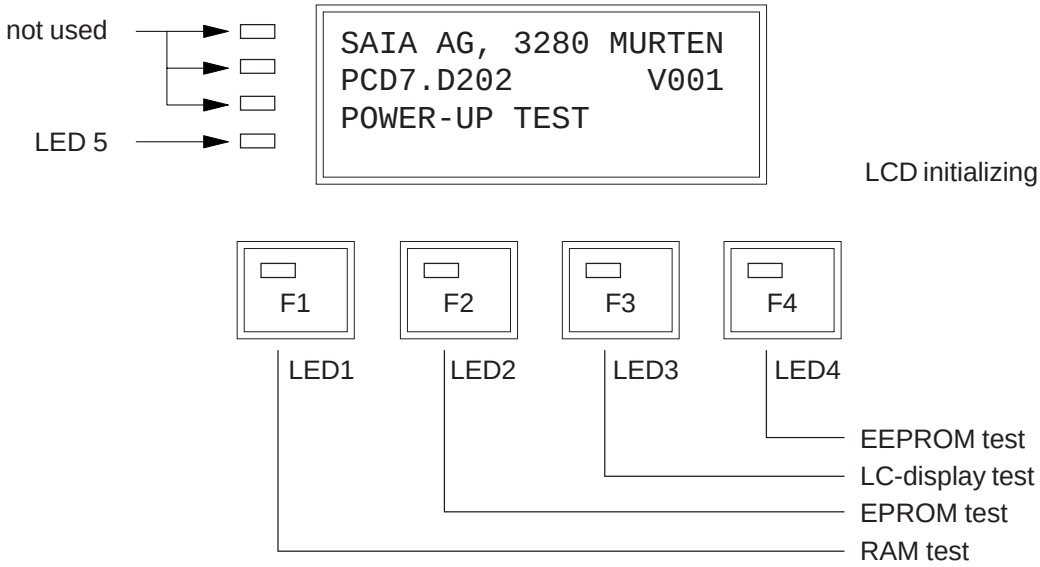
```
SAIA AG, 3280 MURTEN
PCD7.D202       V001
POWER-UP TEST
```

The power-up tests are executed, and the D202 is initialized. This takes about 3 seconds. The user program should not send commands to the D202 during this period, because they will be ignored. The user program can use the "poll D202" command, described in section 6.5, to determine when the D202 is ready to accept commands, or can simply delay for short period.

If any test fails, the D202 attempts to indicate the failure on the display and the D202's microprocessor is halted. The tests are automatically repeated after about 1.5 seconds, when the watchdog timer resets the D202.

At the start of each test a single LED is turned on.

Power-up test indication on LEDs

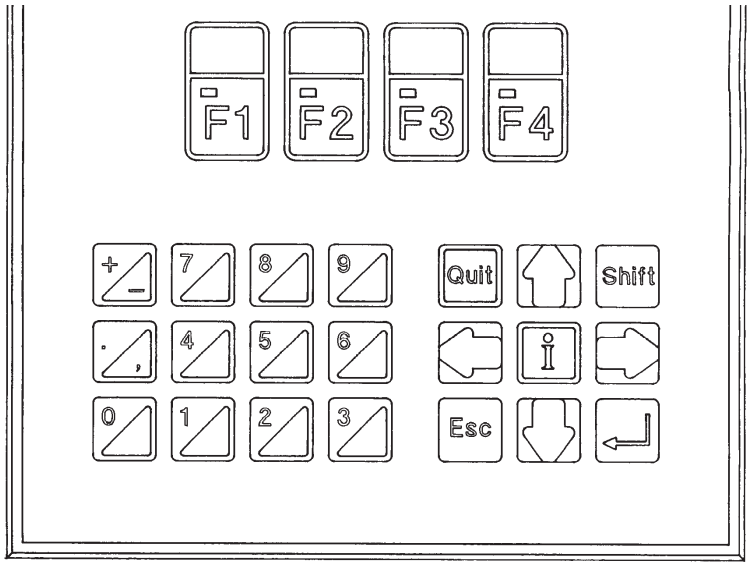


ALL LED ON = CPU Test

If all LEDs remain permanently lit, it means that the microprocessor cannot run or is faulty.

5.2 The keyboard

The D202 has a membrane keyboard which is compatible with the D100 terminal's keyboard.



Returned key codes are:

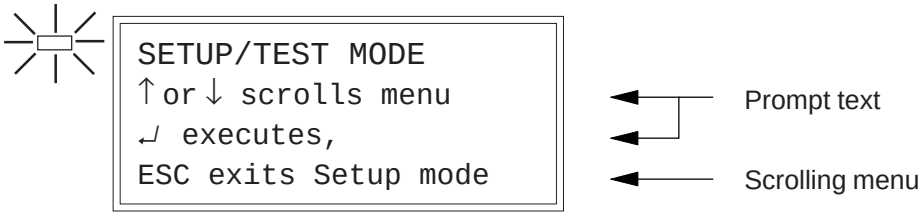
Key	Dec	Hex	ASCII	Notes
F1	65	41	'A'	
F2	66	42	'B'	
F3	67	43	'C'	
F4	68	44	'D'	
0	48	30	'0'	
1	49	31	'1'	
2	50	32	'2'	
3	51	33	'3'	
4	52	34	'4'	
5	53	35	'5'	
6	54	36	'6'	
7	55	37	'7'	
8	56	38	'8'	
9	57	39	'9'	
+	43	2B	'+'	
-	45	2D	'-'	Shift+'+'
.	46	2E	'.'	
,	44	2C	','	Shift+'.'

Key	Dec	Hex	ASCII		Notes
i	105	69	"i"	*	Information
Quit	113	71	'q'	*	Quit
Shift	-	-	-		No code returned
Esc	27	1B	ESC		Escape
↵	13	0D	CR		Carraiage return (enter)
↑	11	0B	VT		Up arrow
↓	5	05	ENQ		Down arrow
←	8	08	BS		Left arrow
→	6	06	ACK		Right arrow
Shift + F1	119	77	'w'		Shifted states of function keys
Shift + F2	120	78	'x'		
Shift + F3	121	79	'y'		
Shift + F4	122	7A	'z'		
Shift+0	97	61	'a'		Shifted states of numeric keys
Shift+1	98	62	'b'		
Shift+2	99	63	'c'		
Shift+3	100	64	'd'		
Shift+4	101	65	'e'		
Shift+5	102	66	'f'		
Shift+6	103	67	'g'		
Shift+7	104	68	'h'		
Shift+8	106	6A	'j'	*	
Shift+9	107	6B	'k'	*	
Shift+i	-	-	-		Enters "Setup/Test mode", no code is output.
Shift + Quit bis Shift + →					Same codes as without Shift

*) These four codes have changed from prov. Firmware version β1.0 to the def. version V001 (see appendix 1).

5.3 Setup/Test mode

This mode is entered by pressing **Shift+i** on the D202 keyboard. Setup/Test mode can be entered when the D202 on or off line, all data received from the host is ignored until the mode is exited.



Pressing the up or down arrow key steps through the Setup/Test mode menu:

Setup mode	Configures the D202
Default setup	Restores factory default setup
Demo display	Demonstration display
Hardware tests	Runs hardware tests continuously
Display test	Tests the LCD display
Keyboard test	Tests the keyboard
LED test	Tests the LEDs

Once the desired menu item is selected, pressing ↵ (carriage return) executes.

To exit Setup/Test mode, press **"Quit"** or **"Esc"**.

Note: If the host computer is sending data to the D202 when the operator enters Setup/Test mode, characters may be lost, which can cause the display to become corrupted on return to normal operation.

5.3.1 Setup mode

This displays and configures the setup data in the non-volatile EEPROM. The first screen shows a help text:

```
SETUP MODE
↑or↓ scrolls menu
←or→changes data
↵ accepts,ESC aborts
```

Pressing any key displays the first item in the menu:

```
SETUP MODE

Baudrate:
9600
```

Pressing the up or down arrow key steps through the menu of configurable items:

Baudrate	110, 150, 300, 600, 1200, 2400, 4800 [9600], 19200
Data bits	[8], 7
Parity	[Even], Odd, None, Low
Stop bits	[1], 2
Handshaking	[None], RTS/CTS, XON/XOFF
Echo key to display	[No], Yes
Page/scroll mode	[Page], Scroll
Auto line feed	[No], Yes
Key auto-repeat	[No], All keys, All keys 2 speed, Arrow keys, Arrow keys 2 speed.
Character set	[D100 compatible], English, French, German, Scandinavian
Backlight	[On], Off
Contrast	0... 15 [7]

[ ] Factory default settings are shown in square brackets. Each item is described in detail below.

Press the left or right arrow key to change the selected item's setting. For the baudrate example above, the left/right arrow keys step through the list of available baudrates (110..19200).

Once all settings are correct, press ↵ (carriage return) to store the data to the non-volatile EEPROM memory. To abort, discarding any changes, press **"Quit"** or **"Esc"**.

All features except the baudrate, data bits, parity, stop bits and handshaking can also be controlled from the host computer by sending an escape sequence to the D202. These are described in section 6.1.

Communication parameter (Baudrate, Data bits, Parity and Stop bits)

These settings define the communications protocol
1 Startbit
7 or 8 Data bits
1 Parity bit (or none)
1 or 2 Stop bits

If "High" parity is required, this can be simulated by setting the parity to "None" and using 2 stop bits. This is the same as high parity and one stop bit.

Handshaking [None]

"Handshaking" refers to the signalling between the host computer and the D202 which indicates when the unit is ready to receive and process data on the serial line. If data and commands are sent to the D202 faster than it can process them, it can use handshaking to prevent the host computer sending more data until it is ready for it. The host can also prevent the D202 sending key depressions until it is ready to process them.
Normally handshaking is not required because the D202 can process incoming data very fast and also has a 512 character receive buffer.

The high baudrate 19200 always requires a handshaking (either RTS/CTS or XON/XOFF).

RTS/CTS : This handshaking uses the RTS (Request To Send) and CTS (Clear To Send) lines for the handshaking. The host must not send data to the D202 when the CTS output from the D202 is false. The D202 will not send key depressions to the host if the CTS output from the host is false (key depressions are buffered until CTS goes true). RTS/CTS must be connected as shown in the second diagram in section 4.3 and the SAIA° PCD is assigned in mode MC1.

XON/XOFF : handshaking uses the XOFF (17 decimal, 11H) and XON (19 decimal, 13H) characters to disable (XOFF) and enable (XON) transmission. Pins 7 and 8 of the terminal plug must be connected together and SAIA° PCD is assigned in mode MC2.

Echo (Echo key to display) [No]

When a key is pressed in "Echo=Off" mode (the default), the ASCII code is transmitted directly to the host computer and is not displayed. The user program in the host computer must echo the character back to the D202 for it to be displayed. When a key is pressed in "Echo=Yes" mode, the character is automatically written to the display at the current cursor position, and it is also transmitted to the host.

Page/scroll mode [Page]

Page mode : The cursor moves from the last line to the first line when the D202 receives a line feed character. The display is not altered.

Scroll mode: If the cursor is on the last line when a line feed is received, then the display scrolls up one line and the cursor remains on the last line, which is now blank, in the same column. If the line feed was caused by a carriage return character, with "auto line feed" set to "Yes", then the cursor is also moved to the start of the line.

Auto line feed [No]

When the D202 receives a carriage return character (13 decimal, 0DH), it moves the cursor to the start of the current line. If "auto line feed" is set to "Yes", then the cursor also moves to the next line down automatically. If the cursor is on the last line, it moves to the first line or scrolls the display up one line according to the page/scroll mode. If auto line feed is "No", then a line feed character (10 decimal, 0AH) must be sent after the carriage return to achieve the same effect.

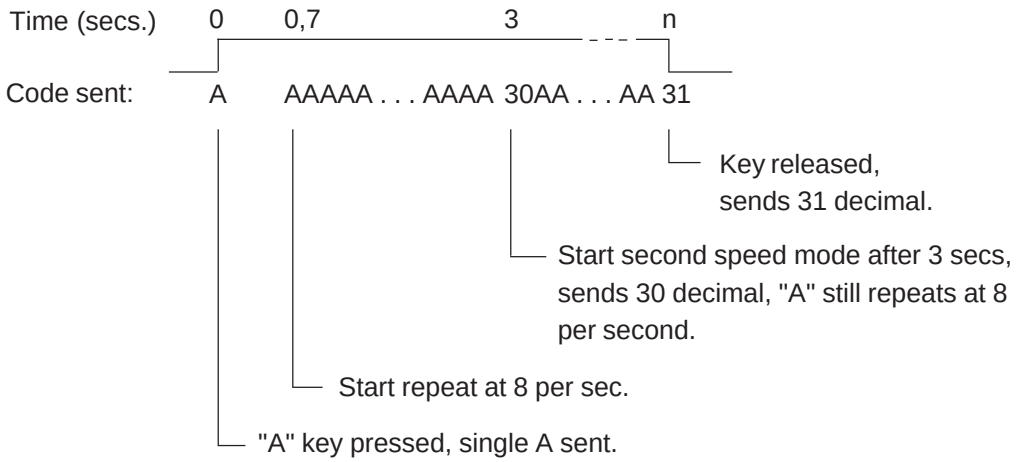
Key auto-repeat [No]

Keys can be made to repeat at a rate of 8 per second if the key is held depressed for more than 0.7 seconds. The auto-repeat feature has these settings:

No	No keys repeat (default)
All keys	All keys repeat
All keys "2 speed"	All keys repeat, with 2-speed signalling, see below
Arrow keys	Only the arrow keys repeat
Arrow keys "2 speed"	Only the arrow keys repeat, with 2 speed signalling, see below

"2 speed" signalling mode is for use by host programms that have stepping up/down controls, which are stepped by pressing up/down keys. With auto-repeat on, key codes are sent at a rate of 8 per second if the key is held down for 0.7 sec. The same occurs with the 2 speed feature, but after holding the key down for 3 seconds a special "start second speed" character (30 decimal) is sent to the host to indicate 2 speed mode, followed by more repeated key codes at the same 8-per-second rate. When the key is released an "end 2 speed" character (31 decimal) is sent to indicate that the key has been released.
When the host's program receives the up/down key code, it should increment/decrement the associated value. If the host receives a "start second speed" character it should step the value by two (or more) and also for each additional up/down key code received and stop when the "end 2 speed" character is received (or any character which is not the same repeated up/down key code).

For example, if "A" is pressed, with "All keys, 2 speed" auto-repeat, this is the sequence of events:



Character set [D100]

Five character sets are available. Each character set has the same characters for those with codes 32 to 127 decimal (20H to 7FH), but extended ASCII characters with codes 128 to 255 decimal (80H to FFH) are selected according to the character set. (see section 7).

Backlight [On]

The display's LED backlight can be turned off if required. The backlight is normally always on, and is required to make the text visible. The backlight is usually only turned off and on (blinked) to provide a visual indication of an alarm etc. using escape sequences sent by the host computer.

Contrast [7]

The contrast of the LCD display (it's blackness) can be adjusted in 16 steps by selecting a value between 0 and 15. 0 is the lightest, 15 is the darkest.

5.3.2 Default setup

This restores the factory default setup, and writes it into the non-volatile EEPROM. The factory default settings are as follows:

Baudrate	9600
Data bits	8
Parity	Even
Stop bits	1
Echo key to display	No
Handshaking	None
Page/scroll mode	Page
Auto line feed	No
Key auto-repeat	No
Character set	D100 compatible
Backlight	On
Contrast	7 (medium)

5.3.3 Demo display

This is for use when showing the D202 at an exhibition, when it is not connected to a host computer. The display shows some information about the unit. **Press Shift+F4 to exit**.

```
 -=< PCD7.D202 >=-
INDUSTRIAL TERMINAL
      SAIA AG
  CH-3280 MURTEN
```

5.3.4 Hardware tests

This runs the power-up tests in a continuous loop, which can be used for detecting intermittent faults when the D202 is in the field. The tests run until an error occurs, which displays a text and the D202 is reset by the watchdog timer and the tests are repeated. The only way to exit the tests is to **power the D202 off and on.**

5.3.5 Display test

This is a comprehensive test of the LCD display, the character set and the LCD controller's internal RAM. **Press any key** to exit.

5.3.6 Keyboard test

This displays a "map" of the keyboard, with a digit for each key. If the key is not pressed, the digit will be "0", when the key is pressed the digit should be "1". It also shows the character assigned to the last key which was pressed, enclosed in square brackets, e.g. [Q], [ESC]

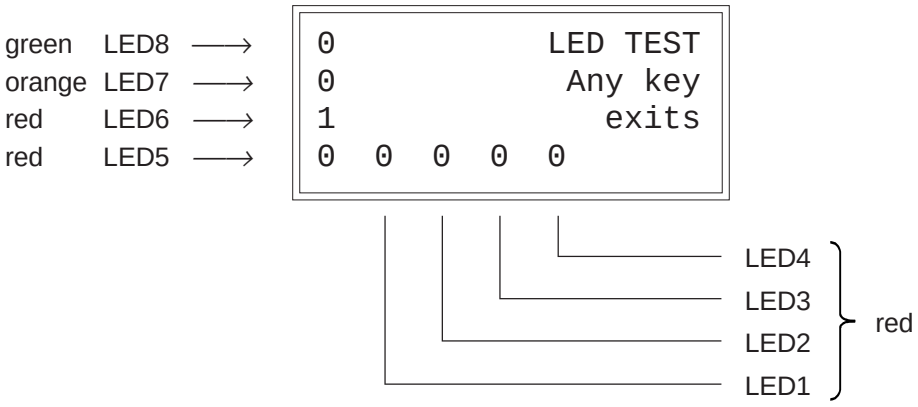
The map is organized in the same layout at the D202 keyboard:

```
0000 [ESC]  KEYBOARD
0000 000    TEST
0000 000    Shift+F4
0000 100    exits
```

Press Shift+F4 to exit the keyboard test.

5.3.7 LED test

Each LED in sequence is turned on for 500mS, and the display shows a '1' for the LED which should be on:



Press any key to end the test and return to Setup/Test mode.

6. Commands

Single control characters or two, three or four character "escape sequences" are transmitted to the D202 using the PCD's STXT (send text) or STXD (transmit character) instructions.

Note: Some escape sequences use the '@' character. If using a SAIA° PCD port running in MODE C, the PCD interprets an '@' character as the start of an indirect addressing control string. So when using MODE C, enter each '@' character as '@@', so the PCD intreprets it as a single '@' character.

6.1 Configuration (by the serial interface)

The configuration of the D202 can be modified by sending a series of special commands. The configuration remains active until the D202 is powered off and on, whereupon the configuration defined from "setup mode" is restored.
All required commands can be included in a single PCD Text and transmitted to the D202 in one go.

Echo key to display

See section 5.3.1 for details.

Command	ASCII	Decimal	Hex
Echo off	ESC @ 0	27 64 48	1B 40 30
Echo on	ESC @ 1	27 64 49	1B 40 31

Page and scroll mode

See section 5.3.1 for details.

Command	ASCII	Decimal	Hex
Scroll mode	ESC @ 4	27 64 52	1B 40 34
Page mode	ESC @ 5	27 64 53	1B 40 35

Auto line feed after carriage return

See section 5.3.1 for details.

Command	ASCII	Decimal	Hex
Auto line feed on	ESC @ 2	27 64 50	1B 40 32
Auto line feed off	ESC @ 3	27 64 51	1B 40 33

Key auto-repeat

See section 5.3.1 for details.

Command	ASCII	Decimal	Hex
Auto-repeat off	ESC A	27 65	1B 41
Auto-repeat on:			
• all keys	ESC B	27 66	1B 42
• arrow keys only	ESC C	27 67	1B 43
• all keys, "2 speed"	ESC D	27 68	1B 44
• arrow keys, "2 speed"	ESC E	27 69	1B 45

Character set

Five character sets are available, as described in section 7.

Command	ASCII	Decimal	Hex
D100 compatible	ESC @ F	27 64 70	1B 40 46
English	ESC @ 6	27 64 54	1B 40 36
French	ESC @ 7	27 64 55	1B 40 37
German	ESC @ 8	27 64 56	1B 40 38
Scandinavian	ESC @ E	27 64 69	1B 40 45

Backlight and contrast see part 6.3

6.2 Cursor control

Cursor up/down/left/right

The cursor can be moved one place up, down, left or right with a single-character command. These commands work in the same way for both scroll and page modes. If the cursor is moved off the display, it wraps around automatically. For example if the cursor is on the first line, a "cursor up" command moves it to the same column of the last line. If the cursor is on the last column, a "cursor right" command moves it to the start of the same line.

Command	ASCII	Decimal	Hex
Cursor up	CTRL+K	11	0B
Cursor down	CTRL+E	5	05
Cursor left	CTRL+H	8	08
Cursor right	CTRL+F	6	06

Cursor positioning

Apart from the cursor address code (16 dec. or 10H), this function also requires X and Y addresses to position the cursor. Add an offset of 32 dec. or 20H to both addresses. If either of the addresses is incorrect, the cursor is not moved.

Example (sequence: 16 dec., Code X, Code Y) :

Cursor position	Decimal command	Hex command
Column 1, Line 1	16 32 32	10 20 20
Column 4, Line 2	16 35 33	10 23 21
Column 16, Line 4	16 47 35	10 2F 23

Y Code / X Code		<32>	<33>	<34>	<35>	<36>	<37>	<38>	<39>	<40>	<41>	<42>	<43>	<44>	<45>	<46>	<47>	<48>	<49>	<50>	<51>
<32>	1	x																			
<33>	2	1	2	3	4 x	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<34>	3																				
<35>	4																x				

Note: To place the cursor in x-pos. 36 (equal ASCII $), please enter in each PCD text <36><36>.

```
Example: TEXT xxxx  "... 16 36 36 34 ..."
                              x-pos y-pos
```

Cursor home

This single-character command moves the cursor to the first column of the first line.

Command	ASCII	Decimal	Hex
Cursor home	CTRL+Z	26	1A

Cursor on/off

These two-character commands turn the cursor on and off.

Command	ASCII	Decimal	Hex
Cursor on	ESC W	27 87	1B 57
Cursor off	ESC T	27 84	1B 54

Line feed

Line feed moves the cursor down one line. If the cursor was on the last line, this scrolls the display if in scroll mode, or the cursor moves to the first line if in page mode. The column position is not changed.

Command	ASCII	Decimal	Hex
Line feed	LF	10	0A

Carriage return

Carriage return moves the cursor to the start of the current line. If "auto line feed after carriage return" is selected, a line feed is also done as described above.

Command	ASCII	Decimal	Hex
Carriage return	CR	13	0D

Delete character

Delete removes the character to the left of the cursor (changes it to a space), and moves the cursor left one place. If at the start of a line, the cursor is moved to the end of the preceding line. Delete stops at the home position.

Command	ASCII	Decimal	Hex
Delete (backspace)	DEL	127	7F

6.3 Display control

Clear display

Clear display sets all the characters on the display to spaces, and moves the cursor to the home position.

Command	ASCII	Decimal	Hex
Clear display	CTRL+L	12	0C

Save display/Restore display

These commands save and restore the contents of the display and the cursor position and state (visible/not visible). Ten save/restore areas are provided, numbered 0 to 9. Restoring from a display area that was not previously saved will produce unexpected results.

Command	ASCII	Decimal	Hex
Save display 'n'	ESC @ S n	27 64 83 n	1B 40 53 n
Restore display 'n'	ESC @ R n	27 64 82 n	1B 40 52 n

Where 'n' is '0'..'9' (48..57 decimal, 30H..39H)

Backlight off/on

The display's LED backlight can be turned off if required. The backlight is normally always on, and is required to make the text visible. The backlight can be turned off and on (blinked) to provide a visual indication of an alarm etc.

Command	ASCII	Decimal	Hex
Backlight off	ESC O	27 79	1B 4F
Backlight on	ESC L	27 76	1B 4C

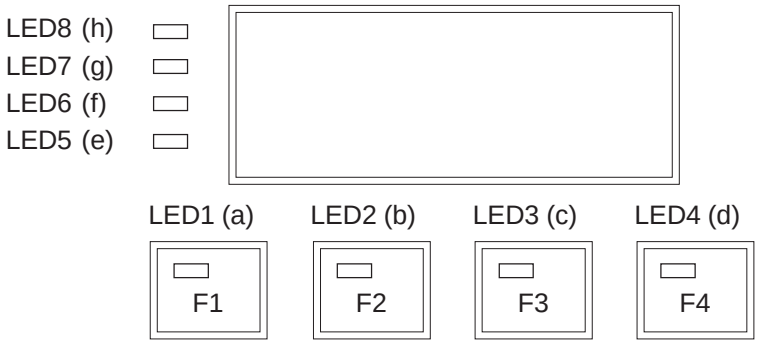
Display contrast

The contrast of the LCD display (it's blackness) can be adjusted by sending a hex contrast value between 0 and F, where 0 is lightest and F is darkest.

Command	ASCII	Decimal	Hex
High contrast	ESC @ D 0	27 64 68 48	1B 40 44 30
Medium contrast	ESC @ D 7	27 64 68 55	1B 40 44 37
Low contrast	ESC @ D F	27 64 68 70	1B 40 44 46

6.4 LED control

The D202 has 8 LEDs, numbered 1 to 8, which can be used as general-purpose indicators. Each can be turned on and off by a four character escape sequence. A lower case letter 'a' to 'h' is used to select LED 1 to 8 ('a'= LED 1, 'h'= LED 8). To turn on the LED use '1', to turn it off use '0'.



Command	ASCII	Decimal	Hex
Turn on LED 1	ESC @ a 1	27 64 97 49	1B 40 61 31
Turn off LED 1	ESC @ a 0	27 64 97 48	1B 40 61 30
Turn on LED 2	ESC @ b 1	27 64 98 49	1B 40 62 31
Turn off LED 2	ESC @ b 0	27 64 98 48	1B 40 62 30
Turn on LED 3	ESC @ c 1	27 64 99 49	1B 40 63 31
Turn off LED 3	ESC @ c 0	27 64 99 48	1B 40 63 30
Turn on LED 4	ESC @ d 1	27 64 100 49	1B 40 64 31
Turn off LED 4	ESC @ d 0	27 64 100 48	1B 40 64 30
Turn on LED 5	ESC @ e 1	27 64 101 49	1B 40 65 31
Turn off LED 5	ESC @ e 0	27 64 101 48	1B 40 65 30
Turn on LED 6	ESC @ f 1	27 64 102 49	1B 40 66 31
Turn off LED 6	ESC @ f 0	27 64 102 48	1B 40 66 30
Turn on LED 7	ESC @ g 1	27 64 103 49	1B 40 67 31
Turn off LED 7	ESC @ g 0	27 64 103 48	1B 40 67 30
Turn on LED 8	ESC @ h 1	27 64 104 49	1B 40 68 31
Turn off LED 8	ESC @ h 0	27 64 104 48	1B 40 68 30

LED colours:	LED 1 to 6	red
	LED 7	orange
	LED 8	green

6.5 Miscellaneous commands

Lock keyboard/Unlock keyboard

These commands enable or disable the keyboard. When locked, all key depressions are ignored.

Command	ASCII	Decimal	Hex
Lock keyboard	ESC N	27 78	1B 4E
Unlock keyboard	ESC Q	27 81	1B 51

Restart warm/ Restart cold

"Restart warm" resets the D202 and restores the customer setup. It is the same as a power-up reset.
"Restart cold" initializes the setup to the factory defaults listed in section 5.3.2.

Command	ASCII	Decimal	Hex
Restart warm	ESC H	27 72	1B 48
Restart cold	ESC @ G	27 64 71	1B 40 47

Disable and Enable Setup/Test mode

Once the D202 has been configured, you may want to prevent unautorized users changing the setup. This can be done with the escape sequence below, which disables or enables the Shift+i key combination. If desabled, Shift+i is also restored by powering the D202 off and on, or by sending a "Restart" command.

Command	ASCII	Decimal	Hex
Disable Setup/Test	ESC @ H	27 64 72	1B 40 48
Enable Setup/Test	ESC @ I	27 64 73	1B 40 49

Demonstration display and hardware tests

These commands execute the tests described in sections 5.3.3 to 5.3.7. The "poll D202" command can be used determine when test has been completed.

Command	ASCII	Decimal	Hex
Demonstration display	ESC J	27 74	1B 4A
Display test	ESC @ A	27 64 65	1B 40 41
Keyboard test	ESC @ 9	27 64 57	1B 40 39
LED test	ESC @ L	27 64 76	1B 40 4C
Hardware tests	ESC @ C	27 64 67	1B 40 43

Poll

To determine if the D202 is connected and is ready to receive commands, the "poll" message can be sent. If the D202 is ready, it returns an "**SOH**" response character (1 decimal, 01H). If not ready there will be no response. This is typically used to determine when the D202 has finished its power-up tests.
The poll command is the only command which has a response. It can also be used to check that the D202 is still operational. If it fails, the user program could take the necessary action to alert the operator that the D202 terminal is not responding.

Command	ASCII	Decimal	Hex
Poll	ESC @ B	27 64 66	1B 40 42

6.6 Command Summary

Command	ASCII	Decimal	Hex
Configuration:			
Echo off	ESC @ 0	27 64 48	1B 40 30
Echo on	ESC @ 1	27 64 49	1B 40 31
Auto line feed on	ESC @ 2	27 64 50	1B 40 32
Auto line feed off	ESC @ 3	27 64 51	1B 40 33
Scroll mode	ESC @ 4	27 64 52	1B 40 34
Page mode	ESC @ 5	27 64 53	1B 40 35
D100 character set	ESC @ F	27 64 70	1B 40 46
English	ESC @ 6	27 64 54	1B 40 36
French	ESC @ 7	27 64 55	1B 40 37
German	ESC @ 8	27 64 56	1B 40 38
Scandinavian	ESC @ E	27 64 69	1B 40 45

Note: To output the character "@", please enter in each PCD text "@@" !

Command	ASCII	Decimal	Hex
Auto-repeat off	ESC A	27 65	1B 41
Auto-repeat on:			
• all keys	ESC B	27 66	1B 42
• arrow keys only	ESC C	27 67	1B 43
• all keys, "2 speed"	ESC D	27 68	1B 44
• arrow keys, "2 speed"	ESC E	27 69	1B 45
Cursor control:			
Cursor up	CTRL+K	11	0B
Cursor down	CTRL+E	5	05
Cursor left	CTRL+H	8	08
Cursor right	CTRL+F	6	06
Cursor home	CTRL+Z	26	1A
Cursor on	ESC W	27 87	1B 57
Cursor off	ESC T	27 84	1B 54
Line feed	LF	10	0A
Carriage return	CR	13	0D
Delete (backspace)	DEL	127	7F
Cursor positioning	ASCII	CTRL+P ' '+X	' '+Y
	Decimal	16 32+X 32+Y	
	Hex	10 20+X 20+Y	
Display control:			
Clear display	CTRL+L	12	0C
Save display 'n'	ESC @ S n	27 64 83 n	1B 40 53 n
Restore display 'n'	ESC @ R n	27 64 82 n	1B 40 52 n
Backlight off	ESC O	27 79	1B 4F
Backlight on	ESC L	27 76	1B 4C
Low contrast	ESC @ D 0	27 64 68 48	1B 40 44 30
Medium contrast	ESC @ D 7	27 64 68 55	1B 40 44 37
High contrast	ESC @ D F	27 64 68 70	1B 40 44 46
LED control:			
Turn on LED 1	ESC @ a 1	27 64 97 49	1B 40 61 31
Turn off LED 1	ESC @ a 0	27 64 97 48	1B 40 61 30
(for other LEDs: 'b'=2, 'c'=3, 'd'=4, 'e'=5, 'f'=6, 'g'=7, 'h'=8)			

Note: To output the character "@", please enter in each PCD text "@@" !

Command	ASCII	Decimal	Hex
Miscellaneous commands:			
Lock keyboard	ESC N	27 78	1B 4E
Unlock keyboard	ESC Q	27 81	1B 51
Restart warm	ESC H	27 72	1B 48
Restart cold	ESC @ G	27 64 71	1B 40 47
Disable Setup/Test	ESC @ H	27 64 72	1B 40 48
Enable Setup/Test	ESC @ I	27 64 73	1B 40 49
Demonstration display	ESC J	27 74	1B 4A
Display test	ESC @ A	27 64 65	1B 40 41
Keyboard test	ESC @ 9	27 64 57	1B 40 39
LED test	ESC @ L	27 64 76	1B 40 4C
Hardware tests	ESC @ C	27 64 67	1B 40 43
Poll (D202 responds with SOH)	ESC @ B	27 64 66	1B 40 42

Note: To output the character "@", please enter in each PCD text "@@" !

7. Character sets

The character set determines which special characters are displayed. The D202 has eight programmable characters which are programmed according to the selected character set.

7.1 First ASCII-table (32...127 dec)

The characters 20..7F hex (32..127 decimal) are the same for all character sets:

Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
32	20	SP	48	30	0	64	40	@	80	50	P	96	60	`	112	70	p
33	21	!	49	31	1	65	41	A	81	51	Q	97	61	a	113	71	q
34	22	"	50	32	2	66	42	B	82	52	R	98	62	b	114	72	r
35	23	#	51	33	3	67	43	C	83	53	S	99	63	c	115	73	s
36	24	$	52	34	4	68	44	D	84	54	T	100	64	d	116	74	t
37	25	%	53	35	5	69	45	E	85	55	U	101	65	e	117	75	u
38	26	&	54	36	6	70	46	F	86	56	V	102	66	f	118	76	v
39	27	'	55	37	7	71	47	G	87	57	W	103	67	g	119	77	w
40	28	(	56	38	8	72	48	H	88	58	X	104	68	h	120	78	x
41	29	)	57	39	9	73	49	I	89	59	Y	105	69	i	121	79	y
42	2A	*	58	3A	:	74	4A	J	90	5A	Z	106	6A	j	122	7A	z
43	2B	+	59	3B	;	75	4B	K	91	5B	[	107	6B	k	123	7B	{
44	2C	,	60	3C	<	76	4C	L	92	5C	\	108	6C	l	124	7C	|
45	2D	-	61	3D	=	77	4D	M	93	5D	]	109	6D	m	125	7D	}
46	2E	.	62	3E	>	78	4E	N	94	5E	^	110	6E	n	126	7E	→
47	2F	/	63	3F	?	79	4F	O	95	5F	_	111	6F	o	127	7F	DEL

7.2 Extended ASCII-table (128...255 dec)

Extended ASCII characters 128..255 decimal (80..FF hex) are slightly different, depending on the selected character set. IBM extended ASCII character codes have been used (except for the "D100 compatible" character set). This allows the characters to be entered directly into TEXTs in the PCD's user program, using a PC-based ASCII text editor such as EDIT or IBM's Personal Editor (PE).
In the following diagrams, ASCII characters which are left blank display as a space.

Note:	The displayed character shapes in the extended ASCII characters may not be exactly as shown due to differences between the D202 and IBM PC character shapes.

7.2.1 D100 compatible

This is the same as the original D100 character set.

Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
128	80		144	90		160	A0		176	B0	
129	81		145	91		161	A1	□	177	B1	
130	82		146	92		162	A2		178	B2	
131	83		147	93		163	A3		179	B3	
132	84		148	94		164	A4		180	B4	
133	85		149	95		165	A5		181	B5	
134	86		150	96		166	A6		182	B6	
135	87		151	97		167	A7		183	B7	
136	88		152	98		168	A8		184	B8	
137	89		153	99		169	A9		185	B9	
138	8A		154	9A		170	AA		186	BA	
139	8B		155	9B		171	AB		187	BB	
140	8C		156	9C		172	AC		188	BC	
141	8D		157	9D		173	AD		189	BD	
142	8E		158	9E		174	AE	∑	190	BE	
143	8F		159	9F		175	AF		191	BF	

Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
192	C0		208	D0		224	E0	α	240	F0	
193	C1		209	D1		225	E1	ä	241	F1	
194	C2		210	D2		226	E2	ß	242	F2	
195	C3		211	D3		227	E3		243	F3	
196	C4	Ä	212	D4		228	E4	ä	244	F4	Ω
197	C5	Å	213	D5		229	E5	å	245	F5	
198	C6	Æ	214	D6	Ö	230	E6	æ	246	F6	ö
199	C7		215	D7		231	E7		247	F7	π
200	C8		216	D8	Ø	232	E8		248	F8	Ø
201	C9		217	D9		233	E9		249	F9	
202	CA		218	DA		234	EA		250	FA	
203	CB		219	DB	□	235	EB	x	251	FB	
204	CC		220	DC	Ü	236	EC	Φ	252	FC	ü
205	CD		221	DD		237	ED		253	FD	
206	CE		222	DE		238	EE		254	FE	
207	CF		223	DF	□	239	EF	Ö	255	FF	■

7.2.2 English

The English character set has a '£' sign and additional box drawing characters: ┌ ┐ └ ┘ │ ─ ┬ ┴

Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
128	80		144	90		160	A0		176	B0	
129	81	ü	145	91		161	A1		177	B1	
130	82		146	92		162	A2		178	B2	
131	83		147	93		163	A3		179	B3	│
132	84	ä	148	94	ö	164	A4	ñ	180	B4	
133	85		149	95		165	A5		181	B5	
134	86		150	96		166	A6		182	B6	
135	87		151	97		167	A7		183	B7	
136	88		152	98		168	A8		184	B8	
137	89		153	99		169	A9	←	185	B9	
138	8A		154	9A		170	AA	→	186	BA	
139	8B		155	9B	¢	171	AB		187	BB	
140	8C		156	9C	£	172	AC		188	BC	
141	8D		157	9D	¥	173	AD		189	BD	
142	8E		158	9E		174	AE		190	BE	
143	8F		159	9F		175	AF		191	BF	┐

Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
192	C0	└	208	D0		224	E0	α	240	F0	
193	C1	┴	209	D1		225	E1	ß	241	F1	
194	C2	┬	210	D2		226	E2	Γ	242	F2	
195	C3		211	D3		227	E3	π	243	F3	
196	C4	─	212	D4		228	E4	Σ	244	F4	
197	C5		213	D5		229	E5	σ	245	F5	
198	C6		214	D6		230	E6	µ	246	F6	÷
199	C7		215	D7		231	E7		247	F7	
200	C8		216	D8		232	E8		248	F8	°
201	C9		217	D9	┘	233	E9	θ	249	F9	•
202	CA		218	DA	┌	234	EA	Ω	250	FA	
203	CB		219	DB	▉	235	EB		251	FB	√
204	CC		220	DC		236	EC	∞	252	FC	
205	CD		221	DD		237	ED		253	FD	
206	CE		222	DE		238	EE	∈	254	FE	■
207	CF		223	DF		239	EF		255	FF	

7.2.3 French

The French character set includes: é â à ê è î ô ù

Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
128	80		144	90		160	A0		176	B0	
129	81	ü	145	91		161	A1		177	B1	
130	82	é	146	92		162	A2		178	B2	
131	83	â	147	93	ô	163	A3		179	B3	
132	84	ä	148	94	ö	164	A4	ñ	180	B4	
133	85	à	149	95		165	A5		181	B5	
134	86		150	96		166	A6		182	B6	
135	87		151	97	ù	167	A7		183	B7	
136	88	ê	152	98		168	A8		184	B8	
137	89		153	99		169	A9	←	185	B9	
138	8A	è	154	9A		170	AA	→	186	BA	
139	8B		155	9B	¢	171	AB		187	BB	
140	8C	î	156	9C		172	AC		188	BC	
141	8D		157	9D	¥	173	AD		189	BD	
142	8E		158	9E		174	AE		190	BE	
143	8F		159	9F		175	AF		191	BF	

Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
192	C0		208	D0		224	E0	α	240	F0	
193	C1		209	D1		225	E1	ß	241	F1	
194	C2		210	D2		226	E2	Γ	242	F2	
195	C3		211	D3		227	E3	π	243	F3	
196	C4	–	212	D4		228	E4	Σ	244	F4	
197	C5		213	D5		229	E5	σ	245	F5	
198	C6		214	D6		230	E6	µ	246	F6	÷
199	C7		215	D7		231	E7		247	F7	
200	C8		216	D8		232	E8		248	F8	°
201	C9		217	D9		233	E9	θ	249	F9	•
202	CA		218	DA		234	EA	Ω	250	FA	
203	CB		219	DB	▉	235	EB		251	FB	√
204	CC		220	DC		236	EC	∞	252	FC	
205	CD		221	DD		237	ED		253	FD	
206	CE		222	DE		238	EE	∈	254	FE	■
207	CF		223	DF		239	EF		255	FF	

7.2.4 German

The German character set includes: ä ö ü Ä Ö Ü "(opening) and " (closing)

Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
128	80		144	90		160	A0		176	B0	
129	81	ü	145	91		161	A1		177	B1	
130	82		146	92		162	A2		178	B2	
131	83		147	93		163	A3		179	B3	
132	84	ä	148	94	ö	164	A4	ñ	180	B4	
133	85		149	95		165	A5		181	B5	
134	86		150	96		166	A6		182	B6	
135	87		151	97		167	A7		183	B7	
136	88		152	98		168	A8		184	B8	
137	89		153	99	Ö	169	A9	←	185	B9	
138	8A		154	9A	Ü	170	AA	→	186	BA	
139	8B		155	9B	¢	171	AB		187	BB	
140	8C		156	9C		172	AC		188	BC	
141	8D		157	9D	¥	173	AD		189	BD	
142	8E	Ä	158	9E		174	AE	"	190	BE	
143	8F		159	9F		175	AF	"	191	BF	

Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
192	C0		208	D0		224	E0	α	240	F0	
193	C1		209	D1		225	E1	ß	241	F1	
194	C2		210	D2		226	E2	Γ	242	F2	
195	C3		211	D3		227	E3	π	243	F3	
196	C4	–	212	D4		228	E4	Σ	244	F4	
197	C5		213	D5		229	E5	σ	245	F5	
198	C6		214	D6		230	E6	µ	246	F6	÷
199	C7		215	D7		231	E7		247	F7	
200	C8		216	D8		232	E8		248	F8	°
201	C9		217	D9		233	E9	θ	249	F9	•
202	CA		218	DA		234	EA	Ω	250	FA	
203	CB		219	DB	▉	235	EB		251	FB	√
204	CC		220	DC		236	EC	∞	252	FC	
205	CD		221	DD		237	ED		253	FD	
206	CE		222	DE		238	EE	∈	254	FE	■
207	CF		223	DF		239	EF		255	FF	

7.2.5 Scandinavian

The Scandinavian character set includes: å Ä Å æ Æ Ö Ü ¢

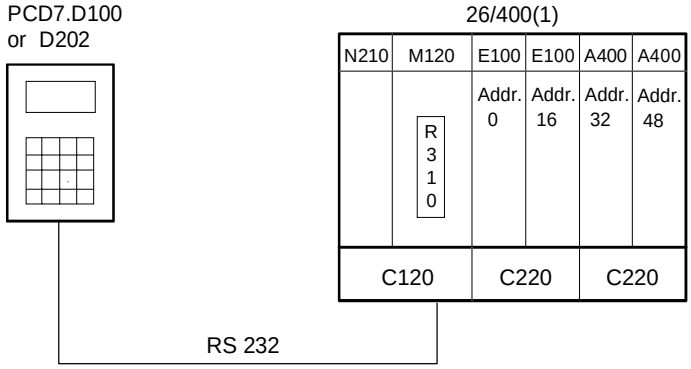
Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
128	80		144	90		160	A0		176	B0	
129	81	ü	145	91	æ	161	A1		177	B1	
130	82		146	92	Æ	162	A2		178	B2	
131	83		147	93		163	A3		179	B3	
132	84	ä	148	94	ö	164	A4	ñ	180	B4	
133	85		149	95		165	A5		181	B5	
134	86	å	150	96		166	A6		182	B6	
135	87		151	97		167	A7		183	B7	
136	88		152	98		168	A8		184	B8	
137	89		153	99	Ö	169	A9	←	185	B9	
138	8A		154	9A	Ü	170	AA	→	186	BA	
139	8B		155	9B	¢	171	AB		187	BB	
140	8C		156	9C		172	AC		188	BC	
141	8D		157	9D	¥	173	AD		189	BD	
142	8E	Ä	158	9E		174	AE		190	BE	
143	8F	Å	159	9F		175	AF		191	BF	

Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC	Dec	Hex	ASC
192	C0		208	D0		224	E0	α	240	F0	
193	C1		209	D1		225	E1	ß	241	F1	
194	C2		210	D2		226	E2	Γ	242	F2	
195	C3		211	D3		227	E3	π	243	F3	
196	C4	–	212	D4		228	E4	Σ	244	F4	
197	C5		213	D5		229	E5	σ	245	F5	
198	C6		214	D6		230	E6	µ	246	F6	÷
199	C7		215	D7		231	E7		247	F7	
200	C8		216	D8		232	E8		248	F8	°
201	C9		217	D9		233	E9	θ	249	F9	•
202	CA		218	DA		234	EA	Ω	250	FA	
203	CB		219	DB	▉	235	EB		251	FB	√
204	CC		220	DC		236	EC	∞	252	FC	
205	CD		221	DD		237	ED		253	FD	
206	CE		222	DE		238	EE	∈	254	FE	■
207	CF		223	DF		239	EF		255	FF	

8. User program examples for the PCD

8.1 Hardware configuration

The following examples are based on the hardware of the PCD4 workshop model 26/400 or 26/401.



Serial channel 1	:	RS232
Cable	:	wired for mode MC0 (without RTS/CTS)
D100-Setup (DIL-Switches)	:	according to the factory setting
D202-Setup (EPROM)	:	"Default Setup" -configuration (see part 5.3)

8.2 Single text transmission

When the switch connected to input 0 is switched on a simple text is transmitted to the terminal.

8.2.1 The user program is structured in BLOCTEC.
8.2.2 The user program is structured in GRAFTEC.

8.3 Transmission of several texts

When the switches connected to input 0, 1 and 2 are switched on the following texts are transmitted to the terminal:

Input 0 : a simple text is displayed.
Input 1 : a text containing the state of the inputs 8 and 9 is displayed.
Input 2 : a text containing the state of the inputs 10 and 11 is displayed.

8.3.1 The user program is structured in BLOCTEC.
8.3.2 The user program is structured in GRAFTEC.

8.4 Recognition of a pressed key with a following action

When one of the function keys F1, F2 or F3 is pressed the following texts are transmitted.

Key F1 : a simple text is displayed
Key F2 : a text containing the state of the inputs 0 to 15 is displayed.
Key F3 : a text containing the the value of the BCD switches connected to the inputs 16... 31 is displayed.
Key F4 : a text containing the date, week and time is displayed.

By pressing the key F4 the date, week and time is transmitted only once to the terminal. If a value should be displayed cyclically (for instance to refresh the time) then the following points should be noted to get a stable display:

- Switch off the cursor
- Don't send the control code "12" (clear screen) at the beginning of the text.

8.4.1 The user program contains jumps.
8.4.2 The user program is structured in BLOCTEC.
8.4.3 The user program is structured in GRAFTEC.

8.5 Entering numerical parameters

Guided by a menu the contents of a register and counter should be modified by the terminal.

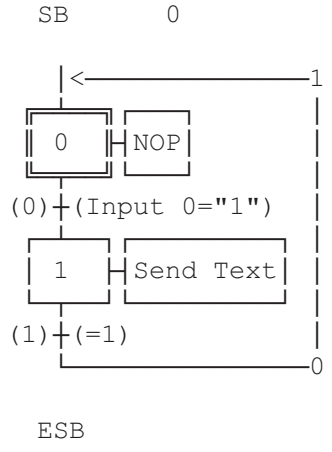
Conditions:
- The values for the register should be input in either positive or negative values using the form at with a fixed decimal point.
- The values for the counter may be input as positive only and without decimal point.

To realise that function the universal function block **INPUT** had been developed.
The complete description of that function block can be found attached to the listing of the demonstration program.

Note: The user software PCD for PCD7.D100 and ..D202 is fully upwards compatibel with one exception:
To key in a minus sign in the function block "INPUT" the D100 uses the key "F4" while D202 has the key "-"
(see page 8-30).

```
;╔═══════════════════════════════════════════════════════════════════╗
;║                                                                   ║
;║  User program example 8.2.1 for the industrial terminal PCD7.D1.. ║
;║  ================================================================ ║
;║  The program is structured in BLOCTEC                             ║
;║                                                                   ║
;║  File  :     DEMO21.SRC                                           ║
;║                                                                   ║
;║  Creation:   03.09.91        U.Jäggi                              ║
;║                                                                   ║
;╚═══════════════════════════════════════════════════════════════════╝


TEXT    1       "<12>"                          ; Clear display
                "<27><84>"                      ; Cursor off
                *#    INDUSTRIAL    #"
                "# CONTROL-TERMINAL #"
                "#    PCD7.D100     #"
                "####################"


TEXT    100     "UART:9600,8,E,1;MODE:MC0;DIAG:O32,R100"


        ;---------------
        ; Coldstart
        ;---------------
        XOB             16
        SASI            1               ; Assignation RS232 interface
                        100             ; Text 100
        EXOB
        ;---------------
        ; Mainprogram
        ;---------------
        COB             0
                        0
        STH     I       0
        DYN     F       0
        ANL     O       38              ; Text busy flag
        CPB     H       0               ; Send text
        ECOB


        PB              0               ; Send text
        STXT            1               ; Interface 1
                        1               ; Text 1
        EPB
```

```
;╔═══════════════════════════════════════════════════════════════════╗
;║                                                                   ║
;║  User program example 8.2.2 for the industrial terminal PCD7.D1.. ║
;║  ================================================================ ║
;║  The program is structured in GRAFTEC                             ║
;║                                                                   ║
;║  File  :     DEMO22.SRC                                           ║
;║                                                                   ║
;║  Creation:   03.09.91        U.Jäggi                              ║
;║                                                                   ║
;╚═══════════════════════════════════════════════════════════════════╝

TEXT    1       "<12>"                          ; Clear display
                "<27><84>"                      ; Cursor off
                "#    INDUSTRIAL    #"
                "# CONTROL-TERMINAL #"
                "#    PCD7.D100     #"
                "####################"

TEXT    100     "UART:9600,8,E,1;MODE:MC0;DIAG:O32,R100"

        ;---------------
        ; Coldstart
        ;---------------
        XOB             16
        SASI            1               ; Assignation RS232 interface
                        100             ; Text 100
        EXOB
        ;---------------
        ; Mainprogram
        ;---------------
        COB             0
                        0
        CSB             0
        ECOB
        ;---------------
```



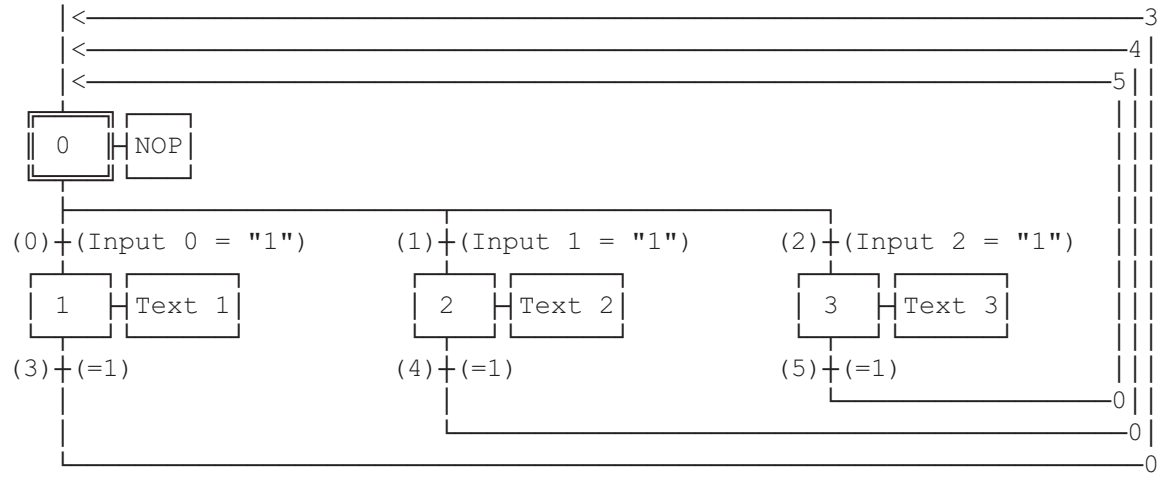
```
SB      0
;---------------
IST     0                       ;NOP
EST
;---------------
ST      1                       ;Send Text
STXT            1
                1
EST
;---------------
TR      0                       ;Input 0="1"
STH     I       0
DYN     F       0
ANL     O       38              ; Text busy
ETR
;---------------
TR      1                       ;=1
ETR
;---------------
ESB
```

```
;╔═══════════════════════════════════════════════════════════════════╗
;║                                                                   ║
;║  User program example 8.3.1 for the industrial terminal PCD7.D1.. ║
;║  ================================================================ ║
;║  The program is structured in BLOCTEC                             ║
;║                                                                   ║
;║  File  :     DEMO31.SRC                                           ║
;║                                                                   ║
;║  Creation:   03.09.91        U.Jäggi                              ║
;║                                                                   ║
;╚═══════════════════════════════════════════════════════════════════╝


TEXT    1       "<12>"                          ; Clear display
                "<27><84>"                      ; cursor off
                "Main menu  [I0]<10><13>"
                "Display status      "
                "Input 8,9   : [I1]  "
                "Input 10,11 : [I2]  "

TEXT    2       "<12>"
                "Status <10><13>"
                "Input  8 : $i0008<10><13>"
                "Input  9 : $i0009<10><13>"
                "Main menu  [I0]"

TEXT    3       "<12>"
                "Status <10><13>"
                "Input 10 : $i0010<10><13>"
                "Input 11 : $i0011<10><13>"
                "Main menu  [I0]"

TEXT    100     "UART:9600,8,E,1;MODE:MC0;DIAG:O32,R100"
```

```
;---------------
; Coldstart
;---------------
XOB             16
SASI            1               ; Assignation RS232 interface
                100             ; Text 100
EXOB
;---------------
; Mainprogram
;---------------
COB             0
                0
;---------------
STH     I       0
DYN     F       0
ANL     O       38              ; Text busy flag
CFB     H       0               ; Send text
                1               ; Text 1
;---------------
STH     I       1
DYN     F       1
ANL     O       38              ; Text busy flag
CFB     H       0               ; Send text
                2               ; Text 2
;---------------
STH     I       2
DYN     F       2
ANL     O       38              ; Text busy flag
CFB     H       0               ; Send text
                3               ; Text 3
ECOB


FB              0               ; Send text
STXT            1               ; Interface 1
        =       1               ; Textnumber
EFB
```

```
;╔═══════════════════════════════════════════════════════════════════╗
;║                                                                   ║
;║  User program example 8.3.2 for the industrial terminal PCD7.D1.. ║
;║  ================================================================ ║
;║  The program is structured in GRAFTEC                             ║
;║                                                                   ║
;║  File  :     DEMO32.SRC                                           ║
;║                                                                   ║
;║  Creation:   03.09.91        U.Jäggi                              ║
;║                                                                   ║
;╚═══════════════════════════════════════════════════════════════════╝


TEXT    1       "<12>"                          ; Clear display
                "<27><84>"                      ; Cursor off
                "Main menu  [I0]<10><13>"
                "Display status      "
                "Input 8,9   : [I1]  "
                "Input 10,11 : [I2]  "

TEXT    2       "<12>"
                "Status <10><13>"
                "Input  8 : $i0008<10><13>"
                "Input  9 : $i0009<10><13>"
                "Main menu  [I0]"

TEXT    3       "<12>"
                "Status <10><13>"
                "Input 10 : $i0010<10><13>"
                "Input 11 : $i0011<10><13>"
                "Main menu  [I0]"

TEXT    100     "UART:9600,8,E,1;MODE:MC0;DIAG:O32,R100"
```

```
;---------------
; Coldstart
;---------------
XOB             16
SASI            1               ; Assignation RS232 interface
                100             ; Text 100
EXOB
;---------------
; Mainprogram
;---------------
COB             0
                0
CSB             0
ECOB


SB      0
```




```
ESB
```

```
SB      0
;---------------
IST     0                       ;NOP
EST
;---------------
ST      1                       ;Text 1
STXT            1
                1
EST
;---------------
ST      2                       ;Text 2
STXT            1
                2
EST
;---------------
ST      3                       ;Text 3
STXT            1
                3
EST
;---------------
TR      0                       ;Input 0 = "1"
STH     I       0
DYN     F       0
ANL     O       38              ; Text busy
ETR
;---------------
TR      1                       ;Input 1 = "1"
STH     I       1
DYN     F       1
ANL     O       38              ; Text busy
ETR
;---------------
TR      2                       ;Input 2 = "1"
STH     I       2
DYN     F       2
ANL     O       38              ; Text busy
ETR
;---------------
TR      3                       ;=1
ETR
;---------------
TR      4                       ;=1
ETR
;---------------
TR      5                       ;=1
ETR
;---------------
ESB
```

```
;╔═══════════════════════════════════════════════════════════════════╗
;║                                                                   ║
;║  User program example 8.4.1 for the industrial terminal PCD7.D1.. ║
;║  ================================================================ ║
;║  The program contains jumps                                       ║
;║                                                                   ║
;║  File  :     DEMO41.SRC                                           ║
;║                                                                   ║
;║  Creation:   03.09.91        U.Jäggi                              ║
;╚═══════════════════════════════════════════════════════════════════╝

TEXT    1       "<12>"                          ; Clear display
                "<27><84>"                      ; Cursor off
                "Main menu     [F1]<10><13>"
                "Input 0..15   [F2]<10><13>"
                "BCD-Switch    [F3]<10><13>"
                "Date/Time     [F4]"

TEXT    2       "<12>"                          ; Clear display
                "Input Status        "
                "I 0..7  : $I0000<10><13>"
                "I 8..15 : $I0008<10><13>"
                "Main menu  [F1]"

TEXT    3       "<12>"                          ; Clear display
                "BCD-Switch (I16..31)"
                "ùùùùùùùùùùù"
                "Value  : $R0010<10><13>"
                "Main menu  [F1]"

TEXT    4       "<12>"                          ; Clear display
                "Date : $D<10><13>"
                "Week : $W<10><13>"
                "Time : $H<10><13>"
                "Main menu  [F1]"

TEXT    100     "UART:9600,8,E,1;MODE:MC0;DIAG:O32,R100"

; Symboldefinitions
;=====================================
; Diagnostic outputs serial interface
;-------------------------------------
RBSY    EQU     O       32              ; Receiver Busy
RFUL    EQU     O       RBSY+1          ; Receive Buffer Full
RDIA    EQU     O       RBSY+2          ; Receiver Diagnostic
TBSY    EQU     O       RBSY+3          ; Transmitter Busy
TFUL    EQU     O       RBSY+4          ; Transmit Buffer Full
TDIA    EQU     O       RBSY+5          ; Transmitter Diagnostic
XBSY    EQU     O       RBSY+6          ; Text Busy
NEXE    EQU     O       RBSY+7          ; Not Executed
;-------------------------------------
; Function/Program blocks
;-------------------------------------
READ    EQU     FB      0               ; Read character
SEND    EQU     FB      1               ; Send text
COMPARE EQU     PB      0               ; Compare received character
;-------------------------------------
; Register
;-------------------------------------
RBUF_R  EQU     R       1000
```

```
      ;-------------------------------
      ; Coldstart
      ;-------------------------------
      XOB             16
      SASI            1               ; Assignation RS232 interface
                      100             ; Text 100
      STXT            1               ; Interface 1
                      1               ; Text 1
      SOCL            1               ; nötig weil Kabel für MC1-Mode
                      0
      EXOB
      ;-------------------------------
      ; Main program
      ;-------------------------------
      COB             0
                      0
      STH     O       RBSY            ; Receiver busy
      ANL     O       XBSY            ; Text busy
      JR      L       END             ; If RBSY = low then do nothing
      SRXD            1               ; Interface 1
              R       RBUF_R          ; Receive buffer register
      ;-------------------------------  Compare received character
      CMP     R       RBUF_R
              K       65              ; F1
      ACC     Z
      JR      L       F2
      STXT            1               ; Interface 1
                      1               ; Text 1
      JR              END
      ;-------------------------------
F2:   CMP     R       RBUF_R
              K       66              ; F2
      ACC     Z
      JR      L       F3
      STXT            1               ; Interface 1
                      2               ; Text 2
      JR              END
      ;-------------------------------
F3:   CMP     R       RBUF_R
              K       67              ; F3
      ACC     Z
      JR      L       F4
      STXT            1               ; Interface 1
                      3               ; Text 3
      JR              END
      ;-------------------------------
F4:   CMP     R       RBUF_R
              K       68              ; F4
      ACC     Z
      JR      L       END
      STXT            1               ; Interface 1
                      4               ; Text 4
      JR              END
      ;-------------------------------; Read BCD-Switch
END:  DIGI            4
              I       16
              R       10
      ;-------------------------------
      ECOB
```

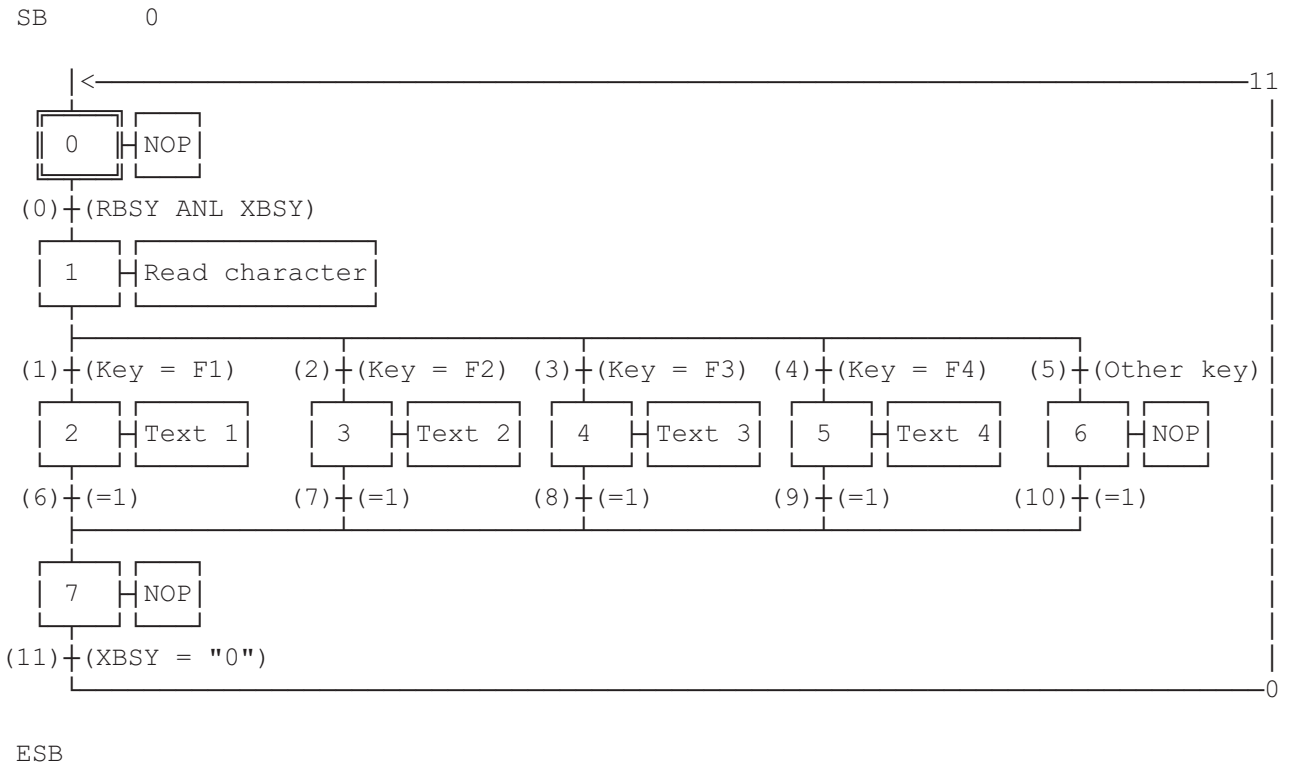
```
;╔═══════════════════════════════════════════════════════════════════╗
;║                                                                   ║
;║  User program example 8.4.2 for the industrial terminal PCD7.D1.. ║
;║  ================================================================ ║
;║  The program is structured in BLOCTEC                             ║
;║                                                                   ║
;║  File  :     DEMO42.SRC                                           ║
;║                                                                   ║
;║  Creation:   03.09.91        U.Jäggi                              ║
;╚═══════════════════════════════════════════════════════════════════╝

TEXT    1       "<12>"                          ; Clear display
                "<27><84>"                      ; Cursor off
                "Main menu     [F1]<10><13>"
                "Input 0..15   [F2]<10><13>"
                "BCD-Switch    [F3]<10><13>"
                "Date/Time     [F4]"

TEXT    2       "<12>"                          ; Clear display
                "Input Status        "
                "I 0..7  : $I0000<10><13>"
                "I 8..15 : $I0008<10><13>"
                "Main menu  [F1]"

TEXT    3       "<12>"                          ; Clear display
                "BCD-Switch (I16..31)"
                "--------------------"
                "Value  : $R0010<10><13>"
                "Main menu  [F1]"

TEXT    4       "<12>"                          ; Clear display
                "Date : $D<10><13>"
                "Week : $W<10><13>"
                "Time : $H<10><13>"
                "Main menu  [F1]"

TEXT    100     "UART:9600,8,E,1;MODE:MC0;DIAG:O32,R100"

; Symboldefinitions
;======================================
; Diagnostic outputs serial interface
;--------------------------------------
RBSY    EQU     O       32              ; Receiver Busy
RFUL    EQU     O       RBSY+1          ; Receive Buffer Full
RDIA    EQU     O       RBSY+2          ; Receiver Diagnostic
TBSY    EQU     O       RBSY+3          ; Transmitter Busy
TFUL    EQU     O       RBSY+4          ; Transmit Buffer Full
TDIA    EQU     O       RBSY+5          ; Transmitter Diagnostic
XBSY    EQU     O       RBSY+6          ; Text Busy
NEXE    EQU     O       RBSY+7          ; Not Executed
;--------------------------------------
; Function/Program blocks
;--------------------------------------
READ    EQU     FB      0               ; Read character
SEND    EQU     FB      1               ; Send text
COMPARE EQU     PB      0               ; Compare received character
;--------------------------------------
; Register
;--------------------------------------
RBUF_R  EQU     R       1000
```

```
;-------------------------------
; Coldstart
;-------------------------------
XOB             16
SASI            1               ; Assignation RS232 interface
                100             ; Text 100
CFB             SEND
                1
SOCL            1               ; nötig weil Kabel für MC1-Mode
                0
EXOB
;-------------------------------
; Main program
;-------------------------------
COB             0
                0
STH     O       RBSY            ; Receiver busy
ANL     O       XBSY            ; Text busy
CFB     H       READ            ; Read character
        R       RBUF_R          ; Receive buffer register
CPB     H       COMPARE         ; Compare received character
;-------------------------------; Read BCD-Switch
DIGI            4
        I       16
        R       10
;-------------------------------
ECOB
```

```
PB              COMPARE         ; Compare received character
;-------------------------------; Key = F1 ?
CMP     R       RBUF_R
        K       65              ; F1
ACC     Z
CFB     H       SEND            ; Send text
                1               ; Text 1
;-------------------------------; Key = F2 ?
CMP     R       RBUF_R
        K       66              ; F2
ACC     Z
CFB     H       SEND            ; Send text
                2               ; Text 2
;-------------------------------; Key = F3 ?
CMP     R       RBUF_R
        K       67              ; F3
ACC     Z
CFB     H       SEND            ; Send text
                3               ; Text 3
;-------------------------------; Key = F4 ?
CMP     R       RBUF_R
        K       68              ; F4
ACC     Z
CFB     H       SEND            ; Send text
                4               ; Text 4
;-------------------------------
EPB

;===============================
FB              READ            ; Read character
SRXD            1               ; Interface 1
        =       1
EFB
;-------------------------------
FB              SEND            ; Send text
STXT            1               ; Interface 1
        =       1               ; Textnumber
EFB
```

```
;╔═══════════════════════════════════════════════════════════════════╗
;║                                                                   ║
;║  User program example 8.4.3 for the industrial terminal PCD7.D1.. ║
;║  ================================================================ ║
;║  The program is structured in GRAFTEC.                            ║
;║                                                                   ║
;║  File  :     DEMO43.SRC                                           ║
;║                                                                   ║
;║  Creation:   28.10.91        U.Jäggi                              ║
;║                                                                   ║
;╚═══════════════════════════════════════════════════════════════════╝

TEXT    1       "<12>"                          ; Clear display
                "<27><84>"                      ; Cursor off
                "Main menu     [F1]<10><13>"
                "Input 0..15   [F2]<10><13>"
                "BCD-Switch    [F3]<10><13>"
                "Date/Time     [F4]"

TEXT    2       "<12>"                          ; Clear display
                "Input Status        "
                "I 0..7  : $I0000<10><13>"
                "I 8..15 : $I0008<10><13>"
                "Main menu  [F1]"

TEXT    3       "<12>"                          ; Clear display
                "BCD-Switch (I16..31)"
                "--------------------"
                "Value  : $R0010<10><13>"
                "Main menu  [F1]"

TEXT    4       "<12>"                          ; Clear display
                "Date : $D<10><13>"
                "Week : $W<10><13>"
                "Time : $H<10><13>"
                "Main menu  [F1]"

TEXT    100     "UART:9600,8,E,1;MODE:MC0;DIAG:O32,R100"

; Symboldefinitions
;=====================================
; Diagnostic outputs serial interface
;-------------------------------------
RBSY    EQU     O       32              ; Receiver Busy
RFUL    EQU     O       RBSY+1          ; Receive Buffer Full
RDIA    EQU     O       RBSY+2          ; Receiver Diagnostic
TBSY    EQU     O       RBSY+3          ; Transmitter Busy
TFUL    EQU     O       RBSY+4          ; Transmit Buffer Full
TDIA    EQU     O       RBSY+5          ; Transmitter Diagnostic
XBSY    EQU     O       RBSY+6          ; Text Busy
NEXE    EQU     O       RBSY+7          ; Not Executed
;-------------------------------------
; Register
;-------------------------------------
RBUF_R  EQU     R       1000
```

```
;-------------------------------
; Coldstart
;-------------------------------
XOB             16
SASI            1               ; Assignation RS232 interface
                100             ; Text 100
STXT            1
                1
EXOB
;-------------------------------
; Main program
;-------------------------------
COB             0
                0
CSB             0
;-------------------------------; Read BCD-Switch
DIGI            4
        I       16
        R       10
;-------------------------------
ECOB
```

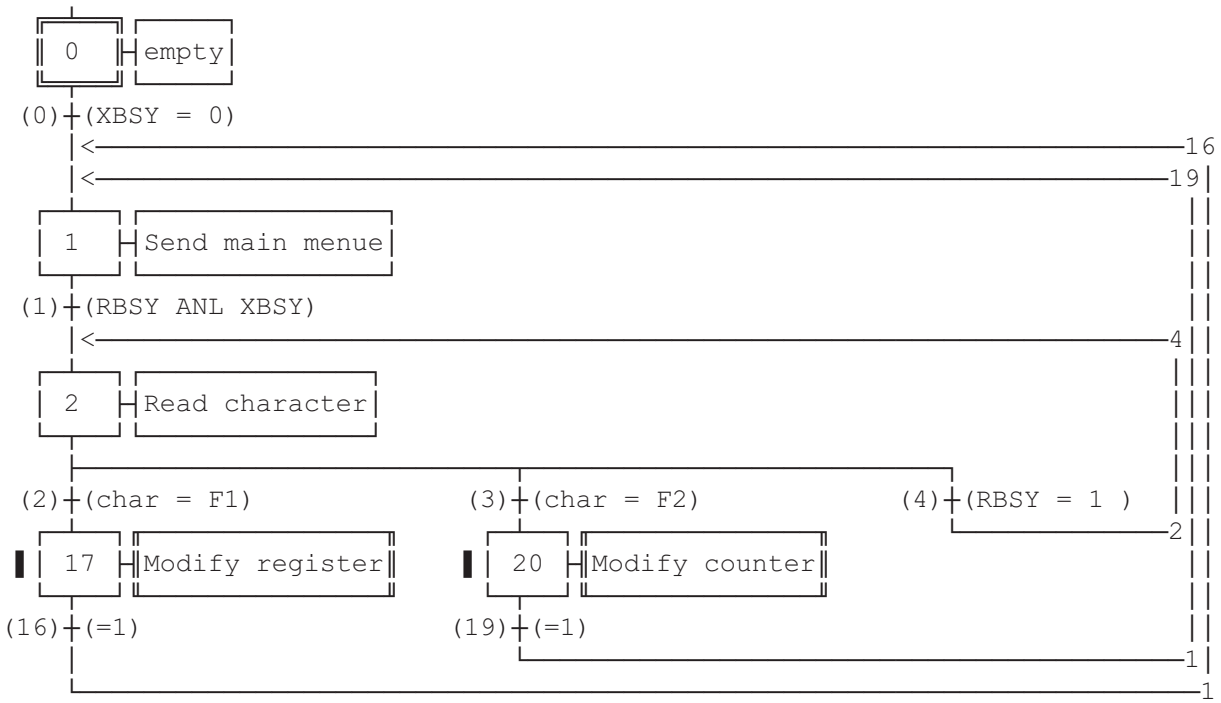


```
SB      0
;------------------------------
IST     0                       ;NOP
EST
;------------------------------
ST      1                       ;Read character
SRXD            1
        R       RBUF_R
EST
;------------------------------
ST      2                       ;Text 1
STXT            1               ; send
                1               ; text 1
EST
;------------------------------
ST      3                       ;Text 2
STXT            1               ; send
                2               ; text 2
EST
;------------------------------
ST      4                       ;Text 3
STXT            1               ; send
                3               ; text 3
EST
;------------------------------
ST      5                       ;Text 4
STXT            1               ; send
                4               ; text 4
EST
;------------------------------
ST      6                       ;NOP
EST
;------------------------------
ST      7                       ;NOP
EST
;------------------------------
```

```
TR      0                       ;RBSY ANL XBSY
STH     O       32              ; Receiver busy
ANL     O       38              ; Text busy
ETR
;-------------------------------
TR      1                       ;Key = F1
CMP     R       RBUF_R
        K       65              ; F1
ACC     Z
ETR
;-------------------------------
TR      2                       ;Key = F2
CMP     R       RBUF_R
        K       66              ; F2
ACC     Z
ETR
;-------------------------------
TR      3                       ;Key = F3
CMP     R       RBUF_R
        K       67              ; F3
ACC     Z
ETR
;-------------------------------
TR      4                       ;Key = F4
CMP     R       RBUF_R
        K       68              ; F4
ACC     Z
ETR
;-------------------------------
TR      5                       ;Other key
ETR
;-------------------------------
TR      6                       ;=1
ETR
;-------------------------------
TR      7                       ;=1
ETR
;-------------------------------
TR      8                       ;=1
ETR
;-------------------------------
TR      9                       ;=1
ETR
;-------------------------------
TR      10                      ;=1
ETR
;-------------------------------
TR      11                      ;XBSY = ä0ô
STL     O       38              ; Text busy
ETR
;-------------------------------
ESB
```

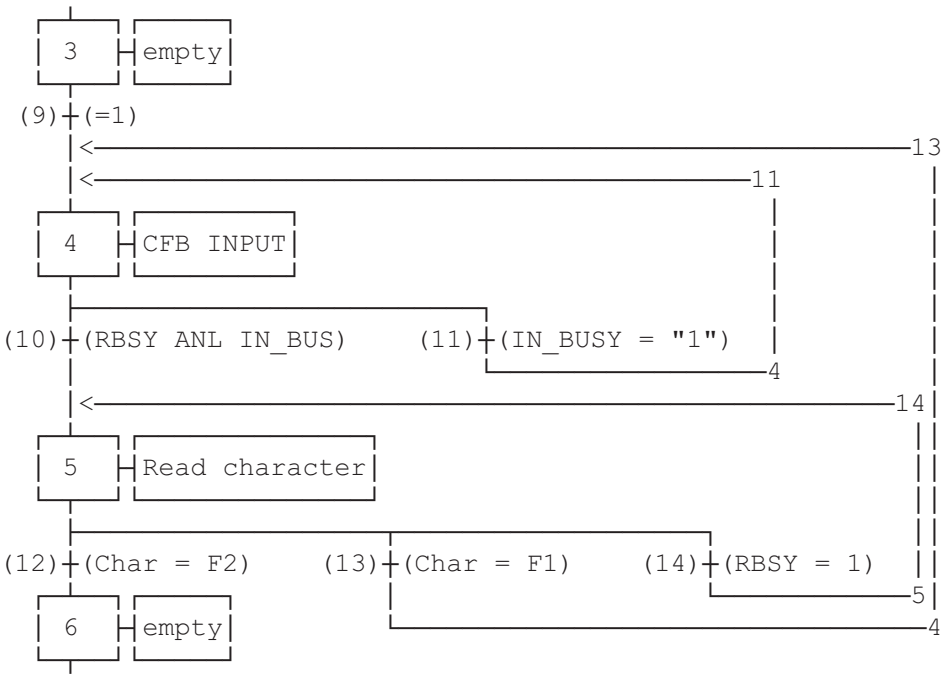
```
;╔═══════════════════════════════════════════════════════════════════════╗
;║                                                                       ║
;║  User program example 8.5 for the industrial terminal PCD7.D1..       ║
;║  ==============================================================       ║
;║                                                                       ║
;║  Input of numerical parameters                                        ║
;║                                                                       ║
;║  File  :     DEMO.SRC                                                 ║
;║                                                                       ║
;║  Creation:   03.09.91        U.Jäggi                                  ║
;║                                                                       ║
;╚═══════════════════════════════════════════════════════════════════════╝
;
RBSY_F          EQU     O 32                    ; Receiver Busy
XBSY_F          EQU     O 38                    ; Text Busy
SIGN            EQU     O 46                    ; Sign input
IN_BUSY         EQU     O 47                    ; Input busy
DIGIT           EQU     R 0                     ; Number of digits
X_POS           EQU     R 1                     ; X-position
Y_POS           EQU     R 2                     ; Y-position
DECIMAL         EQU     R 3                     ; Number of decimal places
DIAG_R          EQU     R 999                   ; Diagnostic register
MAIN            EQU     TEXT 0                  ; Main menue
IN_TXT_R        EQU     TEXT 1                  ; Input text register
IN_TXT_C        EQU     TEXT 2                  ; Input text counter
ASSIGN          EQU     TEXT 999                ; Assign. of the serial interf.
INPUT           EQU     FB 0                    ; Functionblock input
CHAN_N          EQU     1                       ; Number of serial channel

PUBL    CHAN_N                                  ; Number of serial channel
PUBL    RBSY_F                                  ; Receiver Busy
PUBL    XBSY_F                                  ; Text Busy
PUBL    IN_BUSY                                 ; Input Busy
PUBL    INPUT                                   ; D100 input

TEXT    ASSIGN    "UART:9600,8,E,1;"
                  "MODE:MC0;"
                  "DIAG:",RBSY_F.T,";",DIAG_R.T,""

TEXT    MAIN      "<12>"                        ; Clear display
                  "<27><84>"                    ; Cursor off
                  "==PARAMETER  INPUT=="
                  "--------------------"
                  "MODIFY REGISTER [F1]"
                  "MODIFY COUNTER  [F2]"

TEXT    IN_TXT_R  "<12>"
                  "R-Value : $%00.3d$R0500<10><13>"
                  "ACCEPT VALUE    [CR]"
                  "MODIFY VALUE    [F1]"
                  "MAIN MENU       [F2]"

TEXT    IN_TXT_C  "<12>"
                  "C-Value : $C0100<10><13>"
                  "ACCEPT VALUE    [CR]"
                  "MODIFY VALUE    [F1]"
                  "MAIN MENU       [F2]"
```

```
;------------------------
; Coldstart
;------------------------
XOB     16              ; Cold start

SASI    CHAN_N          ; Assignation RS232 interface
        ASSIGN          ; Text 999
ACC     H
RES     IN_BUSY         ; Reset input busy flag

EXOB
;------------------------
; Mainprogram
;------------------------
COB     0               ; Main program
        0

CSB     0               ; Call communication SB

ECOB


SB      0
```

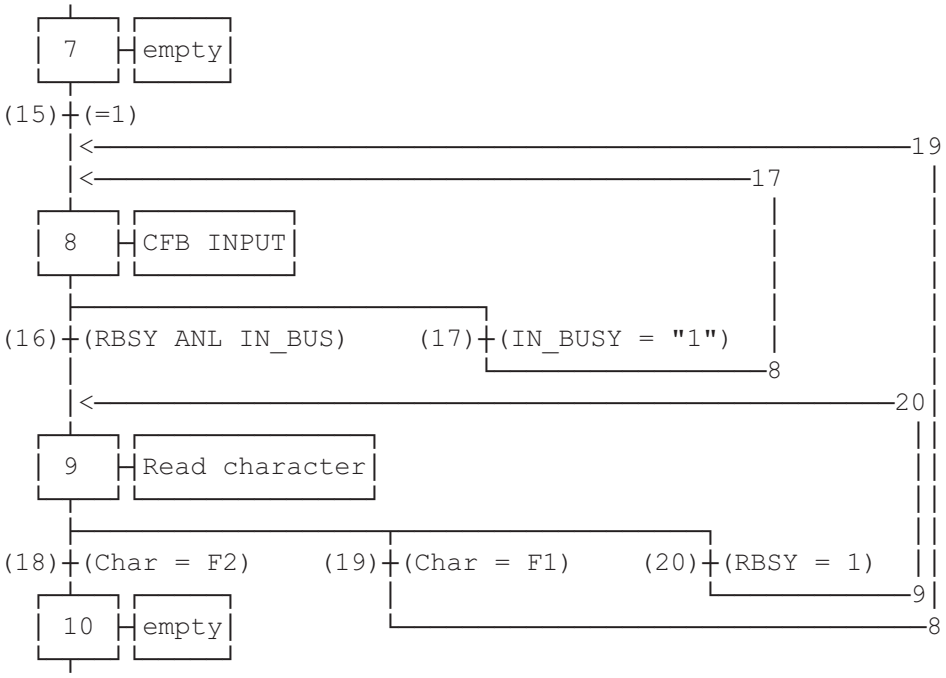



```
ESB
```

PAGE-NB: 5 Modify counter



PAGE-NB: 7 Modify register



```
SB      0
;-------------------------------
IST     0                       ;empty
EST
;-------------------------------
ST      1                       ;Send main menue
STXT            CHAN_N          ; Send
                MAIN            ; the main menue
EST
;-------------------------------
ST      2                       ;Read character
SRXD    CHAN_N                  ; Read character
        R 1000                  ; from the receive buffer
EST
;-------------------------------
ST      3                       ;empty
EST
;-------------------------------
ST      4                       ;CFB INPUT
RES     SIGN                    ; Sign input not allowed
LD      X_POS                   ; X-position
        42
LD      Y_POS                   ; Y-position
        32
LD      DIGIT                   ; Number of digits
        9                       ;
LD      DECIMAL                 ; Number of decimal places
        0                       ;
CFB     INPUT                   ; D100 input
        IN_TXT_C                ; Input text counter
     C  100                     ; Counter to be modified
        DIGIT                   ; Number of digits
        DECIMAL                 ; Number of decimal places
        X_POS                   ; X-position
        Y_POS                   ; Y-position
        SIGN                    ; Sign input yes/no (1/0)
EST
;-------------------------------
ST      5                       ;Read character
SRXD            CHAN_N          ; Read character
                R 1000          ; from the receive buffer
EST
;-------------------------------
ST      6                       ;empty
EST
;-------------------------------
```

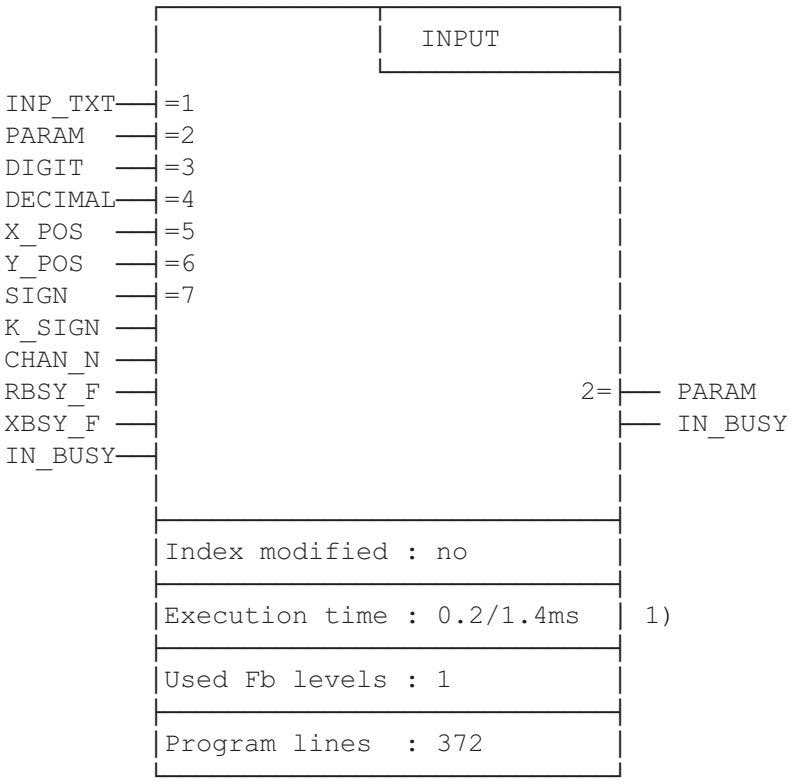
```
ST      7                       ;empty
EST
;-------------------------------
ST      8                       ;CFB INPUT
SET     SIGN                    ; Sign input allowed
LD      X_POS                   ; X-position
        42
LD      Y_POS                   ; Y-position
        32
LD      DIGIT                   ; Number of digits
        9                       ;
LD      DECIMAL                 ; Number of decimal places
        4                       ;
CFB     INPUT                   ; D100 input
        IN_TXT_R                ; Input text register
     R  500                     ; Register to be modified
        DIGIT                   ; Number of digits
        DECIMAL                 ; Number of decimal places
        X_POS                   ; X-position
        Y_POS                   ; Y-position
        SIGN                    ; Sign input yes/no (1/0)
EST
;-------------------------------
ST      9                       ;Read character
SRXD            CHAN_N          ; Read character
                R 1000          ; from the receive buffer
EST
;-------------------------------
ST      10                      ;empty
EST
;-------------------------------
```

```
TR      0                       ;XBSY = 0
STL             XBSY_F
ETR
;-------------------------------
TR      1                       ;RBSY ANL XBSY
STH     RBSY_F
ANL     XBSY_F
ETR
;-------------------------------
TR      2                       ;char = F1
CMP     R 1000
        K 65                    ; F1
ACC     Z
ETR
;-------------------------------
TR      3                       ;char = F2
CMP     R       1000
        K       66              ; F2
ACC     Z
ETR
;-------------------------------
TR      4                       ;RBSY = 1
STH             RBSY_F
ETR
;-------------------------------
TR      5                       ;Modify counter
ETR
;-------------------------------
TR      6                       ;=1
ETR
;-------------------------------
TR      7                       ;Modify register
ETR
;-------------------------------
TR      8                       ;=1
ETR
;-------------------------------
TR      9                       ;=1
ETR
;-------------------------------
TR      10                      ;RBSY ANL IN_BUSY
STH     RBSY_F
ANL     IN_BUSY
ETR
;-------------------------------
TR      11                      ;IN_BUSY = "1"
STH     IN_BUSY
ETR
;-------------------------------
```

```
TR      12                      ;Char = F2
CMP     R       1000
        K       66              ; F2
ACC     Z
ANL     XBSY_F
ETR
;-------------------------------
TR      13                      ;Char = F1
CMP     R 1000
        K 65                    ; F1
ACC     Z
ANL     XBSY_F
ETR
;-------------------------------
TR      14                      ;RBSY = 1
STH     RBSY_F
ETR
;-------------------------------
TR      15                      ;=1
ETR
;-------------------------------
TR      16                      ;RBSY ANL IN_BUSY
STH     RBSY_F
ANL     IN_BUSY
ETR
;-------------------------------
TR      17                      ;IN_BUSY = "1"
STH     IN_BUSY
ETR
;-------------------------------
TR      18                      ;Char = F2
CMP     R       1000
        K       66              ; F2
ACC     Z
ANL     XBSY_F
ETR
;-------------------------------
TR      19                      ;Char = F1
CMP     R 1000
        K 65                    ; F1
ACC     Z
ANL     XBSY_F
ETR
;-------------------------------
TR      20                      ;RBSY = 1
STH     RBSY_F
ETR
;-------------------------------
ESB
```

Function block: INPUT

Data entry using the PCD7.D100 or ..D202 industrial terminal



1) 0.2ms : RBSY_F = "0" (no character in receive buffer)
1.4ms : RBSY_F = "1" (number 0.. 9 is read from the receive buffer and processed.)

Function description

This function block allows the editing of the contents of a register or counter via the PCD7.D100 or ..D202 industrial terminal. A minus sign and decimal point are supported.
For the minus sign the D100 uses the key "F4" (dec.68) while D202 has the key "-" (dec.45). This must be entered in the EQU - List (see page 8-30).

List of inputs and outputs

Symbol	Description	Para-meter	Data Type	Data format	Data Value	Address
INP_TXT	Input Text Eingabe Text	yes	X	Text	any value	0..3999
PARAM	Input parameter (registers or counter)	yes	R/C	Integer	-2147483648 ...+2147483647	0..4095
DIGIT	Number of digits	yes	R	Integer	1..11	0..4095
DECIMAL	Number of decimal places	yes	R	Integer	0,1..10	0..4095
X_POS	Cursor x-position	yes	R	Integer	32..51	0..4095
Y_POS	Cursor y-position	yes	R	Integer	32..35	0..4095
SIGN	Sign yes/no (1/0)	yes	F/I/O	Binary	0/1	0..8191
K_SIGN	Sign key (ASCII code)	no	K	ASCII	0..255	–
CHAN_N	Serial channel number Schnittstellennummer	no	K	Number	0..3	–
RBSY_F	Receive busy flag	no	F/O	Binary	0/1	0..8191
XBSY_F	Text busy flag	no	F/O	Binary	0/1	0..8191
IN_BUSY	Input Busy	no	F/O	Binary	0/1	0..8191

Internally used and reserved elements with symbolic names:

Seven work registers and 6 work flags are used internally by the FB. These registers and flags contain intermediate values during data entry and therefore can only be used by this FB. Only the base addresses of these elements need to be defined in the module.

Symbol	Description	Data Type	Data Format	Address
WORK_R	Base address of 7 used work registers	R	Integer	0..4089 (+6)
WORK_F	Base address of 6 used work flags	F	Binary	0..8186 (+5)

Key allocation:

Since keys can be designated according to specific applications, symbols can be used to allocate any desired ASCII code to the keys. The defaults are the standard key designations. The numeric keys (0..9) should not be reallocated, otherwise an error will occur when the ASCII value is converted to decimal.

Symbol	Description	Data		Value
		Type	Format	
K_BS	Backspace key	K	ASCII	0..255
K_CR	Carriage return key	K	ASCII	0..255
K_DP	Decimalpoint key	K	ASCII	0..255
K_SIGN	Negative sign key	K	ASCII	0..255 *)
K_0	0 key	K	ASCII	48
K_1	1 key	K	ASCII	49
K_2	2 key	K	ASCII	50
K_3	3 key	K	ASCII	51
K_4	4 key	K	ASCII	52
K_5	5 key	K	ASCII	53
K_6	6 key	K	ASCII	54
K_7	7 key	K	ASCII	55
K_8	8 key	K	ASCII	56
K_9	9 key	K	ASCII	57

*) For D100 enter dec. 68 ("F4"), for D202 enter dec. 45 ("-").

Calling the function block

```
CFB       INPUT      ; Input
          INP_TXT    ; Input text
      R   PARAM      ; Parameter
      R   DIGIT      ; Number of digits
      R   DECIMAL    ; Number of decimal places
      R   X_POS      ; X-position
      R   Y_POS      ; Y-position
      F   Sign       ; Sign input yes/no (1/0)
```

Detailed description of inputs and outputs

• Input text "INP_TXT":

This text is transmitted the first time the FB is called. The value of the element to be edited (register/counter) is only displayed when the FB outputs this text, and must be represented in the text. Apart from this, the text can be any size and can contain any characters. The current value of the element can be displayed in any format, however it is recommended that same format is used for both the input and the display of the data.

Example:

```
TEXT   INP_TXT "<12>"                      ; Clear display
               "PARAMETER INPUT<10><13>"
               "================<10><13>"
               "Value : $%00.3d$",PARAM.04T,"<10><13>"
               "Accept value  [CR]"
```

• Input parameter "PARAM":

This parameter indicates which register or counter is to be changed.

• Number of digits "DIGIT":

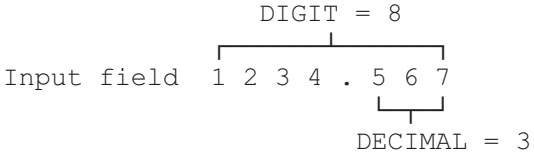
This value defines the input field size. The register value defines the number of digits including the minus sign and decimal point. The number of digits entered is monitored and limited during input.

Note: the last digit of the display line must not be used for the entry field.

• Number of decimal places "DECIMAL":

Fixed point format is used, this defines the number of decimal places. If no decimal point is required, use a value of 0 in this register. The number of decimal places is monitored and limited during input.

Example:



• Cursor position "X_POS"/"Y_POS":

Defines the position for the first character of the input field.

• Leading sign "SIGN":

Defines the position for the first character of the input field.

"SIGN" = 0 —> Input of minus sign disabled.
"SIGN" = 1 —> Input of minus sign enabled.

• Sign key "K_SIGN":

Defines the ASCII code for the minus key. A leading plus sign cannot be entered.

• Serial channel number "CHAN_N":

Defines the serial channel number. The serial channel must be assigned in mode C before calling the FB. (Possible assignment modes for the PCD7.D100 terminal are: MC0, MC1 and MC2).

• Serial channel diagnostic flags "RBSY_F"/"XBSY_F":

Addresses for the RBSY_F and XBSY_F flags must agree with the diagnostic flag addresses defined by the SASI instruction.

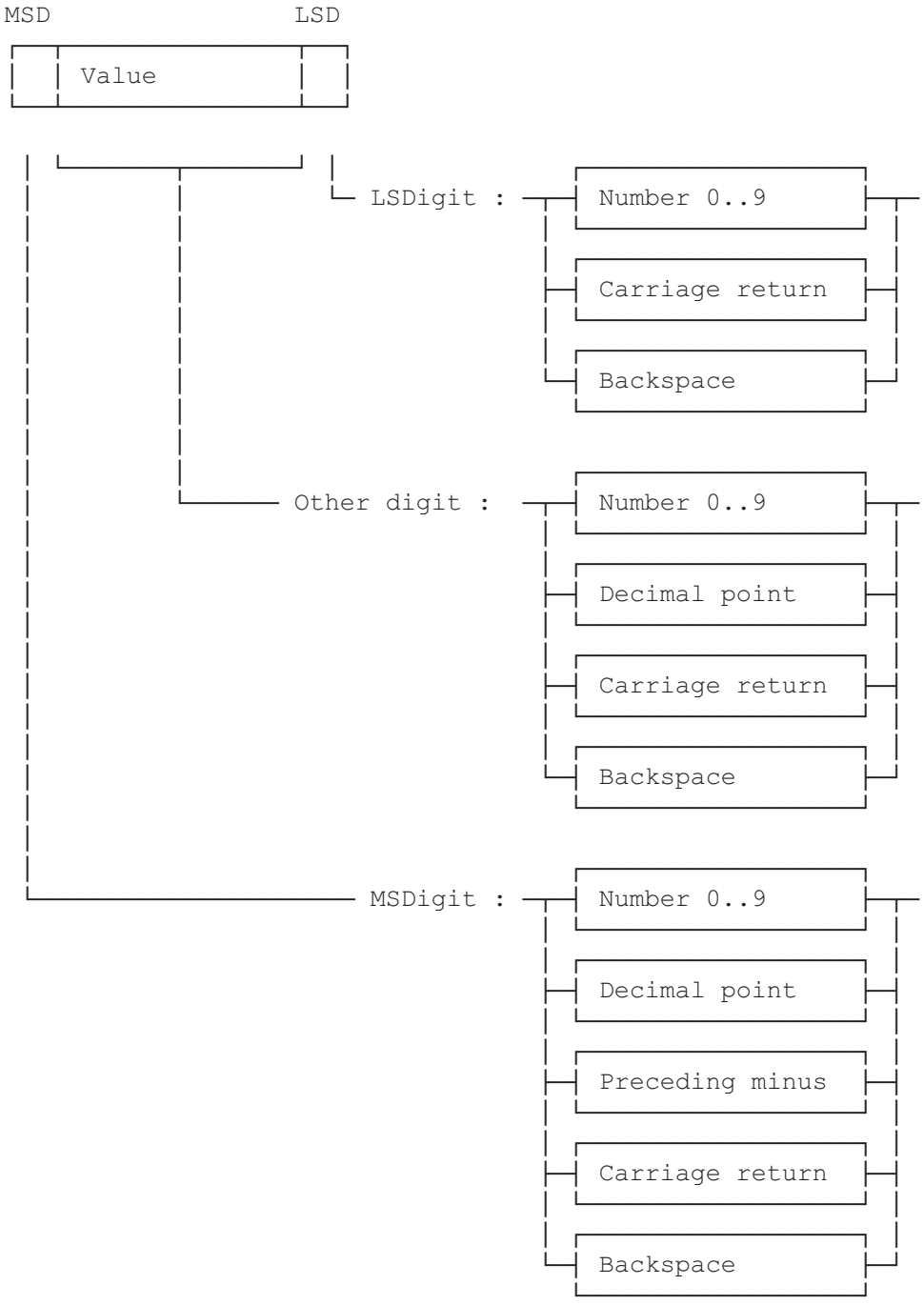
• Input busy flag "IN_BUSY":

The input busy flag "IN_BUSY" must initially be zero otherwise the FB will not function correctly.
--> Reset the "IN_BUSY" flag in XOB 16.
The flag is set high the first time the FB is called. The flag is reset when a carriage return is received.

Input/change of a parameter:

The first time the FB is called, the input text is output, the "IN_BUSY" flag is set, and the cursor is positioned according to FB parameters "X_POS" and "Y_POS".
It is then possible to enter a number (with optional minus) via the keyboard. If the first key depression is numerical, a preceding minus or the decimal point, the parameter input field is deleted. Input field size is limited by the maximum number of digits (defined with FB parameter "DIGIT"). The maximum number of digits is monitored and limited by the FB during input.
When the carriage return (CR) key is depressed, the number entered is stored in the "PARAM" register/counter, the "IN_BUSY" flag is reset and the data input ends.
During input of a value (while the "IN_BUSY" flag is high) the FB must be called cyclically by the user program.

Input format of numerical value to the PCD7.D100 or ..D202 terminal:



The following example demonstrates the principles:

FB parameters contain the following values:

```
Input text   "INP_TXT"  : "<12>"  ; Clear display
                          "PARAMETER INPUT<10><13>"
                          "===============<10><13>"
                          "Value : $%00.3d$",PARAM.04T,"<10><13>"
                          "Accept value  [CR]"

Register  "PARAM"    : 567890
Register  "DIGIT"    : 8
Register  "DECIMAL"  : 3
Register  "X_POS"    : 40
Register  "Y_POS"    : 34
```

The minus sign is defined as :

- for D100 = function key F4 : K_SIGN EQU K 68 ;Negative Sign key
- for D202 = minus key : K_SIGN EQU K 45 ;Negative Sign key

When the FB is first called, this text appears on the display:

```
PARAMETER INPUT
===============
Value : 567.890
Accept value  [CR]
```

The data is then input according to the following table. Only the data input field is affected, the rest of the display remains unchanged during input.

Key depressed	ASCII code dec	Input field display (max. 8 digits)	Register/ counter "PARAM"	Input busy flag "IN_BUSY"
-	-	-	-	0
(1st FB call)	-	567.890	567890	1
3	51	3_	567890	1
5	53	35_	567890	1
7	55	357_	567890	1
<-	8	35_	567890	1
<-	8	3_	567890	1
<-	8	_	567890	1
<-	8	567.890	567890	1
1	49	1_	567890	1
2	50	12_	567890	1
3	51	123_	567890	1
4	52	1234_	567890	1
5	53	1234_	567890	1
.	54	1234._	567890	1
7	55	1234.7_	567890	1
8	56	1234.78_	567890	1
9	57	1234.789	567890	1
4	52	1234.784	567890	1
<-	8	1234.78_	567890	1
<-	8	1234.7_	567890	1
CR	13	1234.7	1234700	0
-	-	-	-	0
(1st FB call)	-	1234.700	1234700	1
F4 *)	68 *)	-_	1234700	1
8	56	-8_	1234700	1
4	52	-84_	1234700	1
6	54	-846_	1234700	1
CR	13	-846	-846000	0

*) For D100 it is key "F4" (68), for D202 it is key "-" (45).

Using the function block in user programs

The FB is located in file D1_INP.SRC. This file also contains all symbol definitions necessary for use with the FB. Any symbols which are used globally in the user program are defined in the file as EXTN (external) and must be defined in another user file. This means that the file D1_INP.SRC only has to be assembled once and then linked with the other user files.

Global symbols: INPUT, CHAN_N, IN_BUSY, RBSY_F, XBSY_F

If the FB is to be included in the user program by means of the assembler directive $INCLUDE, the EXTN definitions must be deleted or replaced by local symbol definitions.

9. Comparison of terminals PCD7.D100 and ..D202

Differences	**D100**	D202
Colour	pebble grey	black
Display	4x20 characters, LED back light	4x20 characters, LED back light
Character set	Character 0 to 127: standard Character 128 to 255: specific and fix	Character 0 to 127: standard Character 128 to 255: specific with 8 characters which are D100 or language selectable
Keypad	20 short-stroke keys under polyester film	25 keys with tactile feedback under polyester film (same keys as D100 output same code)
Slide-in labelling strip	for all keys	only for function keys
Housing	Metal	Front: plastic cover: metal
Panel opening	Opening with 4 wholes	bigger opening without wholes
Serial interface	RS232 and 20 mA TTY	RS232
Connector	25-pole, D-type (female)	9-pole, D-type (female)
Baudrate	150.. 19200 bps	110.. 19200 bps
Set up	by DIL switches	by menue on keyboard (non volatile) or by serial interface (commands)
Handshaking - non - RTS/CTS - XON/XOFF	by DIL switches	by commands
Display contrast	by potentiometer	by keyboard or commandl
Configuration - Full / half duplex - Auto line feed - Scroll / page mode - Echo	by DIL switches	by commands
New commands		- select character set D100/D/F/E/SC - turn on / off LED 1.. 8 - test hardware, keyboard, display or LEDs - restart warm 7 cold - save displays (0.. 9) - poll D202 (if OK, responds SOH)

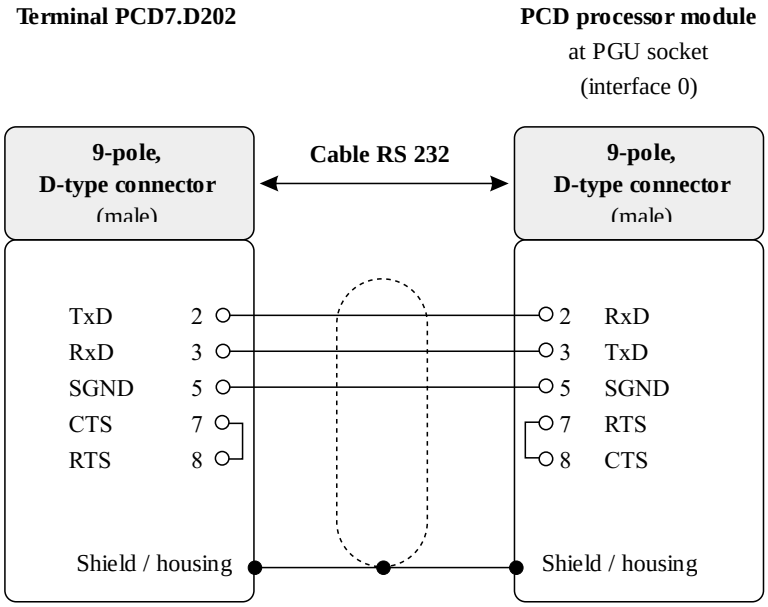
Notes :

10. Interface connection cables RS 232

The cables are double shielded with metallized connectors, in 2.5 m standard lengths.

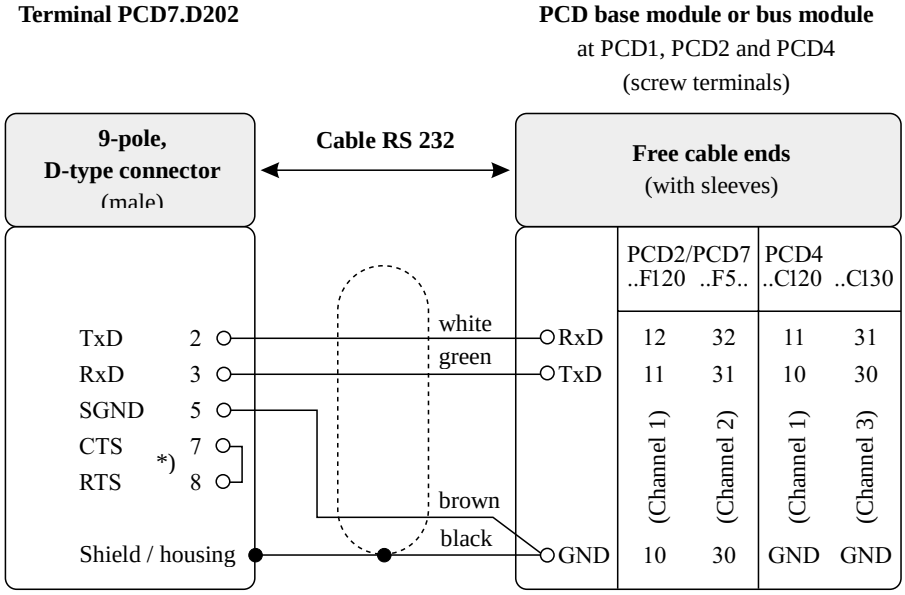
Type PCD7.K412: For interface RS 232
without handshaking RTS/CTS

Connection between terminal ..D202 and PGU socket (channel 0) of all PCD processor modules.



Type PCD7.K422: For interface RS 232
without handshaking RTS/CTS

Connection between terminal ..D202 and processor module or bus module of the series PCD1, PCD2 or PCD4. Free cable ends (with sleeves).

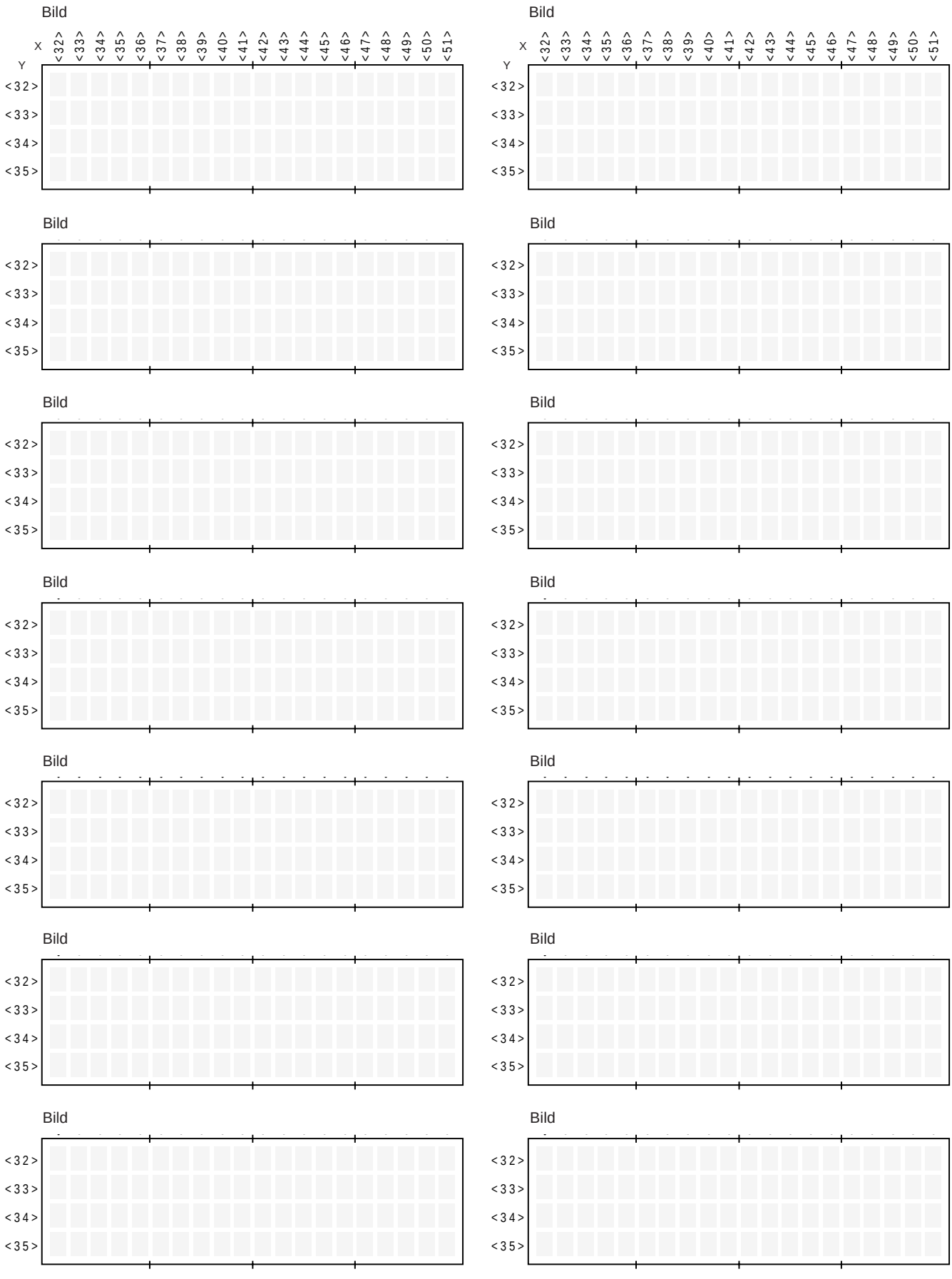


*) CTS 7 and RTS 8 are bridged inside of the connector

Returned key codes are:

Key	Dec	Hex	ASCII	Notes
F1	65	41	'A'	
F2	66	42	'B'	
F3	67	43	'C'	
F4	68	44	'D'	
0	48	30	'0'	
1	49	31	'1'	
2	50	32	'2'	
3	51	33	'3'	
4	52	34	'4'	
5	53	35	'5'	
6	54	36	'6'	
7	55	37	'7'	
8	56	38	'8'	
9	57	39	'9'	
+	43	2B	'+'	
-	45	2D	'-'	Shift+'+'
.	46	2E	'.'	
,	44	2C	','	Shift+'.'
Quit	81	51	'Q'	Quit
Shift	-	-	-	No code returned
Esc	27	1B	ESC	Escape
i	73	49	'I'	Information
↵	13	0D	CR	Carriage return (enter)
↑	11	0B	VT	Up arrow
↓	5	05	ENQ	Down arrow
←	8	08	BS	Left arrow
→	6	06	ACK	Right arrow
Shift+0	97	61	'a'	Shifted states of numeric keys
Shift+1	98	62	'b'	
Shift+2	99	63	'c'	
Shift+3	100	64	'd'	
Shift+4	101	65	'e'	
Shift+5	102	66	'f'	
Shift+6	103	67	'g'	
Shift+7	104	68	'h'	
Shift+8	105	69	'i'	
Shift+9	106	6A	'j'	
Shift+i	-	-	-	Enters "Setup/Test mode", no code is output.

Note: From the prov. firmware β 1.0 to the def. version V001, the four marked codes have changed (see also part 5.2).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From :

Company :
Department :
Name :
Address :

Tel. :

Date :

Send back to :

Saia-Burgess Controls Ltd.
Bahnhofstrasse 18
CH-3280 Murten (Switzerland)
http://www.saia-burgess.com

Industrial terminal PCD7.D202

If you have any suggestions concerning the SAIA® PCD, or have found any errors in this manual, brief details would be appreciated.

Your suggestions :