

PCS 91.PDP

english

One does not refer in the manual explicitly to the devices of the PCS plus/win series, the description applies to all devices. With differentiations between the equipment series the following allocations apply:

PCS topline	=	micro/mini:	PCS 009, PCS 090, PCS 095, PCS 095.1, PCS 095.2
		midi:	PCS 900, PCS 950, PCS 950c, PCS 950q, PCS 950qc,
		maxi:	PCS 9000/9100
PCS plus	=	micro/mini:	PCS 009 plus, PCS 090 plus, PCS 095 plus
		midi:	PCS 950 plus, PCS 950c plus, PCS 950q plus,
			PCS 950qc plus
PCS win	=	micro/mini:	PCS 009 win, PCS 090 win, PCS 095 win
		midi:	PCS 950 win, PCS 950c win, PCS 950q win,
			PCS 950qc win

Systeme Lauer GmbH & CoKG
Postfach 1465
D-72604 Nürtingen

Operator reference manual: PCS 91.PDP
Version: 31. Januar 2003
Person responsible: Zoch

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- Since diskette represent manipulatable data media, we can only guarantee the physical completeness. The responsibility is limited to a replacement.
- At any time, we welcome suggestions for improvements and remarks on errors.
- The agreement also applies to the special appendices to this reference manual.

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Notes for the user

Please read the manual before beginning and keep the manual for later use.

Target group The manual has been conceived and written for users who are experienced in the use of PCs and automation technology.

Typographical conventions

[KEY]	Keys that are to be pressed by the user are given in square brackets, e.g [CTRL] or [DEL]
<i>Courier</i>	On-screen messages are given in the Courier font, e.g. C:\>
Courier bold	Keyboard input to be made by the user are given in Courier bold, e.g. C:\>DIR
<i>Italics</i>	Names of buttons to be pressed, menus or other on-screen elements and product names are given in italics.

Pictograms The manual uses the following pictograms to highlight certain text passages:



Danger!
Possibly dangerous situation. Injury to persons can be the result.



Attention!
Possibly dangerous situation. Property damages can be the result.



Tips and supplementary notes

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Quality and support

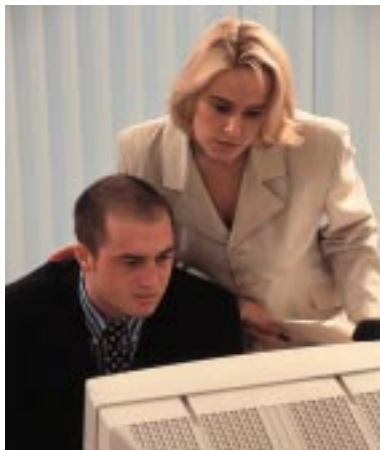


In our company, quality comes first. From the electronics component up to the finished device, the quality assurance test competently and comprehensively.

National and international test standards (ISO, TÜV, Germanischer Lloyd) are the basis.

Within 48 hours, every device passes a 100% check and continuous test under worst case conditions at changing temperatures (0...50°C) and test voltages.

A guarantee for maximum quality.



Our products not only feature a maximum economic efficiency and reliability but also a comprehensive complete service.

You not only receive demo devices but we rather make specialists available who support you in person with your first application.

Qualified user consultation by competent sales engineers is obvious for us.

Our support is for you for the side with advice and deed every day.



We set up training programs and technical training for you in our modern training center or alternatively also in your house.

Request the current training catalog.



From the consultation up to the user support, from the hotline up to the service, from the reference manual up to the training and all covering and individual service for the entire product line is waiting for you.

Whenever you need us, we are there for you: dynamically, creatively and enormously efficiently. With the entire experience of a world-wide successful enterprise.

Telephone

07022/9660-132, -231, -230

eMail

support@systeme-lauer.de

Web site

www.lauer-systeme.net

Systeme Lauer Active Area

(Download of Software, driver, manuals, Forum...)

Safety regulations

This reference manual contains the most important remarks in order to safely operate the device.

- This operator's guide, particularly the safety remarks are to be noted by all persons working with the device.
- Furthermore, the rules and regulations for the accident prevention applying to the application location are to be observed.
- Use as directed. The device is designed for the application in the industrial area.
- The device is manufactured to the state of the art and the official safeguarding regulations. Nevertheless, due to the application, dangers or impairments can result to the machine or to material assets.
- The device meets the requirement of the EMC guidelines and harmonized European standards. Any hardware-related modification of the system can influence the EMC behavior.
- The device may not be used without special protective measures in the hazardous area and in plants requiring a special monitoring.
- Do not heat up the buffer batteries. Danger of explosion. Serious burning can be the result.
- The installation and operation may only be performed by trained personnel.
- The operating voltage of the device may only be in the specified ranges.
- You find information on this on the type plate and in the specifications of this reference manual.

Norms

The device is constructed using up-to-date technologies and fulfils the requirements of the following guidelines and norms:

- Compliant with the EMC Directive 89/336/EEC and the German law on electro-magnetic compatibility
- Interference compliant with the generic requirements norm EN 50081-2 and product norm EN 55022:
- Measurement of the conducted interference voltage as per EN 55022
- Measurement of the radiated radio interference field power as per EN 55022 class A
- Interference immunity in compliance with generic requirements norm EN 50082-2 and product norm EN 61000-6-2:
 - Electro-static discharge (ESD) as per with EN 61000-4-2
 - High-frequency electromagnetic fields as per EN 61000-4-3 and ENV 50204
 - Fast transient interference (burst) as per EN 61000-4-4
 - Surge voltages as per EN 61000-4-5
 - High-frequency conducted fields as per EN 61000-4-6
 - Voltage dips and short-term interruptions as per EN 61000-4-11

The assembly and connection instructions contained in this documentation must be followed.

Conformity of this equipment is confirmed by the CE logo.
The EC declaration of conformity can be requested from:

Systeme Lauer GmbH & Co KG
P-O-Box 1465
D-72604 Nürtingen

About what does this manual report?

This manual informs you exclusively about the application of the PCS 807 Profibus DP Multibox together with the PCS micro, mini/VPC 090 Multi Interface, the SIEL2DME.DRV midi and maxi driver and the programmable controller handling software PROFIBUS.S5D or PCSS7L2.AWL (S7). The PCS 590/595p operating consoles do not require the PCS 807 Multibox since this is integrated into the PCS 590p/595p. The settings of the master board and the use of the handling software is absolutely identical. Therefore, this principle is used for the here described procedure.

The network structure set-up was tested with a S5-115U (CPU 942, 943, 944, 945), an S5-135U (CPU 928) in connection with an IM308B (version 6) S5 DP master board, an IM308C (version 2), and a CP5431 (version 3). The setup was also tested with an S7 fitted with a CPU 315-2 DP. The following describes the startup of this set-up.

The PCS 807 firmware is based on the Siemens SPC-3 chip set with Siemens object code. Systeme Lauer can take over no responsibility for errors and limitations due to the Siemens software.

Programming of the Siemens programmable controllers, of the Profibus master board, and the basic Profibus DP functions are assumed as known.

Which parts do I need?

The following products are required from Systeme Lauer for a Profibus DP network set-up:

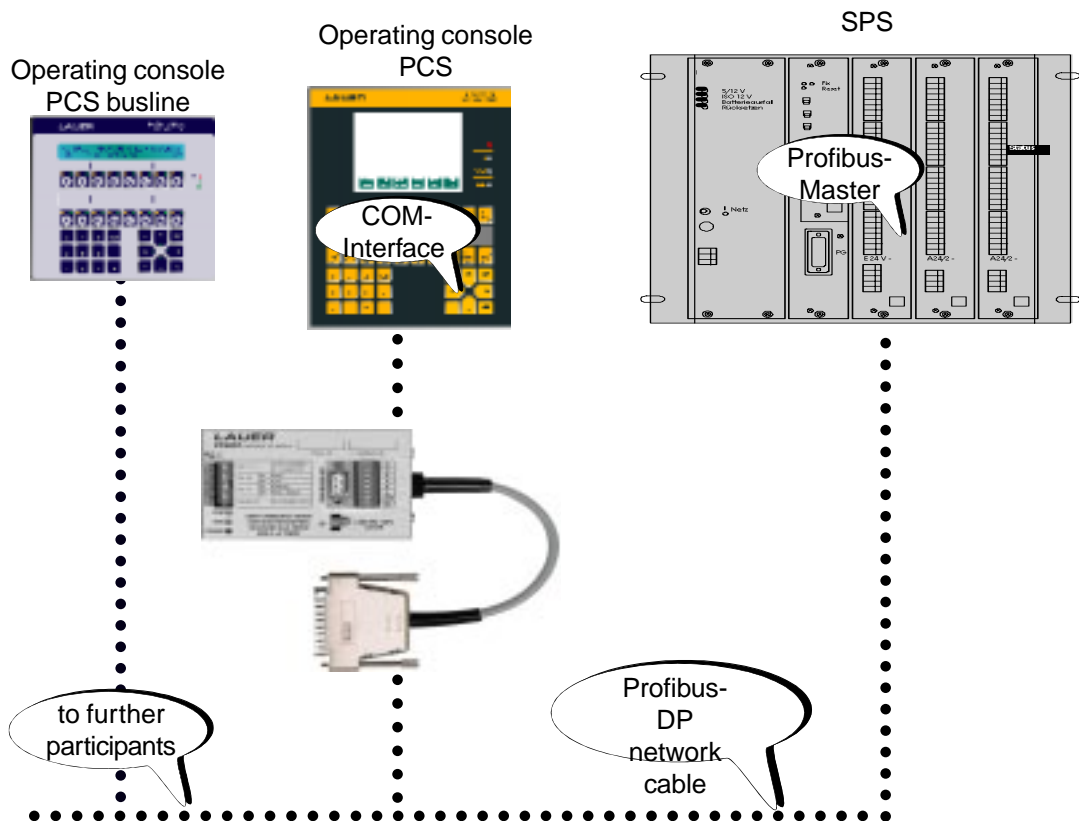
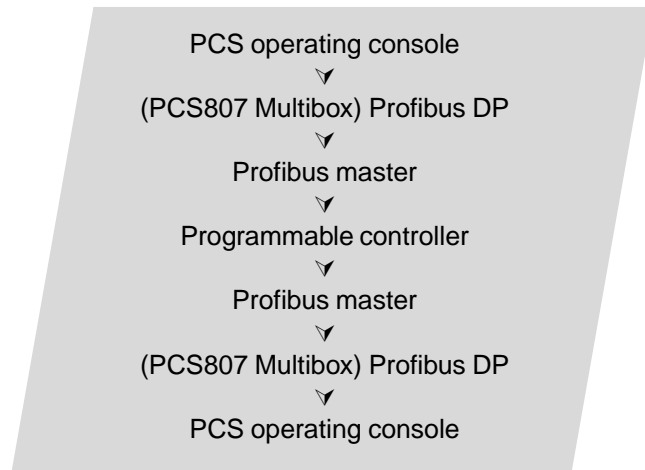
- PCS807 Profibus DP Multibox, version PX807 0001 (SPC2), or PX807 1000 (SPC3), or higher.
- A PCS micro, mini, midi, or maxi operating console or the VPC 090 Multi Interface.
- The PCSPRO, PCSPRO^{WIN}/PCSPRO^{PLUS} or PCS 9092 configuration software and a PCS 733 programming cable for the PCS operating console.
- This manual including the PCS91.PDP floppy disk.

....as well as power supplies for all components.

A General remarks

A.1 Basic data interchange

The communication connection between the PCS and the programmable controller data area is made via the following communication devices:



A General remarks

PCS operating console

The PCS operating console determines the tasks to be executed (according to the network configuration, the enables, the display content, and the keys) and sends these in one package to the PCS 807 Multibox Profibus DP slave.

The PCS 807 Multibox Profibus DP slave passes the package on to the Profibus master.



The master stores the package in the I-area of the programmable controller.



Programmable controller

The communication data block is located in the programmable controller and occupies 256 words (e.g. DB50).

The tasks input buffer is located in an I-area of the programmable controller.

The tasks response buffer is located in an O-area of the programmable controller.

A cyclically selected handling block (FB203) executes the tasks present in the I-buffer on the data block and stores the result in the O-buffer.



The master picks up the response package from the O-area of the programmable controller and submits it to the slave.



The PCS 807 Multibox Profibus DP slave submits the response to the PCS.



PCS operating console

The PCS operating console evaluates the response and shows the data on the display.

The inquiry/response package is supplied with a task number so that the response always matches the inquiry.

With the PCS 590p/595p and the PCS plus/win, the intermediate steps referring to the PCS 807 Multibox are skipped. The master communicates directly with the PCS.

A General remarks

A.1.1 Settings of the Multibox slave

The PCS 807 Multibox Profibus DP slave automatically adapts to the given configuration. For this, only the slave number of the PCS 807 Multibox Profibus DP needs to be set. Using the DIL-switches 1 to 7, you can set the slave number of the PCS 807 Multibox Profibus DP between 3 and 127. The settings must be performed either with the power being removed or in the reset state (the settings are taken over at the start).

The slave address is calculated as follows (OFF = 0 and ON = 1):

$$\text{DIL1} \times 64 + \text{DIL2} \times 32 + \text{DIL3} \times 16 + \text{DIL4} \times 8 + \text{DIL5} \times 4 + \text{DIL6} \times 2 + \text{DIL7} \times 1$$

Slave-Nr	DIL 1	DIL 2	DIL 3	DIL 4	DIL 5	DIL 6	DIL 7
3	OFF	OFF	OFF	OFF	OFF	ON	ON
4	OFF	OFF	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	OFF	OFF	ON	OFF	ON
6	OFF	OFF	OFF	OFF	ON	ON	OFF
7	OFF	OFF	OFF	OFF	ON	ON	ON
...							
125	ON	ON	ON	ON	ON	OFF	ON
126	ON	ON	ON	ON	ON	ON	OFF

The slave number of the PCS 590p/595p and PCS plus/win is set in the driver using the PCSPRO configuration software. Select the *Project* menu item and then *Driver parameters*.

A General remarks

A.1.2 Parameterizing of the PCS

Both, the application program with data and a selected driver is transferred when configuring the PCS. The presettings of the variable can be changed for optimizing the driver.

Variable AJ - number of tasks per package

Using this variable, the number of tasks per task package can be influenced. Thus, this variable is influenced by the size of the I/O buffer. Furthermore, the refresh of the variable and the refresh of the keys/LEDs is offset by this value. The relation is explained best using an example:

AJ = 1 -->

Keys and LEDs will be quickly transferred, variables are refreshed slowly - suited for jog operation. The I/O buffer can be small.

AJ = 10 -->

Default values. Represent a balance between the key and the variable refresh.

AJ = 20 -->

Keys and LEDs will be transferred simultaneously with variables - suited for the display of many variables. The I/O buffer should be as large as possible.

AA variable - Time-out time

The time-out time to be set is related to the maximum time that is required by the programmable controller for the cyclical call of the communication program plus the communication time. The time is adjustable in the range of 2 and 9.9 seconds - default is 4 second. Time monitoring is activated only if the task read by the PCS is not yet the current one.

In addition, the PCS 590p/595p and PCS plus/win features the following variables:

AH variable - PCS station number

Here, the slave station number of the Profibus DP slave is set. The value range is 3 (default value) to 127.

BC variable - Direct key values

You can reserve 0 2 words of the programmable controller I/O area for the direct transfer of keys. These keywords are then constantly assigned to the key bits and are directly to be evaluated. The key transfer time is significantly faster compared to the PCS transfer since no interpretation of the data is required. You can use these key words for jog operations. Assumed, you have reserved 16 bytes from I20 to I35 for slave 3 that is a PCS 590p/595p. The key words are assigned to I20 to I23 if you have set 2 key words. These words are now lost for the PCS Expander communication: set the start of the Expander (e. g. RXFA) to 24 and the length (e. g. RXLE) to 12. Please note that you can only reserve one word for direct keys of an input area having a size of eight bytes.

BD BG variables - Contents of the key bytes

Using five instances, you can assign the key words of each byte a certain information (key bits).

Please refer to the PCS 591/PCS 096 manual for further information on key bytes.

A General remarks

A.1.3 Transfer of the record into the PCS

1. Set DIL-switch 8 on the rearside of the PCS to „OFF“ and DIL-switches 9 to „ON“. (Not with the PCSmaxi)
2. Apply operating voltage (19 ... 33V) to the PCS. The ERR-LED is now ON.
3. Connect the programming interface of the PC with the PCS operating console using the PCS 733 programming cable.
4. Run the PCSPRO/PCSPRO^{WIN}/PCSPRO^{PLUS} configuration software.
5. Select the Profibus DP driver for your PCS.
6. Create or load your data file.
7. Set the driver parameters using the menu items „Options“ and „Drivers“. You can take over the default settings in the normal case.
8. Transfer the compiled record into the PCS.

A.1.4 Set-up and first powering-up

Disconnect the supply voltage to the set-up when you have configured all parts. Thereby, the following points are to be considered:

Profibus DP network

- Use only suited cable for the wiring.
- The last participant in the Profibus DP network must have a terminator. Use the Siemens SINEC L bus connector for this. Special bus connectors are required for baud rates between 3 and 12 MHz (Siemens part number: 6ES7 972-0BA10-0XA0).

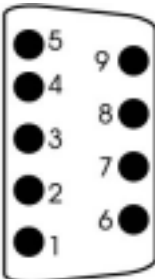
Instead of the Siemens connectors you can also use the supplied Lauer terminals between PCS 807 Multibox Profibus DP slaves (only recommended up to 500Kbaud).

When using the Lauer terminals, the red wire is connected to „A“ and the green wire to „B“. The cable screening is connected to the cable clip (not with the PCS 590p/595p and PCS plus/win).

Proceed as follows for powering-up:

- Supply power to the programmable controller and to the PCS 807 Multibox Profibus DP.
- The „SEND“ LED of the master board is activated after a maximum time of 5 seconds. Then, the green „COM“ LED of the PCS 807 Multibox or of the PCS 590p/595p lights statically.
- Now, connect the PCS (COM interface) to the PCS 807 Multibox Profibus DP (not the PCS 590p/595p).
- Set the restart input of the programmable controller to „ON“ or switch the programmable controller from STOP to RUN.
- The „COM“ LED of the PCS is deactivated after a maximum time of 2 seconds.

A General remarks

View	Pin	Signal name	Designation
	1	-	-
	2	-	-
	3	RxD/TxD-P	data line - B
	4	RTS	request to send
	5	M5V2	data reference potential (from the station)
	6	P5V2	power supply plus (from the station)
	8	RxD/TxD-N	data line - A
	9		

Mechanical mounting of the PCS 807 Multibox Profibus DP

The PCS 807 Multibox Profibus DP can be mounted on a top hat rail (DIN rail). The PCS operating console and the PCS 807 Multibox Profibus DP must be earthed!

A.1.5 PCS 807 Specifications

Description	PCS 807 Multibox Profibus DP slave
System requirements	Standard Profibus DP network according to DIN 19245
System assignments	<ul style="list-style-type: none"> min. 8 bytes in the input area of the program-mable controller min. 8 bytes in the output area of the program-mable controller max. 32 bytes in the input area of the programmable controller max. 32 bytes in the output area of the program-mable controller
Mounting dimensions	height: 50 mm width: 80 mm length: 120 mm (without cable)
Supply voltage	24 volts \pm 10 %
Current consumption	200 mA max.
Power consumption	5 VA max.
Operating temp. range	0 ... +50° C
Storage temp. range	- 20 ... +80° C
Interfaces	RS-232 interface with 25-pin sub D female connector to the PCS operating console RS-485 interface with 9-pin sub D male connector RS-485 interface with 8-pin terminal strip and 24 volts supply voltage
Indicators	<ul style="list-style-type: none"> 1 yellow LED for supply voltage 1 yellow LED for LOAD/RUN state 1 green LED for communication state
DIL-switches	<ul style="list-style-type: none"> DIL 1 .. 7 for setting the slave address DIL 10 as reset switch DIL 11 for switching from LOAD to RUN

B Siemens PLC

PCS 807 Profibus-DP Multibox
or PCS 590p/595p connected
to Siemens PLC with
I/O communication

B Siemens PLC

B Siemens PLC

B.1 Determining the configuration

For a Profibus-DP network setup are required by Siemens following products:

- a S5-SPS or S7-300 (400) with Profibus-DP master
- a Profibus-DP master plug-in module (only for S5), version IM308b (version 6), IM308c (version 2) or CP5431
- Programming software for the programmable controller and the master board
- Profibus-DP network cable and bus connector

... as well as the power supply for all components.

The settings of the components must match to enable all parts to correctly work together!

IM308 master board

Search for the right slot for your board. Otherwise, it may be damaged. The possible outlets are hatched gray.

Slots in the S5-115U system

Module rack CR 700-4:									
PS	CPU	0	1	2	3	4	5	6	IM

Module rack CR 700-2:									
PS	CPU	0	1	2	3	4	5	6	IM

Module rack CR 700-3:									
PS	CPU	0	1	2	3	4	5	6	IM

Slots in the S5-135U and S5-155U system

Central unit S5-135U:																				
3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163

Central unit S5-155U:																				
3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163

Central unit S5-135U/155U:																				
3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163

B Siemens PLC

Master board (S7 Profibus master)

You determine the Profibus-DP network by configuring the master board (S7 Profibus master).

The following limits are valid for a slave:

- maximum number of bytes = 32 for I/O buffer
- minimal number of bytes = 8 for I/O buffer
- optimal number of bytes = buffer size of 12 inputs and 24 outputs for PCS micro/mini
= buffer size of 24 inputs and 32 outputs for PCS midi and maxi

B.1.1 Configuration of the master board (S5)

You define the settings of the Profibus-DP network in the COM ET200 software. Also, each slave must be defined with its data length.

IM308b (version 6)

To be able to define the PCS 807 Multibox Profibus DP slave, you have to copy the „PCS002TD.200“ file from the PCS91.PDP diskette (please note the README.TXT file) into the COM ET200 directory.

Pay attention, that under DOS the last drive statement is set to „LASTDRIVE=Z“ before executing the software.

IM308c (version 2 or higher)

Copy the „LAUERDPX.200“ type data into the „Typdat5x“ sub-directory.

CP5431

In the DP editor, set the slave interval time manually.

Call up now the COM ET200 software for an IM308b (version 6)... ET200 parameters

- the baud rate should be between 187.5 and 1500 Kbaud.
- the bus profile must be selected as „Standard Profibus-DP“.
- the CPU type must be correctly selected.
- a diagnosis is not required.

Config parameters

- here, you determine the slave parameters.
- select the parameter file: „LauerDP slave 50“ for IM308b,
- set the consistency to „0“.
- define 8 ... 32 input bytes and 8 ... 32 output bytes per slave.

Call up the COMWIN10 software for an IM308c...

Bus parameters

Select Profibus-DP

B Siemens PLC

Host parameters

Select the used CPU

Master parameters

- station type: IM308c
- addressing type: select the linear range for the P or Q page frame. P or Q tiles are possible in the page frame. Then, select the number of the IM308c (0/16/32/48). Each IM308c manages up to 16 tiles.
- error message mode: Can be set to QVZ (acknowledgment delay on error).
- set the response monitoring to: ON

Slave parameters:

- select the „LAUER_PCS_LCA“ type file.
- you can SELECT P000-P255 and Q000-Q255 in the linear range.
- OP192-15P255 is possible in the P page frame.
- 0Q0-15Q254 is possible in the Q page frame.
- specify the input bytes between 8 and 32 and the output bytes between 8 and 32.
- sync or Freeze are not necessary.
- activate Module Consistency.

Transfer

Now, program the EPROM cassette or the Flash module and plug this into your IM308 board.



Note the slave settings for the programmable controller programming.

B Siemens PLC

Call SINEC.NCM for a CP5431 (version 4.6).

In contrast to the IM308 board, the CP5431 sends no configuration telegram. Thus, the setting on the boards and in the PCS 807 must agree.

I/O byte	8/8	16/16	24/24	32/32
DIL 5	OFF	ON	OFF	ON
DIL 6	OFF	OFF	ON	ON

The settings of DIL-switches 8 and 9 are taken over after a power up or reset.

For a PCS 590p/595p, DIL-switches 5 and 6 are used for the configuration selection:

I/O byte	8/8	16/16	24/24	32/32
DIL 5	OFF	ON	OFF	ON
DIL 6	OFF	OFF	ON	ON

The CP5431 works only together with the SPC3 chip. Therefore use the PX807 1000.

The Profibus-DP function may only be combined with asynchronous FMS services! Use only the I/O area of bytes 0...127 in the 115U CPU 941-943 programmable controllers. Otherwise, inconsistencies can appear.



Please note, that not all RAM modules are permissible for the CP5431 board!

Please note following settings:

CP INIT:

Network file: NETZ2NCM.NET

Network parameters:

Default SAP: 61

Peripheral/ I/Oarea:

DP Update: Cycle synchronous

Input and output areas: enter ZI/DP start (even) and ZI/DP end (odd).

Peripheral/ DP slave parameterizing:

Maker ident: 0008

Sync mode: OFF

Freeze mode: OFF

B Siemens PLC

Peripheral / DP editor:

Global data:

Largest min. slave interval: 2 x 1ms

Min. poll cycle time: 1 x 10ms

response monitoring time: 20 x 10ms

Discontinue the user interface accordingly. Perform a network balance using the „NETZ2NCM.NET“ file and transfer database file into the CP5431.

B.1.2 Configuration of the L2-DP network (S7)

Sinec L2-DP network

A Sinec L2-DP network is composed of a DP master and DP slave which are connected by a bus cable. They communicate with each other using the DP (decentralized peripheral) protocol.

DP master

As DP master you can use:

- a CPU with firmly integrated or pluggable DP master interface (firmly integrated into e.g. CPU 315-2 DP)
- a interface module that is assign to a CPU/FM (e. g. IF 964-DP in CPU 488-4)
- a CP together with a CPU (e. g. CP 342-5: this is parameterized using a special software in called up STEP 7).

DP slaves

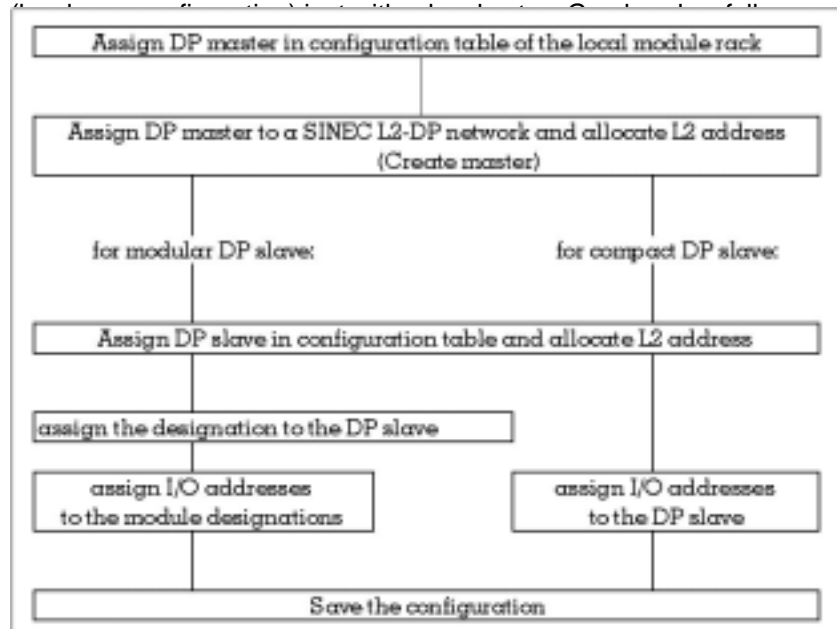
As DP slaves you can use:

- modules with integrated digital/analog I/O channels (compact DP slaves, e. g. ET 200B, PCSS 807 or LCA 3xx.3)
- interface modules with associated S5 or S7 modules (modular DP slaves, e. g. ET 200M).

B Siemens PLC

Procedure

Basically, you configure a SINEC L2-DP network using the Step7 software



Conversion into a configuration table

Allocate the DP master locally to a module rack. Allocate the DP slaves to an own configuration table. The change to this configuration table is only made after you have configured the DP master.

B.1.3 Defining a master system

- **Requirement**
You have called up the configuration table.
- **Master system**
All DP slaves associated to a DP master and the DP master form a master system. A master system is part of a SINEC L2-DP network.
- **Master system definition**
After you have allocated the DP master in the configuration table, you define the pertinent master system.
A master system means that you associate the DP master a SINEC L2-DP network and assign an L2 address to the DP master.
- **Select and allocate a DP master**
You select a DP master from the module catalogue and position it in the configuration table.

Result: if the DP master is an integrated interface of a CPU then a „+“ is indicated to the left of the CPU. A second line appears with the DP master if you click onto the + sign.

B Siemens PLC

Further procedure:

If you have allocated the DP master in the configuration table then you can either:

- continue to allocate the „local“ modules in the configuration table
- or
- configure the SINEC L2-DP network further by associating the DP master a SINEC L2-DP network and assign it an L2 address.
- **L2 address**
For the unambiguous identification, you must assign an L2 address to each DP master and DP slave of a master system in the SINEC L2-DP network.
- **Network and L2 address assignment**
Go ahead as follows to assign the network and L2 address:
 - 1 mark the line in which the DP master is found.
select the **Edit -> Master system -> Open** menu command. The dialog field for the network and L2 address assignment is displayed.
 - 2 assign the DP master a SINEC L2-DP network (a default network is offered).
 - 3 assign an L2 address to the DP master (the lowest free L2 address is offered as default value).
Result: the „Master system configuration table“ is displayed after the assignment of the SINEC L2-DP network and L2 address.

Master system configuration table

In the master system configuration table, you allocate and parameterize all DP slaves of a master system.

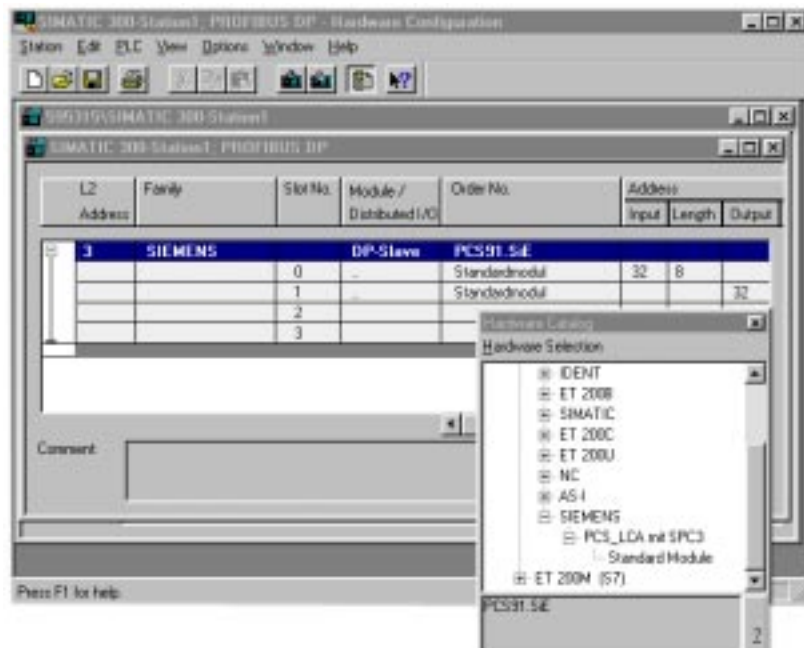
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Select and allocate a DP slave

Go ahead as follows to allocate a DP slave in the configuration table:

- 1 You must create the type file:

From the PCSS 91.PDP diskette copy the LAUSPC3X.200 file into your STEP7\S7DATA\TYPE FILE directory. Open your configuration table. Select the **Extras Update type files** menu command on. Now, close your application and restart the STEP 7 software. The type file has now been entered in your hardware catalog.
- 2 Select the PCS_LCA with SPC3 DP slave from the hardware catalog (to be found under ProfibusDP\Normslave\Siemens).
- 3 Allocate the DP slave in the configuration table. STEP 7 offers you automatically the free L2 addresses in a list box. The next free L2 address is offered as default value.
- 4 Assign the L2 address.



Allocate modular DP slave modules

Go ahead just as if you allocate modules in a local setup to allocate modules to a modular DP slave. Please note that the DP slave must be opened before you can associate modules (click onto „+“).

Now, insert 2 standard modules.

Assign a designation to a modular DP slave

Designations are assigned to modular DP slaves. the characteristics of the modules, e. g. addressing range and consistency of the data are encoded in the DP designation.

The DP designation is automatically displayed if you insert the module in the configuration table. You can edit the DP designation by double-clicking onto the line of the DP designation.

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Assigning of I/O addresses

Each input/output of a DP slave is assigned to exactly one address that is used for addressing. Therefore, you must assigned a starting address to each module/DP designation of a DP slave.

STEP 7 automatically presents default addresses when you insert the module/the DP slave in the configuration table. The default addresses and their lengths are entered in „I addr.“ and „O addr.“ and „length columns. Enter the number of the input and output bytes for each slave. You can select between 8 and 32 bytes.



Note the I/O address for the programmable controller programming!

B.1.4 Programming of the programmable controller

In the following, „FC“ is valid instead of „FB“ for an S7 application. You find the „README.TXT“ in the root directory of the PCS91.PDP floppy disk. The relevant handling block for each project is described in this file. Load the handling block for the Profibus-DP project into the programmable controller for a first test of the connection. With a Siemens S7, load the „PCSS7L2.AWL“ file as S0 object (source) and compile it. (In case you are using a S7 300 then OB 101 should be deleted after compilation since it can only be used with the S7 400). Edit FB 201 and FB 202 (S7: FC 101 and FC 102). Adjust the assignment to the one of the PCS. Remove the stop commands! The PCS data block must be present in the start OB.



Please note that the MB 236 ... 255 are used as temporary flags.

For each PCS 807 Multibox Profibus DP slave, include a call of the handling block FB 203 („PROFIB-PS5D“ for the P page frame, „PROFIB-Q.S5D“ for the Q page frame or PCSS7I2.AWL for the I/O area of an S7) in your programmable controller program. In case you are using the P-page frame or the Q-page frame, you must set these before calling the FB 203. In the calling parameters, you define:

- UBDB the name of the data block, e.g. DB50
- RXFA the location of the I-buffer (same as master board), e.g. KF +40
(S7: input location)
- RXLE the length of the I-buffer (same as master board), e.g. KF + 16
- TXFA the location of the O-buffer (same as master board), e.g. KF +50
(S7: output location)
- TXFE the length of the O-buffer (same as master board), e.g. KF + 16
- RSET the restart input, e.g. E0.0
- TIMES the designation of the time-out timer, e.g. T5

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TIMZ the time-out time, e.g. KT 20.1 = 2 seconds

RFLM the first start flag, e.g. M10.0

EROR the error flag, e.g. A0.0

COFF the error block, e.g. FB 202

(S7: FC 102)

INIT the first initializing block, e.g. FB 201

(S7: FC 101)

Thus, the example is set to the following values:

- The I-buffer is located from PW40 to PW54 and/or QW40 to QW54.
- The O-buffer is located from PW50 to PW64 and/or QW50 to QW64.
- Timer is the time-out timer T5 with a value of 2 seconds.
- E0.0 is the restart input
- A0.0 is the error output
- FB 201 is selected in the first cycle.
- FB 202 is called only once at a communication loss.

B.1.5 Settings of the slave Multibox

The PCS 807 Multibox Profibus DP slave automatically adapts to the alleged configuration. Only the slave number of the PCS 807 Multibox Profibus DP must be set. You set the slave number of the PCS 807 Multibox Profibus DP using the DIL-switches 1 to 7 to a number between 3 and 126. The setting must be made with the power being removed or in a reset condition (the setting is taken over at the start).

The slave address is calculated as follows (OFF=0 and ON= 1):

Slave-Nr	DIL 1	DIL 2	DIL 3	DIL 4	DIL 5	DIL 6	DIL 7
DIL 1 x 64 + DIL 2 x 32 + DIL 3 x 16 + DIL 4 x 8 + DIL 5 x 4 + DIL 6 x 2 + DIL 7 x 1							
3	OFF	OFF	OFF	OFF	OFF	ON	ON
4	OFF	OFF	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	OFF	OFF	ON	OFF	ON
6	OFF	OFF	OFF	OFF	ON	ON	OFF
7	OFF	OFF	OFF	OFF	ON	ON	ON
...							
125	ON	ON	ON	ON	ON	OFF	ON
126	ON	ON	ON	ON	ON	ON	OFF

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For the PCS 590p/595p operating console, the slave number is set in the driver using the PCSPRO configuration software.

Start-up the components in two steps

Step 1: Network

- Set up the Profibus-DP network.
- Supply power to the programmable controller and to the PCS 807 Multibox Profibus DP.
- The IM 308 „RN“ LED is activated and the „BF“ LED of the flashes.
- After about 5 seconds, the „BF“ LED of the master board is deactivated and the green „COM“ LED of the PCS 807 Multibox Profibus DP or the PCS 590p/595p is statically ON.
- With the S7, the „SF-DP“ and the „BUSF“ LEDs are deactivated.

Step 2: Logical communication

- Now, you can connect the PCS (COM interface) to the PCS 807 Multibox Profibus DP (not the PCS 590p/595p).
- Set the restart input of the programmable controller to „ON“ or switch the programmable controller from STOP to RUN.
- The „COM“ LED of the PCS is deactivated after a maximum time of 2 seconds.

B.1.6 S5 demo project

A demo project for an IM308c is included on the Siemens floppy disk to enable a simple introduction into the Profibus-DP configuration. There, a Profibus-DP network with a PCS operating console in the linear P page frame area occupying bytes 0...15 is available. The procedure for commissioning is documented in detail in the enclosed README.DOC

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file.

B.1.7 Trouble-shooting

Programmable controller enters STOP mode

- The Stop commands in the handling software were not yet eliminated. Please eliminate these.
- Programmable controller STOP on Profibus-DP error set in master configuration. Get network up and running.
- Configuration of the master board is not compatible to the programmable controller. Please correct.

IM308 does not enter the RUN mode or flashes (S7: master)

- Wrong slot for IM308. Please correct.
- Configuration data are wrong, not programmed or EPROM or Flash module is missing. Examine your data and the cassette.

Programmable controller in RUN mode, IM308 „BF“ LED (S7: „BUSF“ LED) flashes longer than 10 seconds

- error in the network configuration. Please eliminate.
- PCS 807 Multibox Profibus DP not ready, because:
 - incorrectly connected. Please correct.
 - in the Load condition (DIL-switch 11 = OFF).
first DIL 10 = ON,
next DIL1 1 = ON,
then DIL10 = OFF.
- in reset condition (DIL-switch 10 = ON). Set DIL10 to OFF.
- not powered up. Supply PCS 807 Multibox Profibus DP with 24V ± 10% voltage.
- wrong slave number. Set slave number correctly and trigger reset via DIL 10 (initiate reset with DIL 10 = ON, then DIL 10 = OFF)

Programmable controller in RUN mode, IM308 „BF“ LED (S7: „BUSF“ LED) OFF, PCS „COM“ LED ON

- PROFIBUS block is not called in the programmable controller. Please link. FB203 configuration does not match the master board.
Time-out timer expired, set restart input to 0. (UEROR: =RSET)
- PCS 807 Multibox Profibus DP DIL-switch 10 set to ON. Set PCS 807 Multibox Profibus DP DIL-switch to OFF.
- A wrong driver was loaded into the PCS operating console. Load the right driver together with the data record once more into the PCS operating console.
- IM308B start problems: the IM308B does not consider the slave

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interval time during the start process. Thus, it can cause problems with the PX807 001. Switch master board from STOP to RUN.

Programmable controller in RUN mode, IM308 „BF“ LED (S7: „BUSF“ LED) OFF, PCS „COM“ LED OFF, later ON again

At first, communication is active (PCS „COM“ LED is deactivated) but after a certain time, the „COM“ LED starts to flash. This signals that the communication is basically functioning but a monitoring condition such as the time-out time was not observed. Possibly, the restart input is not set or the handling block is called irregularly.

PCS 807 Multibox Profibus DP power LED (yellow) does not light

- Power supply voltage 24 V + 10% must be observed.
- Supply voltage reversed applied. Please correct.
- Fuse in the unit is burned out. Send the unit in for repair.

B.1.8 Term of the communication

PCS 807 Multibox Profibus DP

The PCS 807 Multibox Profibus DP software is based on the object codes of the Siemens company. In addition, serial communication and logical evaluation was added. Furthermore, the firmware is completely loadable.

Loading state

The PCS 807 Multibox Profibus DP is in the loading state if DIL 11 = OFF (yellow Run LED OFF), i. e. the EPROM is active and the EEPROM is externally addressable. Using a PC loader program, firmware can be now loaded into the unit using the serial interface. This is not necessary in the normal case since the unit is supplied with the firmware being loaded.

Run state

The PCS 807 Multibox Profibus DP is in the Run state if DIL 11 = OFF (yellow Run LED OFF) and the EEPROM program is active (the EPROM is switched off). To guarantee a defined initial start of the software, a reset must be triggered before the switching over DIL 10 to ON. This reset is then removed by switching DIL 10 to OFF again.

During the start, the firmware reads the DIP switches 1-7 and takes over these values as slave address. The firmware now can be run as independent slave on the Profibus-DP network.

The logical communication between PCS 807 Multibox Profibus DP and the programmable controller is started after plugging the serial interface into PCS 807 Multibox Profibus DP.

Structure of the logical communication

The Profibus-DP communication uses in Siemens the I/O area. Depending on the programmable controller, its size is between 128 bytes and several kilobytes (paging). A Profibus-DP master must be available in the programmable controller for communication. For this, Siemens supplies the IM308 board. The largest I/O unit that can be transferred is 32 bytes in size (thus, the largest configuration size of the PCS 807 Multibox Profibus DP is 32 bytes).

The configuration of the PCS 807 Multibox Profibus DP slave is determined

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with the IM308 master board (S7: Profibus master). The slave with the correct slave address automatically conforms to the configuration. This configuration will be submitted to the PCS operating consoles driver to setup the correct job/response packages.

According to the configuration, the driver in the PCS operating console splits the occurring jobs into part jobs. One-by-one, every part job is submitted to the PCS 807 Multibox Profibus DP for the transfer. A job number is attached to each transmission. The job is stored in the input area of the programmable controller. A programmable controller expander program reads the job and executes it on a DB. The result is stored in the output area with the job number being inverted. From there, it is submitted to the PCS 807 Multibox Profibus DP. Then, it is serially transferred to the driver.

The currently realized transfer times of PCS 807 Multibox Profibus DP to the programmable controller and vice versa are essentially limited by the SPC3 chip and the Siemens software to 50 msec min. Thus, a transfer „PCS 807 Multibox Profibus DP – programmable controller processing – PCS 807 Multibox Profibus DP“ lasts approx. 150ms. Including the serial transfer, the processing of a part job thus lasts approx. 180 msec. At an average of 6 jobs for a PCS 090, a communication cycle lasts approx. 500msec. Thus, the key LED time is 2 x communication cycle = 1 second.

Visual monitoring

yellow „Power On“ LED. It represents the functioning of the switching power supply.

yellow „RUN“ LED. This LED is OFF in the loading state. It is ON in the Run state.

green „Communication“ LED. This LED is OFF with communications being inactive. The LED flashes if a baud rate is recognized. The LED lights if a data exchange occurs.

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With a PCS 590p/595p, a green „Communication“ LED is available on the rearside of the unit. A data exchange occurs if it is activated. In addition, the „COM“ LED on the PCS 590p/595p frontpanel is only deactivated if the handling software is correctly executed in the programmable controller.

B.1.9 Optimal configuration

The communication speed depends essentially on the following elements:

Occurring tasks in the PCS

The display content and the enabled transfers in the command words determine the tasks of the PCS operating console.

Slave configuration

An increased I/O buffer size in the programmable controller will also increase the processing speed of the jobs in the PCS. The output buffer should have twice the size of the input buffer.

AJ driver variable

This variable changes the refresh behavior of the variables and the keys.

AJ = 1 -->

Keys and LEDs will be quickly transferred, variables are refreshed slowly - suited for jog operation. The I/O buffer can be small.

AJ = 10 -->

Default values. Represent a balance between the key and the variable refresh.

AJ = 20 -->

Keys and LEDs will be transferred simultaneously with variables. This setting is suited for the display of many variables. The I/O buffer should be as large as possible.

PCS 807 module version:

In the PX807 0001 version, a SPC2 chip is integrated that requires a min. slave interval time of 50 msec.

In the PX807 1000 version, a SPC3 chip is integrated that requires a min. slave interval time of 3 msec.

The version with the SPC3 chip is effectively approx. 3 times faster than the SPC2 version.

Configuration examples:

➤ **PCS 900**

- Slave configuration: 16 bytes I-buffer and 32 bytes O-buffer
- AJ = 10
- The command words in the programmable controller are used as follows:

W36 = KH0F60

W37 = KH0001

The transfer of the time and the date is disabled and a message

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block is enabled for the transfer. Now, you will have an optimal communication for the key LED area of less than one second if you take provisions to display only a few variables.

➤ **PCS 095**

- Slave configuration: 12 bytes I-buffer and 24 bytes O-buffer
- AJ = 10
- The command word in the programmable controller is used as follows:

W13 = KH0FC 1

Thus, the messages M0 ... 15 are enabled for the transfer. Now, you will have an optimal communication for the key LED area of less than 0.8 seconds if you take provisions to display only a few variables.

➤ **PCS 095**

- Slave configuration: 8 bytes I-buffer and 16 bytes O-buffer
- AJ = 1
- The command word in the programmable controller is used as follows:

W13 = KH0FC 1

Thus, the messages M0 ... 15 are enabled for the transfer. Keys will be transferred quickly but the refreshing of the variable takes a longer time. The key LED time totals approx. 0.5 seconds. However, if you press a key only for a short time then the LEDs are read only when the key is released again. Thus, the LED will not light.

➤ **PCS 9000**

- Slave configuration: 24 input bytes and 32 output bytes
- AJ = 10
- The command word in the programmable controller is used as follows:

W13 = KH 000C (CLK_D bit on pos. 2) (CLK_C bit on pos. 3)

W16 = KH 0

W17 = KH FF00

The transfer of the time and the date is disabled. Display no external variables in the status window as far as possible.

➤ **PCSS 590p/595p**

- Slave configuration: 16 bytes I-buffer and 32 bytes O-buffer
- AJ = 7
- The command word in the programmable controller is used as follows:

W13=KH 0FC4

W27 = 0

Thus the messages M0 ... M63 are enabled for the transfer. Now, you will have a communication time of less approx. 0.8 seconds for the key LED area if you take provisions to display only a few variables.

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PCS 807 Profibus-DP Multibox
or the PCS 590p/595p
for Bosch PLC with
I/O-communication

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C.1 Determining the configuration

The following Bosch products are required for a Profibus-DP network setup:

- 1 CI400 programmable controller
- 2 DESI-DP or DESI-DP12 Profibus master board
- 3 programming software for the programmable controller and the master board
- 4 Profibus-DP network cable and bus connector

... as well as power supplies for all components

C.1.1 Configuration of the master board (DESI-DP)

The corresponding settings must match to secure a correct interaction of all parts!

Type file

Copy the „LAUERDP.GSD“ file into your BOSCH.BIB directory.

This file is required for the master file to be created and contains all configuration possibilities of the PCS 807 slaves.

Call up now the Profi software of the master board. Select the DP software using F3. Create a new project or use the included PCS DP project.

Use F2 to enter the editor. Select the PCS 807 in the BTN overview. Under the Modules group select the configuration fitting your application best (size of the transfer buffer in bytes). Specify the slave address for the PCS 807 module or the PCS 590p/595p.

Now, switch to the BTN detail window using F5. Enter here the input and output bytes desired for the communication. You can use also the expanded inputs and outputs. Make sure that you specify an ascending order since otherwise the handling block interprets the communication commands wrong.

The Desi-DP master board requires coupling field with a size of 6 byte for the data exchange. Set the starting address of the coupling field in the „Bus master settings“ menu.

Load the master file into the master board. Consider the set baud rate of the software and the set baud rate of the master board.



Remark!

Note the set sizes for inputs and outputs, their start addresses and all other settings. They are required for the handling block or for the DIL-switch settings of the master board.

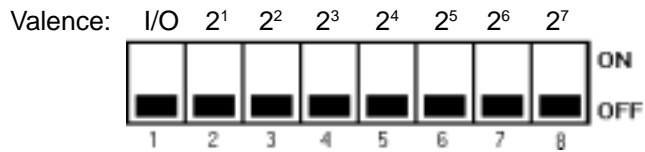
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Hardware settings using the DESI-DP board as an example (refer also to the Bosch DESI-DP Bus Master manual)

Set the coupling address using DIL-switch S4: switch 1 of S4 is used to select the addressing range.

- ON I/O field
- OFF EZ/AZ field

The other switches of S4 are used for the start address settings (refer to the following figure).



Example: Coupling address: EZ/AZ.



Used: 0.0 - 5.7

Example: Coupling address: I/O 4



Used: 4.0 - 9.7

Baud rate [Kbaud]	switches			
	1	2	3	4
9.6	OFF	OFF	OFF	OFF
19.2	ON	OFF	OFF	OFF
93.75	OFF	ON	OFF	OFF
187.5	ON	ON	OFF	OFF
500	OFF	OFF	ON	OFF
1500	OFF	ON	ON	OFF

Set the desired transfer rate using DIL-switch S5. Thereby, the PCS 807 slave module is adjusted automatically.

All DIL-switches of S3 were set to OFF in the test setup.

Remark!

With other boards used, possibly other settings are required for the master station address (refer to DESI-DP12). Please inform yourself using the corresponding manuals of the master board.



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For the evaluation of the received data, the „PCS_KOMM“ block is required that takes over the data traffic with the PCS DBs. Furthermore, an initialization (INIT) and an error block (COFF) is made available. You can use these blocks to define data word pre-assignments or emergency assignments. In addition, an example OB 1 is provided in which the block call is implemented. You find the files on the PCS 91.PDP floppy disk in the Profibus directory.



Remark!

In OB1, the first input word of the master coupling field must be copied to the first output word of the coupling field. This is required for the synchronization of CPU-DP master.

Parameters of the PCS_KOMM block:

The block requires 14 parameters. This makes it possible to freely select the addresses.

An example is provided in OB 1 (refer to the printout of the handling block).

The meaning of the parameters is as follows:

- P0: PCS user DB. (PCS data 256 words)
- P1: Start address of your selected Profibus input bytes
- P2: Length of the selected Profibus input field minus 1 byte
- P3: Start address of your selected Profibus output bytes
- P4: Length of the selected Profibus output field minus 1 byte
- P5: Restart input or flag. This is required to restart the communication after a communications fault. (Set the input to permanently high for an automatic reset)
- P6: Timer for time-out monitoring
- P7: timer time as constant
- P8: Communication error output (the output is set to high level after a communications fault)
- P9: PB of the „INIT“ block
- P10: PB of the „COFF“ block
- P11: Required flag (freely selectable, may not be used by other program parts)
- P12: Required flag (freely selectable, may not be used by other program parts)
- P13: Required flag (freely selectable, may not be used by other program parts)

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C.1.2 Trouble-shooting

Programmable controller enters STOP mode

- The Stop commands in the handling software were not yet eliminated. Please eliminate these.
- Configuration of the master board is not compatible to the programmable controller. Please correct.

Programmable controller in RUN mode, „Send“ LED“ is OFF

- Errors in the network configuration
- Multibox not ready due to:
 - Wrong slave address. Check whether the master file matches the address.
 - In reset condition (DIL-switch 10 is set to ON). Set DIL 10 to OFF.
 - No supply voltage. Apply voltage to the Multibox.

Programmable controller in RUN mode, „Send“ LED is ON, status message 01

- Programmable controller in Stop mode. Switch the programmable controller to RUN
- Network fault. Check whether all participants are configured correctly. Check the cabling.
- Coupling fault (CPU is not synchronized with master board). Check whether the start input word of the selected coupling field is cyclically copied to the start output word.

Programmable controller in RUN mode, „Send“ LED is ON, no status message, PCS „Com“ LED is ON

- Lauer handling block is not called in the programmable controller program. Please link in with correct parameters.
- A wrong driver was loaded into the PCS. Transfer the data record together with the correct driver again into the PCS operating console.

Programmable controller in RUN mode, „Send“ LED is ON, no status message, PCS „Com“ LED is OFF but later ON again

- The network configuration was not synchronized with all participants. Power down all involved units. Restart all units.
- The network setup is located in noisy environment. Provide for corresponding interference suppression.

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Configuration examples:

➤ **PCS 900**

- Slave configuration: 16 bytes I-buffer and 32 bytes O-buffer
- AJ = 10
- The command words in the programmable controller are used as follows:

W36 = KH0F60

W37 = KH0001

The transfer of the time and the date is disabled and a message block is enabled for the transfer. Now, you will have an optimal communication for the key LED area of less than one second if you take provisions to display only a few variables.

➤ **PCS 095**

- Slave configuration: 12 bytes I-buffer and 24 bytes O-buffer
- AJ = 10
- The command word in the programmable controller is used as follows:

W13 = KH0FC 1

Thus, the messages M0 ... 31 are enabled for the transfer. Now, you will have an optimal communication for the key LED area of less than 0.8 seconds if you take provisions to display only a few variables.

➤ **PCS 095**

- Slave configuration: 8 bytes I-buffer and 16 bytes O-buffer
- AJ = 1
- The command word in the programmable controller is used as follows:

W13 = KH0FC 1

Thus, the messages M0 ... 31 are enabled for the transfer. Keys will be transferred quickly but the refreshing of the variable takes a longer time. The key LED time totals approx. 0.5 seconds. However, if you press a key only for a short time then the LEDs are read only when the key is released again. Thus, the LED will not light.

➤ **PCS 9000**

- Slave configuration: 24 input bytes and 32 output bytes
- AJ = 10
- The command word in the programmable controller is used as follows:

W13 = KH 000C (CLK_D bit on pos. 2) (CLK_C bit on pos. 3)

W16 = KH 0

W17 = KH FF00

The transfer of the time and the date is disabled. Display no external variables in the status window as far as possible.

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➤ **PCSS 590p/595p**

- Slave configuration: 16 bytes I-buffer and 32 bytes O-buffer
- AJ = 7
- The command word in the programmable controller is used as follows:

W13=KH 0FC4

W27 = 0

Thus the messages M0 ... M63 are enabled for the transfer. Now, you will have a communication time of less approx. 0.8 seconds for the key LED area if you take provisions to display only a few variables.

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C.2 Print out handling software

```

OB1  OB1          Master Baustein
PB0  PCS_KOMM    Expanderprogramm für PCS
PB2  INIT        Initialisierungsbaustein
PB3  COFF        Fehlerbaustein

;      OB1
; Filename:      OB1
; function:      Organisationsbaustein

;      p r o g r a m
;*****
1  L   W  EZ64,A          ; copy the first word of your I/O-Area of the
2  T   W  A,AZ64         ; CPU - DESI-DP communication from input to
                          ; output

; call the Lauer communication subroutine PB (PCS_KOMM)

3  BA   -PCS_KOMM,14    ; call expander program
   P0  W  -DB1          ; DB  PCS-datafield of 256 words
   P1  W  &EZ10         ; W  startaddress of the Profibus-Input
   P2  W  K31D         ; K  lenght of input-bytes - 1
   P3  W  &AZ10         ; W  startaddress of the Profibus-Output
   P4  W  K31D         ; K  lenght of output-bytes - 1
   P5  B  -RESTART     ; B  restart input
   P6  W  -TIMER       ; T  watch dog PCS-communication
   P7  W  K4.2         ; K  timevalue for watch dog
   P8  B  M100.0       ; B  output-bit communication error
   P9  W  -INIT        ; PB  INIT (communication init PCS)
   P10 W  -COFF        ; PB  COFF (communication error PCS)
   P11 B  M100.2       ; B  for internal use
   P12 B  M100.3       ; B  for internal use
   P13 B  M100.4       ; B  for internal use

;U   B  M100.0         ; communication error to output
;=   B  A3.7

4  PE
   ;program end

;      PCSKOMM
;      expander-program for communication via Profibus with PCS-Topline      ; Filename:
PCS_KOMM
; function:      expander for the CL400
;      D e c l a r a t i o n
; subroutine parameter:
;~~~~~
;BA   -PCS_KOMM,14    ; call expander program
;P0  W  -DB1          ; DB  PCS-datafield of 256 words
;P1  W  &EZ10         ; W  startaddress of the Profibus-Input
;P2  W  K31D         ; K  lenght of input-bytes - 1
;P3  W  &AZ10         ; W  startaddress of the Profibus-Output
;P4  W  K31D         ; K  lenght of output-bytes - 1
;P5  B  -RESTART     ; B  restart input
;P6  W  -TIMER       ; T  watch dog PCS-communication
;P7  W  K4.2         ; K  timevalue for watch dog
;P8  B  M100.0       ; B  output-bit communication error
;P9  W  -INIT        ; PB  INIT (communication init PCS)
;P10 W  -COFF        ; PB  COFF (communication error PCS)
;P11 B  M100.2       ; B  for internal use
;P12 B  M100.3       ; B  for internal use
;P13 B  M100.4       ; B  for internal use

;      p r o g r a m
;*****
;

```

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```

; processor reset => reset BT9_KOM
;~~~~~
PZ: 1
1  U   B   -P_RI
2  O   B   -NEU_RI
3  SPB  -START_KO ; →
4  BX   -P0
PZ: 2
5  U   B   -P12           ;second cycle to catch whole data (inputs)
6  SPB  -WAITDAT1
PZ: 3
7  U   B   -P13
8  SPB  -WAITDAT2           ;second cycle to catch whole data (outputs)
; no process if timeout and restart input = 0
;~~~~~
PZ: 4
9  UN   B   -P5           ; timeout ?
10 U   B   -P8           ; restart ?
11 BEB
; instruction-number = 0 => wait for instruction-number = 0 ;
; if instruction-number = n => process received data
;~~~~~
12 XO   W   B,B           ; A Register = 0
13 L    W   -P1,A         ; instruction-number = 0 ? Input
14 L    BY [A],A
15 VGL  BY A,B
16 SPZ  -NO_AUFTR ; →
17 BX   -P0           ; open PCS-DB
; instructions-number > 0 => process the instructions
;
; Have the whole instruction received ?
18 L    BY DX3,B         ; old instruction-number in byte 3
19 L    W   -P1,A         ; load instruction-number (input)
20 L    BY [A],A
21 VGL  BY A,B           ; compare old with new
22 SPZ  -NO_AUFTR       ; if even → no new instructions
23 L    W   -P1,A         ; load address of receive inputs
24 L    BY [A],B         ; load instruction-number 1. byte
25 ADD  W   -P2,A         ;
26 L    BY [A],A         ; load instruction-number last byte
27 VGL  BY A,B           ; compare first with last
28 SPN  -NO_AUFTR       ; if not even → instructions are not
; complete
PZ: 5
29 UN   B   -P11         ;set wait-flag and wait one cycle
30 =    B   -P12
31 BE
   -WAITDAT1
PZ: 6
32 U    B   -P11         ;reset the wait-flag
33 =    B   -P12
34 L    W   -P1,A         ; indir.address of datainputs
35 ADD  W   K1H,A        ; at byte 2 load first instruction
36 L    W   -P3,B         ; indir.address of dataoutputs
37 ADD  W   K1H,B
38 L    W   K2H,D         ; reset receive counter
39 T    BY D,DX2         ; DX2 = receive-counter

; analyse of the instructions

   -read_new   ; ←
40 L    BY [A],C         ; read actual instruction
41 L    W   A,A
   ;SP        -AUFT_END
42 PUSH W   C

```

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```

43 ADD W K1,A
44 L BY [A],C
45 T BY C,D
46 U BY KF0H,C
47 VGL BY K10H,C ; read instruction
48 SPZ -READ ; →
49 VGL BY K20H,C ; write instruction
50 SPZ -WRITE ; →
51 VGL BY K40H,C ; write and „AND“ instruction
52 SPZ -WRITE_U ; →
53 VGL BY K80H,C ; write and „OR“ instruction
54 SPZ -WRITE_O ; →
55 POP W C
56 SP -AUFT_END

;=====
; read instruction: copy data from PCS-datafield to send outputs
;=====
-READ ; ←
57 POP W C
58 PUSH W A ; pointer receive inputs to stack

59 L BY C,A ; load dataword address
60 U W K00FFH,A
61 SLL W A,1 ; * 2
62 O W K1800H,A ; at to indirect address PCS-Datafield
63 L BY D,C ; load instruction
64 U BY K0FH,C ; mask count of datawords

-return_r ; ← copy until count of datawords = 0
65 VGL BY K0H,C
66 SPZ -r_end ; read instruction end
67 INC W A,1
68 L BY [A],D ; load high byte from PCS-datafield
69 T BY D,[B] ; write to send outputs
70 DEC W A,1
71 INC W B,1 ; increment send pointer
72 L BY [A],D ; load low byte from PCS-datafield
73 T BY D,[B] ; write to send-outputs
74 INC W B,1 ; increment send pointer
75 INC W A,2 ; increment datafield-address
76 DEC BY C,1 ; decrement dataword counter
77 SP -return_r ; →

; is there another instruction ?
;~~~~~
-r_end
78 POP W A ; load from stack receive pointer
79 L BY DX2,D ;
80 U W K00FFH,D
81 ADD W K2H,D ; increment receive pointer
82 VGL W -P2,D ; check if receive end
83 SPP -AUFT_END
84 T BY D,DX2
85 INC W A,1 ; next instruction address
86 L BY [A],D ;
87 VGL BY K0H,D ; check if instruction = 0
88 SPZ -AUFT_END
89 SP -read_new ; → ; there is another instruction
; → process the next instruction

; end read instruction
;=====
; write instruction: copy datawords from receive inputs to PCS-datafield
;=====
-WRITE ; ←

```

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```

90 POP W C
91 PUSH W B ; send pointer to the stack

92 L W C,B ; load PCS-dataword-address
93 U W K00FFH,B
94 SLL W B,1 ; * 2
95 O W K1800H,B ; add to indirect address PCS-datafield
96 L BY D,C ; load instruction
97 U BY K0FH,C ; mask count of datawords
98 PUSH W C ; dataword counter to the stack
99 INC W A,1 ; increment receive pointer

-return_w ; ← ; copy until dataword counter = 0
100 VGL BY K0H,C
101 SPZ -w_end ; write instruction end
102 INC W B,1 ; receive address of high byte
103 L BY [A],D ; load byte from receive inputs
104 T BY D,[B] ; and store it as high byte
105 DEC W B,1 ; receive address of low byte
106 INC W A,1 ; increment datafield address
107 L BY [A],D ; load byte from receive inputs
108 T BY D,[B] ; and store it as low byte
109 INC W A,1 ; increment datafield address
110 INC W B,2 ; increment receive pointer
111 DEC BY C,1 ; decrement dataword counter
112 SP -return_w ; ←

; is there another instruction ?
;~~~~~
-w_end
113 POP W C ; load from stack dataword counter
114 POP W B ; load from stack send pointer
115 INC W C,1 ; count +1 instruction word
116 SLL W C,1 ; count of byte
117 L BY DX2,D
118 U W K00FFH,D
119 INC W D,[C] ; increment receive pointer
120 VGL W -P2,D ; check if receive end
121 SPP -AUFT_END
122 T BY D,DX2
123 L BY [A],D ; load next instruction
124 VGL BY K0H,D ; check if instruction = 0
125 SPZ -AUFT_END ; →
126 SP -read_new ; → ; there is another instruction
; → process the next instruction

; end write instruction

; write and „AND“ instruction: that is an „AND“ function between received
; data and the data in the datafield, stored
; later in the datafield
;=====

-WRITE_U
127 POP W C
128 PUSH W B ; send pointer to the stack

129 L W C,B ; load PCS-dataword-address
130 U W K00FFH,B
131 SLL W B,1 ; * 2
132 O W K1800H,B ; add to indirect address PCS-datafield
133 L BY D,C ; load instruction
134 U BY K0FH,C ; mask count of datawords
135 PUSH W C ; dataword counter to the stack
136 INC W A,1 ; increment receive pointer

-return_u ; ← ; copy until dataword = 0

```

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```

137 VGL BY K0H,C
138 SPZ -u_end ; write „AND“ instruction end
139 INC W B,1 ; receive address of high byte
140 L BY [A],D ; load high byte from receive inputs
141 U BY [B],D ; „AND“ byte from PCS-datafield
142 T BY D,[B] ; store it as high byte
143 DEC W B,1 ; receive address of low byte
144 INC W A,1 ; increment datafield address
145 L BY [A],D ; load low byte from receive inputs
146 U BY [B],D ; „AND“ byte from PCS-datafield
147 T BY D,[B] ; store it as low byte
148 INC W A,1 ; increment datafield address
149 INC W B,2 ; increment receive pointer
150 DEC BY C,1 ; decrement dataword counter
151 SP -return_u ; →

; is there another instruction ?
; ~~~~~
-u_end
152 POP W C ; load from stack dataword counter
153 POP W B ; load from stack send pointer
154 INC W C,1 ; count +1 instruction word
155 SLL W C,1 ; count of byte
156 L BY DX2,D
157 U W K00FFH,D
158 INC W D,[C] ; increment receive pointer
159 VGL W -P2,D ; check if receive end
160 SPP -AUFT_END
161 T BY D,DX2
162 L BY [A],D ; load next instruction
163 VGL BY K0H,D ; check if instruction = 0
164 SPZ -AUFT_END ; →
165 SP -read_new ; → ; there is another instruction
; → process the next instruction

; end write „AND“ instruction

; write and „OR“ instruction: that is an „OR“ function between received
; data and the data in the datafield, stored
; later in the datafield

-WRITE_O ; ←
166 POP W C
167 PUSH W B ; send pointer to the stack

168 L W C,B ; load PCS-dataword-address
169 U W K00FFH,B
170 SLL W B,1 ; * 2
171 O W K1800H,B ; add to indirect address PCS-datafield
172 L BY D,C ; load instruction
173 U BY K0FH,C ; mask count of datawords
174 PUSH W C ; dataword counter to the stack
175 INC W A,1 ; increment receive pointer

-return_o ; ← ; copy until dataword counter = 0
176 VGL BY K0H,C
177 SPZ -o_end ; write „OR“ instruction end
178 INC W B,1 ; receive address of high byte
179 L BY [A],D ; load byte from receive inputs
180 O BY [B],D ; „OR“ byte from PCS-datafield
181 T BY D,[B] ; and store it as high byte
182 DEC W B,1 ; receive address of low byte
183 INC W A,1 ; increment datafield-address
184 L BY [A],D ; load byte from receive inputs
185 O BY [B],D ; „OR“ byte from PCS-datafield
186 T BY D,[B] ; and store it as low byte

```

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```

187 INC W A,1 ; increment datafield-address
188 INC W B,2 ; increment receive pointer
189 DEC BY C,1 ; decrement dataword counter
190 SP -return_o ; →

; is there another instruction ?
;~~~~~
-o_end
191 POP W C ; load from stack dataword counter
192 POP W B ; load from stack send pointer
193 INC W C,1 ; count +1 instruction word
194 SLL W C,1 ; count of byte
195 L BY DX2,D
196 U W K00FFH,D
197 INC W D,[C] ; increment receive pointer
198 VGL W -P2,D ; check if receive end
199 SPP -AUFT_END
200 T BY D,DX2
201 L BY [A],D ; load next instruction
202 VGL BY K0H,D ; check if instruction = 0
203 SPZ -AUFT_END ; → ;
204 SP -read_new ; → ; there is another instruction
; process the next instruction

; end write „OR“ instruction

; AUFT_END: all instructions are done

-AUFT_END ; ←
PZ: 7
205 UN B -P11 ; wait one cycle to be sure that
206 = B -P13 ; all outputs are refreshed

207 BE

; Invert instruction-number and write it to the first and last byte
; of the communication outputs
;~~~~~
-WAITDAT2
PZ: 8
208 U B -P11 ; reset wait-flag
209 = B -P13

210 L W -P1,A
211 L BY [A],D ; load instruction-number
212 T BY D,DX3 ; store it in byte 3
213 XO BY KFFH,D ; invert the instruction-number
214 L W -P3,A
215 T BY D,[A] ; store it in the first and last
216 ADD W -P4,A ; output bytes
217 T BY D,[A]

; watch dog
;~~~~~
; trigger time
;-----
218 U W -P7,D ; timevalue
PZ: 9
219 U B -LOG0
220 SE D,-P6 ;

PZ: 10
221 U B -LOG1 ; Watchdogmerker reset
222 R B -P8

223 BE ; →

```

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```

; end instructions

; no new instructions
-NO_AUFTR                                ; ←

224 L   W   -P7,D                          ; timevalue
PZ: 11
225 U   B   -LOG1
226 SE   D,-P6

PZ: 12
227 U   B   -P6                          ; timeout ?
228 BEI

; set fault   watch dog has responded
;~~~~~
-KOMM_FEL

229 S   B   -P8                          ; watch dog
230 XO   W   D,D

; init after communication error
;~~~~~
231 BA   -P0                              ; open PCS-DB
232 BA   -P10                             ; COFF
233 BE           ; →
;           end watch dog

; start of communication

-START_KO
; start timer
;~~~~~
234 L   W   -P7,D                          ; timervalue
PZ: 13
235 U   B   -LOG0
236 SE   D,-P6

; reset fault
;~~~~~
PZ: 14
237 U   B   -LOG1
238 R   B   -P8                          ; watch dog

239 XO   W   D,D

; init output at the first cycle
;~~~~~
240 L   W   -P3,A
241 T   W   D,[A]

; init PCS-DB at first cycle
;~~~~~
;BA   P0                                  ; open PCS-DB
;BA   P9                                  ; INIT

242 BE           ; →
; end start communication

;program end

;** INIT: Subroutine INIT inits the PCS-datafield at the first cycle
;**           The user can program his own specifications

;HLT   ;!!!! Here you have to specify your init values

;***** !!! at least set your

```

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```
;***** key-bytes to zero !!!!!
```

```
;***** Example PCS 009/090/095*****
```

```
;L W K0D,A
;T W A,D8
;T W A,D10
;T W A,D46
;L W K0FC8H,A
;T W A,D26 ;CONTROLWORD A
;L W K0080H,A
;T W A,D28 ;CONTROLWORD B
```

```
;***** EXAMPLE PCS 900/920/950 *****
```

```
;L W K0D,A
;T W A,D8
;T W A,D10
;T W A,D12
;T W A,D18
;T W A,D78 ;CONTROLWORD D
;L W K0080H,A
;T W A,D76 ;CONTROLWORD C
;L W K00FFH,A
;T W A,D74 ;CONTROLWORD B
;L W K1F00H,A
;T W A,D72 ;CONTROLWORD A
```

1 BE

```
** COFF: subroutine COFF inits the PCS-datafield after communication error
** ( emergency case ) The user can program his own specifications
```

```
;HLT ;!!!! Here you have to specify your emergency values
;*****
;*****
;***** !!!!! CAUTION !!!!!
;***** at least set the Key-bytes to zero
;*****
```

```
;***** Example PCS 009/090/095 *****
```

```
;L W K0D,A
;T W A,D8 ; keys
;T W A,D10 ; keys
;T W A,D46 ; keys
```

```
;***** Example PCS 900/920/950 *****
```

```
;L W K0D,A
;T W A,D8 ;keys
;T W A,D10 ;
;T W A,D12
```

1 BE