LCA 301.SIE
Siemens Manual

LCA 301

Appendix to the manual of
the LCA 300/320

Reg 10226/1099

Version 2/10.99

Systeme Lauer GmbH & Co KG
Postfach 1465
D-72604 Nürtingen

Operator reference manual: LCA 301.SIE
Version: 19. Oktober 1999
Person responsible: Lackenbauer

- We reserve the right to make changes to the reference manual without prior notice.
- We can not guarantee the accuracy of the programs and data stored on the diskette and the fault-free state of this information.
- Since diskettes 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.

Suggestions for the user

Please read the reference manual before applying the unit first and store the manual at a safe location for later use.

Target group

The reference manual is written for users with previous knowledge in PC and automation technology.

Representation conventions

[KEY]	Key inputs of the user are represented in square brackets, e.g. [CTRL] or [DEL]
`Courier`	Display outputs are printed 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**
Kursiv	Names of buttons to be selected, menus or other screen elements and product names are printed in *Italics*.

Symbols The following symbols in the reference manual are used to mark certain text sections:

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 tests 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 an 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 -222, -132, -231, -230
eMail:	support@systeme-lauer.de
Web site:	www.systeme-lauer.de
	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 requirements 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 burnings 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.

Standards

The PCS is manufactured to the state of the art and meets the requirements of following guidelines and standards:

- EMC guideline 89/336/ EEC
- EMC specialist basic standard EN50081 part 2 Noise Emission in The Industrial Area
- EMC specialist basic standard EN50082 part 2 Interference Resistance in The Industrial Area
- European Extra Low Voltage Guideline 73/23/EEC

The mounting and connection instructions described in this documentation are to be observed.

The conformity is confirmed by attaching the CE sign.
The EC conformity declarations can be asked for at:

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

1 AS511 - Driver

1.1 First commissioning

Delimitation

Warning!
Use only the LCAPRO software for the configuration. Other software packages can cause malfunctions in the LCA and programmable controller.

The successful parameterization of the LCA as described in the LCA and/or LCAPRO manual is assumed. This appendix is exclusively concerned with the application of the LCA together with the SIEMENS S5 90U to 135U programmable controller series. This controller is called programmable controller in the following. The SIEMENS-specific terminology and the programming of the programmable controller using the software is assumed to be known. The LCA 300 mentioned in the following represents also the LCA 320. Functionally, both text displays are identical.

Required devices and accessories

The following products (from the System Lauer company) are required to operate a programmable controller with an already parameterized LCA 300/320:

1. The LCA text display (already parameterized).
2. The LCA 716 connecting cable for the connection of the LCA to the programmable controller via the TTY interface.
3. This manual.
4. The LCAPRO diskette with the L300AS08.FRM, L300AS16.FRM, and L300AS20.FRM firmware modules.
5. LCA 300 or LCA 320.
6. Possibly a PG-MUX 809 for CPUs with one port.

Also required are (from SIEMENS):

7. One 155U,(CPU 928), 135U (CPU 928), 115U (CPU 941 and higher), 100U (CPU 100, CPU 102 or CPU 103), 95U or 90U programmable controller
8. One corresponding rack or bus module for the programmable controller.
9. One PG 635, PG 675, PG 685, PG 710, PG 730, or PG 750 programming unit.
10. Power supply for all components.

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1.1.1 Loading of the AS511 firmware into the LCA

The LCA firmware and one or two binary records are transferred during the configuration. The modules have the .FRM extension and are associated to the CPUs as followed:

- L300AS08.DRV for all programmable controllers of the 95U, 100U, 102U, 103U series (all CPUs), 115U for the CPU 941 up to and including the CPU 944.
- L300AS20.DRV for the 945 programmable controller.
- L300AS16.DRV for the 135U and 155U series (all CPUs besides CPU 921)

All parameters and settings which affect the linkage are taken from the 1st record. These are:

1. [Y001] variable: time-out time
   The time-out time determines the maximum admissible time (in milliseconds) between the sending of a request and the arriving of the programmable controller response. Since a repeat is started after the first missing reception data, the message may appear only after the twice the time. By default, this time is preset to 400 milliseconds. Admissible values are between 0 (no time monitoring) and 30000 (30 sec.).
2. ADDRESS REFERENCES are also retrieved from the first record. If references are specified in the second record which are not contained in the first record (e.g. variables) then these values remain at 0 and are never read. The preset value addresses are also taken from the 1st record.

1.1.2 Connection of the LCA to the PLC

Warning!
Check the function of the LCA and programmable controller after parameterization and/or a firmware transfer. All parameterized functions must be checked.

1. Create possibly required DBs in the programmable controller.
2. Apply operating voltage (24V DC 20%) to the LCA. The red ERR LED must now be activated.
3. Connect the programming interface of the programmable controller to the LCA using the LCA 716 cable.
4. The ERR LED on the LCA must be deactivated after approx. 1 second.
5. A communication time-out has to be waited for when exchanging the connected programmable controller CPU in the RUN state! This applies specially for changing byte-oriented CPUs against word-oriented CPUs and conversely.

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1.1.3 Trouble-shooting

Here, the most frequent faults are listed which appear during the first commissioning and in continuous operation:

1. Wrong firmware loaded. In this case, the LCA signals the fault in plain text. This applies to all known CPUs having the production date November 1994.
2. Faulty cable. This results in no error message since a time overflow is evaluated as fault first after the link has already been started. However, the ERR LED lights permanently.
3. DB in the programmable controller not created or too short. In this case, the LCA signals the fault when it tries to access the missing data element. The following information are shown in the display: the corresponding LCA address, the required DB/DX number, and the required byte number (DL/DR).
4. First, communications starts normally (LCA ERR LED is deactivated) but after a short time, the following message appears on the topmost display line of the LCA:

   »COMMUNICATION-ERROR«

   The following faults can appear on the second line:

   TIMEOUT:
   This fault appears possibly when using the MUX PCS 809. When using this device, the variable [Y001] is to be parameterized according to the time to be bridged. Usually, 2000 milliseconds are sufficient. Without MUX, 200 milliseconds are sufficient.

   PROTOCOL VIOLATION:
   Sequencing fault in the AS511 protocol. In this case, the LCA to programmable controller interface cabling is routed in a heavy interference-loaded environment, the cable is too long, or the grounding is insufficient.

   TOO MANY REPETITIONS:
   A re-synchronization and a repetition is performed after unexpected characters have been received. Interferences, defective screens or bad grounding situations can be the source of the problem if unexpected character are received again.

   ERROR CODE:
   xx: This error message could appear with new revisions and new CPUs. We can perform a more detailed analysis if we are informed about the shown code.

Warning!
Check the reaction/action of the programmable controller! The desired reaction/action of the programmable controller is to be checked to avoid malfunctions after the restart of the pro- grammable controller following a communication loss.

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1.1.4 Diagnosis

Beside the normal operation, the LCA also allows the diagnosis operation. This mode is activated by pressing an arbitrary key during the powering up. Subsequently, values read from the programmable controller can be displayed in the KH format. The addresses are selected using the ARROW UP and ARROW DOWN keys. The read value is continuously displayed. The keys are only treated internally. The key status and key event are always transferred as 0 to the programmable controller.
This mode is terminated be powering the LCA down and up again.

Notes for the connection of the LCA to a programmable controller:

- Connect the cable screening to the central common point in the swiching cabinet!
- Provide for good common connections between the LCA on the one, and to the programmable controller bus board on the other hand! Remember that a copper grounding strip based on its large surfacearea has a somewhat better RF conductivity than normal flexible wire.
- Avoid as far as possible the creation of high frequency interferences since these are very difficult to dampen. Using photocouplers, there is a potential separation between the programmable controller and the LCA. But this galvanic isolation is nearly without effect for fast transients since photocouplers also have (even though minor)a coupling capacity.
- Provide for clear reference points for the supply voltage.To facilitate this, the power supply is potential-free!
- The use of an own power supply for the LCA (24 volt, 10 VA) is recommended where the supply voltage is subject to high noise levels. The power supply should have a corresponding noise filter. Then, 0 volt can be directly connected to the LCA with the protective conductor.
- The LCA and the communication cable should have a minimum distance of 200 mm from noise sources. This applies especially to inductivities and frequency converters.
- Take care that the serial data lines are covered as completely as possible by the screening. Use metal-covered connector hoods on both the LCA as well as on the programmable controller side. These hoods should have a low impedance connection to the cable screen. With grounding at both sides is to be noted however that possibly (because of ground potential shifts) a potential compensation wire is required having at least 10 times the screen cross section. This applies particularly if LCA and programmable controller are not connected to the same common point. This is for example valid where the LCA and programmable controller are not housed in the same switching cabinet!

  Reason: Avoidance of compensation currents on the cable screen!

Warning!
The text display writes data cyclically into the programmable controller. The programmable controller may in no case be compressed using the second interface if a DW is the target! This results in an uncontrollable malfunction of the programmable controller!

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1.2. PLC-Handling software

1.2.1 General description of the AS511 protocol

The AS511 protocol is a pure programming protocol and anticipates only a few possibilities for the fault detection. It's advantage is the quick asynchronous access to programmable controller data. Thereby, the scan time load remains under 2 ms and is thus approximately just as large as the scan time variation of a programmable controller without communication. Data is asynchronously accessed byte-by-byte as much as possible.
The protocol does not support any block check. It performs only a character test via the parity.

1.2.2 AS511 and LCA

The transfer exchanges the following data:

- Key bits and life bit (cyclically, direction LCA R PLC)
- Key code and the internal bit (after a change, direction LCA R PLC)
- LCA addresses, byte 4 up to the last used variable address (cyclically in blocks, direction PLC R LCA)

For this, the entire byte field (byte 4 up to the last used variable address) to read is split into individual blocks. With larger blocks sizes, fewer transfer cycles are required for a complete data interchange. The parameterization of the cross-references determines this block size most extensively. Therefore, it is recommended that in the programmable controller, the data field is only split for important reasons. LCAPRO optimizes the individual cross-references by functionally summarizing these into individual blocks.

The basic communication sequence is as follows:

1. Write the key status (byte 1)
2. Write the key code (byte 3) if a key has been pressed.
3. Write a preset value if ENTER was used in the edit mode.
4. Read the next block
5. Repeat starting with 1.

No programmable controller program is required for transferring the entire field. For the preset value transfer, AS511 directly accesses the byte or word for writing. A logical 1 is transferred in bit 0 for each writing of byte 1 so the programmable controller program can recognize the connected text display.

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1.2.3 Transfer times/response times

The response of the protocol for transferring the entire field to read depends on one hand on the splitting of the read area and on the other hand on the highest used data byte address. With linear addressing, a standard time of 150 milliseconds + 1.2 milliseconds per byte can be assumed. The key transfer is delayed by a maximum of 100 milliseconds + 2 programmable controller scan cycles.

1.2.4 Multiple use of AS 511

A parallel operation of 2 LCA or an LCA and a PU/PC which are connected to the programmable controller is either possible via two interfaces on the CPU or by means of an AUTOMUX PCS 809.
A parallel operation of 2 LCA is possible starting with a time-out time > 200 msec. However, the bytes 1 and 3 must be setup for different addresses.

1.2.5 Configuration of the address reference

Based on the above described peculiarities of the AS511 protocol, the following limitations emerge which are to be considered during the configuration:

- In the programmable controller of the 135U series, the access to data words (DB and DX) is only possible word-by-word. Thus, bytes 1 and 3 must be distributed across various DWs. When writing preset values back into DBs and DXs these data can likewise only be written word-by-word. Thus, only DL are basically sensible for word variables. Separate DWs must be configured for all byte variables. If word variables start at DR, then framing bytes are set to 0 on writing back. The same applies to byte variables where the non-required byte is also set to zero. This limitation is not valid for EB, AB, and MB.
- Preset values should only be written by the programmable controller if it is ensured, that they are not simultaneously edited in the LCA. Preset values must never be continuously written! An indicator for the operating mode is bit 7 of byte 3 (see manual).
- Bit variables which are used as preset values may not be set up along with continuously written present values within a byte. When writing, the text display uses the bits of the entire byte which have been last read. Then, it combines these with the preset value bit and writes the entire byte back (AS511 offers no bit transfer). Bits outside of the preset value which are used by the programmable controller for other purposes can thereby be overwritten.

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- Sufficient time must be elapsed between the 2 ENTER actions if several preset value bits are located within a byte. It must be ensured that the first written value is read in again into the text display before ENTER is used to complete the second variable (otherwise, the preset value bit would be combined with the old not yet valid but finally read bits in the byte and thus the first edited bit would be lost. This monitoring is possible e.g. by means of a simultaneously visible present value.
- There is no monitoring if the programmable controller program is executed. Writing of the key bits and the preset values is also possible in the stop mode of the programmable controller.

1.2.6 Driving of the LCA

Besides the application-specific programmable controller program no further program is necessary to operate the LCA 300/320 text displays. The following points should be considered when writing the programmable controller program.

Evaluation of the life identification

If a function to monitor the regular work of the entire system is desired in the programmable controller then this can be realized as follows:
If bit 0 of byte 1 = 1 then it is zeroed and a time delay of approx. 300msec is triggered. If this time has elapsed then it can be assumed that a non-temporary interference has appeared. In this case, all key bits should be zeroed by the programmable controller.

Key status

Byte 1 (key status) is written during each transfer cycle. The edge detection must be performed in the programmable controller for the evaluation of the key bits. Without edge detection it has to be considered that a loss during a key activity can result in the key bit not being reset anymore. This situation can be avoided however with the above-mentioned programmable controller program.

Key code

In bits 0 to 2 of byte 3, a key code of 1..7 (ARROW LEFT = 1, HELP = 7) is signaled in addtional to the Internal flag (bit 7). This byte is assumed to be zero at the restart. It is sent ONCE with every pressing of a key. Bits 0, 1 and 2 must be zeroed by the programmable controller after processing the key code.

THERE IS NO REACTION IN BYTE 3 WHEN RELEASING THE KEY!

The Internal bit is made available in bit 7. Byte 1 is also transferred once if the status in the LCA changes. On power-up, both devices assume an equal state if this byte is NOT located in the non-volatile area.

Message bits

At a restart, the message memory of the text display is erased. Furthermore, a zeroed message bit field is assumed. It is recommendable NOT to locate the counterpart in the programmable controller in the non-volatile area since then both devices assume the same initial state. Thus, each rising edge results in a new entry in the message memory. Each negative edge will remove the message from the message memory.

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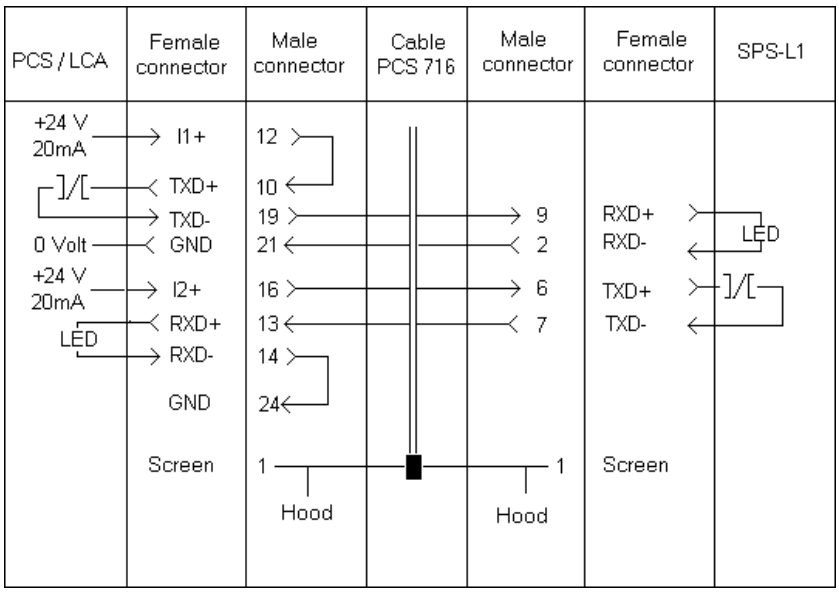
1.3 Cables

PCS 716 Adapter cable

LCA to programmable controller connection
The connection is made via the TTY interface. The current loop is powered by the LCA. Thus, there is a strict potential separation to the programmable controller.



Shielded standard cable (4 * 0.14, not twisted) results in a recommended maximum length of 20 meters.
When using low-capacity data cables twisted in pairs, the length can be extended by a factor of 10!
Recommended cable: 2 * 2 * 0.2 stranded in pairs, with single screening in foil design for pairs of wires (e.g. Belden cable no. 8723)

Screening

The screen should be connected on both sides to a metal coated connector hood. In addition, the screen can also be connected to pin 1. With grounding at both sides is to be noted however that possibly (because of ground potential shifts) a potential compensation wire is required having at least 10 times the screen cross section (reason: compensation currents should not flow through the cable screen if possible!). This applies particularly if LCA and programmable controller are not connected to the same grounding point. This is for example valid where the LCA and programmable controller are not housed in the same switching cabinet!

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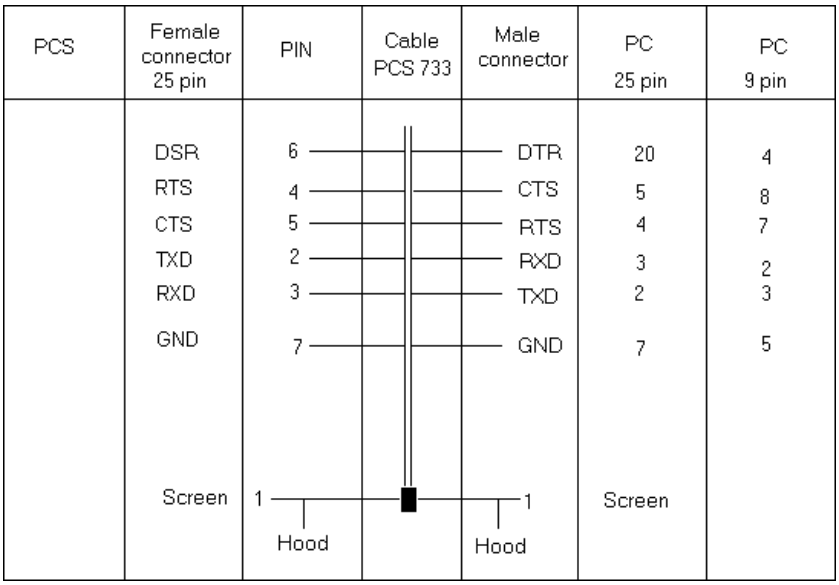
PCS 733 Programming cable

PC/PG 730 and 750 to LCA connection



The transfer is only possibly when of all above listed handshake signal lines are connected. Since DTR to PC (20) R DSR to LCA (6) is only connected in a direction, the cable ends may not be exchanged. The programming mode is initiated on the LCA side by setting DSR to a high level.

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2.1 First commissioning

Delimitation

The successful parameterization of the LCA as described in the LCA 300/320 manual is assumed. This appendix is exclusively concerned with the application of the LCA together with the PCS 810 communication board and a Siemens S5 controller.

Required devices and accessories

The following products are required (System Lauer company) to operate a programmable controller with an already parameterized LCA:

1. The LCA text display (already parameterized).
2. The PCS 736 connecting cable for the connection of the LCA to the programmable controller via the TTY interface.
3. The (LCA 301.SIE) appendix.
4. LCA 301.SIE/PCS 91.SIE floppy disk with handling blocks and example.

Also required are (from Siemens):

5. 115U (CPU 941 upwards) programmable controller
6. one input board
7. one output board
8. one CR 700.x rack
9. A PG 675, PG 685, PG 710, PG 730 or PG 750 programming unit. Note for the PG 675: floppy disks are needed separately (quote project number when ordering).

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

Alternatively, the corresponding boards of the 135U,150U and 155U series can be used.

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2.1.1 Lauer driver variables

During configuration of the LCA, both the application program with data and a selected driver are transferred. The following variables are to be set for the Lauer driver:

Function	default value	value input min.	max. value
Time-out	400ms	0ms	30000ms
Number of repetitions	4	0	254

- **Time-out (see also B3.5)**
  A continual interchange of data takes place during communication between the LCA and the PCS 810. The time-out time is the monitoring time between the data packages.

  In case of an error, „COMMUNICATION ERROR: TIME-OUT“ appears on the LCA.
- **Number of repetitions**
  A repeat request is sent when receiving a wrong data package. The setting = 0 corresponds to a repeat command. Counting continues after a correct package is received. „COMMUNICATION ERROR: CONNECT“ is displayed when the maximum number of repetitions has been exceeded.
- **Baud rate settings**

Setting	Baud rate	Interface
1	1200	TTY
2	4800	TTY
3	9600	TTY
4	19200	TTY*)
5	1200	RS232
6	48600	RS232
7	9600	RS232
8	19200	RS232

*) Remark: The default parameters are loaded if no other parameters are specified in the LCAPRO software.

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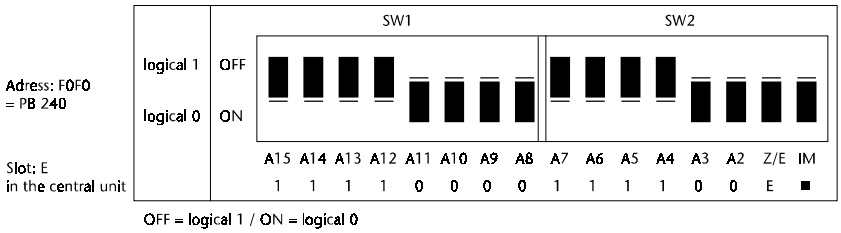
2.1.2 Procedure

Since you can select one of several drivers for the LCA, you should load the enclosed example program, together with the LAUER driver into the LCA. Thereby, pay attention to the port parameter assignment for the desired interface setting.

1. Set the LCA interface with the LCAPRO to 19200 baud and TTY.
2. Check the DIL-switch position on the PCS 810.1 board:



This switch position corresponds to address F0F0, address decoding as intelligent peripheral board with the simulation of the terminator connector.

3. Plug the board (first of all without adaptor) into the last slot on the right (when using the adaptor, the last seating guide on the rack must be unscrewed beforehand).
4. Plug in an input board as 1st board and an output board as 2nd board.
5. Connect the PCS 810 board to the LCA with the PCS 736 cable. Take note of the labeling at the cable ends.
6. Switch the programmable controller to STOP and supply operating voltage to the programmable controller and the LCA. The following display must now appear on the LCA:

```
LCA 320        machine runs
Test 14.10.94      correctly
AUTO HAND MENU END PRESET ACTUAL SET UP
```

7. Check the pre-setting mask in the programming unit when using the PG 675 (also with some older PG 685 versions). >>YES<< must be preset for the >>SYSTEM COMMAND<< item beforehand.
8. Transfer the FBs 201, 202, 203, and the OBs 1, 21 and 22 from the floppy disk into the programmable controller. The transfer DB (DB 50) is generated at the restart. In addition, starting with the 135U programmable controller, OB 20, OB 23, OB 29 and DB 50 (is not generated!) must be inserted. Remove the STS commands in FB201 and FB202.

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9. Switch the programmable controller from STOP to RUN. Now, the RUN LED must light at the programmable controller. The ERR LED at the LCA is deactivated. Output 4.0 should not be active!

Attention!
A fault analysis(section 2.1.3) must be performed if one of the above points is not correct.

At the programmable controller, LCA driving can now be simulated by writing and reading the corresponding DWs in DB 50. Output O 4.0 is activated if the connection is interrupted. The communication can be restarted by a momentary switch connected to input I 0.0.
All texts, various variables, all message texts, and HELP texts are now prepared in the LCA. Thus, all functions can be tested (manually via CONTROL VARIABLE at the programming unit).

2.1.3 Trouble-shooting

Here, the most frequent faults are listed which occur during the first commissioning:

1. The jumper below the RS-232C connector is set to PROG. If set, then after powering-up, the LCA enters a diagnosis routine which is only required for test purposes. Remedy: move the jumper to AUTO and restart the LCA (by cycling power to the text display).
2. The PCS 736 cable ends are exchanged, the baud rate was incorrectly assigned.
3. The programmable controller enters the STOP mode after starting. Diagnosis: the IM DIL-switch on the PCS 810 board is not set to ON. The switch does not simulate the terminator connector on the last slot.
4. The programmable controller enters the STOP mode although the DIL-switches are correctly set. If DB50 was created manually, check its length. DW 255 must still be displayed at the programming unit. The variable for the idle text 0 is taken from this address when communication is started.
5. The programmable controller enters of course the RUN mode but the ERR LED at the LCA is not deactivated. The PCS 810 to LCA connection has to be examined (in this case the PCS 810 transmitting line) if after a 2nd attempt this LED is not deactivated. If the ERR LED flashes at the LCA, then the LCA transmitting line is faulty (the communication was started by the programmable controller, the LCA 810 however got no answer).
6. In DW3, a fault is signaled with a value > KH 0000. In this case search for a fault in the PCS 810 to LCA connection. Either the cable ends are exchanged, or the cable is defective.
7. First, communications starts normally (LCA ERR LED is deactivated) but after a short time the following message appears on the topmost display line of the LCA:

   COMMUNICATION ERROR

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Mostly, addresses intersecting with counters or analog boards are the reason for this fault.

8. Noise on the communication line originated in electric and magnetic interferences causes mostly a communication loss over long periods of time. Frequency converters are a common source of those interferences.

Remedy possibilities

- Connect the cable screening on both ends of the communications cable to a metal coated connector case, and in addition to pin 1. Ground the LCA as well as the programmable controller bus board using a cable with at least the 10-fold screen cross-section.
- Provide for good common connections between the LCA on the one, and to the programmable controller bus board on the other hand! Remember that a copper grounding strip based on its large surface area has a somewhat better RF conductivity than normal flexible wire.
- Avoid as far as possible the creation of high frequency interferences since these are very difficult to dampen. Using photocouplers, there is a potential separation between the programmable controller and the LCA. But this galvanic isolation is nearly without effect for fast transients since photocouplers also have (even though minor)a coupling capacity.
- Provide for clear reference points for the supply voltage. To facilitate this, the power supply is potential-free!
- The use of an own power supply for the LCA (24 volt, 10 VA) is recommended where the supply voltage is subject to high noise levels. The power supply should have a corresponding noise filter. Then, 0 volt can be directly connected to the PCS with the protective conductor.
- The LCA and the communication cable should have a minimum distance of 200 mm from noise sources. This applies especially to inductivities and frequency converters.
- Short-term noise can possibly be cured by multiple repeat requests. The number of repeats can be programmed with the AB driver variables and calling up FB 203 (WDHA parameter).
- Only if none of these measures provides the desired result, then a reduction of the baud rate should be taken into account. This must be specified as a parameter for FB203. In addition, the baud rate must be correspondingly adjusted via the LCAPRO programming software.
- Potential coupling is created by the programming cable that is connected to the programming unit since 0 volt of the (RS232) interface is connected to the protective conductor. Therefore, a decrease in noise immunity has to be considered during communication. Recommendation: disconnect the programming unit when the link is no longer needed.

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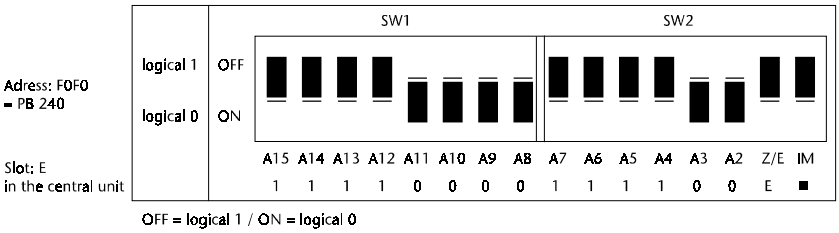
2.2 PCS 810 Handling FB

The PCS 810 board is independent of the slot and suitable for the 115U, 135U, 150U and 155U programmable controllers. It uses four S5 addresses and can be freely addressed in steps of 4 via DIL-switch settings. It is to be noted that the set address does not intersect with already used addresses!
Project 1 (P81019ST.S5D) relates to the 115 U programmable controller. Project 2 (P81029ST.S5D) relates to 135 U programmable controller and higher. This project is only to be found on the floppy disk!

2.2.1 Addressing

The area F080 to F0FF is reserved for intelligent peripheral boards in all programmable controllers. The I/O boards are located in the F000 to F07F area. This area should not be used since it is scanned for plugged in boards by some programmable controllers during the restart (refer to the programmable controller manual: Memory assignment).
EXAMPLE:



2.2.2 Selection of the slot

The board can be plugged into each slot which has a 48-pin connector strip. The lower connector strip is not required. The usual limitations with CP boards are not valid since the LCA 300/320 provides both line current sources.

- Exceptions

  11, 163 in the 135U programmable controller

  27, 35, 43, 51, 59, 155, 163 in the 150U programmable controller

  11, 19, 27 in the 155U programmable controller

PCS 810.1 operation in these slots is not possible!

EG set to ON allows the usage in the EU or on the EU slot completely to the right of the CU. In this case, the SW 2 position is irrelevant since the PESP signal is evaluated instead of the higher significant address byte. Thus, only the lower 8 address lines are decoded. In this case an address between F080 and F0FC (intelligent peripheral devices area) is to be selected for the FB.

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EU set to OFF means, that all address lines are decoded. This is the correct position for all slots in the central unit, excluding the last slot on the right.

Attention!
The IM and EG switches must be set to on if the board is plugged into the last slot on the right (EU activated)!

Explanation!
Since the A12 to A15 address lines on the interfacing slot are not always available, the PESP signal must be evaluated instead of the address lines. In this case it only makes sense to set the F080..F0FC addresses.

- **Addressing outside of F080-F0FF**
  With the 115U series, the addresses above F100 (to F2FF) can also be set.
  These addresses can also be set if the 135U interfacing area is not used further. Then, this area may not be entered in DB 1!
  Starting with the 135 U programmable controller, the FB 203 handling block from project 1 (115U) must be used when specifying addresses outside of the peripheral area since the handling block for project 2 directly accesses the peripheral bytes.
- **Testing of the addressing**
  In the stop mode, the correct addressing can be checked at the programming unit with >>OUTPUT ADDRESSES TEST STATUS<<. Without the LCA 300/320 being connected, FFC0 FFC0 appears under the selected address at the first scan after powering up. Unused addresses in the F080..F0FF area are always displayed as FF.

Attention!
Take note:

1. When using the 928CPU, a reliable operation is only possible with release 5 and higher since older versions transact faulty bus accesses!
2. With the S processor (135U), the F100..F1FF and F000..F0FF address ranges are mirrored, i.e. the I/O boards from F000 to F07F appear also at F100..F17F!

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2.2.3 Handling software

The enclosed FB 203 determines the data traffic between a transfer DB and a PCS 810.1. This FB needs no adjustment and is suited for all LCA operating units which can be operated together with the PCS 810.1. All device-specific presettings can be entered in separate FBs (customer-specific). The block number for this presetting FB is parameterizable. The block in project 1 (P8101ST.S5D) is language independent and suited for all programmable controllers except the 155U. The P81039ST.S5D project must be used for the CPU 945, S5 115 series.
FB 203 in project 2 (P81029ST.S5D) is considered for the programmable controllers 135U, 150U and 155U (language area B). It differs by the PADR address specification (see Chapter 2.2.4 „PARAMETERIZATION“).

Take note!
Important for all programmable controllers!

1. In the first project (for the 115U) MBs 250 to 255 and in the second project 2 (starting with 135U) MBs 239 to 255 are used as temporary flags. Writing to these MWs does not disturb the FB as long as this does not occur within the interrupt program. If these MWs are read by other FBs, then the contents must be newly written at the entrance and saved at the exit. A separate temporary flag area is recommended in interrupt programs anyhow!
2. With project 1 the FB accesses data by means of the TNB command and with project 2 by means of L PBxx/T PBxx. When using the PG 675 or the older PG 685 for transferring data into the controller, >>WITH SYSTEM COMMANDS<< must nearly always be selected during presetting.
3. The transfer DB may not be set in the programmable controller program EPROM! It should be created in the start OBs (unfortunately, this is not feasible via a formal operand in all programmable controllers. Thus, the creation is not part of the handling FB).
4. FB 203 consists of a single network. Since interrupt processing occurs only at the network end in some programmable controllers, it must be modified perhaps if time-critical interrupt programs are used in such programmable controllers (highly theoretical case!).

   The implementation limits itself (excluding the FB 203 cyclical call) to reading and writing the DWs in the transfer DB. The presence of the (selectable) transfer DB is not checked. It must be available in the programmable controller with the necessary net length (dynamically). Otherwise, the programmable controller shows a TRAF error (initially at the 1st call of a present value). A summary error bit (EROR) enables the communication status to be evaluated via a ladder diagram program. If this error bit = 1, then the data transfer has been stopped. It can be restarted by setting a flag (RSET). In addition, a further flag is required for the restart. This is set after the first successful execution of the handling FB. It must be reset in OB 20 (only for the 135U and higher), 21 and 22!

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2.2.4 Parameterization of the FB 203

- **UBDB**
  Here, the DB number of the transfer DB is to be specified (e.g. DB 50). If the DB should not be available, then >>TRAF error<< is shown.
- **RSET**
  Reset: as soon as this flag is = 1, the PCS 810 hardware is reset and a restart is initiated (FB 201 is called). This flag is subsequently set to zero again. It should be set by a positive edge of a momentary pushbutton. If this remains set, then restarts are constantly initiated. Thus, no more “correct” communication would be possible.
- **EROR**
  This is a global error message that is set to logical 1 as soon as communication is irrevocably lost. A more exact fault analysis is possible through the evaluation of DW3. EROR is reset automatically as soon as the first correct package is received.
- **RFLM**
  This is the flag for the first cycle. It must be reset in OB21 and OB22, and after the first successful execution it is set by FB 203 to logical 1. After that, it may only be indirectly reset by RSET! If it remains reset, then restarts are constantly initiated. Thus, no more “correct” communication would be possible.
- **PADR**
  Here, the base address is of course, to be specified in KH for project 1, and in KF for project 2 (peripherals byte address) of the PCS 810 board.
- **BAUD**
  Here, one of the following baud rates can be selected: KF+0 = 1200 baud, KF+1 = 4800 baud, KF+2 = 9600 baud, KF+3 = 19200 baud.
- **INIT**
  Here, the FB to be selected at a new start and RSET = 1 must be indicated. This is FB 201 on the floppy disk. This FB must be modified for the customer specific presetting of preset values.
- **COFF**
  The FB that is immediately executed on a COMMUNICATION ERROR must likewise be indicated here. In other words, this FB should at least set the DW4 key word to zero. This is FB 202 on the floppy disk.
- **WDHA**
  The number of additional permitted repeat requests by the user on behalf of PCS 810 must be indicated there. A repeat request is sent if a faulty data package is received by the LCA. If the value 0 is shown, then a maximum of one repeat request is allowed. A remedy for short-term RF interferences can possibly be created by increasing this number.

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- **MAFB**
  This parameter is only present in project 1, that means available for the 115U programmable controller. If FB 0 is shown here, then the handling block is processed via normal step 5 commands (as in the example).

  Assembler blocks exist for the CPU 941, CPU 942, and CPU 943 which considerably shorten the FB 203 execution times (approx. 3 times).

Generally, the following is valid:
Additional FBs are available on the floppy disk. The numbering corresponds to the CPU types:
CPU 941 = FB 141, CPU 942 = FB 142, CPU 943, 94xB = FB 143.
The corresponding FB must be transferred into the controller and be passed on as parameter when FB 203 is called up. The FB 141, FB 142 and FB 143 function blocks cannot be read nor changed by the programming unit.

The FB is designed in such a way, that in case of each fault, the communication is interrupted and the fault is signaled to the outside. Then, the communication must be consciously restarted using an input (RSET parameter). This of course, does not affect the faults reparable by repeating. These are processed internally in the PCS 810.

SPECIAL CASE 135U, 150U PROGRAMMABLE CONTROLLERS (project 2)
This function block does not realize the data transfer through TNB commands but by means of L / T PBxx operations. Although it would be operational on programmable controllers of the 115U series, execution would be slower. If it is parameterized, the PADR address must be specified as PY (relatively):

F080 KF+128

F0FC KF+252

Here, only the P area starting at F080 can be used! If no more space is available in the P area, then FB 203 of project 1 can also be used for the 135U and 150U programmable controllers.

- Advantage:
  free addressing possibilities
- Disadvantage:
  In some CPUs, the PESP signal is not activated by the TNB instruction in the peripheral area. This means for instance, that a PCS 810 which is operated remotely in the expansion unit, is not selected. Clearly: PCS 810 in the EU 183 of a 150U programmable controller. CU and EU are connected via the EG-AS 301 and ZG-AS 310 interfaces.

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2.2.5 Operation of the PLC with EPROM

- **115U programmable controller**

  The transfer DB should be automatically created by the following commands in OB 21 and OB 22:

  L KF +255 (length of the DB in words - 1)

  E DB xx (xx = DB number)

- **135U programmable controller and higher**

  Here, a function block should be called by OB 20, OB 21 and OB 22. The function block should check again whether the corresponding DB is already available. If not, then it is created. This can be done with the 135U programmable controller (CPU 922 928) by executing the following programming sequence:

```
L          KY 1,50     (1 = data block, 50 = block number)
SPA        OB 181      this OB tests the presence of DB 50
SPB = M001             -->--> M001, if DB not present!
SPA = M002
M001:
L          KF +256     (length of the DB in words)
E          DB xx
M002:.....
```

  The DB should only then be located in EPROM if the programmable controller copies it into the internal RAM of the CPU at a restart.

  The DB cannot be integrated into the handling FB since the automatic creation of a DB by a formal operand is only possible via self-modifying program code. Project 1 on the floppy disk however, contains restart OBs which generate the DB 50. For project 2, the data block (P81029ST.S5D) is to be found on the floppy disk (attention: do not copy into the EPROM!).

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2.2.6 Implementation of the handling FB

1. Power-down the programmable controller.
2. Determine the PCS 810 address with DIL-switches.
3. Plug in the board.
4. Switch the programmable controller to stop and supply voltage.
5. Create (with KH0000 preset) and insert the transfer DB in OB 21 and 22 (starting with the 135U programmable controller also in OB 20).
6. Reset the RFLM flag in OB 21 and 22 (for 135U programmable controllers and higher also in OB 20).
7. load the handling FB.
8. Cyclically select and parameterize FB 203.
9. Select the momentary reset pushbutton and set RSET with the positive edge.
10. Power-up the programmable controller and switch to RUN.

If the KH 2000 fault appears in DW3 (time-out, when the LCA is not connected) and the RFLM and EROR flags are both at logical 1, then the implementation is successfully completed.

An example (OB1) is contained on the floppy disk which signals faults on output 4.0, expects a momentary reset pushbutton on I 0.0, uses the 20.0 / 20.2 flags and accesses the PCS 810 board at F0F0. 19200 baud are selected as baud rate. The logic (following the FB 203 call-up) prevents a multiple manual RESET (can be omitted also).

2.2.7 Program integration

The LCA makes the following assumption after a restart:

- **0 is selected as idle text**

Take note of this run-up behavior when presetting the transfer DB .

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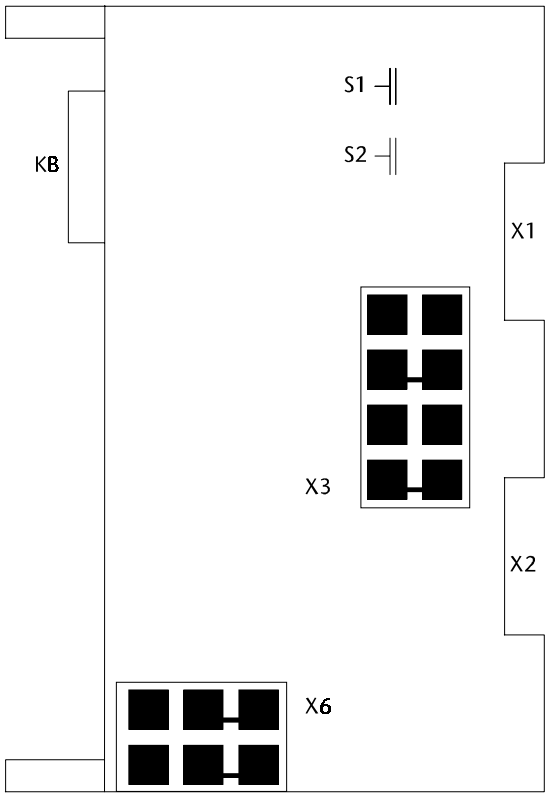
2.3 PCS 810 technical data

Mechanical design	Board with 2 * 48-pin DIN 48612 F connector terminal strips
Height	1 1 / 3 standard installation locations (SEP)
Power supply	via S5 PCB bus: 5 V ± 5%
Current requirement	360 mA
Address allocation	4 successive addresses, freely settable in the entire address range
Interfaces	1 x TTY
TTY current supply	internally / externally selectable; not required however for LCA
Potential separation	yes, photocouplers HP 4100 / 4200
Dimensions	243 * 196 * 20 mm



X6 current loop power supply
drawn: internal supply
S1 address switch A15 ... A8
S2 IM, EU and address switch A7 ... A2
X3 line current selection X1/X2
drawn: X1
KBS of communication selection (25-pin)

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2.4 Communication

2.4.1 Current loop power supply

The current loop current sources can be powered either internally or externally. To avoid capacitive coupling, It is recommended to always activate both current loop current sources (for receiver and transmitter) only on one side of the device.

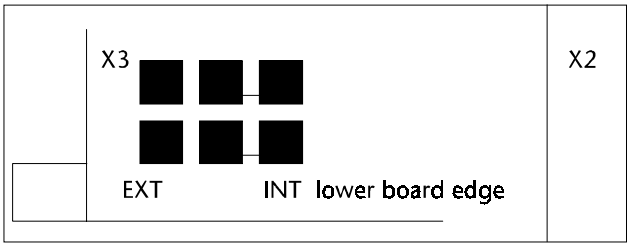
- **SUPPLY BY THE LCA**

The cable assignment can be seen in the following section. Thereby, the setting of X3 and X6 is not important. The PCS 736 cable polarity is decisive: it must be made according to the corresponding labeling.

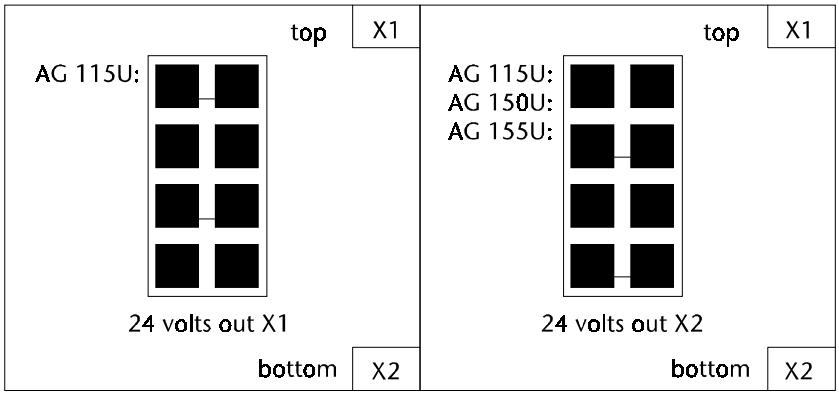
- **SUPPLY BY THE PCS 810**

The current loop supply for communication is taken from the PCS 810. The connector assignment of the interface connectors on the PCS 810 and the LCA are identical. If the PCS 736 cable is used, then exchange the cable ends and set the jumper on the PCS 810 correspondingly:

Jumper X6 selects the source for the TTY current sources. It is drawn here for internal supply:



The X3 jumper selects the connector for the internal TTY power supply: X1 connector (top) or X2 connector (bottom).



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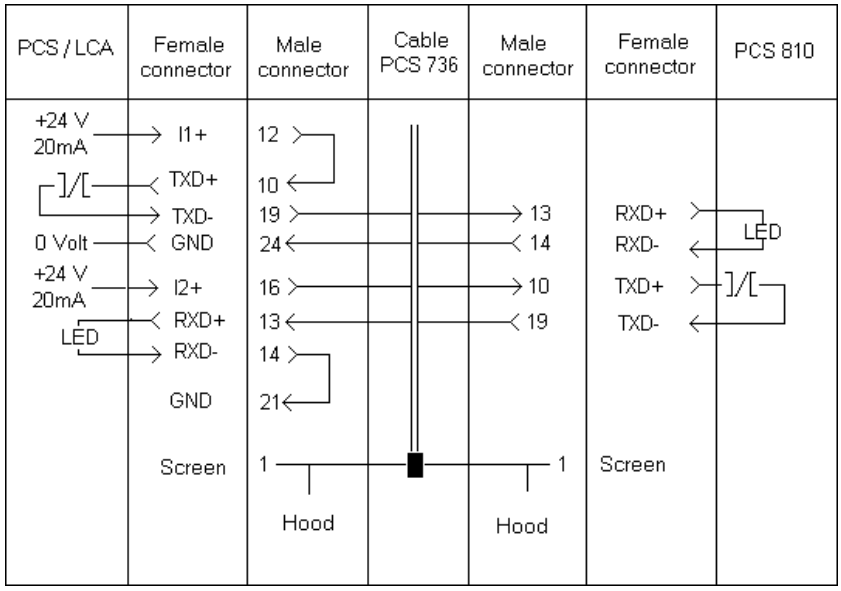
2.4.2PCS 736 Adapter cable

Communication cable between PCS 810 and LCA.
The connection is made via 2 TTY channels. The LCA supplies current for the current loops of both channels. The positions of the jumpers on the PCS 810 board is thus irrelevant. There is a strict potential separation from the programmable controller since the LCA supplies the current.



Maximum lengths

The following recommended maximum lengths emerge when using standard shielded cable (4 * 0.14, not twisted in pairs),:

19200 baud	10 meters
9600 baud	20 meters
4800 baud	40 meters
1200 baud	160 meters

10 times the lengths can be used when using pairs of twisted and mutually shielded data cable!
Recommended cable: 2 * 2 * 0.2 stranded in pairs, with single screening in foil design for pairs of cable (e.g. Belden cable no. 8723)

Screening

The screen should be connected on both sides to a metal coated connector or case. The screen can also be connected to pin 1 when using non-metal coated connector cases. However, this is not recommended for error-technical reasons. There, the data lines should be covered as completely as possible by the screen! With grounding at both sides is to be noted however that possibly (because of ground potential shifts) a potential compensation wire is required having at least 10 times the screen cross section (reason: compensation currents should not flow through the cable screen if possible!). This applies particularly if LCA and programmable controller are not connected to the same earthing point. This is for example valid where the LCA and programmable controller are not housed in one switching cabinet!

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2.4.3 PCS 733 programming cable

PC/PU 750 - LCA connection

PCS	Female connector 25 pin	PIN	Cable PCS 733	Male connector	PC 25 pin	PC 9 pin
	DSR	6		DTR	20	4
	RTS	4		CTS	5	8
	CTS	5		RTS	4	7
	TXD	2		RXD	3	2
	RXD	3		TXD	2	3
	GND	7		GND	7	5
	Screen	1 Hood		1 Hood	Screen	

2.4.4 LCA/PCS 810 data transfer

The data traffic with the control is performed in packages. Each package has a checksum and its contents are checked for possible faults in the PCS 810. At the minimum, each package consists of one sub-package which performs a clearly defined task.

- **SET-UP**

During running communication, the LCA issues commands in the following format to the programmable controller:

```
COMMAND (DATA) COMMAND (DATA).... CHECK SUM TERMINATOR
```

In principle, the programmable controller answer is set up as follows:

```
ALL DATA.... CHECK SUM TERMINATOR
```

- **Timely sequence of the data transfer**

```
1111 2222222222222222 33 44444 55555 6666666666666666 (1111)
```

- **1111**

The LCA assembles a new package. The required time totals 2.5 milliseconds.

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- **2222222222222222222**

The package is transferred. The required time depends on the package length and the baud rate. Since the package length is not constant, this time can not be determined in principle.

- **33**

The PCS 810 examines the package for plausibility and signals the readiness for data interchange to the handling FB.

- **44444**

Waiting time until the handling FB is processed.

- **55555**

The handling FB performs the data interchange in both directions. The required times are to be taken from the handling FB description.

- ***6666666666666666666***

The answer package is transferred. The length of this package is also variable. A new package is assembled as described in 1 as soon as the package is completely received in the LCA.

2.4.5 PCS 810/S5 Bus data transfer

The PCS 810 uses 4 addresses on the S5 bus. These addresses have the following meanings (only for diagnosis purposes):

- **COMMAND CHANNEL**

ADDRESS:	base address +0
DIRECTION:	writing
Code 00H	send a new package
Code x1H	restart with 1200 baud
Code x2H	restart with 4800 baud
Code x3H	restart with 9600 baud
Code x4H	restart with 19200 baud
Code 05..0FH	software reset: waiting for the signaling of a baud rate.
Note:	x... number of additional repeat requests (0H..FH)
DIRECTION:	reading the internal RAM of the PCS 810 is used here for diagnosis.

- **COMMAND STATUS**

ADDRESS:	base address +1
DIRECTION:	reading only
BIT 7 = 1	ready for instruction
Bit 7 = 0	wait, board is not ready!

- **DATA CHANNEL**

ADDRESS:	base address +2
DIRECTION:	bi-directional
COMMANDS	LCA R PROGRAMMABLE CONTROLLER
DATA	LCA ´ PROGRAMMABLE CONTROLLER

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- **DATA STATUS**

ADDRESS: Base address +3
DIRECTION: reading only
Bit 5 = 1 further sub-packages are waiting
Bit 5 = 0 finished!

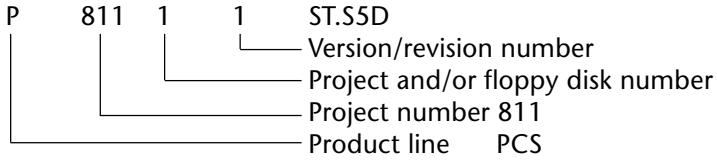
The data transfer is managed by the enclosed FB (FB203), thus relieving the user from evaluation. The indicated meanings (above) are relevant only for diagnosis purposes. The >>TEST ADDRESSES<< programming unit function may not be carried out while the handling FB is running,. In >>AG STOP<< however, the correct addressing can be checked with >>TEST ADDRESSES<<. The KH C0 value (handshake signal) appears at base address + 1 while non-used addresses reply with KH FF. Different data appear on the base address (command channel) because internal RAM values are generated here for diagnosis purposes.

2.4.6 Software

You receive the floppy disk in MS-DOS format. On demand, you can also receive a floppy disk in the PG 675 format. Since two project files are contained on the PG 685 / 750 floppy disk, the project number must also be indicated when ordering the PG 675 floppy disk!

Attention!
Test the handling software function. This will avoid LCA and programmable controller malfunctions.

The project number has the following assignment coding:



The following projects are currently to be found on the floppy disk:

PCS 810.1

Project 1: P81019ST.S5D	Handling software for the 115U programmable controller
Project 2: P81029ST.S5D	Handling software starting with the 135U programmable controller
Project 3: P81039ST.S5D	Handling software for the 115U programmable controller with CPU 945
Projekt 4: P81049ST.S5D	Handling software for the 135U programmable controller with CPU 948

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PCS 810.3

Project 1: P81111ST.S5D	Handling software for the 115U programmable controller
Project 2: P81121ST.S5D	Handling software starting with the 135U programmable controller
Project 3: P81131ST.S5D	Handling software for the 115U programmable controller with CPU 945
Projekt 4: P81141ST.S5D	Handling software for the 135U programmable controller with CPU 948

PCS 840

Project 1: P84113ST.S5D	Handling software for the 115U programmable controller
Project 2: P84123ST.S5D	Handling software starting with the 135U/ 155U programmable controller
Project 3: P84133ST.S5D	Handling software for the 115U programmable controller with CPU 945

Project changes are listed in the README.TXT file on the commissioning disk.

*) The floppy disk(s) is(are) located in the respective PCS manuals.

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2.4.7 PROJEKT 1: P81019ST.S5D

```
FB 201                          C:P81019ST.S5D

NETZWERK 1     0000
NAME :INIT

0005     : STS              EXAMPLE PCS 900!!!!!!!!!
0006     :                  TYPICAL PRESETS
0007     :                  L KH 0000
0008     :                  T DW 4
0009     :                  T DW 5
000A     :                  T DW 6
000B     :                  T DW 9
000C     :                  T DW 39
000D     :                  L KH 0080
000E     :                  T DW 38
000F     :                  L KH 00FF
0010     :                  T DW 37
0011     :                  L KH 1F00
0012     :                  T DW 36
0013     :
0014     :                  EXAMPLE PCS 090/095 !!!!!!!!!!!
0015     :                  TYPICAL PRESETS
0016     :                  L KH 0000
0017     :                  T DW 4
0018     :                  T DW 5
0019     :                  L KH 0FC8
001A     :                  T DW 13
001B     :                  L KH 0080
001C     :                  T DW 14
001D     :BE


FB 202                          C:P81019ST.S5D

NETZWERK 1     0000
NAME :COFF

0005     : STS              EXAMPLE PCS 900 !!!!!!!!!!!!!!
0006     :                  PRESETS EMERGENCY CASE
0007     :                  L KH 0000
0008     :                  T DW 4
0009     :                  T DW 5
000A     :                  T DW 6
000B     :                  T DW 9
000C     :                  IF USED,
000D     :                  CLEAR ADDITIONAL KEYS
000E     :
000F     :                  EXAMPLE PCS 090/095 !!!!!!!!!!!
0010     :                  PRESETS EMERGENCY CASE
0011     :                  L KH 0000
0012     :                  T DW 4
0013     :                  T DW 5
0014     :                  IF USED,
0015     :                  CLEAR ADDITIONAL KEYS
0016     :BE
```

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```
OB 1                                C:P81019ST.S5D

NETZWERK 1     0000
0000          : SPA FB 203
0001 NAME     : HANT.PCS
0002 UBDB     :       DB  50      COMMUNICATION DB = DB 50
0003 RSET     :       M   20.1    DEFINE RESET WITH M 20.1=1
0004 EROR     :       A    4.0    DEFINE ERROR-FLAG AT A 4.0
0005 RFLM     :       M   20.0    DEFINE RESET-FLAG-MARK FOR
                                  1.CYCLE M 20.0
0006 PADR     :       KH F0F0     BASIC ADDRESS PCS810(MOD.8)
0007 BAUD     :       KF +3       BAUD RATE (POSSIBLE KF 0..+3)
0008 INIT     :       FB 201      INITIALISATION ACTIONS FB
0009 COFF     :       FB 202      ERROR ACTIONS FB
000A WDHA     :       KF +0       EXTRA WDHA (POSSIBLE: KF 0..+15)
000B MAFB     :       FB   0      FB FOR CPU 141/142/143 0=ALL
000C          :U   E    0.0       RESET KEY
000D          :UN  M   20.2       FLAG FOR RESET-EDGE
000E          :S   M   20.1       IF POSITIVE-EDGE R RESET
000F          :S   M   20.2       (SLOPE FLAG FOR KEY)
0010          :UN  E    0.0       NEGATIVE EDGE NOT USED
0011          :R   M   20.2
0012          :BE


OB 21                               C:P81019ST.S5D

NETZWERK 1     0000
0000          :U   M   20.0
0001          :R   M   20.0
0002          :L   KF +255
0004          :E   DB  50
0006          :BE


OB 22                               C:P81019ST.S5D

NETZWERK 1     0000
0000          :U   M   20.0
0001          :R   M   20.0
0002          :L   KF +255
0004          :E   DB  50
0006          :BE
```

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