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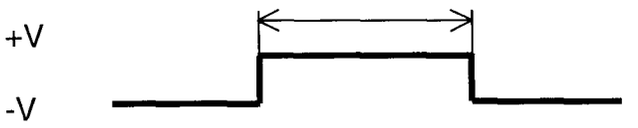
1 Automatics communication

1.1 RS 232 Configuration

* ASCII Dataformat
* Fullduplex
* PC: Delimiter CR (Chr 13h)
* PLC: Delimiter CR, LF (Chr 13h, 10h)
* 9600 Baud
* 8 Databits
* 1 Stopbit
* Paritiy even

1.2 Command transmission procedure

According to the manufacturer, the SPS Type KEYENCE KV-16T must be initialized with a "Break Signal" after establishment of the connections.



1.3 Command syntax

Some commands are required for communication purposes. A command is an ASCII-string which is transmitted to the Controller. The response is an ASCII-string which is transmitted from the Controller.
Important! Each command requires a response.

Command Segment	Command	Response
Communication Request	CR	CC *cr* IF
Communication Quit	CQ	CF *cr* IF
Communication Clear	CC	CC *cr* IF
Communication Finished	CF	CF *cr* IF
Set	ST	OK *cr* IF
Reset	RS	OK *cr* IF
Read	RD	OK *cr* IF
Write	WR	OK *cr* IF
Write Set	WS	OK *cr* IF
Data Memory	DM	
Timer	T	
Space ASCII 20h	*sp*	
Line Feed ASCII 0Ah	*lf*	
Carriage Return ASCII oDh	*cr*	

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1.4 System status

	Command	Response
Read Ready Flag	RD *sp* 1915 *cr*	x *cr lf*
Read Recover Flag	RD *sp* 1808 *cr*	x *cr lf*
Read Error Flag	RD *sp* 1814 *cr*	x *cr lf*

1.5 Basic commands

	Command	Response
Reset	ST *sp* 1900 *cr*	OK *cr lf*
Activate Handling System	ST *sp* 1801 *cr*	OK *cr lf*
Deactivate Handling System	RS *sp* 1801 *cr*	OK *cr lf*
Status Carousel	RD *sp* 1801 *cr*	0/1 *cr lf*
Handler is waiting with the MTP inside, rear door is closed. After setting command 1901 rear door will open, handler will turn to transfer station.	1601	
Set gate mode 1	ST *sp* 1601 *cr*	OK *cr lf*
Reset gate mode 1	RS *sp* 1601 *cr*	OK *cr lf*
Start shaker mode	ST *sp* 1607 *cr*	OK *cr lf*
Stop shaker mode	RS *sp* 1607 *cr*	OK *cr lf*
Shovel is waiting outside the rear door, until command 1902 is set	1610	
Reset handshake mode	RS *sp* 1610 *cr*	OK *cr lf*
Set handshake mode	ST *sp* 1610 *cr*	OK *cr lf*
Set Carousel rotation position z (0 ... 9)	WR *sp* DM0 m *cr*	OK *cr lf*
Set Handler level position z)**	WR *sp* DM5 n *cr*	OK *cr lf*
Show Handler *)/Open Gate	ST *sp* 1901 *cr*	OK *cr lf*
Hide Handler *)/ Close Gate	ST *sp* 1902 *cr*	OK *cr lf*
Terminate Access	ST *sp* 1903 *cr*	OK *cr lf*
Load Plate to m,n *)	ST *sp* 1904 *cr*	OK *cr lf*
Unload Plate from m,n *)	ST *sp* 1905 *cr*	OK *cr lf*
Move MTP from handler to transferstation *)	ST *sp* 1906 *cr*	OK *cr lf*
Move MTP from transferstation to handler *)	ST *sp* 1907 *cr*	OK *cr if*
Move MTP from stacker to handler *)	ST *sp* 1908 *cr*	OK *cr if*
Move MTP from handler to stacker *)	ST *sp* 1909 *cr*	OK *cr if*

The Activate Carousel-Command serves to initialize the handler system.
The functions marked with *) can be performed only if the carousel has been properly positioned.
The Error Flag is set if the Handling System was not able to successfully complete an action.
The Terminate –Access-Command serves to bring the system in stand-by-mode.
The reset command serves to stop the system.

**) max. level depence see capacitiy of stacker level.

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1.6 Extended Commands

	Command	Response
Read User Door Status	RD *sp* 1811 *cr*	0 *cr* 1
Read Plate Detection Handler	RD *sp* 1812 *cr*	0 *cr* 1
Read Plate Detection x-fer	RD *sp* 1813 *cr*	0 *cr* 1
Read Actual Carousel Position	RD DM1 *cr*	nnnn *cr lf*
Read Handler z-Offset	RD DM20 *cr*	zzzz *cr lf*
Read Handler dz Pick- & Place-Movement in Cassette	RD DM21 *cr*	zzzz *cr lf*
Read Handler In-Transfer z-Position (default~1000)	RD DM22 *cr*	zzzz *cr lf*
Read Handler z-Pitch	RD DM23 *cr*	zzzz *cr lf*
Read Max. Number of Levels (default = 21)	RD DM25 *cr*	zzzz *cr lf*
Read Handler dz Pick- & Place-Movement at Transfer Station (default = 700)	RD DM26 *cr*	zzzz *cr lf*
Set Handler z-Offset*	WR DM20 *sp* s *cr*	OK *cr lf*
Set Handler dz Pick- & Place-Movement*	WR DM21 *sp* s *cr*	OK *cr lf*
Set Handler In-Transfer z-Position*	WR DM22 *sp* s *cr*	OK *cr lf*
Set Handler z-Pitch*	WR DM23 *sp* s *cr*	OK *cr lf*
Set Handler Out-Transfer z-Position*	WR DM24 *sp* s *cr*	OK *cr lf*
Set Handler dz Pick- & Place-Movement at Transfer Station*	WR DM26 *sp* s *cr*	OK *cr lf*

z = 0...9
s = set value



*With the factory settings a safety operation is guaranteed.
A change to the factory settings can cause a breakdown and should be done only from a authorized person.

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1.7 Controller error messages

If an error occurs, the Controller sends one of the messages listed below as a response to a received command. The Controller Error Messages are system errors and should not be confused with handling or process error messages (see "Handling Error Messages").

Error	Comment	Response
Relay Error	Undefined timer, counter, data memory , check if requested unit is valid	E0 *cr lf*
Command Error	Invalid command, check if communication is opened by CR, check command sent to controller, check for interrupts during string transmission	E1 *cr lf*
Programm Error	Firmware lost, reprogram controller	E2 *cr lf*
Hardware Error	Controller hardware error, turn controller ON/OFF, controller is faulty and has to be replaced	E3 *cr lf*
Write Protected Error	Unauthorized access	E4 *cr lf*
Base Unit Error	Unauthorized access	E5 *cr lf*

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1.8 Handler error messages

Error messages are given if the Handler System recognizes an internal error (e.g. if a plate is placed on an occupied position). In case of an error message, the Error Flag (1814) is set from "0" to "1". The exact cause of the error message can be indicated in the Data Memory 200 (DM 200). A certain code is entered in the DM 200 for each error (rd DM 200 has as result a dec-value, which must be converted in hex). The meaning of the error messages is shown on the list below. The actual value of DM 200 is put together as follows:

DM 200 = uvww HEX

Errors are recognized by reading the contents of DM 200. An error reset is performed by transmitting the Reset Command (ST 1900).

u – values:

Errors DM 200 = 1vww are load plate errors (1904)
Errors DM 200 = 2vww are unload plate errors (1905)
Errors DM 200 = 3vww are remove plate errors (1906)
Errors DM 200 = 4vww are barcode errors (1910)
Errors DM 200 = 5vww are put plate errors (1909)
Errors DM 200 = 6vww are set plate errors (1907)
Errors DM 200 = 7vww are get plate errors (1908)

	Command	Response
Read Error Flag (default = 0)	RD *sp* 1814 *cr*	x *cr lf*
Read Error Code (volatile)	RD *sp* DM200 *cr*	zzzz *cr if*
Read Error Code (non-volatile) (If Error Flag = 1; DM200 → DM201)	RD *sp* DM201 *cr*	zzzz *cr if*

z = 0...9

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ww-values

Error	Description	Code
General Handling Error	Handling action could not be performed in time	uv01 *cr if*
Gate Open Error	Gate could not reach upper position or Gate did not reach upper position in time	uv07 *cr if*
Gate Close Error	Gate could not reach lower position or did not reach lower position in time	uv08 *cr if*
General Lift Positioning Error	Handler-Lift could not reach desired level position or does not move	uv09 *cr if*
User Access Error	Unauthorized user access in combination with manual rotation of carrousel	uv0A *cr if*
Carrousel Positioning Error	Carrousel cannot be positioned	uv0B *cr if*
Remote Access Level Error	Undefined cassette level has been requested	uv0C *cr if*
Plate Transfer Detection Error	Unload operation while plate is on transfer station	uv0D *cr if*
Lift Initialization Error	Lift could not be initialized	uv0E *cr if*
Plate Detection Error 1	Handler is occupied, but should pick up another plate	uv0F *cr if*
Plate Detection Error 2	Handler is free, but should deliver a plate	uv10 *cr if*

uv-values:

Error	Description	Code
Load Plate Carrousel Positioning Error	Carrousel could not reach desired radial positioning during Load Plate procedure or Lift could not reach transfer level during Load Plate procedure	010ww *cr if*
Load Plate Handler Transfer Turn out Error	Handler could not reach turn out position at transfer level during Load Plate procedure	011ww *cr if*
Load Plate Shovel Transfer Outer Error	Shovel could not reach front position at transferlevel during Load Plate procedure	012ww *cr if*
Load Plate Lift Transfer Error	Lift did not reach upper pick position at transfer level during Load Plate procedure	013ww *cr if*
Load Plate Shovel Transfer Inner Error	Shovel could not reach back position at transfer level during Load Plate procedure	014ww *cr if*
Load Plate Handler Transfer Turn In Error	Handler could not reach turn in position at transfer level during Load Plate procedure	015ww *cr if*

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Error	Description	Code
Load Plate Lift Cassette Travel error	Lift could not reach desired cassette level during Load Plate procedure	017ww *cr if*
Load Plate Shovel Cassette Front Error	Shovel could not reach front position on cassette access during Plate Load procedure	018ww *cr if*
Load Plate Lift Cassette Place Error	Lift could not reach cassette place level during Load Plate procedure	019ww *cr if*
Load Plate Shovel Cassette Inner Error	Shovel could not reach back position at cassette plate placement during Load Plate procedure	01Aww *cr if*
Load Plate Lift Travel Back	Lift could not reach zero level during Load Plate procedure	01Bww *cr if*
Load Plate Lift Init Error	Lift could not be initialized after Load Plate procedure	01Cww *cr if*
Unload Plate Lift Cassette Travel Error	Carousel could not reach desired radial position during Unload Plate procedure or Lift could not reach desired cassette level during Unload Plate procedure	020ww *cr if*
Unload Plate Shovel Cassette Front Error	Shovel could not reach front position on cassette access during Plate Unload procedure	021ww *cr if*
Unload Plate Lift Cassette Load error	Lift could not reach cassette pick level during Unload Plate procedure	022ww *cr if*
Unload Plate Shovel Cassette Inner Error	Shovel could not reach back position at cassette plate pick during Unload Plate procedure	023ww *cr if*
Unload Plate Lift Transfer Positioning Error	Lift could not reach transfer level during Unload Plate procedure	025ww *cr if*
Unload Plate Handler Transfer Turn out Error	Handler could not reach turn position at transfer level during Unload Plate procedure	026ww *cr if*
Unload Plate Shovel Transfer Outer Error	Shovel could not reach outer position at transfer level during Unload Plate procedureredure	027ww *cr if*
Unload Plate Lift Transfer Place Error	Lift did not reach lower place position at transfer level during Unload Plate procedure	028ww *cr if*

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Error	Description	Code
Unload Plate Shovel Transfer Inner Error	Shovel could not reach inner position at transfer level during Unload Plate procedure	029ww *cr if*
Unload Plate Handler Transfer Turn in Error	Handler could not reach inner turn position at transfer level during Unload Plate procedure	02Aww *cr if*
Unload Plate Lift Travel Back Error	Lift could not reach Zero position during Unload Plate procedure	02Bww *cr if*
Unload Plate Lift Init Error	Lift could not be initialized after Unload Plate procedure	02Cww *cr if*
Remove Plate Lift Transfer Positioning Error	Lift could not reach transfer level during remove plate procedure	034ww *cr if*
Remove plate Handler Transfer Turn out Error	Handler could not reach outer turn position at transfer level during Remove Plate procedure	035ww *cr if*
Remove Plate Shovel Transfer Outer Error	Shovel could not reach outer position at transfer level during Remove Plate procedure	036ww *cr if*
Remove Plate Lift Transfer Place Error	Lift did not reach lower place position at transfer level during Remove Plate procedure	037ww *cr if*
Remove Plate Shovel Transfer Inner Error	Shovel could not reach inner position at transfer level during Remove Plate procedure	038ww *cr if*
Remove Plate Handler Transfer Turn in Error	Handler could not reach inner turn position at transfer level during Remove Plate procedure	039ww *cr if*
Remove Plate Lift Travel Back Error	Lift could not reach Zero position during Remove Plate procedure	03Aww *cr if*
Remove Plate Lift Init Error	Lift could not be initialized after Remove Plate procedure	03Bww *cr if*
Bar Code read Error		04vww *cr if*
Put Plate Lift Cassette Travel Error	Lift could not reach desired cassette level during Put Plate procedure	056ww *cr if*
Put Plate Shovel Cassette Front Error	Shovel could not reach front position on cassette access during Put Plate procedure	057ww *cr if*

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Error	Description	Code
Put Plate Lift Cassette Place Error	Lift could not reach cassette place level during Put Plate procedure	058ww *cr if*
Put Plate Shovel Cassette Inner Error	Shovel could not reach inner position at cassette plate placement during Put Plate procedure	059ww *cr if*
Put Plate Lift Travel Back Error	Lift could not reach zero level during Put Plate procedure	05Aww *cr if*
Put Plate Lift Init error	Lift could not be initialized after Put Plate procedure	05Bww *cr if*
Set Plate Handler Transfer Turn out error	Handler could not reach outer turn position at transfer level during Set Put Plate procedure	061ww *cr if*
Set Plate Shovel Transfer Turn Outer Error	Shovel could not reach outer position at transfer level during Set Put Plate procedure	062ww *cr if*
Set Plate Lift Transfer Error	Lift did not reach upper pick position at transfer level during Set Plate procedure	063ww *cr if*
Set Plate Shovel Transfer Inner Error	Shovel could not reach inner position at transfer level during Set Plate procedure	064ww *cr if*
Set Plate Handler Transfer Turn in Error	Handler could not reach inner turn position at transfer level during Set Plate procedure	065ww *cr if*
Get Plate Lift Cassette Travel Error	Carousel could not reach desired radial position during Get Plate procedure or Lift could not reach desired cassette level during Get Plate procedure	070ww *cr if*
Get Plate Shovel Cassette Front Error	Shovel could not reach front position on cassette access during Plate Get procedure	071ww *cr if*
Get Plate Lift Cassette Load Error	Lift could not reach cassette pick level during Get Plate procedure	072ww *cr if*
Get Plate Shovel Cassette Inner Error	Shovel could not reach inner position at cassette plate pick during Get Plate procedure	073ww *cr if*
Get Plate Lift Transfer Positioning Error	Lift could not reach transfer level during Get Plate procedure	074ww *cr if*

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1.9 General programming information

The *maximum cycle time* (*one cycle* is from x-fer station to stacker or from stacker to x-fer station) for a

HS –System is	35 sec
UHS – System is	20 sec

The control status request (e.g. Ready-Bit, setpoint/actual carousel position etc.) must be performed by the control computer (polling). The plc cannot transmit spontaneous signals.

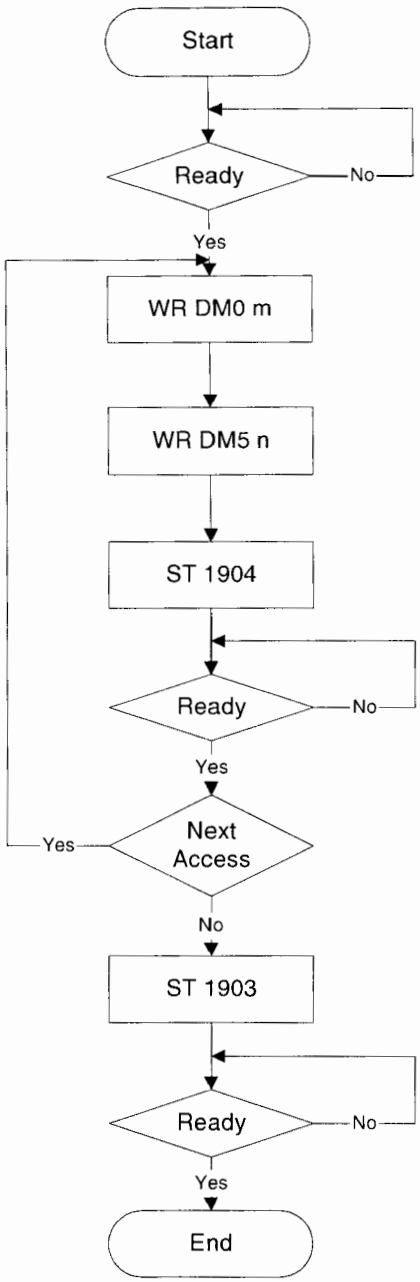
After sending commands, you always have to wait > 100 ms prior first polling the ready flag.

Following prerequisites applys to the flowcharts 1.2.9 – 1.2.14:
– handling system is activatet (ST 1801)
– system is ready (RD 1915 = 1)

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1.10 Flow chart load access using pick- and place station



Check Ready Flag

Rotate Carousel to position m

Lift Handler to level n

Load plate command

Check Ready Flag

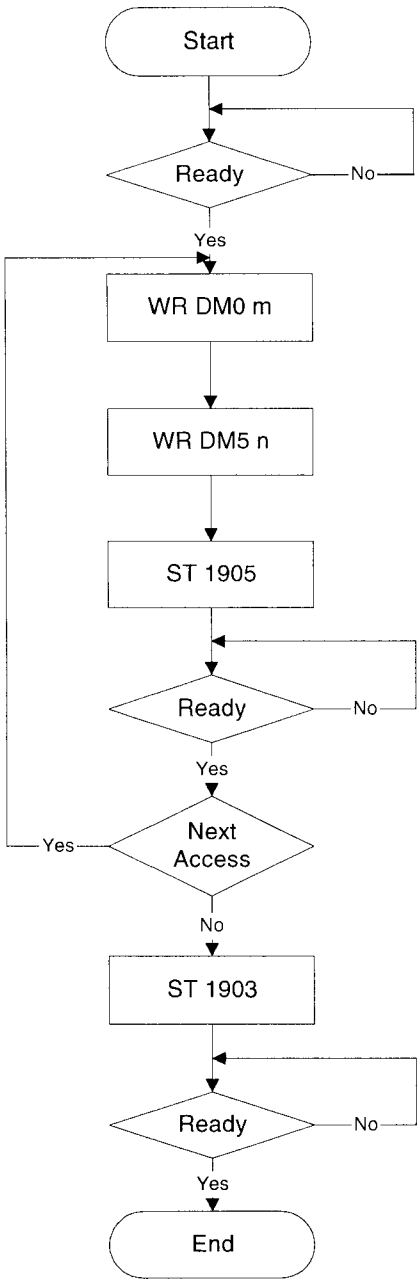
End Access

Check Ready Flag

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1.11 Flow chart unload access using pick- and place station



Check Ready Flag

Rotate Carousel to position m

Lift Handler to level n

Unload plate command

Check Ready Flag

End Access

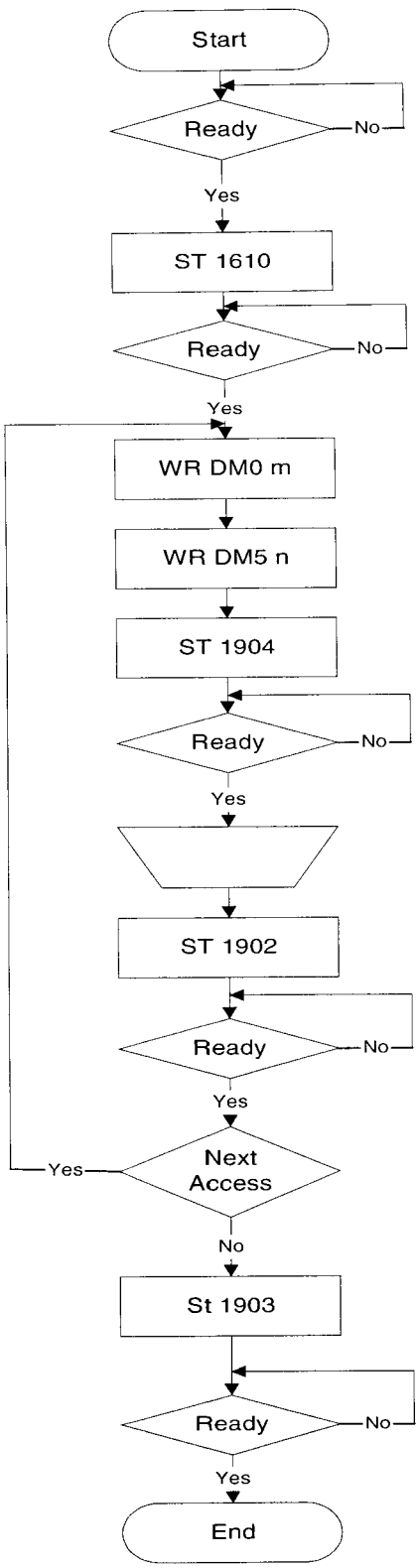
Check Ready Flag

For safety reasons,the hardware does not allow positioning of the carousel when the glass door is open. This means that the glass door must be shut between each access to a carousel position.

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1.12 Flow chart load plate access using handshake mode



Check Ready Flag

Activate handshake mode

Check Ready Flag

Rotate carousel to position m

Lift handler to level n

Load plate command

Check Ready Flag

Put plate on handler / handler turn out at lower position at x-fer station

Hide handler and close gate

Check Ready Flag

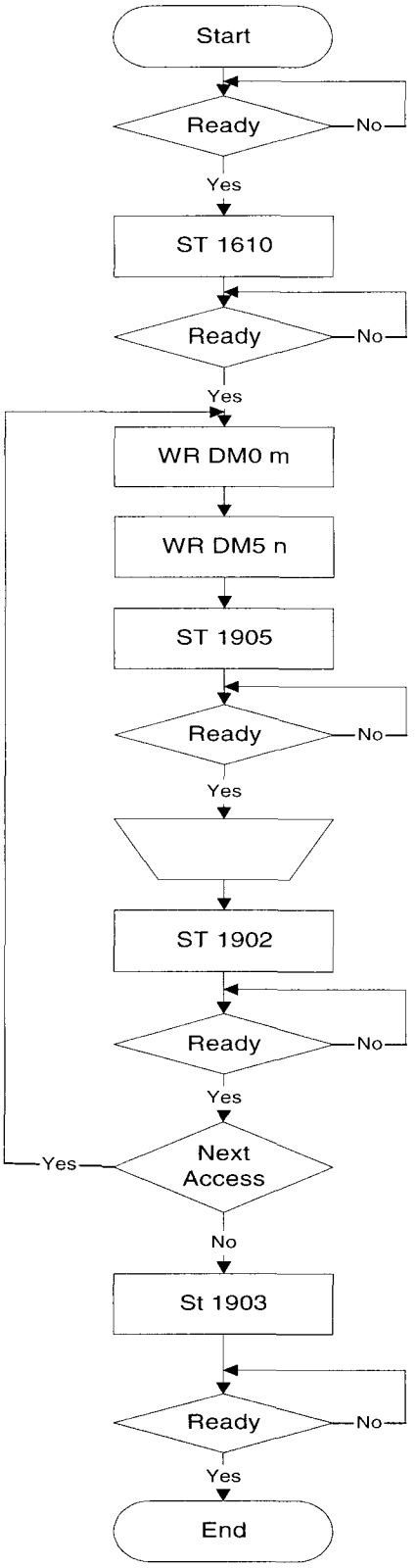
End Access

Check Ready Flag

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1.12 Flow chart unload plate using handshake mode



Check Ready Flag

Activate handshake mode

Check Ready Flag

Rotate carousel to position m

Lift handler to level n

Unload plate command

Check Ready Flag

Remove plate from handler /
Handler turns out at upper position

Hide handler and close gate

Check Ready Flag

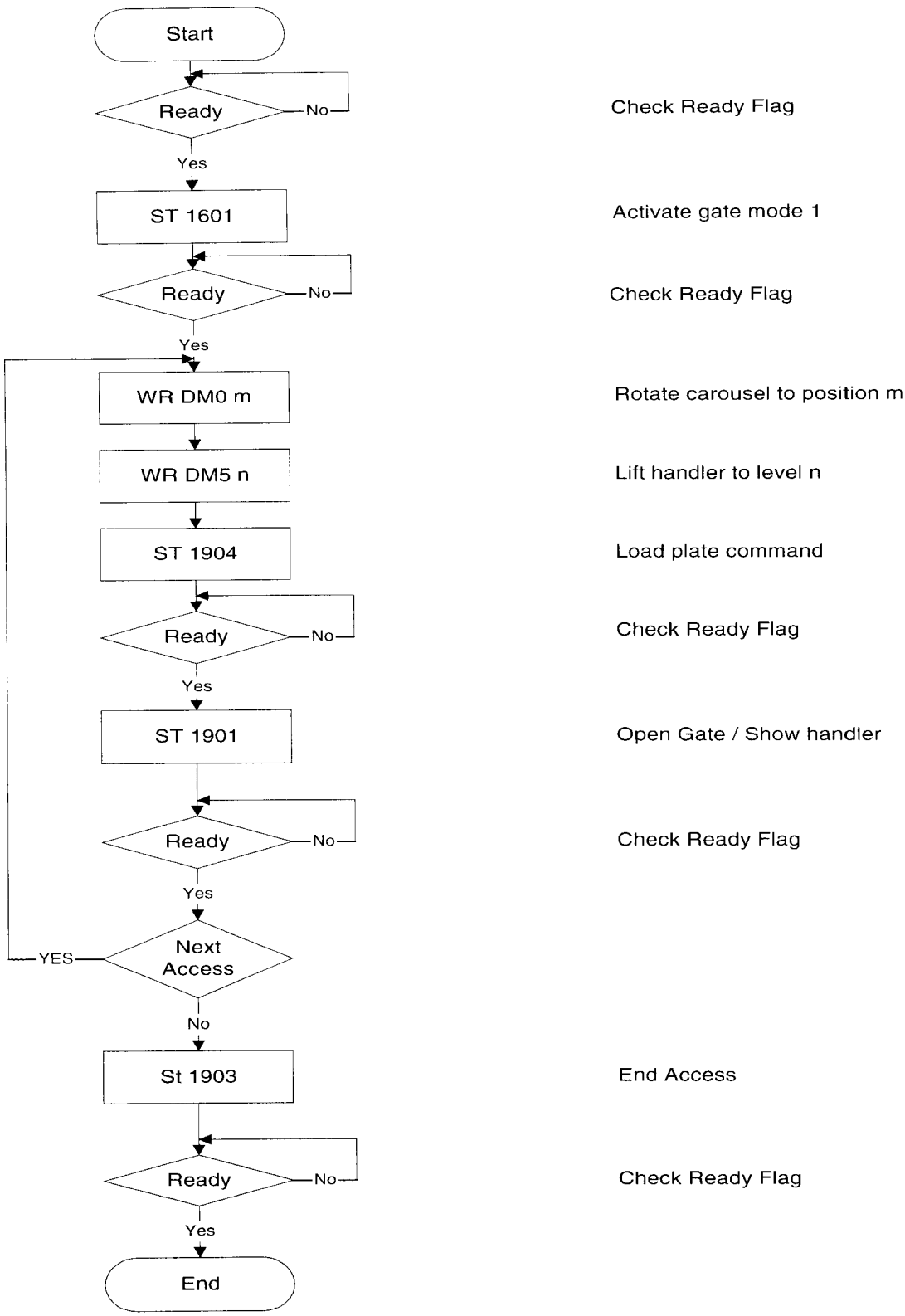
End Access

Check Ready Flag

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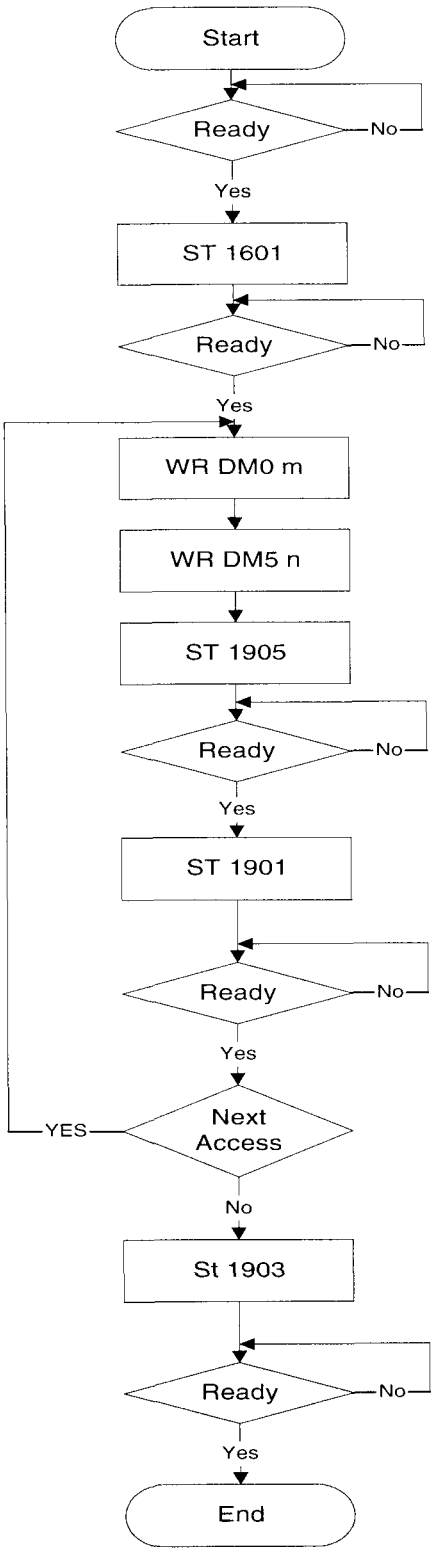
1.13 Flow chart load plate using Gate mode 1



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1.14 Flow chart unload plate using Gate mode 1



Check Ready Flag

Activate gate mode 1

Check Ready Flag

Rotate carousel to position m

Lift handler to level n

Unload plate command

Check Ready Flag

Open Gate / Show handler

Check Ready Flag

End Access

Check Ready Flag

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1 Automatics communication

1.15 Recover Function

If a failure of the handling system occures during the execution of a command, the PLC starts a recover routine.
There are different reactions of the recover function with the different commands.

The recover routine for the commands 1904 – 1909 is shown in the flow chart 1.2.16.

If the system is running in Gate Mode 1 (1601), the recover routine for the commands 1904 – 1909 is shown in flow chart 1.2.16. If a failure happens after the 1901 command, the recover routine is shown in flow chart 1.2.17.

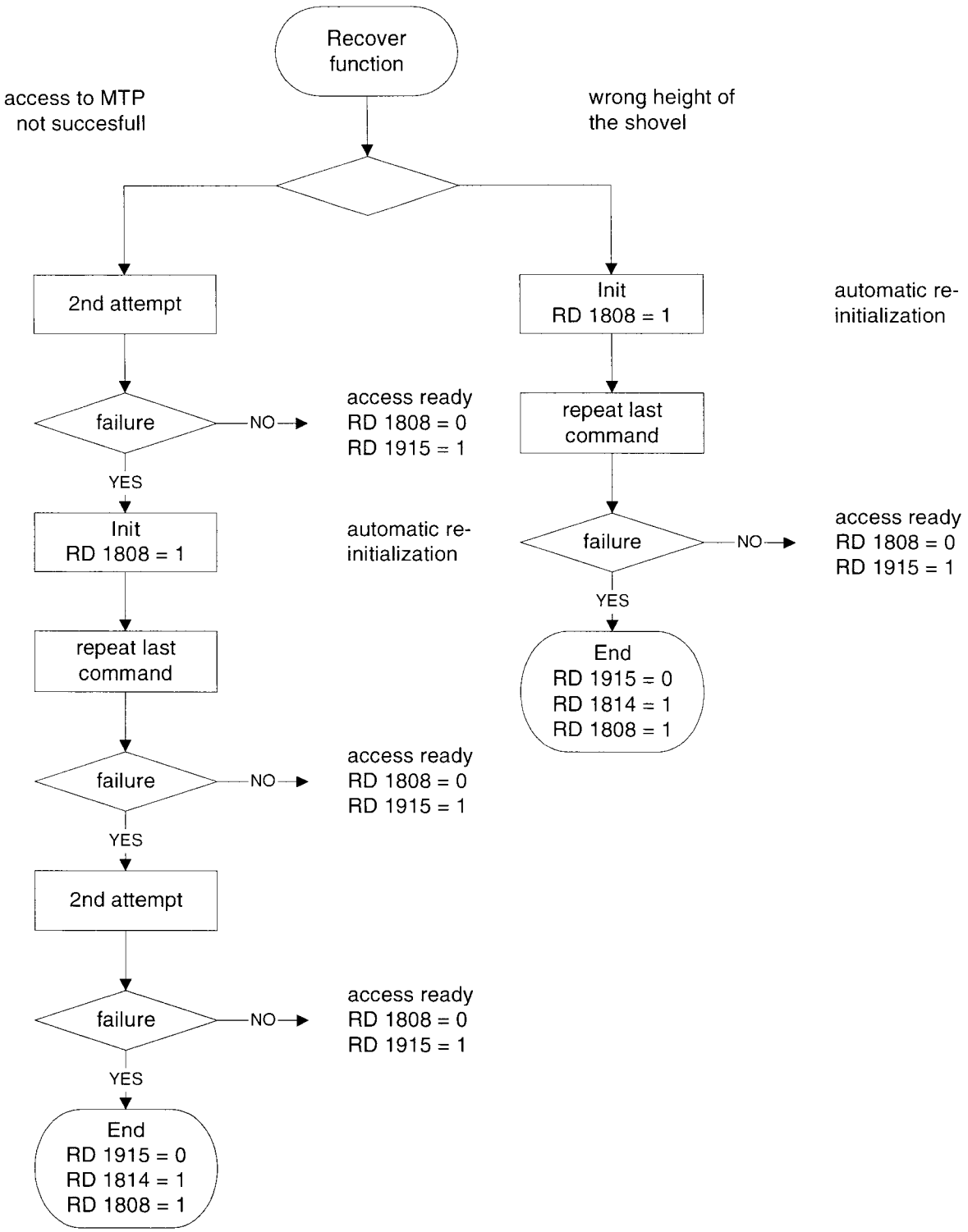
If the system is running in Handshake Mode (1610), the recover routine for the commands 1904 – 1909 is shown in flow chart 1.2.16. If a failure happens after the 1902 command during an unload sequence, the recover routine is shown in flow chart 1.2.18. If a failure happens after the 1902 command during a load sequence, the recover routine is shown in flow chart 1.2.19.

The maximum time for a recover cycle (RD 1808 = 1) is 120 sec.

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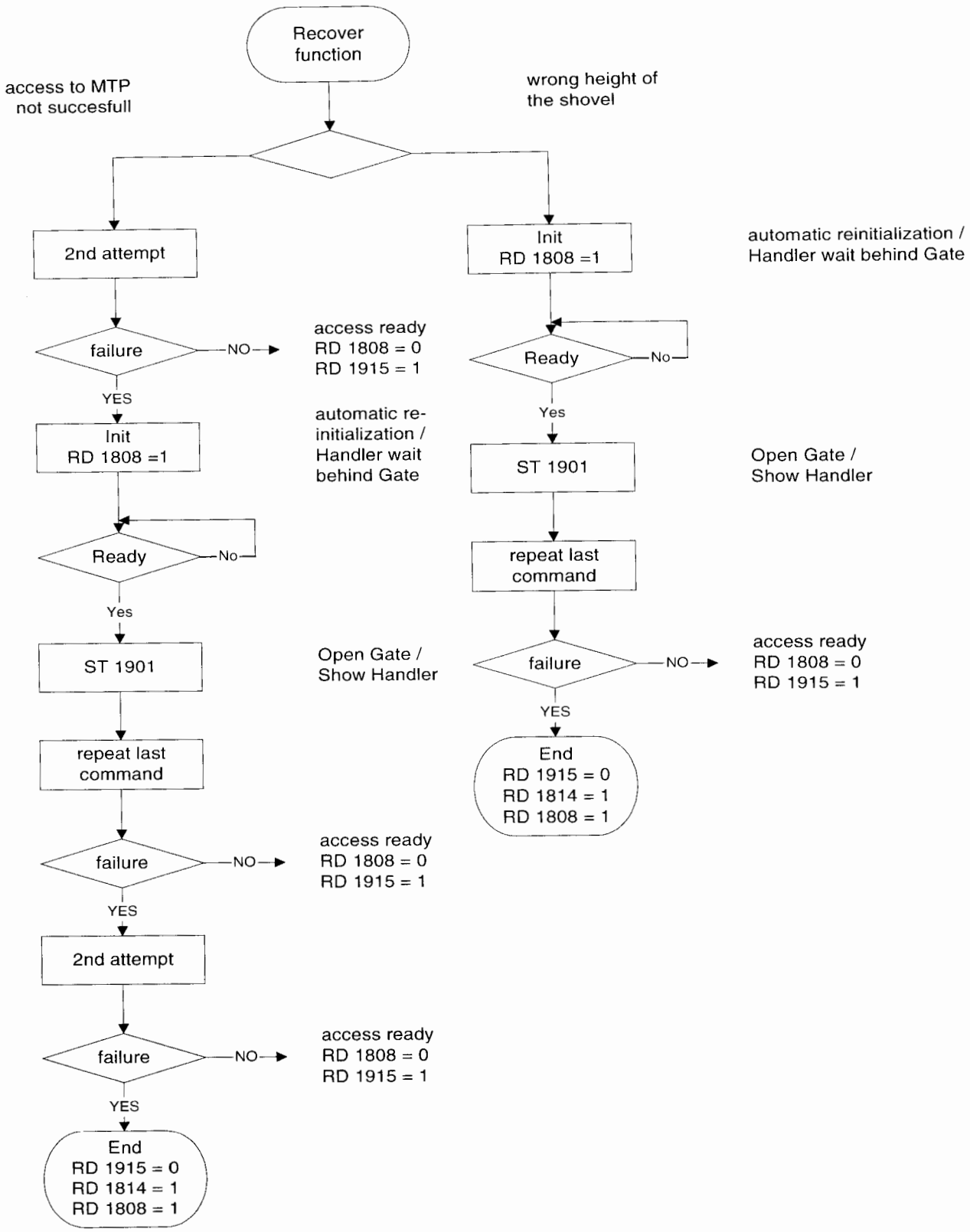
1.16 Recover Function at 1904 – 1909 commands



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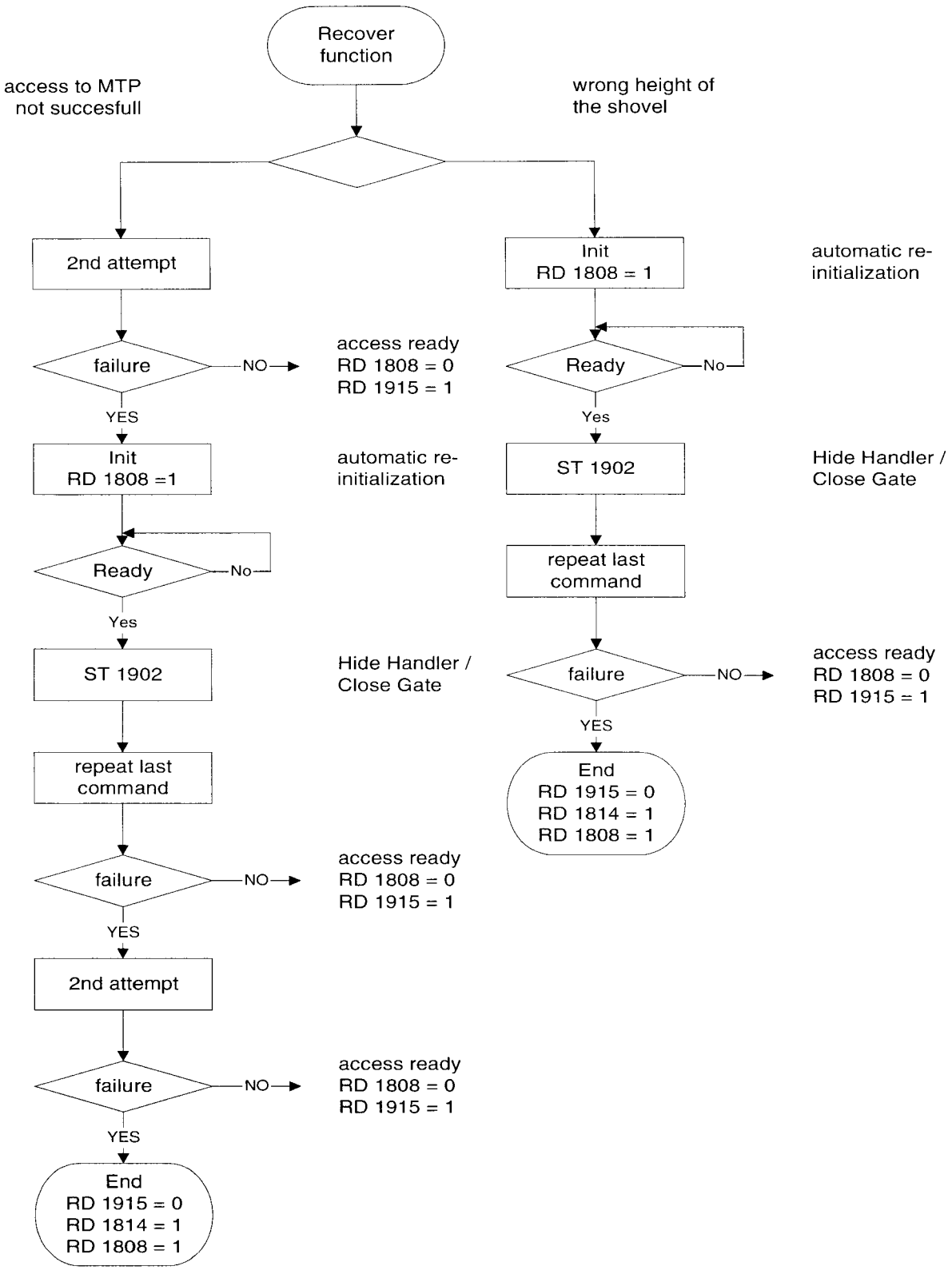
1.17 Recover Function at Gate Mode 1 (at 1901 command)



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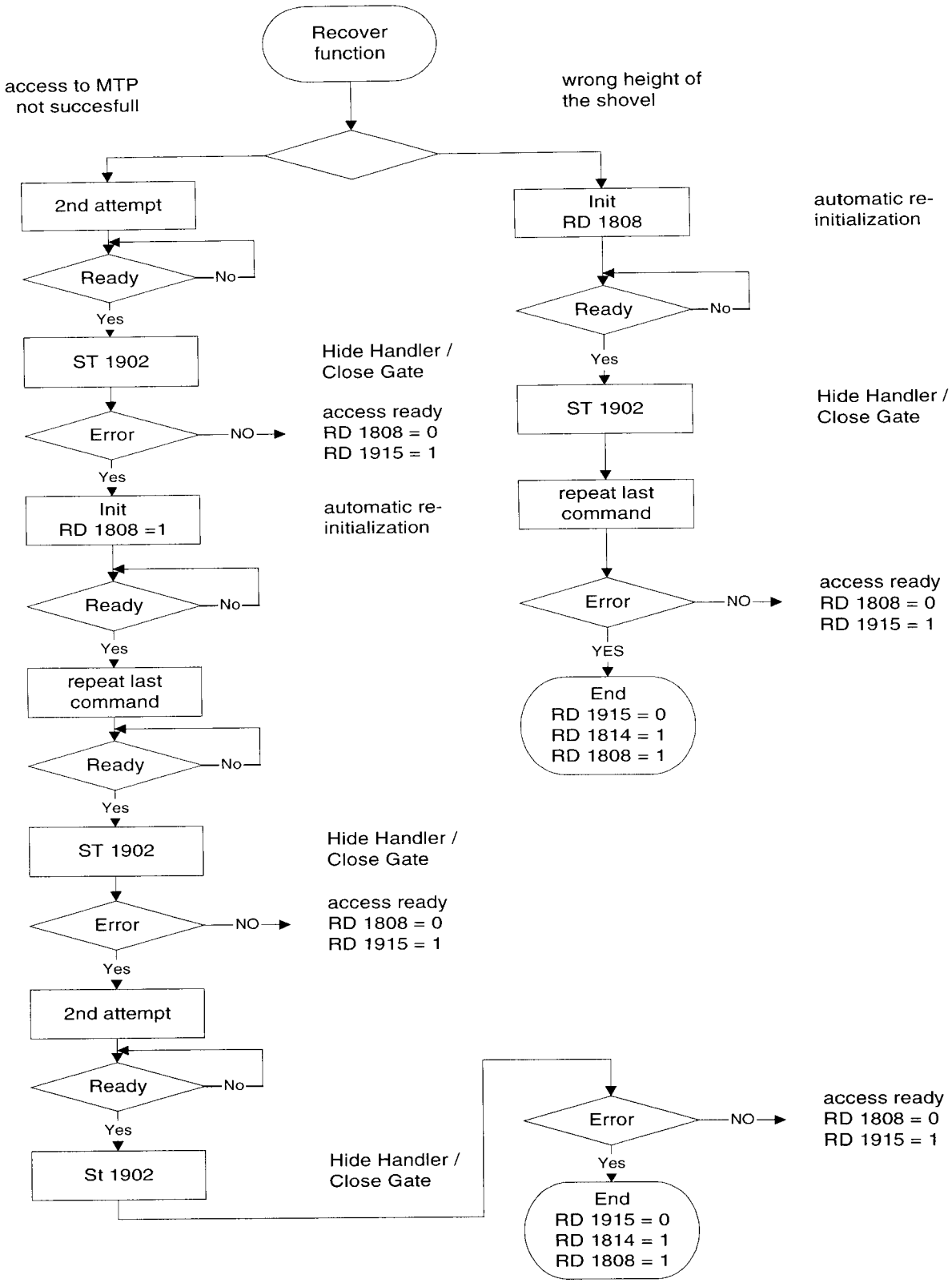
1.18 Recover Function Handshake Mode / unload (at 1902 command)



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1.19 Recover Function Handshake Mode / load (at 1902 command)



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2. Software

2.1 Utility Software "CYT"

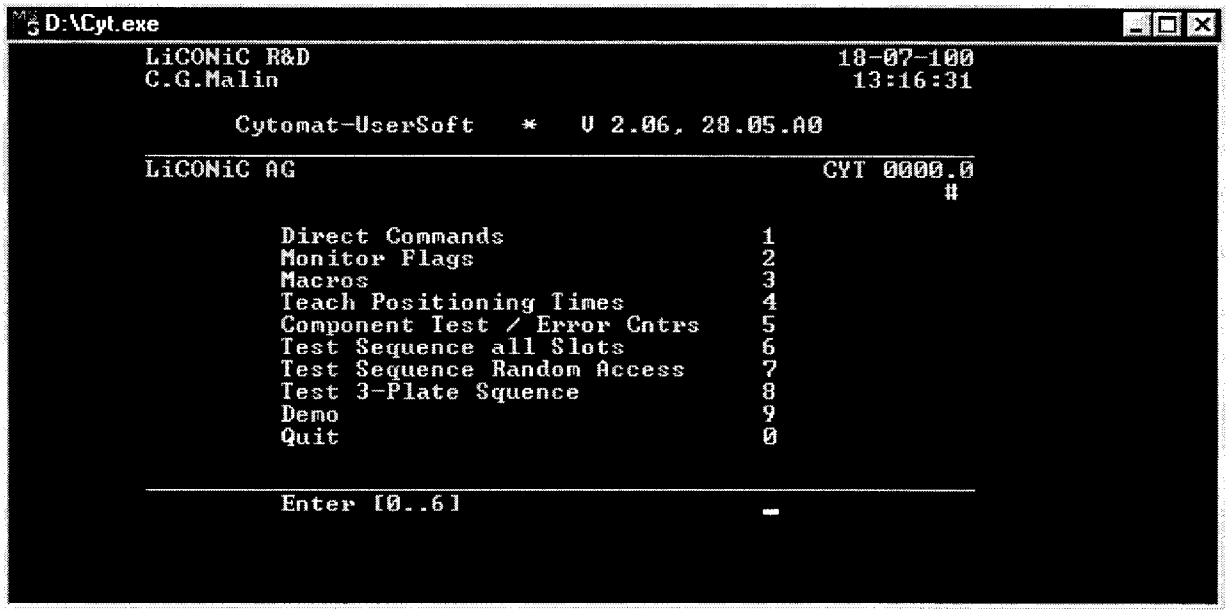
The LiCONiC Utility Software CYT.EXE allows a simple serial communication with the Upgrade via PC.

It is especially designed for starting the Upgrade, recording the unit output data and performing long-duration tests.

The Utility-SW is started using DOS with the command CYT. As a first step, the following basic information must be entered:

* Port Number — Enter the Port Number of the PC which is used for the Upgrade communication (normally 1) ↵.
* Serial Number — ↵
* Operator Name — ↵

After this information has been entered, the program offers the user the following seven menu functions (see following page). They are selected by entering the appropriate number (1-9,0).

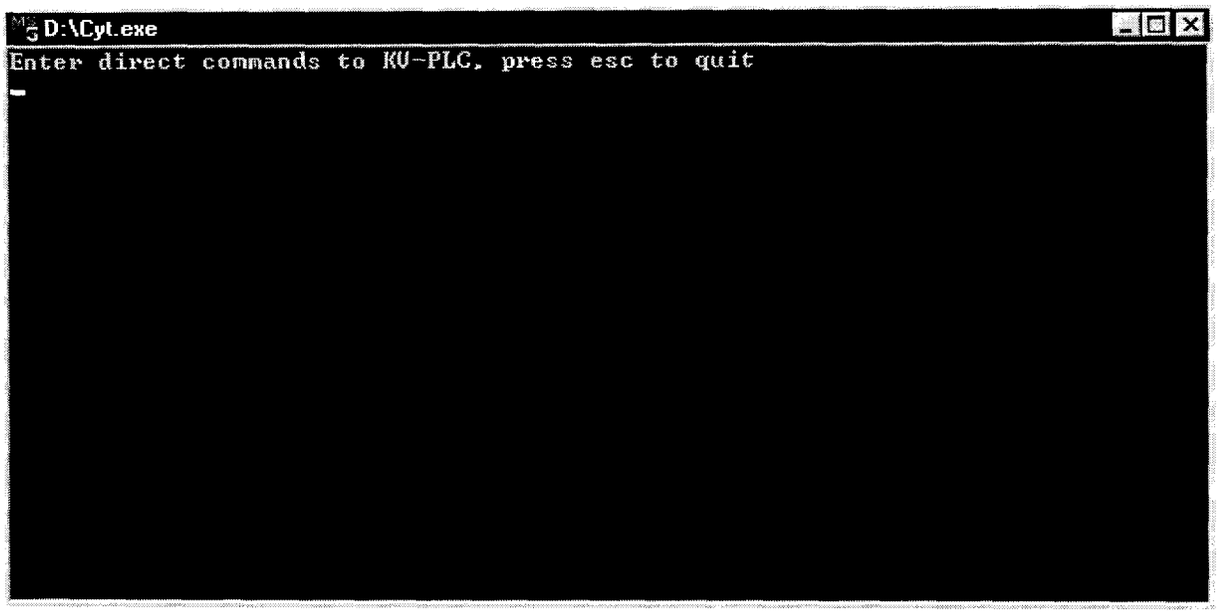


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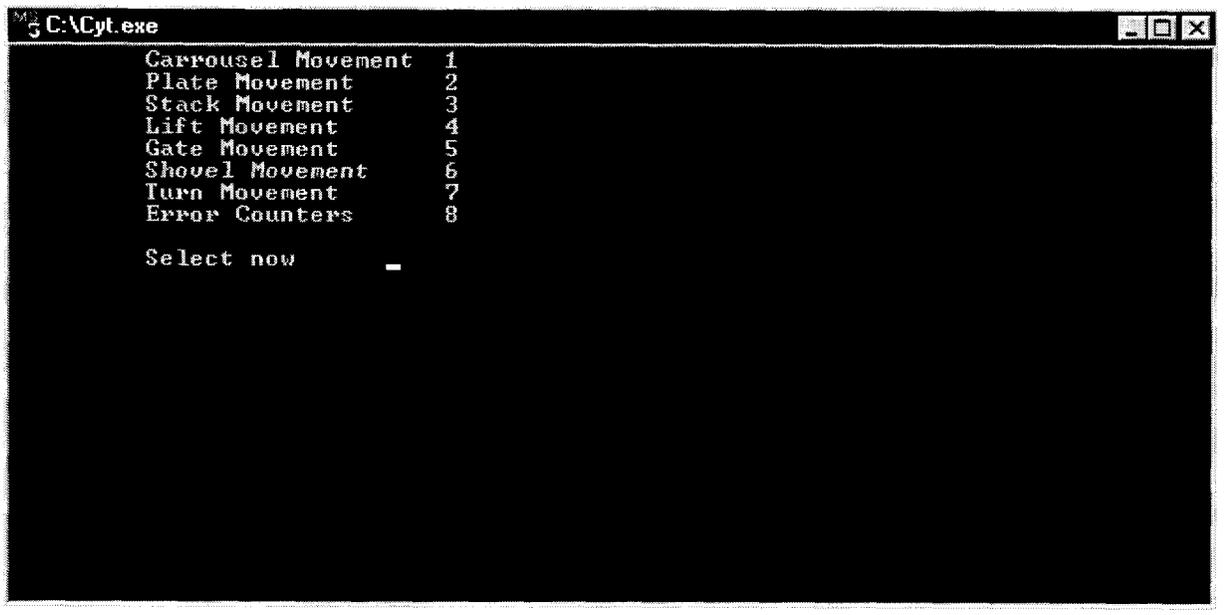
2 Software

2.1.1 Direct Commands

Menu to execute individual commands as described in chapter 1.3 – 1.6. The letters can be entered as lower case or capital letters. Every entry must be finished by pressing the < ↵ > key.



2.1.2 Component Test / Error Cntrs

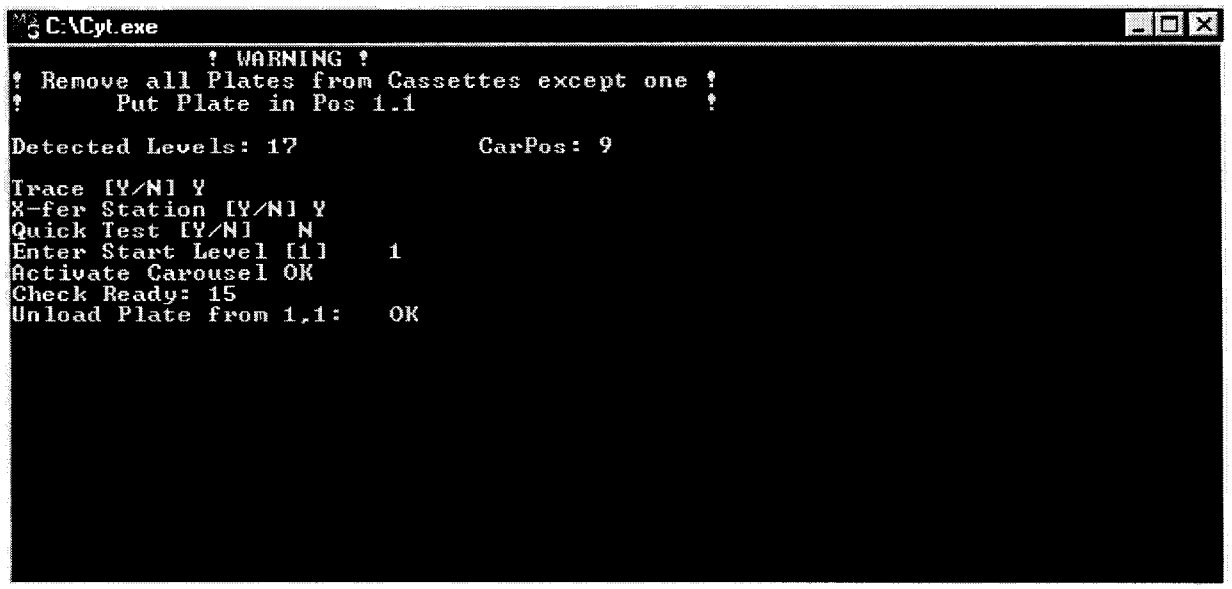


The menu points 1, 2, 3, 6, and 7 are not fully operative at the moment.
At the menu point "lift movement" the lifting device is moved upwards to a defined height within a defined time span. With "gate movement" the gate is opened within a previously determined time span and subsequently closed again. The menu "error counters" indicates dm211 through dm219, with an opportunity to reset them from this point. You leave the menu point via the ESC key.

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2 Software

2.1.3 Test Sequence all Slots



"Test sequence all slots" allows for starting a permanent test with one disk only. The MTP must be located in stacker 1 level 1; this disk is being re-stored first by position and then by level within the magazine. There is an option to select whether a transfer station is present or not [X-fer Station [Y/N]. Moreover, it is possible to run a quick test [Y/N] which only drives to level 1 and level 21. An interruption is possible via ESC.

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A Annex

A1. Barcode Scanner

A1.1 Interface

- RS 232 True (V 24) interface for external serial communication with 9pin SubD socket female.

A1.2 Data output

- seriell asynchronous with the transfer parameters 9600 baud, odd parity, 7 databits and on stop bit.
- preamble: small letter to identify the read bar-code type
- postamble: CR/LF

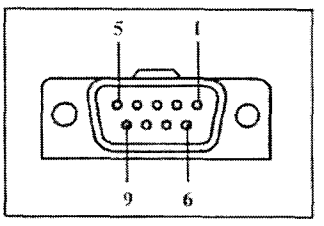
A1.3 Triggering

The triggering is effected serially from the host computer.

- disable decoding	- a single bit 13h (DC3) disables the decoding mechanism and puts the decoder into idle mode (reduced electricity absorption)
- enable decoding	- a single bit 11h (DC1) enables the decoder
- trigger	- a single bit 07h (BEL) enables the scanner for a period of 6 seconds.

A1.4 Pin assignment

9pin SubD female – top view



Pin 2 - RxD (input)
Pin 3 - TxD (output)
Pin 5 - GND
Pin 7 - RTS (output)
Pin 8 - CTS
Pin 9 - Vcc + 5 V DC input

For connection to a standard RS 232 interface a zero modem cable (with turned lines 2 and 3 as well as 7 and 8, with additionally added voltage distribution on pin 9) must be used.

The decoder board always operates with activated hardware protocol. In case of missing control signals from the side of the connected host computer, or in case of a three-wire connection, pin 7and pin 8 of the decoder connection are to be connected directly to one another!

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A Annex

A1.5 Commands

	Command	Response
Activate Scan Mode	ST *sp* 1910 *cr*	OK *cr if*
Deactivate Scan Mode	RS *sp* 1910 *cr*	OK *cr if*
Set Carrousel Position	WR *sp* DM0	OK *cr if*
Set Handler Position	WR *sp* DM0	OK *cr if*

A1.6 Technical data

Ligth source:	670 nm, visible laser diode
Scan pattern:	Line bidirectional
Scan rate:	60 scans/s
Min. reflection difference:	40 %
Read angle:	50 ° (typical)
Barcodes:	Code 39, Codabar, Code 11, MSI/Plessey, UPC/EAN, Code 128, 2/5 Matrix , 2/5 Interleaved, 2/5 Industrial, Code 16 K
Scan rate:	40 scans/sec
Interface:	RS 232 True
Supply voltage:	+5 V DC
Operating current:	65 mA (with Scanner), standby 15 mA
Triggering:	Seriell (enable, disable, trigger), opitonal HardWare-Triggering
Data output:	Seriell asynchron
Transfer parameters:	9600 baud, odd parity, 7 databit, 1 stopbit
Enclosure:	Anodized aluminum tubing, dust and water resistant, IP 65
Laser protection class:	CDRH class II
Start-Up-time:	15 ms
Humidity:	0 %...95 %, non-condensing
Temperature:	-18 °C...50 °C

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A Annex

A2 Swap-Station

After turning on the power to the cytomat unit the swap-station goes automatically to position 1 (marked on the swap station).

The swap-station turns using the command ST 1912 (=1) and rs 1912 (=0). This movement is independent from the ready flag, because the PLC prevents automatically collisions shovel/swap-station or gate/swap-station to allow time optimized access.

The position is checked by reading the status of 1912:

rd 1912 = 0	Position 1 is right behind the gate
rd 1912 = 1	Position 2 is right behind the gate

The plate-sensors on the station are checked by reading the status of 1807 and 1813:

rd 1813 = (0) 1	(no) plate is on position 1
rd 1807 = (0) 1	(no) plate is on position 2

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A Annex

A3 Status display of the SPS-Modul

Inputs:

Number	0	1	2	3	4
Function	Carousel zero point	Carousel position	Gate closed	Gate open	Keyswitch

Number	5	6	7	8	9
Function	Glass door	Coding positioning	Coding positioning	Coding positioning	Coding positioning

Number	10	11	12	13	14
Function	Plate occupation, shovel	Turn-in position	Shovel extended	Shovel retracted	Turn-out position

Number	15	100 Expan. module	101 Expan. module	102 Expan. module	103 Expan. module
Function	Lift zero point	Rotating transfer station	Rotating transfer station	Plate occupied, transfer station	Ready-flag

Outputs:

Number	500	501	502	503
Function	Lift stepper motor	Gate motor activation	Lift stepper motor	Gate motor direction

Number	504	505	506	507
Function	Carousel stepper motor	Red LED	Shovel direction motor	Turn direction motor

Number	600 Expansion module	601 Expansion module	602 Expansion module	603 Expansion module
Function	Not used	Not used	Transfer station motor direction	HS version

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A Annex

A4 RS 232 Interface

In order to connect the appliance with the PC a RS232 connection line with 1:1 conducted contacts is required (prolongation line).

The communication between the PC and the add-on motherboard is effected with the following settings: 9600 baud, 8 information bits, 1 stop bit, no parity.
The data exchange is effected via command sequences (frame) which are subject to the following construction schedule:

Frame structure:	<STX I command I data I BCC I ETX>
Command:	Bit 0 - 3 = length of data field in byte Bit 4 - 7 = command
Check total:	BCC = 1 - compliment (bit-wise negation) (command XOR data1 XOR...XOR dataN)

Command list – read control circuit data

Command:	0110 0001
Data:	1. byte = parameter [0001 iiii] iiii = 0: parameter set incubation temperature iiii = 1: parameter set CO2 iiii = 2: parameter set O2
Example CO2:	< STX I 61h I 11h I 8fh I ETX >

Answer: The control circuit data transfer for protocol purposes is effected in 14 bytes:

Only internal use	(2 bytes)
Actual value (float)	(4 bytes)
For internal use	(5 bytes)

When exchanging data between PC and micro controller the following particularity is to be observed: The sequence order of the floating decimal point value (float) must be reversed.

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