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Sampler Communication Protocol PS70

General

Commands are communicated to the PS70 as command strings via a serial interface. The interface uses V24 settings.   **9600 Baud,**
8 data bit,
1 stop bit.
parity none

The communication proceeds according to the XON/XOFF protocol.

A command string consists of one of the following commands in which capital and small letters have to be observed and whose numerical operands are separated from each other by at least one blank space. The command string is terminated by 'CR' (only carriage return and not 'LF' (line feed)).

The command string is loaded into a ring buffer under interrupt control. The special commands for emergency stop and status request are filtered out and registered in the process.

All commands are checked by the interpreter for syntactical correctness and plausibility of the operands and acknowledged by returning: "Z"   - command correct
"E01" - command not exist
"E02" - wrong numerical operand

Commands recognized as correct will be
- either answered immediately by returning information (*request commands*) or
- stored in the magazine and executed by the controller after finishing command string analysis (*basic commands*) or
- acknowledged like basic commands and stored in the command memory for later, repeatable, execution (*complex commands*).

Status requests are allowed during the execution of commands by the controller and are answered. After finishing the execution phase the interpreter waits for the next command string to analyse.

Emergency stop is possible at any time. This stopped all motors and terminate the current execution phase.

Request commands

s (lowercase) return status (Qxx)
F   return error status (Fxx), clear error
T   return tray ident (Tn) (T0 = no tray, T1, T2)
N   return sample position (Np)
M   return number of samples
V   return device typ and firmware version

Status requests are answered immediately after receiving the command. All other requests are answered when the current execution phase of the controller has been finished (or before).   n = 0, 1, 2
t = 0, 1, 2
p = sample position (0 = sample tip off tray)
xx = hex number

Basic commands

I   initialization PS70 (like power on)
- cannula over rinse position
- tray angle = 0
- rinse pump 6 s on
- initialization Diluter XLP 6000 with 5 ml and default speed = 5
- diluter 1 x suck and give off
- diluter valve to rinse bottle
- rinse pump 6 s on
- command memory and magazine cleared

K   - arm in rinse position

(step) carry out a "step" (see below) as basic command

Complex command

Complex commands consist of steps which are separated by commas and are stored successively in the command memory. The content of the command memory will be transferred to the controller only after receiving an **X**-command. The execution can be repeated as often as required by means of further **X**-commands until the memory is overwritten by a new complex command or erased by an **I**-command.

Y step[,step...] store complex command
X   execute complex command

Steps

G(n) go absolute to sample no. (n)
Gr(n) go relative (n) samples (positively or negatively)
GS(n) go to sample track (n) (outside track = 0)
GSp   go to rinse position (outside of sample tray, right side)
GKe   go to external position (outside of sample tray, left side)

     The cannula is after **G**-command in upper position

Tau   cannula in under position
Tao   cannula in upper position
Ta(t) move cannula (t) steps down (1 step = 0,125mm)
     max. moving down [steps]: rinse position   = 830
                sample position = 830 (tray)
                extern sample position = 570 (left side)

W(n) wait (n) 1/10 s example: W30 -> wait 3 seconds

Special command

14h   emergency stop command (DC4)

Acknowledgements

All acknowledgements are terminated by 'CR'.

Z	the command was recognized as correct.
E01	the command is syntactically wrong ore not exist
E02	the command contains wrong operands
E03	the command contains wrong number of operands
E04	no Y-command found
E10	sampler not initialized
E77	command crash

The acknowledgements are processed in the interpreter during command decoding of the basic or complex commands and transferred after leaving the interpreter.

The messages are created and transferred immediately after receiving the s-command. The Hex number contains the content of the status register whose bits have the following meaning.

Qxx   device status acknowledgement

S0:	the sampler has an error registered	Q01
S1:	no plate on - without bit S0	Q02
S2:	the sampler has been halted by emergency stop (DC4)	Q04
S3:	not used	
S4:	not used	
S5:	initialization required	Q20
S6:	the sampler was switched on anew (SWITCH_ON)	Q40
S7:	active command execution (DEVICE_BUSY)	Q80

For example: Qa1 = DEVICE_BUSY
+ "initialization required"
+ "error registered"

Fxx   error status acknowledgement after F-command

F0:	Diluter error	F01
F1:	Diluter overflow	F02
F2:	no used..........	
F3:	Stirrer error	F08
F4:	tray drive error	F10
F5:	track drive error	F20
F6:	sample arm drive error	F40
F7:	tray missing error	F80

The F-command clears all errors registered in the error status (F-bits)

For example: F12 = "tray drive error" + "Diluter overflow"

Tn   return tray code 1 or 2, = means "no tray"
Nn   return of the current sample position
Vg.nn   software version "V0.00emu"

Reaction in special situations

   Emergency stop

After receiving DC4 all motors are switched off immediately and the processing of commands is stopped. The sampler is to be newly initialised using the **I**-command or else correct working is not possible.

   Tray error
If the tray is removed or changed during the run ore if no tray is present at a new start, the sampler detects tray error (bit 7 in the error status). Meaningful work then is possible only after inserting the correct tray and executing the initialising with **I**-command.