TECAN.

**Command Set
VCC
Volume Control Center**

GENESIS **RSP**

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1.   Revision Control

Index:	Date:	Who:	What:	FW Version:
0.0	02.11.98	HPR	Initial draft of this document.	VCC 0.482
0.1	08.02.99	HPR	Low Volume Commands	VCC 0.51
1.0	07.03.99	HPR	Last modifications corresponding to V1.00	VCC 1.00
1.1	27.12.99	HPR	Changing and extensions described in the Update History. (2) V1.00 to V1.10	VCC 1.10
1.2	08.06.00	HPR	Piezo Module Commands described in the Update History. (2) V1.10 to V1.20	VCC 1.20

2. Firmware Update History Version V1.10 to V1.20

- *RFP*   reports the piezo module firmware version.
- *RPS*   reports the piezo module status.
- *ROV*   reports the output volume handled by the *ADV* command.
- *RRV*   reports the rest volume left by the *ADV* command.
- *RPV*   reports the piezo module output voltage.
- *RPF*   reports the piezo module pulse frequency.
- *RPW*   reports the piezo module pulse width.
- *RPN*   reports the selected number of pulses used by the *APS* command.
- *RDV*   reports the micropump drop volume.
- *RDB*   reports the delay before run in an *ADV* command.
- *RDA*   reports the delay after run in an *ADV* command.
- *RRP*   reports the position of the LLD/PIEZO relay.
- *SOV*   sets the output volume handled by the *ADV* command.
- *SRV*   sets the rest volume left by the *ADV* command to zero.
- *SPV*   sets the piezo module output voltage.
- *SPF*   sets the piezo module pulse frequency.
- *SPW*   sets the piezo module pulse width.
- *SPN*   sets the number of pulses used by the *APS* command.
- *SDV*   sets the micropump drop volume.
- *SDB*   sets the delay before run in an *ADV* command.
- *SDA*   sets the delay after run in an *ADV* command.
- *SRP*   sets the position of the LLD/PIEZO relay.
- *SPC*   starts the micropump continuously.
- *SPH*   stops the micropump.
- *APS*   starts the micropump for a certain number of drops.
- *ADV*   starts dispensing a volume with the micropump and plunger.

- *RPP*   has a new selector number 12. It reports the low current value.
- *SCP*   has a second parameter to define the low current of the plunger.
- *PIW*   is removed from TECAN style command set.

- *I / O / B*   have a new selector to reactivate the valve after a *W* initialization.

3.   Command Set VCC style

3.1.   Report Commands

RFV n
REPORT FIRMWARE VERSION:
This command reports the actual loaded firmware and bootware version. Also this instruments serial number can be reported.
n: 0 = Firmware Version
          1 = Bootware Version
          2 = Serial Number.
EXAMPLE: #D1RFV
Reports the actual firmware version.
RESPONSE: "VCC-Vx.xx-MM/YYYY"
GENERATED ERRORS: (3) invalid operand.

RFP
REPORT PIEZO MODULE FIRMWARE VERSION:
This command reports the actual installed firmware version of the PIEZO module.
EXAMPLE: #D1RFP
Reports the actual firmware version.
RESPONSE: "PIEZO-Vx.xx-MM/YYYY"
GENERATED ERRORS: (16) piezo communication error.

RSD Selector
REPORT SYSTEM DEVICES:
This command reports the actual system device connected to the VCC module.
Selector: 0 = Low volume installed.
                   1 = Piezo Module installed.
EXAMPLE: D1RSD0
Reports if the Low Volume module is installed.
RESPONSE: 0 = not installed, 1 = installed.
GENERATED ERRORS: (3) invalid operand.

RYV
REPORT SYRINGE VOLUME:
This command reports the volume of the syringe. Any volume in micro liters can be programmed by the *SYV* command. This parameter can be stored in non-volatile memory for system information.
EXAMPLE: #D1RYV
Reports the syringe volume in micro liters.
RESPONSE: 1000 is equal 1ml.
GENERATED ERRORS: none.

RPP Selector
REPORT PLUNGER DRIVE PARAMETER:
This command reports the current parameter of the plunger drive. Only one axis parameter can be reported at a time.

Selector:

0	=	Report calculated position in steps.
1	=	Report current position in steps.
2	=	Report encoder position in steps.
3	=	Report encoder deviation in steps.
4	=	Report initialization offset in steps.
5	=	Report absolute range in steps.
6	=	Report end speed in Hz.
7	=	Report start speed in Hz.
8	=	Report stop speed in Hz.
10	=	Report ramp frequency in 2.5kHz increments.
11	=	Report high current value in increments.
12	=	Report low current value in increments.

EXAMPLE: #D1RPP6
Reports the plunger end speed in Hz.
RESPONSE: see selector.
GENERATED ERRORS: (3) invalid operand.

RVP Selector
REPORT VALVE DRIVE PARAMETER:
This command reports the current parameter of the valve drive. Only one axis parameter can be reported at a time.

Selector:

0	=	Report current position in mnemonics
3	=	Report lost steps.
11	=	Report high current value in increments.

EXAMPLE: #D1RPV0
Report the valve position mnemonic.
RESPONSE: i = input, o = output, b = bypass.
GENERATED ERRORS: (3) invalid operand.

RIS
REPORT INSTALLED PINCH VALVE SOLENOID:
This command reports whether a pinch valve solenoid is installed or not. Since the hardware can't detect the pinch valve hardware automatically, it must be set by the *SIS* command. This parameter can be stored in non-volatile memory.
EXAMPLE: #D1RIS
Report if a pinch valve solenoid is installed or not.
RESPONSE: 0 = no pinch valve installed, 1 = pinch valve installed. (default = 0)
GENERATED ERRORS: none.

RTH
REPORT TIME TO HIT PINCH VALVE SOLENOID:
This command reports the time to hit the pinch valve solenoid. The value returned is an increment of 5ms and can be set by the *STH* command This parameter can be stored in non-volatile memory.
EXAMPLE: #D1RTH

Report the actual time to hit the pinch valve.
RESPONSE: [1..255] = n* 5ms. (default = 100)
GENERATED ERRORS: none.

RBH
REPORT TIME BEFORE HIT PINCH VALVE SOLENOID:
This command report the time before hit the pinch valve solenoid. The value returned is an increment of 5ms and can be set by the *SBH* command. This parameter can be stored in non-volatile memory.
EXAMPLE: #D1RBH
Report the actual time before hit the pinch valve.
RESPONSE: [0..255] = n* 5ms. (default = 0)
GENERATED ERRORS: none.

RAH
REPORT TIME AFTER HIT PINCH VALVE SOLENOID:
This command reports the time after hit the pinch valve solenoid. The time returned is an increment of 5ms and can be set by the *SAH* command. This parameter can be stored in non-volatile memory.
EXAMPLE: #D1RAH
Report the actual time after hit the pinch valve.
RESPONSE: [0..255] = n* 5ms. (default = 0)
GENERATED ERRORS: none.

RPS
REPORT PIEZO MODULE STATUS:
The actual status of the PIEZO module can be reported with this command. The PIEZO module knows three different states.
EXAMPLE: #D1RPS
Report the actual state of the PIEZO module.
RESPONSE: 0 = ready, 1 = busy n pulse, 2 = busy continuos.
GENERATED ERRORS: (16) piezo communication error.

ROV
REPORT OUTPUT VOLUME:
This command reports the desired output volume set by the *SOV* command. The volume is involved in calculation by the *ADV* command. The answer is divided into a nl and a pl response separated by a comma.
EXAMPLE: #D1ROV
Report output volume.
RESPONSE: 123,456 means 123nl plus 456pl = 123456pl total.
GENERATED ERRORS: none.

RRV
REPORT REST VOLUME:
This command reports the rest volume that was left in syringe after an *ADV* command. The rest
volume can be set to zero by the *SRV* command. The answer is divided into a nl and a pl
response separated by a comma.
EXAMPLE: #D1RRV
Report the rest volume.
RESPONSE: 4,395 means 4nl plus 395pl = 4395pl total.
GENERATED ERRORS: none.

RPV Selector
REPORT PIEZO MODULE VOLTAGE:
This command reports the actual or target output voltage of the micropump. The voltage can be
changed by the *SPV* command.
Selector: 0 = target voltage, 1 = actual voltage.
EXAMPLE: #D1RPV1
Report the actual measured voltage of the micropump in 1/10 Volts.
RESPONSE: 200..1200 1/10Volts.
GENERATED ERRORS: (3) invalid operand, (16) piezo communication error.

RPF Selector
REPORT THE PULSE FREQUENCE FOR PIEZO AKTUATION:
This command reports the pulse frequency either in Hz or in counts. The frequency can be
changed by the *SPF* command.
Selector: 0 = frequency, 1 = frequency in counts.
EXAMPLE: #D1RPF0
Report the actual frequency in Hz.
RESPONSE: 50..5000Hz.
GENERATED ERRORS: (3) invalid operand, (16) piezo communication error.

RPW Selector
REPORT THE PULSE WIDTH FOR PIEZO AKTUATION:
This command reports the pulse width either in μs or in counts. The pulse width can be
changed by the *SPW* command.
Selector: 0 = pulse width in μs, 1 = pulse width in counts.
EXAMPLE: #D1RPW
Report the actual pulse width.
RESPONSE: 40..250 μs.
(3) invalid operand, (16) piezo communication error.

RPN
REPORT PULSE NUMBER OF PIEZO MODULE:
This command reports the number of pulses generated by the micropump while using the *APS*
command. The number of pulses can be defined by the *SPN* command.
EXAMPLE: #D1RPN
Report the number of pulses.
RESPONSE: 1..20000.
GENERATED ERRORS: (16) piezo communication error.

RDV
REPORT PIEZO DROP VOLUME:
This command reports the drop volume dispensed by micropump at one pulse in pl. The volume can be changed by the *SDV* command. Drop volume is involved in calculation by the *ADV* command.
EXAMPLE: #D1RDV
Report the drop volume in pl.
RESPONSE: 1..10000 pl.
GENERATED ERRORS: none.

RDB
REPORT DELAY BEFORE RUN:
This command reports the delay before the dilutor starts in ms. The delay is involved in calculation for *ADV* command.
EXAMPLE: #D1RDB
Report the delay in ms before the diluter starts moving.
RESPONSE: -1000..1000 ms.
GENERATED ERRORS: none.

RDA
REPORT DELAY AFTER RUN:
This command reports the delay after dilutor stops in ms. The delay is involved in calculation for *ADV* command.
EXAMPLE: #D1RDA
Report the delay in ms after the diluter stops moving.
RESPONSE: -1000..1000 ms.
GENERATED ERRORS: none.

RRP
REPORT LLD/PIEZO RELAY POSITION:
This command reports the position of liquid level detection / piezo micropump actuation relay.
EXAMPLE: #D1RRP
Report the position of the relay.
RESPONSE: 0 = LLD position, 1 = piezo position.
GENERATED ERRORS: none.

RDF Selector
REPORT DIAGNOSTIC FUNCTIONS:
All the diagnostic values will be saved at power off of the instrument or if a *Power fail* occurs. The stored data can be read by this command.
Selector: 0 = Report number of power ups.
                  1 = Report minute meter.
                  2 = Report number of initializations.
                  3 = Report number of plunger movements.
                  4 = Report number of valve movements.
EXAMPLE: #D1RDF1
Reports the sum of *switched on* time in minutes.
RESPONSE: see selector.
GENERATED ERRORS: (3) invalid operand.

RED n

READ EEPROM DATA:

This command reads data directly from the EEPROM. The overall size of the EEPROM is 1024 words.

CAUTION! This command is for service purposes only (board exchange). Overwriting of such variables can cause malfunction of the instrument and software.

n: 0 = overall EEPROM size in words.

                 [1.. 1024] words.

EXAMPLE: #O1RED123

Reads the word value at storage location number 123

RESPONSE: none

GENERATED ERRORS: (3) invalid operand, (13) no access to serial EEPROM.

3.2.   Set Commands

SYV Volume
SET SYRINGE VOLUME:
This command sets the volume of the syringe. Any volume in micro liters can be programmed and stored in non-volatile memory by the *AWE* command for system information.
Volume: [0..32767]   (default = 0)
EXAMPLE: #D1SYV1000
Set the syringe volume to 1000 micro liters.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SEP EndSpeed
SET THE PLUNGER DRIVE END SPEED:
This command sets the plunger drive end speed in Hz.
EndSpeed: [5...6000]   (default = 1400)
EXAMPLE: #D1SEP2000
Sets the end speed to 2000Hz.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

STP StartSpeed
SET THE PLUNGER DRIVE START SPEED:
This command sets the plunger drive start speed in Hz.
StartSpeed: [50...1000]   (default = 900)
EXAMPLE: #D1STP300
Sets the start speed to 300Hz.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SPP StopSpeed
SET THE PLUNGER DRIVE STOP SPEED:
This command sets the plunger drive stop speed in Hz.
StopSpeed: [50...2700]   (default = 900)
EXAMPLE: #D1SPP100
Sets the stop speed to 100Hz.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SFP Ramp
SET THE PLUNGER DRIVE RAMP:
This command sets the plunger drive ramp in 2.5kHz/s increments.
Ramp: [1...20]   (default 7 = 17.5kHz/s)
EXAMPLE: #D1SFP5
Sets the ramp to 12.5 kHz/s.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SCP HiCu, LoCu
SET PLUNGER DRIVE HIGH AND LOW CURRENT VALUE:
With this command it is possible to change the values of high and low current of the plunger drive. High current is active while moving this drive and a short while after positioning has been completed. Low current is active while remaining on the same position. This setting can be stored by the *AWE* command in non-volatile memory.
CAUTION! This command should be used only in consultation with TECAN AG. Overwriting of such variables can destroy the VCC hardware.
HiCu: [2..100]   (default = 55)
LoCu: [0..100]   (default = 27)
EXAMPLE: #D1SCP40,0
Decreases the high current value to 40 and low current is off.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SCV HiCu
SET VALVE DRIVE HIGH CURRENT VALUE:
With this command it is possible to change the value of high current of the valve drive. High current is active while moving this drive and a short while after positioning has been completed. While remaining on the same position, the current is reduced to zero.
CAUTION! This command should be used only in consultation with TECAN AG. Overwriting of such variables can destroy the VCC hardware.
HiCu: [0..255]   (default = 140)
EXAMPLE: #D1SCV150
Increases the high current value to 150.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SIS Selector
SET INSTALLED PINCH VALVE SOLENOIDS:
This command is used to configure whether a pinch valve solenoid should be installed or not. This setting can be stored by the *AWE* command in non-volatile memory.
Selector: [0...1] 0 = no pinch valve installed, 1 = pinch valve installed. (default = 0)
EXAMPLE: #D1SIS1
Configures the pinch valve solenoid as installed.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

STH HitTime
SET TIME TO HIT:
This command sets the time to hit the pinch valve solenoid. The minimum time to set is 5ms and it ranges up to 1.25 seconds. This setting can be stored by the *AWE* command in non-volatile memory.
HitTime: [1..255] = n* 5ms. (default = 100)
EXAMPLE: #D1STH20
Sets the hit time to 100ms.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SBH HitTime
SET TIME BEFORE HIT:
This command sets the time before hit the pinch valve solenoid. The minimum time to set is
0ms and it ranges up to 1.25 seconds. This setting can be stored by the *AWE* command in non-
volatile memory.
HitTime: [0..255] = n* 5ms. (default = 0)
EXAMPLE: #D1SBH100
Sets the time before hit to 500ms.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SAH HitTime
SET TIME AFTER HIT:
This command sets the time after hit the pinch valve solenoid. The minimum time to set is 0ms
and it ranges up to 1.25 seconds. This setting can be stored by the *AWE* command in non-
volatile memory.
HitTime: [0..255] = n* 5ms. (default = 0)
EXAMPLE: #D1SAH75
Sets the time before hit to 375ms.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SOV nl,pl
SET THE OUTPUT VOLUME DISPENDED BY MICROPUMP:
This command sets the volume dispensed by the micropump. The volume is involved in
calculation for *ADV* command. This command has two parameters. The first is used to set
output volume part in nl and the second defines the output volume part in pl.
nl: [0..10000]   (default = 0)
pl: [0..999]   (default = 0)
EXAMPLE: #D1SOV123,456
Set the output volume to 123456pl
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SRV
SET THE REST VOLUME TO ZERO:
This command sets the rest volume of the calculation by the *ADV* command to zero.
EXAMPLE: #D1SRV
Set the rest volume to zero.
RESPONSE: none.
GENERATED ERRORS: none.

SPV Voltage
SET PIEZO MODULE VOLTAGE:
This command sets the piezo voltage in 1/10 Volts.
Voltage: [200..1200]   (default = 250)
EXAMPLE: #D1SPV1000
Set the piezo voltage to 100 V
RESPONSE: none.

GENERATED ERRORS: (3) invalid operand, (16) piezo communication error, (17) piezo module busy.

SPF PulseFrequence

SET THE PULSE FREQUENCE FOR PIEZO AKTUATION:

This command sets the pulse frequency in Hz.

PulseFrequence: [50...1500]   (default = 100)

EXAMPLE: #D1SPF200

Sets the pulse frequency to 200Hz.

RESPONSE: none.

GENERATED ERRORS: (3) invalid operand, (16) piezo communication error, (17) piezo module busy, (18) piezo frequency / pulse width out of range.

SPW PulseWidth

SET THE PULSE WIDTH FOR PIEZO AKTUATION:

This command sets the pulse width for piezo actuation in μs.

PulseWidth: [40..250]   (default = 133)

EXAMPLE: #D1SPW200

Sets the pulse width to 200 μs.

RESPONSE: none.

GENERATED ERRORS: (3) invalid operand, (16) piezo communication error, (17) piezo module busy, (18) piezo frequency / pulse width out of range.

SPN NofPulse

SET PULSE NUMBER OF PIEZO MODULE:

This command sets the number of pulses generated by the PIEZO module.

NofPulse: [1...20000]   (default = 100)

EXAMPLE: #D1SPN200

Sets the pulse number to 200.

RESPONSE: none.

GENERATED ERRORS: (3) invalid operand, (16) piezo communication error, (17) piezo module busy.

SDV DropVolume

SET PIEZO DROP VOLUME:

This command sets the drop volume dispensed by micropump at one pulse in pl.

DropVolume: [1...10000 pl] (default = 100)

EXAMPLE: #D1SDV1000

Sets the drop volume to 1000 pl

RESPONSE: none.

GENERATED ERRORS: (3) invalid operand.

SDB Delay

SET THE DELAY BEFORE RUN:

This command sets the delay before the dilutor starts in ms. The delay is involved in calculation by the *ADV* command.

Delay: [-1000...1000 ms]   (default = 0)

EXAMPLE: #D1SDB200

Sets the delay before dilutor start (after start of micropump) to 200 ms.

RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SDA Delay
SET THE DELAY AFTER RUN:
This command sets the delay after the dilutor stop in ms. The delay is involved in calculation by the *ADV* command.
Delay: [-1000...1000 ms]   (default = 0)
EXAMPLE: #D1SDA100
Sets the delay after dilutor stop (before stop of micropump) to 100 ms.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SRP RelayStatus
SET THE LLD/PIEZO RELAY POSITION:
This command sets the position of liquid level detection / piezo micropump actuation relay.
RelayStatus: 0 = LLD position, 1 = piezo position.   (default = 0)
EXAMPLE: #D1SRP1
Sets the relay to piezo position
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

SPC
START PIEZO PUMP CONTINOUS:
This command sets the relay to piezo position and starts the micropump (piezo) continuously.
Values set by *SPV, SPF* and *SPW* are in used. The micropump can be stopped by the *SPH*
command.
EXAMPLE: #D1SCP
Starts the micro pump continuously.
RESPONSE: none.
GENERATED ERRORS: (16) piezo communication error, (17) piezo module busy.

SPH
STOP PIEZO PUMP:
This command stops the micropump (piezo) and sets the relay back to liquid level detection position.
EXAMPLE: #D1SPH
Stops the micro pump
RESPONSE: none.
GENERATED ERRORS: (16) piezo communication error.

SED n,word
SET EEPROM DATA:
This command writes data directly into the EEPROM. The overall size of the EEPROM is 1024 words.
CAUTION! This command is for service purposes only (board exchange). Overwriting of such variables can cause malfunction of the instrument and software.
n: [1..1024] words.
word: [-32768..32767]
EXAMPLE: #D1SED123,32000
Writes the word value 32000 to storage location number 123
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand, (13) no access to serial EEPROM.

SOF Firmware
FIRMWARE DOWNLOAD:
This command initiates the firmware downloading process. The *SOF* command should not be used as string command itself. Only in connection with the utility program "DOWNLOAD.EXE", this command makes sense.
Firmware: [INTEL.HEX file format]
EXAMPLE with DOWNLOAD.EXE Program:
c:\ download com=1 firmware=vcc110.hex dev=#D1
RESPONSE: none.
GENERATED ERRORS: none.

3.3. Action Commands

PIZ
INITIALIZE PLUNGER AND VALVE DRIVE (NORMAL POLARITY):
This command initializes the plunger and the valve drive. The valve drive direction has normal polarity now. After initialization, all the speed and ramp settings are set to default again.
EXAMPLE: #D1PIZ
Initializes plunger and valve drive.
RESPONSE: none.
GENERATED ERRORS: (1) invalid init, (3) invalid operand, (10) valve overload.

PIY
INITIALIZE PLUNGER AND VALVE DRIVE (REVERSE POLARITY):
This command initializes the plunger and the valve drive. The valve drive direction has reverse polarity now. After initialization, all the speed and ramp settings are set to default again.
EXAMPLE: #D1PIY
Initializes plunger and valve drive.
RESPONSE: none.
GENERATED ERRORS: (1) invalid init, (3) invalid operand, (10) valve overload.

PPA AbsPos
MOVE PLUNGER TO ABSOLUTE POSITION:
This command moves the plunger to an absolute position. Movements can't be done if the valve is set to bypass position.
AbsPos: [0...3150]
EXAMPLE: #D1PPA2150
Moves the plunger to absolute position 2150.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand, (7) not initialized, (9) plunger overload, (10) valve overload, (11) valve in bypass position.

PPP RelPos
MOVE PLUNGER RELATIVE (PICK LIQUID):
This command moves the plunger relative downward from the current position. Movements can't be done if the valve is set to bypass position.
RelPos: [0...3150]
EXAMPLE: #D1PPP100
Move the plunger downwards 100 steps from current position.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand, (7) not initialized, (9) plunger overload, (10) valve overload, (11) valve in bypass position.

PPD RelPos
MOVE PLUNGER RELATIVE (DISPENSE LIQUID):
This command moves the plunger relative upward from the current position. Movements can't be done if the valve is set to bypass position.
RelPos: [0...3150]
EXAMPLE: #PPD1D20
Move the plunger upward 20 steps from current position.

RESPONSE: none.
GENERATED ERRORS: (3) invalid operand, (7) not initialized, (9) plunger overload, (10) valve overload, (11) valve in bypass position.

PVI
TURN VALVE TO INPUT:
This command turns the valve drive to input port. If the valve drive is not initialized, it will be done automatically by this command.
EXAMPLE: #D1PVI
Turn valve to input.
RESPONSE: none.
GENERATED ERRORS: (10) valve overload.

PVO
TURN VALVE TO OUTPUT:
This command turns the valve drive to output port. If the valve drive is not initialized, it will be done automatically by this command.
EXAMPLE: #D1PVO
Turn valve to output.
RESPONSE: none.
GENERATED ERRORS: (10) valve overload.

PVB
TURN VALVE TO BYPASS:
This command turns the valve drive to bypass port. If the valve drive is not initialized, it will be done automatically by this command.
EXAMPLE: #D1PVB
Sets the stop speed to 100Hz.
RESPONSE: none.
GENERATED ERRORS: (10) valve overload.

AHS
START HIT PINCH VALVE SOLENOIDS:
This command starts the hit pinch valve solenoid sequence. The timing for this sequence is given by the time before, while and after parameter, which can be defined by the commands *SBH*, *STH* and *SAH*.
EXAMPLE: #D1AHS
Hit the pinch valve solenoid.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand, (20) pinch valve not installed.

APS
START PIEZO PUMP FOR N DROPS:
This command sets the relay to piezo position, starts the micropump (piezo) for N pulses and sets the relay back to liquid level detection position. Values set by *SPV, SPF, SPW* and *SPN* are in use.
EXAMPLE: #D1APS
Starts the micro pump for N drops
RESPONSE: none.
GENERATED ERRORS: (16) piezo communication error, (17) piezo module busy.

ADV
DISPENSE VOLUME:
This command calculates the pump dilutor parameters, sets the relay to piezo position, starts the micropump (piezo) and sets the relay back to LLD position after pump stop. Values set by *SPV, SPF, SPW, SOV, SDV, SYV* are in use. The syringe size for this command must be between 10 and 1000 micro liters.
EXAMPLE: #D1ADV
Starts the dispensing sequence.
RESPONSE: none.
GENERATED ERRORS: (11) valve in bypass position, (16) piezo communication error, (17) piezo module busy, (19) dispense setting out of range.

AWE
WRITE DATA TO NON VOLATILE MEMORY:
This command is storing data to non-volatile memory. Parameter of the following commands will be stored: *SIS*, *STH*, *SAH*, *SBH, SCP* and *SYV*.
EXAMPLE: #D1AWE
RESPONSE: none.
GENERATED ERRORS: (13) no access to serial EEPROM.

ARE
READ DATA FROM NON VOLATILE MEMORY:
This command retrieves the last saved data by *AWE* from non-volatile memory.
EXAMPLE: #D1ARE
RESPONSE: none.
GENERATED ERRORS: (13) no access to serial EEPROM.

3.4. Error Codes

These are the possible error codes generated by the VCC style commands.

Code	VCC Error Codes
1	Invalid Initialization
2	Invalid Command
3	Invalid Operand
5	Device not implemented
7	Not Initialized
9	Plunger overload
10	Valve overload
11	Valve in bypass
13	No access to EEPROM
15	Command Overflow
16	Piezo communication error
17	Piezo module busy
18	Piezo parameter out of range
19	ADV parameter out of range
20	No Low Volume installed

4.   Command Set XP style

4.1.   *Report Commands*

Q n
REPORT PUMP PARAMETER:
This command report the pump status, parameter, configuration and diagnose data.
n: 0 = Reports the calculated plunger position.
            Response: full steps.
         1 = Reports the current encoder position.
            Response: full steps.
         2 = Reports the current plunger position.
            Response: full steps.
         3 = Reports the current valve position.
            Response: i = input, o = output, b = bypass.
         4 = Reports plunger end speed frequency.
            Response: half steps per second.
         6 = Reports plunger start speed frequency.
            Response: half steps per second.
         7 = Reports plunger stop / cutoff speed frequency.
            Response: half steps per second.
         10 = Reports command buffer status.
            Response: 0 = empty, 1 = commands in buffer.
         11 = Reports encoder deviation from last move.
            Response: full steps.
         12 = Reports number of backlash steps.
            Response: full steps.
         13 = Reports the status of IN1 (input line 1).
            Response: 0 or 1.
         14 = Reports the status of IN2 (input line 2)
            Response: 0 or 1.
         15 = Reports the number of pump initializations.
            Response: any number between 0 and 16'777'215.
         16 = Reports the number of plunger moves.
            Response: any number between 0 and 16'777'215.
         17 = Reports the number of valve moves.
            Response: any number between 0 and 16'777'215.
         18 = Reports the number of valve moves since last reporting with this command.
            Response: any number between 0 and 255.
         20 = Reports application code checksum.
            Response: four ASCII characters. Example: A23F.
         21 = Response: 0011.
         22 = Reports the fluid sensor voltage.
            Response: voltage in 20 mV increments.
         23 = Reports the firmware version string.
            Response: VCC-x.xx-mm/yyyy.
         24 = Response: 0.
         29 = Reports the current status of the pump (fatal errors).

Response: error code.
EXAMPLE: #D1Q23
Reports the actual firmware version.
RESPONSE: "VCC-V1.10-01/2000"
GENERATED ERRORS: (3) invalid operand.

4.2.   *Initialization Commands*

Z Force
INITIALIZE PLUNGER AND VALVE DRIVE (NORMAL POLARITY):
This command initializes the plunger and the valve drive. The valve drive direction has normal polarity now. The force parameter is only valid for the plunger drive. After initialization, all the speed and ramp settings are set to default again.
Force: 0 = full force, 1 = half force, 2 = quarter force   (default = 0)
EXAMPLE: #D1ZR
Initializes plunger and valve drive.
RESPONSE: none.
GENERATED ERRORS: (1) invalid init, (3) invalid operand, (10) valve overload.

Y Force
INITIALIZE PLUNGER AND VALVE DRIVE (REVERSE POLARITY):
This command initializes the plunger and the valve drive. The valve drive direction has reverse polarity now. The force parameter is only valid for the plunger drive. After initialization, all the speed and ramp settings are set to default again.
Force: 0 = full force, 1 = half force, 2 = quarter force   (default = 0)
EXAMPLE: #D1Y1R
Initialize plunger with half force and valve to reverse polarity.
RESPONSE: none.
GENERATED ERRORS: (1) invalid init, (3) invalid operand, (10) valve overload.

W Force
INITIALIZE PLUNGER DRIVE:
This command initializes only the plunger drive. The valve drive will be ignored and is disabled until either a *Z* or *Y* command is given. After initialization, all the speed and ramp settings are set to default again.
Force: 0 = full force, 1 = half force, 2 = quarter force   (default = 0)
EXAMPLE: #D1W2R
Initialize plunger with quarter force.
RESPONSE: none.
GENERATED ERRORS: (1) invalid init, (3) invalid operand.

z
PLUNGER POSITION RECOVERY:
This command sets the position counter to the value of the encoder counter. It can be used after a plunger overload error, to recover the current position without any re-initialization of the plunger drive.
EXAMPLE: #D1zR
Recovers the position after a plunger overload.
RESPONSE: none.

GENERATED ERRORS: none.

4.3.   Set Commands

S SpeedCode
SET PLUNGER SPEED CODE:
This command sets the plunger speed according to the speed code table.

SpeedCode:	0	=	6000 HS per second;	21	=	160
	1	=	5600	22	=	150
	2	=	5000	23	=	140
	3	=	4400	24	=	130
	4	=	3800	25	=	120
	5	=	3200	26	=	110
	6	=	2600	27	=	100
	7	=	2200	28	=	90
	8	=	2000	29	=	80
	9	=	1800	30	=	70
	10	=	1600	31	=	60
	11	=	1400	32	=	50
	12	=	1200	33	=	40
	13	=	1000	34	=	30
	14	=	800	35	=	20
	15	=	600	36	=	18
	16	=	400	37	=	16
	17	=	200	38	=	14
	18	=	190	39	=	12
	19	=	180	40	=	10
	20	=	170	(default = 11)		

EXAMPLE: #D1S13R
Set plunger speed to 1000 half steps per second.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

V EndSpeed
SET PLUNGER END SPEED:
This command sets the plunger end speed in half steps per second.
EndSpeed: [5...6000]   (default = 1400)
EXAMPLE: #D1V3570R
Sets the plunger end speed to 3570 half steps per second.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

v StartSpeed
SET PLUNGER START SPEED:
This command sets the plunger start speed in half steps per second.
StartSpeed: [50...1000]   (default = 900)
EXAMPLE: #D1v450R
Sets the plunger start speed to 450 half steps per second.
RESPONSE: none.

GENERATED ERRORS: (3) invalid operand.

C CutoffSteps
SET PLUNGER CUTOFF IN STEPS:
This command sets the number of full steps that must be cut off while ramping down from end
speed to stop speed. The number of cutoff steps and the slope setting determine the stop
frequency. Cutoff steps are used only when dispensing liquid.
EndSpeed: [0...25]   (default = 0)
EXAMPLE: #D1C10R
Sets 10 full steps for cut off.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

c CutoffSpeed
SET PLUNGER CUTOFF SPEED:
This command sets the plunger cutoff speed in half steps per second. Cutoff speed is used only
when dispensing liquid.
CutoffSpeed: [50...2700]   (default = 900)
EXAMPLE: #D1c1590R
Sets the plunger cutoff speed to 1590 half steps per second.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

L Slope
SET PLUNGER SLOPE:
This command sets the plunger slope. Slope is an increment of 2500 half steps per second in
square.
Slope: [1..20]   (default = 7)
EXAMPLE: #D1L10R
Sets the plunger slope to 25'000 steps per second in square.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

K BackLashSteps
SET PLUNGER BACKLASH STEPS:
This command sets the backlash compensation in full steps.
BackLashSteps: [0..31]   (default = 0)
EXAMPLE: #D1K5R
Sets the plunger backlash compensation to 5 full steps.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

4.4.   *Valve Movement Commands*

I n
TURN VALVE TO INPUT:
This command turns the valve drive to input port. If the valve drive is not initialized, it will be done automatically by this command. With a selector set to one, the valve can be reactivated after an initialization with the *W* command.
n: [0..1]   0 = normal valve command, 1 = reactivate valve after a *W* initialization.
EXAMPLE: #D1IR
Turn valve to input.
RESPONSE: none.
GENERATED ERRORS: (10) valve overload.

O n
TURN VALVE TO OUTPUT:
This command turns the valve drive to output port. If the valve drive is not initialized, it will be done automatically by this command. With a selector set to one, the valve can be reactivated after an initialization with the *W* command.
n: [0..1]   0 = normal valve command, 1 = reactivate valve after a *W* initialization.
EXAMPLE: #D1O1R
Reactivate valve after a *W* initialization and turn valve to output.
RESPONSE: none.
GENERATED ERRORS: (10) valve overload.

B n
TURN VALVE TO BYPASS:
This command turns the valve drive to bypass port. If the valve drive is not initialized, it will be done automatically by this command. With a selector set to one, the valve can be reactivated after an initialization with the *W* command.
n: [0..1]   0 = normal valve command, 1 = reactivate valve after a *W* initialization.
EXAMPLE: #D1BR
Turn valve to bypass position.
RESPONSE: none.
GENERATED ERRORS: (10) valve overload.

4.5.   *Plunger Movement Commands*

A AbsPos
MOVE PLUNGER TO ABSOLUTE POSITION:
This command moves the plunger to an absolute position. Movements can't be done if the valve is set to bypass position.
AbsPos: [0...3150]
EXAMPLE: #D1A2150R
Moves the plunger to absolute position 2150. (position in full steps)
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand, (7) not initialized, (9) plunger overload, (10) valve overload, (11) valve in bypass position.

P RelPos
MOVE PLUNGER RELATIVE (PICK LIQUID):
This command moves the plunger relative downward from the current position. Movements can't be done if the valve is set to bypass position.
RelPos: [0...3150]
EXAMPLE: #D1P100R
Move the plunger downwards 100 steps from current position. (position in full steps)
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand, (7) not initialized, (9) plunger overload, (10) valve overload, (11) valve in bypass position.

D RelPos
MOVE PLUNGER RELATIVE (DISPENSE LIQUID):
This command moves the plunger relative upward from the current position. Movements can't be done if the valve is set to bypass position.
RelPos: [0...3150]
EXAMPLE: #D1D20R
Move the plunger upward 20 steps from current position. (position in full steps)
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand, (7) not initialized, (9) plunger overload, (10) valve overload, (11) valve in bypass position.

4.6.   Control Commands

R
EXECUTE COMMAND:
This command executes a previously loaded command string.
EXAMPLE: #D1A3000R or #D1A3000 and afterwards #D1R.
Executes a command string.
RESPONSE: none.
GENERATED ERRORS: none.

X
REPEAT COMMAND:
This command repeats a previously loaded command string.
EXAMPLE: #D1P100R and afterwards #D1X.
Repeats the command string.
RESPONSE: none.
GENERATED ERRORS: none.

M Delay
SET DELAY:
This command sets a delay in milliseconds.
Delay: [0..30'000]
EXAMPLE: #D1M1000R.
Pump is waiting for one second.
RESPONSE: none.
GENERATED ERRORS: (3) invalid operand.

4.7.   Error Codes

These are the possible error codes generated by the XP style commands.

Code	XP Error Codes
1	Invalid Initialization
2	Invalid Command
3	Invalid Operand
5	Device not implemented
7	Not Initialized
9	Plunger overload
10	Valve overload
11	Valve in bypass
13	No access to EEPROM
15	Command Overflow