inheco

Customer Firmware Command Set

Teleshake (95) AC USB

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1. Protocol Description

Preface: The here presented “Customer Firmware Command Set” is intended to be used with the provided libraries only (here: DLLs).

For the “Teleshake (95) AC USB” device family a communication protocol is provided that consists of 64 bytes (Figure 1).

- **Index 0** represents one of the three generic command types:
  - o A=Action,
  - o R=Report,
  - o S=Set.
- **Index 1** consists of a subcommand, to address a specific functionality or feature, for example:
  - o C=Clamping features
  - o H=Heating features
  - o S=Shaking features
  - o P=Positioning features (angular)
  - o T= Temperature controller activation
- **Index 2** is reserved for a status byte and needs to be interpreted during read operations. For reference, please read the provided table in chapter 0.
- **Index 3 to 63** are either keyword, selector, parameter, or input values.
  - o Commands within the “Customer Firmware Command Set” do not require a keyword and the required bytes will be filled out automatically.
  - o Further assistance: If a feature is missing, please contact Inheco’s Customer Service.

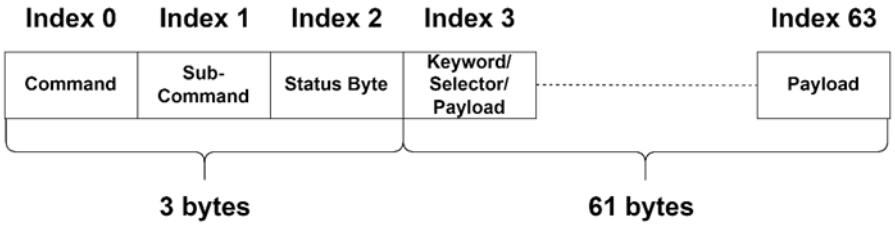

Figure 1: Frame of the Teleshake (95) AC USB communication protocol

Inheco’s USB-devices can be identified by an official vendor ID granted by the USB-IF.

Parameter	Description
0x34CE	Vendor ID (Inheco GmbH)

2. Action Commands

2.1. Action Emergency Off (AEO)

Turns the power supply to the clamping, shaking and heating modules off.

AEO Parameter

Parameter	Description
1	**Use only in emergency situations when you need to quickly turn the power off!** Turns the power supply to several modules off. To re-enable the power supply a device hardware or software restart is required

2.2. Action Temperature Enable (ATE)

Enables or disables the temperature control operations. Use the STT command to set the set point temperature. Then activate the temperature control using the ATE command. The device will then start to reach and hold the set point temperature.

ATE Parameter

Parameter	Description
1	Turns the temperature control on
0	Turns the temperature control off

2.3. Action Shaker Enable (ASE)

Turns the shaker control on or off.

ASE Parameter

Parameter	Description
1	Turns the shaker control on
0	Turns the shaker control off

2.4. Action Clamp Enable (ACE)

Closes or opens the clamps.

ACE Parameter

Parameter	Description
1	Closes the clamps
0	Opens the clamps

2.5. Action Heater Enable (AHE)

Enables or disables the heating element. No temperature control is being performed with this command. Functions as open loop control. Use the SAP command to set the power percentage for the heating element.

AHE Parameter

Parameter	Description
1	Heater on
0	Heater off

2.6. Action Positioner Enable (APE)

Enables or disables the position control. Use the STP command to set the angle position set point for the position control. Then activate the position control using the APE command. The clamps need to be closed during positioning and the shaker needs to be inactive. The device will try to reach and hold the entered position. This feature is intended to be used for pipetting operations.

APE Parameter

Parameter	Description
1	Position control on
0	Position control off

3. Report Commands

3.1. Report Firmware Version (RFV)

Reports the current Firmware Version.

RFV Parameter

Parameter	Description
0	Firmware Version as a group of 3 bytes unsigned int Major Version, Minor Version, Bugfix Version
1	Internal: Commit ID
2	Internal: Branch Name

3.2. Report Diagnostic Counters (RDC)

Reports the current value of the diagnostic counter in milli-seconds.

RDC Parameter

Output	Description
8 bytes unsigned int	Milliseconds since startup

3.3. Report Error Codes (REC)

Reports the list with errors which appeared since the last list delete.

REC Selector Parameter

Selector	Parameter	Output	Description
0	0	1 byte unsigned int for each Error Code	Reports the list with errors which appeared since the last list delete
1	Error Code	1 byte unsigned int for the occurrence, 1byte unsigned int for active since reset, 8 bytes unsigned int for the timestamp in ms	Reports the error occurrence, if the error is active since last reset and the timestamp of the error in milliseconds

3.4. Report Housing Value (RHV)

Reports the measured Supply Voltage.

RHV Parameter

Parameter	Output	Description
0	1 byte float	Measure Supply Voltage [V]

3.5. Report Serial Number (RSN)

Reports the device serial number.

RSN Parameter

Output	Description
4 bytes unsigned int	Device serial number

3.6. Report Type Device (RTD)

Reports the device type.

RTD

Parameter	Description
8 bytes unsigned int	Reports the device type: 1 – Teleshake 95 AC USB 2 – Teleshake AC USB

3.7. Report Clamp Counter (RCC)

Reports the total number of clamp activities.

RCC

Output	Description
4 bytes unsigned int	Total number of clamp activities

3.8. Report Maximum Allowed Temperature (RMT)s

Reports the maximum allowed heating temperature.

RMT

Output	Description
4 bytes unsigned int	The maximum allowed heating temperature

3.9. Report Article Number (RAN)

Reports the device article number.

RAN

Output	Description
30 bytes unsigned int	Device article number

3.10. Report Actual Temperature (RAT)

Reports the actual device temperature.

RAT Parameter

Output	Description
0,1	4 bytes float temperature of the control sensor (default sensor)
1	4 bytes float temperature of the control sensor
2	4 bytes float temperature of the monitor sensor

3.11. Report Target Temperature (RTT)

Reports the target temperature.

RTT

Output	Description
4 bytes float	Target temperature

3.12. Report Device Status (RDS)

Reports the initialization status of the device.

RDS

Output	Description
1 byte unsigned int	Reports the device initialization status: 1 – initializing 0 – initializing completed

3.13. Report Shaker Revolutions (RSR)

Reports the shaker revolutions per minute.

RSR

Output	Description
4 byte unsigned int	Rotations Per Minute (RPM)

3.14. Report Shaker Enable Status (RSE)

Reports the shaker status.

RSE

Output	Description
1 byte unsigned int	1 – shaking 2 – Not shaking

3.15. Report Heater Enable Status (RHE)

Reports the heater status.

RHE

Output	Description
1 byte unsigned int	1 – Heating or Cooling 2 – Not Heating or Cooling

3.16. Report Shaker Clamp Status (RCS)

Reports the clamp status.

RCS

Output	Description
1 byte unsigned int	0 – status unknown 1 – clamps are open 2 – clamps are closed

3.17. Report Motor Runtime Counter (RMC)

Reports the on time of the shaker motor in milliseconds.

RMC

Output	Description
8 byte unsigned int	Shaker motor on time in milli-seconds

3.18. Report New Errors (RNE)

Reports all errors that occurred after a power-up.

RNE

Output	Description
1 byte unsigned int for each Error Code	Reports the list with errors which appeared since the last power up

3.19. Report Shaker Target (RST)

Reports the shaker target revolutions.

RST

Output	Description
4 bytes unsigned int	Target revolutions per minute (RPM)

3.20. Report Actual PWM of Heater (RAP)

Reports the actual power in percentage for the heating element.

RAP

Output	Description
4 bytes float	Actual power in percentage for the heating element

3.21. Report Heater Runtime (RHR)

Reports the on time of the heating element in milliseconds.

RHR

Output	Description
8 bytes unsigned int	Heating element on time in milli-seconds

3.22. Report Positioner Enable Status (RPE)

Reports the positioner status.

RPE

Output	Description
1 byte unsigned int	1 – Positioning On 0 – Positioning Off

3.23. Report Positioner Target (RTP)

Reports the position target in milli°.

RTP

Output	Description
4 bytes unsigned int	Target position in milli°

3.24. Report Real Position (RRP)

Reports the actual position in milli°.

RRP

Output	Description
4 bytes unsigned int	Real position in milli°

3.25. Report Lowest Allowed Temperature (RLT)

Reports the low Limit of Temperature Target.

RLT

Output	Description
4 bytes float	Low Limit of Target Temperature Value [°C]

3.26. Report Position Offset (RPO)

Reports the Shaker Position Sensor Offset.

RPO

Output	Description
4 bytes signed int	Reports the Shaker Position Sensor Offset

4. Set Commands

4.1. Set Error Codes (SEC)

Deletes all errors.

SEC

Description
Deletes the error codes list

4.2. Set Software Reset (SRS)

Performs a software reset.

SRS

Description
Performs a software reset

4.3. Set Target Temperature (STT)

Sets the target temperature of the heating element.

STT Input

Input	Description
4 bytes float	Sets the target temperature of the heating element

4.4. Set Shaker Revolutions (SSR)

Sets the target RPM of the shaker unit for closed loop control.

SSR Input

Input	Description
4 bytes unsigned int	Sets the target RPM of the shaker unit

4.5. Set Actual Power Percentage for heating element (SAP)

Sets the power percentage to be used by the heating element for open loop heating, using the AHE command. No temperature control is being performed during open loop heating. The device will only output the desired power percentage to the heating element.

SAP Input

Input	Description
4 bytes float	Sets the power percentage to be used by the heating element for open loop heating

4.6. Set Target Position (STP)

Sets the target position in milli° of the shaker unit for closed loop control.

STP Input

Input	Description
4 bytes unsigned int	Sets the target position in milli° of the shaker unit for closed loop control

4.7. Set Shaker Shape (SSS)

Sets the shaking direction, clockwise or anti-clockwise.

SSS Input

Input	Description
1 byte unsigned int	1 – clockwise 0 – anticlockwise

5. Status Bytes

Code	Description
0	OK
3	Command not executable
4	Command unknown
5	Wrong parameter
8	Wrong Key
9	Information updated being processed, please try again a bit later

6. Error List

Error number	Description	Warning/Error	Examples
0	No error	-	
8	Device temperature is too high	Error – temperature control stopped	- Invalid calibration values - Sensor values changed by interference (EMC) - Temperature of 135°C exceeded
12	The difference between the control and monitor temperature sensors is too high	Warning	- Inhomogeneous loading of the contact plate - (One) Sensor defective (ref. to short circuit error) - Invalid calibration values - Sensor values changed by interference (EMC) - Maximum span of the temperature sensors exceeded (>10 K)
16	The temperature control sensor is in short circuit	Error – temperature control stopped	- Cable breakage due to wear, internal short circuit (e.g. damage on a sharp edge) - Invalid calibration values - Sensor values changed by interference (EMC)
17	The temperature monitor sensor is in short circuit	Error – temperature control stopped	- Cable breakage due to wear, internal short circuit (e.g. damage on a sharp edge) - Invalid calibration values - Sensor values changed by interference (EMC)
18	Cable break for the temperature control sensor detected	Error – temperature control stopped	- Sensor disconnected - Sensor connection or wire broken - Cable breakage due to wear, internal short circuit (e.g. damage on a sharp edge) - Invalid calibration values - Sensor values changed by interference (EMC)
19	Cable break for the temperature monitor sensor detected	Error – temperature control stopped	- Sensor disconnected - Sensor connection or wire broken - Cable breakage due to wear, internal short circuit (e.g. damage on a sharp edge) - Invalid calibration values - Sensor values changed by interference (EMC)

28	Clamps could not open	Error – shaker control deactivated	- Power supply voltage <15 V --> Servo drive not usable - Device already remains within a different error state - Mechanical blockage - Firmware: after 3 sec. the feedback signal will be read
32	Clamps could not close	Error – shaker control deactivated	- Power supply voltage <15 V --> Servo drive not usable - Device already remains within a different error state - Mechanical blockage - Firmware: after 3 sec. the feedback signal will be read
33	The position of the clamps is unknown	Error – shaker control deactivated	- Servo drive defective - Clamp state "open" and "closed" not defined (missed during internal configuration) - Feedback signal of the servo drive invalid/faulty
40	Motor overcurrent detected	Error – shaker control stopped	- Motor defective - Mechanical blockade of the motor due to too high external resistance to the motor shaft (>>1 kg) - Ball bearing of the contact plate loosened
43	Power undervoltage detected	Error – temperature and shaker control stopped	- Power supply voltage <3 V --> Status-LED=red - Device is disconnected from the power supply or must be removed and reconnected - A different error occurs first (Status-LED=red), error 43 occurs afterwards (e.g. error 49: Logic power undervoltage detected)
45	Power overvoltage detected	Error – temperature and shaker control stopped	- Power supply voltage >29 V --> Status-LED=red

46	The shaker cannot reach the target RPM value	Warning	- Mechanical blockage of the motor due to too high external resistance to the motor shaft (>>1 kg) - Incorrect assembly of the contact plate - Ball bearing of the contact plate loosened - Motor defective, e.g. broken wire - A different error occurs first during shaking (Status-LED=red), error 46 occurs afterwards - Threshold ±50 RPM
47	The shaker cannot reach the target position	Warning	- Mechanical blockage of the motor due to too high external resistance to the motor shaft (>>1 kg) - Incorrect assembly of the contact plate - Motor defective, e.g. broken wire - Threshold ±5° (angle)
49	Logic power undervoltage detected	Error – temperature and shaker control stopped	- Power supply voltage <8,5 V --> Status-LED=red - Defective heating cable (short circuit or broken wire) - Short circuit between PCB and enclosure (e.g. pins of the 24 V power connector) - Device is disconnected from the power supply or must be removed and reconnected
50	Clamping system overcurrent detected	Warning	- Servo drive or power supply defective - Current measurement of the servo drive not valid - Load for the servo drive too high or defective cam plate