

Communication Protocol

TEC Controller

TEC-Family

(TEC-1089, TEC-1090, TEC-1091, TEC-1122, TEC-1123)

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1 General Description

If you have any questions, please do not hesitate to contact us under:
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1.1 Protocol Specifications

- The used communication protocol is based on the “MeCom Protocol Specification” Document me5117B.
- The Control Interface has to use the ‘#’ as source identifier.
- Some Domo Applications could help to implement this specification. Please check also the Example Communication Strings at the end of this document.
 - The **MeComAPI** with demo Application shows the fully implementation of this protocol
 - The LDD-TEC-Sample Application shows only the Query Strings for getting the Service Software Parameters.

1.2 Interfaces, Baud Rate and Address

- Interface RS485 Channel 1 (or TEC-1091 RS232):
 - Default baud rate is 57600. This can be changed to a different value by using the corresponding command. The new baud rate will be saved to the nonvolatile memory.
 - The Default Address is 2. It is possible to use 255 as broadcast
- Interface USB or RS485 Channel 2 (TEC-1091: RS485):
 - All commands are also accessible through this Interfaces
 - The baud rate is fixed to 57600. (Change command is possible upon request)
 - Address is like RS485. Additional the address 0 is also used as broadcast

General Serial Interface Specs: 8 Data bits; no Parity; 1 Stop bit; no Handshaking

1.3 Flash Parameters (nonvolatile) / RAM Parameters (volatile)

Most of the Parameters are being saved to the flash after a delay of 0.5 seconds, after the last parameter has been modified. The flash can only be re written about 100'000 times. This means it is not recommended to write regularly to a parameter that is being saved to the flash. There are 2 possibilities to solve this problem:

- Disabling the automatic save mechanism to the flash: We recommend to setup the TEC like it is being desired and then switch of the saving to the flash. This way, the TEC has always the desired default configuration after startup. Please consult the User Manual for more information about this option.
- The use of special parameters that are only saved in the RAM. Search for “volatile parameter” in this document.

2 TEC-Family Commands

2.1 Set Commands

| Command | Mnemonic | Arguments / Description | | | |
|---------------------|----------|--|-----|--------|--|
| | | Type | Min | Max | Description |
| Parameter Value Set | VS | | | | Sets the corresponding Parameter See 3 Service Software Parameters for details |
| Reset Device | RS | - | - | - | Resets the Processor 200ms after this command. |
| Emergency Stop | ES | - | - | - | Disables all Power Outputs immediately and the Error 11 is generated. |
| Set Address | SA | This Command is used to set the address of a device to a specific address. It can be sent to the device as broadcast command. The device will only recognize this command if the "Device Type" and the "Serial Number" is correct. | | | |
| | | INT32 | 0 | +INT32 | Device Type of the device to be addressed. (ex. 1089, 1090, 1091, 1122, 1123) If the Device Type is sent as 0, the Device Type is ignored. |
| | | INT32 | 0 | +INT32 | Serial Number of the device to be addressed. If the Serial Number is sent as 0, the Serial Number is ignored. |
| | | UINT8 | - | - | 0: Set to the address given by the "Address Field". 1: Set to the CH1 Rack Terminal Output (do not use!) |
| | | UINT8 | 0 | 254 | Address Field. |

2.2 Query Commands

| Request | Mnemonic | Description | Server Response | |
|---|---|--|-------------------------------|---|
| | | | Type | Description |
| Firmware Identification String | ?IF | Returns the Firmware Identification String | 20x 8bit | For TEC-1122: "8065-TEC SW G01 " (Filled up with spaces) |
| Parameter Value Read | ?VR | Returns the corresponding Parameter value | | See 3 Service Software Parameters for details |
| Parameter Limit Read | ?VL | Returns the corresponding Limits | | See 3 Service Software Parameters for details |
| Bootloader Control | ?BC | For Controlling the Bootloader | UINT32 | See 4 Bootloader for Details |
| Bootloader Stream | ?BS | Bootloader Data Stream | | See 4 Bootloader for Details |
| Download Lookup Table Page 256 Byte | ?LT UINT4 1 x UINT32 256 x UINT8 | Command 0: Status Query 1: Program 2: Do Analyze Data Lookup Table Page Offset 32 x 8 Byte Commands | UINT4 | 0: Idle 1: Erasing or Writing (Sent Data is ignored) 2: New Data accepted 3: Error |
| Settings Download | ?SD | Can be used to download the exported Settings Dump (*.mepar) of the Service Software. | | |
| | | One Line of the Settings Dump File (*.mepar) | UINT4 | 0: Parameter Accepted 1: CRC wrong: Possible causes: <ul style="list-style-type: none"> The *.mepar File has been modified The firmware version is not exactly the same as it was while the *.mepar file has been created The *.mepar File was created for an other device. |
| Set Enable, Target Temperature and get Actual Temperature | ?TT UNIT4 UNIT4 FLOAT32 FLOAT32 | Command Live Enable CH1 Live Enable CH2 Target Temp CH1 Target Temp CH2 | UNIT4 FLOAT 32 FLOAT 32 | Device Status (Live Parameter ID 104) Actual Object Temperature CH1 (Writes to Parameter ID 50012) Actual Object Temperature CH2 (Writes to Parameter ID 50012) |
| | This is a customized command: A write to this command sets the Parameter ID 50011 automatically to 1. Set the TEC Output Stage Enable to "Live OFF/ON" to use this command. | | | |

3 Service Software Parameters

3.1 Payload Format description

The Parameter Instance is used to control the TEC Output Channel 1 or 2.

If there is only one instance available, Parameter Instance must be set to 1 (e.g. Firmware Version)

3.1.1 Parameter Value Read

| Type | Mnemonic | Field 1 | Field 2 |
|-------|----------|------------------------|-----------------------------|
| Query | ?VR | UINT16 Parameter ID | UINT8 Parameter Instance |

| Type | Field 1 |
|----------|---|
| Response | <defined Format> Parameter Value Or Server Error Code |

3.1.2 Parameter Value Set

| Type | Mnemonic | Field 1 | Field 2 | Field 3 |
|-------|----------|------------------------|-----------------------------|-------------------------------------|
| Query | VS | UINT16 Parameter ID | UINT8 Parameter Instance | <defined Format> Parameter Value |

| Type | |
|----------|------------------------------------|
| Response | Normal ACK or Server Error Code |

3.1.3 Parameter Limit Read

| Type | Mnemonic | Field 1 | Field 2 |
|-------|----------|------------------------|-----------------------------|
| Query | ?VL | UINT16 Parameter ID | UINT8 Parameter Instance |

| Type | Field 1 | Field 2 | Field 3 |
|----------|---|---|---|
| Response | UINT8 0: FLOAT32 1: INT32 Or Server Error Code | <defined Format> Parameter Min Value | <defined Format> Parameter Max Value |

3.2 General Value Range Description

| Name | Min | Max | Description |
|----------|--------|--------|---------------------------|
| RNG_TEMP | -273°C | 1000°C | General Temperature Range |

3.3 Parameter list

This capture contains all parameters which can also be accessed by the service software. The order is the same as in the service software. Please refer to TEC-Family user manual for detailed parameter description.

3.3.1 Common Product Parameters

3.3.1.1 Device Identification

| ID | Name | Format | Value Range | Description |
|-----|-----------------------------------|--------|-------------|---|
| 100 | Device Type | INT32 | .. | 1122 → TEC-1122 |
| 101 | Hardware Version | INT32 | .. | 123 → 1.23 |
| 102 | Serial Number | INT32 | .. | |
| 103 | Firmware Version | INT32 | .. | 123 → 1.23 |
| 104 | Device Status | INT32 | .. | 0: Init 1: Ready 2: Run 3: Error 4: Bootloader 5: Device will Reset within next 200ms |
| 105 | Error Number | INT32 | .. | |
| 106 | Error Instance | INT32 | | |
| 107 | Error Parameter | INT32 | | |
| 108 | Save Data to Flash | INT32 | .. | 0: Enabled 1: Disabled (All Parameters can then be used as RAM Parameters) |
| 109 | Parameter System: Flash Status | INT32 | .. | 0: All Parameters are saved to Flash 1: Save to flash pending or in progress. (Please do not power off the device now) 2: Saving to Flash is disabled |

Hint: Parameter 100 -999 are ready only, expect Parameter 108.

3.3.2 Tab: Monitor (Read only)

3.3.2.1 CHx Temperature Measurement

| ID | Name | Format | Value Range | Description |
|------|--------------------|---------|-------------|-------------|
| 1000 | Object Temperature | FLOAT32 | °C | |
| 1001 | Sink Temperature | FLOAT32 | °C | |

3.3.2.2 CHx Temperature Control

| ID | Name | Format | Value Range | Description |
|------|-----------------------------------|---------|-------------|-------------|
| 1010 | Target Object Temperature | FLOAT32 | °C | |
| 1011 | (Ramp) Nominal Object Temperature | FLOAT32 | °C | |
| 1012 | Thermal Power Model Current | FLOAT32 | A | |

3.3.2.3 CHx Output Stage Monitoring

| ID | Name | Format | Value Range | Description |
|------|-----------------------|---------|-------------|-------------|
| 1020 | Actual Output Current | FLOAT32 | A | |
| 1021 | Actual Output Voltage | FLOAT32 | V | |

3.3.2.4 CHx FAN Controller

| ID | Name | Format | Value Range | Description |
|------|------------------------|---------|-------------|-------------|
| 1100 | Relative Cooling Power | FLOAT32 | % | |
| 1101 | Nominal FAN Speed | FLOAT32 | rpm | |
| 1102 | Actual FAN Speed | FLOAT32 | rpm | |
| 1103 | FAN PWM Level | FLOAT32 | % | |

3.3.2.5 CHx Temperature Controller PID Status

| ID | Name | Format | Value Range | Description |
|------|----------------------|---------|-------------|-------------|
| 1030 | PID Lower Limitation | FLOAT32 | % | |
| 1031 | PID Upper Limitation | FLOAT32 | % | |
| 1032 | PID Control Variable | FLOAT32 | % | |

3.3.2.6 CHx Temperature Measurement

| ID | Name | Format | Value Range | Description |
|------|-----------------------------|---------|-------------|--|
| 1040 | Object Sensor Raw ADC Value | INT32 | .. | |
| 1041 | Sink Sensor Raw ADC Value | INT32 | .. | |
| 1042 | Object Sensor Resistance | FLOAT32 | Ohm | |
| 1043 | Sink Sensor Resistance | FLOAT32 | Ohm | |
| 1044 | Sink Sensor Temperature | FLOAT32 | °C | Shows the Sink Temperature even if the Sink Temperature Source Selection is set to "Fixed Value" |
| 1045 | Object Sensor Temperature | FLOAT32 | °C | Shows always the calculated Object Temperature of the Measurement CH. Even if the Object Temperature Source Selection is modified or the device is operating in parallel mode. |

3.3.2.7 Firmware and Hardware Versions

| ID | Name | Format | Value Range | Description |
|------|-----------------------|--------|-------------|-------------|
| 1050 | Firmware Version | INT32 | .. | 123 → 1.23 |
| 1051 | Firmware Build Number | INT32 | .. | |
| 1052 | Hardware Version | INT32 | .. | 123 → 1.23 |
| 1053 | Serial Number | INT32 | .. | |

3.3.2.8 Power Supplies and Temperature

| ID | Name | Format | Value Range | Description |
|------|------------------------|---------|-------------|-------------|
| 1060 | Driver Input Voltage | FLOAT32 | V | |
| 1061 | Medium Internal Supply | FLOAT32 | V | |
| 1062 | 3.3V Internal Supply | FLOAT32 | V | |
| 1063 | Base Plate Temperature | FLOAT32 | °C | |

3.3.2.9 Device Temperature Mode (Standard or Extended)

| ID | Name | Format | Value Range | Description |
|------|----------------------------|---------|-------------|-------------|
| 1110 | Maximum Device Temperature | FLOAT32 | °C | |
| 1111 | Maximum Output Current | FLOAT32 | A | |

3.3.2.10 Parallel Output Stage Monitoring (Common Load)

| ID | Name | Format | Value Range | Description |
|------|-----------------------|---------|-------------|-------------|
| 1090 | Actual Output Current | FLOAT32 | A | (CH1 + CH2) |

3.3.2.11 Error Status

| ID | Name | Format | Value Range | Description |
|------|-----------------|--------|-------------|-------------|
| 1070 | Error Number | INT32 | .. | |
| 1071 | Error Instance | INT32 | .. | |
| 1072 | Error Parameter | INT32 | .. | |

3.3.2.12 Driver Status

| ID | Name | Format | Value Range | Description |
|------|--------------------------------|--------|-------------|--|
| 1080 | Driver Status | INT32 | .. | 0: Init 1: Ready 2: Run 3: Error 4: Bootloader 5: Device will Reset within next 200ms |
| 1081 | Parameter System: Flash Status | INT32 | .. | 0: All Parameters are saved to Flash 1: Save to flash pending or in progress. (Please do not power off the device now) |

3.3.2.13 Object Temperature Stability Detection

| ID | Name | Format | Value Range | Description |
|------|-----------------------|--------|-------------|---|
| 1200 | Temperature is Stable | INT32 | .. | 0: Temperature regulation is not active 1: Is not stable 2: Is stable |

3.3.3 Tab: Operation

3.3.3.1 CHx Output Stage Control Input Selection

| ID | Name | Format | Value Range | Description |
|------|-----------------|--------|-------------|--|
| 2000 | Input Selection | INT32 | .. | 0: Static Current/Voltage (Uses ID 2020...) 1: Live Current/Voltage (Uses ID 50001...) 2: Temperature Controller |

3.3.3.2 CHx Output Stage Enable

| ID | Name | Format | Value Range | Description |
|------|--------|--------|-------------|---|
| 2010 | Status | INT32 | .. | 0: Static OFF 1: Static ON 2: Live OFF/ON (See ID 50000) 3: HW Enable (Check PBC Config) |

3.3.3.3 CHx Output Stage 'Static Current/Voltage' Control Values

| ID | Name | Format | Value Range | Description |
|------|-------------|---------|---|-------------|
| 2020 | Set Current | FLOAT32 | 1091: -4A ... 4A 1089 / 1122: -10A ... 10A 1090 / 1123: -16A / 16A | |
| 2021 | Set Voltage | FLOAT32 | -SV Version und TEC-1091: 0V ... 21V -HV Version: 0V ... 30V | |

3.3.3.4 CHx Output Stage Limits

| ID | Name | Format | Value Range | Description |
|------|----------------------------|---------|--|-------------|
| 2030 | Current Limitation | FLOAT32 | 1091: 0A ... 4A 1089 / 1122: 0A ... 10A 1090 / 1123: 0A / 16A | |
| 2031 | Voltage Limitation | FLOAT32 | -SV Version und TEC-1091: 0V ... 21V -HV Version: 0V ... 30V | |
| 2032 | Current Error Threshold | FLOAT32 | 1091: 0A ... 5.6A 1089 / 1122: 0A ... 14A 1090 / 1123: 0A ... 20A | |
| 2033 | Voltage Error Threshold | FLOAT32 | -SV Version: 0V ... 25V -HV Version: 0V ... 34V | |

3.3.3.5 General Operating Mode

| ID | Name | Format | Value Range | Description |
|------|---------------------------|--------|-------------|---|
| 2040 | General Operating Mode | INT32 | .. | 0: Single (Independent) 1: Parallel (CH1 → CH2); Individual Loads 2: Parallel: (CH1 → CH2); Common Load |

3.3.3.6 Device Address

| ID | Name | Format | Value Range | Description |
|------|----------------|--------|-------------|-------------|
| 2051 | Device Address | INT32 | 0 ... 254 | |

3.3.3.7 RS485 Channel 1 Settings

| ID | Name | Format | Value Range | Description |
|------|-------------------|--------|---------------|-------------|
| 2050 | Channel Baud Rate | INT32 | 4800 ... 1M | Bits/s |
| 2052 | Response Delay | INT32 | 0us ... 1E6us | |

3.3.3.8 Communication Watchdog

| ID | Name | Format | Value Range | Description |
|------|---------|---------|--------------|-------------------------|
| 2060 | Timeout | FLOAT32 | 0.1 ... 600s | 0 disables the Watchdog |

3.3.4 Tab: Temperature Control

3.3.4.1 CHx Nominal Temperature

| ID | Name | Format | Value Range | Description |
|------|--------------------|---------|------------------------|-------------|
| 3000 | Target Object Temp | FLOAT32 | RNG_TEMP | |
| 3003 | Coarse Temp Ramp | FLOAT32 | 1E-6°C/s ... 50°C/s | |
| 3002 | Proximity Width | FLOAT32 | 0.1°C ... 200°C | |

3.3.4.2 CHx Temperature Controller PID Values

| ID | Name | Format | Value Range | Description |
|------|--------------------|---------|------------------------|-------------|
| 3010 | Kp | FLOAT32 | 0%/°C ... 10000%/°C | |
| 3011 | Ti | FLOAT32 | 0.0001s ... 10000s | |
| 3012 | Td | FLOAT32 | 0s ... 10000s | |
| 3013 | D Part Damping PT1 | FLOAT32 | 0 ... 1 | |

3.3.4.3 CHx Modelization for Thermal Power Regulation

| ID | Name | Format | Value Range | Description |
|------|------|--------|-------------|--|
| 3020 | Mode | INT32 | 0 ... 3 | 0: Peltier, Full Control 1: Peltier, Cool Only 2: Peltier, Heat Only 3: Resistor, Heat Only |

3.3.4.4 CHx Peltier Characteristics

| ID | Name | Format | Value Range | Description |
|------|--|---------|--------------------|--------------------------|
| 3030 | Maximal Current I _{max} | FLOAT32 | 0.1A ... 1000A | |
| 3031 | Maximal Voltage I _{max} | FLOAT32 | 0.1V ... 1000V | |
| 3032 | Cooling Capacity Q _{max} | FLOAT32 | 0.01W ... 1000W | |
| 3033 | Delta Temperature dT _{max} | FLOAT32 | 1°C ... 200°C | |
| 3034 | Positive Current i _s | INT32 | .. | 0: Cooling 1: Heating |

3.3.4.5 CHx Resistor Characteristics

| ID | Name | Format | Value Range | Description |
|------|-----------------|---------|-------------------------|-------------|
| 3040 | Resistance | FLOAT32 | 0.001Ohm ... 10k Ohm | |
| 3041 | Maximal Current | FLOAT32 | 0.01A ... 1000A | |

3.3.5 Tab: Object Temperature

3.3.5.1 CHx Object Measurement Settings

| ID | Name | Format | Value Range | Description |
|------|--------------------|---------|--------------------------|-------------|
| 4001 | Temperature Offset | FLOAT32 | -1E4°C ... 1E4°C | |
| 4002 | Temperature Gain | FLOAT32 | 0.5°C/°C ... 2.0°C/°C | |

3.3.5.2 CHx Actual Object Temperature Error Limits

| ID | Name | Format | Value Range | Description |
|------|-----------------------|---------|----------------------|-------------|
| 4010 | Lower Error Threshold | FLOAT32 | <i>RNG_TEMP</i> | |
| 4011 | Upper Error Threshold | FLOAT32 | <i>RNG_TEMP</i> | |
| 4012 | Max Temp Change | FLOAT32 | 1°C/s ... 200°C/s | |

3.3.5.3 CHx Object NTC Sensor Characteristics

| ID | Name | Format | Value Range | Description |
|------|------------------------------|---------|-------------------|-------------|
| 4020 | Lower Point: Temperature | FLOAT32 | <i>RNG_TEMP</i> | |
| 4021 | Lower Point: Resistance | FLOAT32 | 10hm ... 1MOhm | |
| 4022 | Middle Point: Temperature | FLOAT32 | <i>RNG_TEMP</i> | |
| 4023 | Middle Point: Resistance | FLOAT32 | 10hm ... 1MOhm | |
| 4024 | Upper Point: Temperature | FLOAT32 | <i>RNG_TEMP</i> | |
| 4025 | Upper Point: Resistance | FLOAT32 | 10hm ... 1MOhm | |

3.3.5.4 CH1 Object Temperature Stability Indicator Settings

| ID | Name | Format | Value Range | Description |
|------|------------------------|---------|---------------|-------------|
| 4040 | Temperature Deviation | FLOAT32 | 0°C ... 50°C | |
| 4041 | Min Time in Window | FLOAT32 | 0s ... 86400s | |
| 4042 | Max Stabilization Time | FLOAT32 | 0s ... 86400s | |

3.3.5.5 CHx Object Temperature Measurement Limits (Read Only)

| ID | Name | Format | Value Range | Description |
|------|--------------------------------------|---------|-------------|-------------|
| 4030 | Lowest Resistance | FLOAT32 | Ohm | |
| 4031 | Highest Resistance | FLOAT32 | Ohm | |
| 4032 | Temperature at Lowest Resistance | FLOAT32 | °C | |
| 4033 | Temperature at Highest Resistance | FLOAT32 | °C | |

3.3.6 Tab: Sink Temperature

3.3.6.1 CHx Sink Measurement Settings

| ID | Name | Format | Value Range | Description |
|------|--------------------|---------|--------------------------|-------------|
| 5001 | Temperature Offset | FLOAT32 | -1E4°C ... 1E4°C | |
| 5002 | Temperature Gain | FLOAT32 | 0.5°C/°C ... 2.0°C/°C | |

3.3.6.2 CHx Actual Sink Temperature Error Limits

| ID | Name | Format | Value Range | Description |
|------|-----------------------|---------|----------------------|-------------|
| 5010 | Lower Error Threshold | FLOAT32 | <i>RNG_TEMP</i> | |
| 5011 | Upper Error Threshold | FLOAT32 | <i>RNG_TEMP</i> | |
| 5012 | Max Temp Change | FLOAT32 | 1°C/s ... 200°C/s | |

3.3.6.3 CHx Sink NTC Sensor Characteristics

| ID | Name | Format | Value Range | Description |
|------|------------------------------|---------|-------------------|-------------|
| 5020 | Lower Point: Temperature | FLOAT32 | <i>RNG_TEMP</i> | |
| 5021 | Lower Point: Resistance | FLOAT32 | 10hm ... 1MOhm | |
| 5022 | Middle Point: Temperature | FLOAT32 | <i>RNG_TEMP</i> | |
| 5023 | Middle Point: Resistance | FLOAT32 | 10hm ... 1MOhm | |
| 5024 | Upper Point: Temperature | FLOAT32 | <i>RNG_TEMP</i> | |
| 5025 | Upper Point: Resistance | FLOAT32 | 10hm ... 1MOhm | |

3.3.6.4 CHx Sink Temperature General

| ID | Name | Format | Value Range | Description |
|------|-------------------------------|---------|-----------------|-------------------------------|
| 5030 | Sink Temperature Selection | INT32 | .. | 0: External 1: Fixed Value |
| 5031 | Fixed Temperature | FLOAT32 | <i>RNG_TEMP</i> | |
| 5032 | Upper ADC Limit Error | INT32 | .. | 0: Enabled 1: Disabled |

3.3.6.5 CHx Sink Temperature Measurement Limits (Read Only)

| ID | Name | Format | Value Range | Description |
|------|-----------------------------------|---------|-------------|-------------|
| 5040 | Lowest Resistance | FLOAT32 | Ohm | |
| 5041 | Highest Resistance | FLOAT32 | Ohm | |
| 5042 | Temperature at Lowest Resistance | FLOAT32 | °C | |
| 5043 | Temperature at Highest Resistance | FLOAT32 | °C | |

3.3.7 Tab: Expert

3.3.7.1 Sub Tab: Temperature Measurement

This settings are hardware depending. Before change, please call the Manufacturer.

3.3.7.1.1 CHx Object Measurement Settings

| ID | Name | Format | Value Range | Description |
|------|------------------------|---------|--------------------------|---|
| 6000 | PGA Gain | INT32 | .. | 0: Gain = 1 1: Gain = 2 2: Gain = 4 3: Gain = 8 4: Gain = 16 5: Gain = 32 6: Gain = 64 7: Gain = 128 8: Auto Gain 1 or 8 9: Auto Gain 1 or 8 or 32 |
| 6001 | Current Source | INT32 | .. | 0: Current OFF 1: Current = 50uA 2: Current = 100uA 3: Current = 250uA 4: Current = 500uA 5: Current = 750uA 6: Current = 1000uA 7: Current = 1500uA |
| 6002 | ADC Rs | FLOAT32 | 10 Ohm ... 1MOhm | |
| 6003 | ADC Calibration Offset | FLOAT32 | -1E5°C ... 1E5°C | |
| 6004 | ADC Calibration Gain | FLOAT32 | 0.5°C/°C ... 2.0°C/°C | |
| 6005 | Sensor Type Selection | INT32 | .. | 0: NTC 1: Pt100 2: Pt1000 |
| 6006 | ADC Rp | FLOAT32 | 0Ohm ... 1MOhm | |

3.3.7.1.2 CHx Sink Measurement Settings

| ID | Name | Format | Value Range | Description |
|------|------------------------|---------|--------------------------|-------------|
| 6010 | ADC Rv | FLOAT32 | 10 Ohm ... 1MOhm | |
| 6013 | ADC vps | FLOAT32 | 0V ... 100V | |
| 6011 | ADC Calibration Offset | FLOAT32 | -1E5°C ... 1E5°C | |
| 6012 | ADC Calibration Gain | FLOAT32 | 0.5°C/°C ... 2.0°C/°C | |

3.3.7.2 Sub Tab: Display

3.3.7.2.1 Display Configuration

Instance 1 is display Line 1 and Instance 2 is Display Line 2.

| ID | Name | Format | Value Range | Description |
|------|--|--------|-------------|---|
| 6020 | Display Type | INT32 | .. | 0: OFF 1: OLED 2x16 |
| 6021 | Display Line 1 / 2 Default Text | INT32 | .. | See TEC Family User Manual |
| 6022 | Display Line 1 / 2 Alternative Text | INT32 | .. | See TEC Family User Manual |
| 6023 | Display Line 1 / 2 Alternative Mode | INT32 | .. | 0: None 1: On Error 2: Toggle on Error 3: Toggle |

3.3.7.3 Sub Tab: PBC

3.3.7.3.1 PBC Configuration (RES1 ... RES8)

Instance 1 is RES1. Instance 2 is RES2...

| ID | Name | Format | Value Range | Description |
|------|----------|--------|-------------|---|
| 6100 | PBC RESx | INT32 | .. | 0: No Function (Output is Z) 1: Data Interface (See 3.3.8.5) 2: TEC OK (1 when Ready or Running) 3: CH1 Stable 4: CH2 Stable 5: CH1 HW Enable 6: CH2 HW Enable 7: CH1 FAN PWM 8: CH2 FAN PWM 9: CH1 FAN Tacho 10: CH1 FAN Tacho 11: TEC Error 12: CH1 Rmp/Stable 13: CH2 Rmp/Stable 14: TEC Run 15: CH1 Not Stable 16: CH2 Not Stable 17: CH1 TempUp 18: CH2 TempUp 19: CH1 TempDown 20: CH2 TempDown 21: CH1 Pump 22: CH2 Pump |

3.3.7.3.2 CHx Change Target Temperature Buttons

| ID | Name | Format | Value Range | Description |
|------|------------------|---------|----------------|-------------|
| 6110 | Lower Temp Limit | FLOAT32 | RNG_TEMP | |
| 6111 | Upper Temp Limit | FLOAT32 | RNG_TEMP | |
| 6112 | Step Size | FLOAT32 | 0°C ... 1000°C | |

3.3.7.3.3 CHx Pump Control

| ID | Name | Format | Value Range | Description |
|------|---------------------------|---------|-------------|----------------------|
| 6120 | Actual Temperature Source | INT32 | .. | 0: Sink 1: Object |
| 6121 | ON Threshold | FLOAT32 | RNG_TEMP | |
| 6122 | OFF Threshold | FLOAT32 | RNG_TEMP | |

3.3.7.4 Sub Tab: FAN

3.3.7.4.1 CHx FAN Control Enable

| ID | Name | Format | Value Range | Description |
|------|--------------------|--------|-------------|---------------------------|
| 6200 | FAN Control Enable | INT32 | .. | 0: Disabled 1: Enabled |

3.3.7.4.2 CHx FAN Temperature Controller

| ID | Name | Format | Value Range | Description |
|------|---------------------------|---------|------------------------|------------------------|
| 6210 | Actual Temperature Source | INT32 | .. | 0: Sink 1: Object |
| 6211 | Target Temperature | FLOAT32 | RNG_TEMP | |
| 6212 | Kp | FLOAT32 | 0%/°C ... 10000%/°C | Temperature Controller |
| 6213 | Ti | FLOAT32 | 0.0001s ... 10000s | Temperature Controller |
| 6214 | Td | FLOAT32 | 0s ... 10000s | Temperature Controller |

3.3.7.4.3 CHx FAN Speed Controller

| ID | Name | Format | Value Range | Description |
|------|----------------------------|---------|------------------------|--|
| 6220 | 0% Speed | FLOAT32 | 0 ... 100000 | FAN Speed when no cooling is required |
| 6221 | 100% | FLOAT32 | 0 ... 100000 | FAN Speed when maximum cooling is required |
| 6222 | Kp | FLOAT32 | 0%/°C ... 10000%/°C | Speed Controller |
| 6223 | Ti | FLOAT32 | 0.0001s ... 10000s | Speed Controller |
| 6224 | Td | FLOAT32 | 0s ... 10000s | Speed Controller |
| 6225 | Bypassing Speed Controller | INT32 | .. | 0: No 1: Yes |
| 6226 | FAN Surveillance | INT32 | .. | 0: Enabled 1: Disabled |

3.3.7.4.4 FAN General Settings

| ID | Name | Format | Value Range | Description |
|------|-------------------|--------|-------------|---------------------|
| 6230 | FAN PWM Frequency | INT32 | .. | 0: 25kHz 1: 1kHz |

3.3.7.5 Sub Tab: Misc

3.3.7.5.1 CHx Actual Object Temperature Source Selection

| ID | Name | Format | Value Range | Description |
|------|------------------|--------|-------------|---|
| 6300 | Source Selection | INT32 | .. | 0: Internal from its own Channel 1: External (Over Parameter 52200) 2: Internal from Channel 2 (only valid on Inst 1) |

3.3.7.5.2 Parameter System Save to Flash Configuration

| ID | Name | Format | Value Range | Description |
|-----|--------------------|--------|-------------|---------------------------|
| 108 | Save Data to Flash | INT32 | .. | 0: Enabled 1: Disabled |

3.3.7.5.3 Error State Auto Restart Delay

| ID | Name | Format | Value Range | Description |
|------|--------------------|---------|---------------|-------------|
| 6310 | Delay till Restart | FLOAT32 | 0s ... 86400s | |

3.3.7.5.4 Device Temperature Mode (Output Stage)

| ID | Name | Format | Value Range | Description |
|------|------|--------|-------------|----------------------------|
| 6330 | Mode | INT32 | .. | 0: Standard 1: Extended |

3.3.7.5.5 Output Stage Controller Limit (Error 108)

| ID | Name | Format | Value Range | Description |
|------|-------------|--------|-------------------|--|
| 6320 | Error Delay | INT32 | -1 ... 20000000ms | -1: does fully disable the Error 108 (Not recommended) 0: Will be set automatically to 1ms. |

3.3.8 Other Parameters (Not directly displayed in the Service Software)

3.3.8.1 Power Supply Parameters (Bus-Controlled) Mode Parameters

The following parameters are volatile parameters. They have a defined reset state.

| ID | Name | Format | Value Range | Description |
|-------|------------------|---------|---|---|
| 50000 | Live Enable | INT32 | .. | 0: Disabled (Reset State) 1: Enabled If the Parameter ID 2010 is set to 'Live OFF/ON' this Parameter defines the Enable status. |
| 50001 | Live Set Current | FLOAT32 | 1091: -4A ... 4A 1089 / 1122: -10A ... 10A 1090 / 1123: -16A / 16A | 0A at Reset If the Parameter ID 2000 is set to 'Live Current/Voltage' this Parameter defines the Set Current. |
| 50002 | Live Set Voltage | FLOAT32 | -SV Version und TEC-1091: 0V ... 21V -HV Version: 0V ... 30V | 0V at Reset If the Parameter ID 2000 is set to 'Live Current/Voltage' this Parameter defines the Set Voltage. |

3.3.8.2 Temperature Regulator additional Parameters

The following parameters are volatile parameters. They have a defined reset state.

| ID | Name | Format | Value Range | Description |
|-------|--|---------|-----------------|--|
| 50010 | Sine Ramp Start Point | INT32 | .. | 0: On a new Target Value, the actually measured Temperature is taken as Start Temperature. (Reset State) 1: On a new Target Value, the current Target Temperature is taken as Start Temperature |
| 50011 | Object Target Temperature Source Selection | INT32 | .. | 0: Taken form Parameter ID 3000 (Reset State) 1: Taken form Parameter ID 50012 |
| 50012 | Object Target Temperature | FLOAT32 | <i>RNG_TEMP</i> | 0°C at Reset |

3.3.8.3 Auto Tuning Module

| ID | Name | Format | Value Range | Description |
|-------|---|----------------------|-------------|---|
| 51000 | Auto Tuning Start | INT32 | 1 | Writing 1 to this parameter initiates the Auto Tuning process. |
| 51001 | Auto Tuning Cancel | INT32 | 1 | Writing 1 to this parameter cancels the Auto Tuning process. |
| 51002 | Thermal Model Speed | INT32 | 0-1 | 0: Fast Model 1: Slow Model |
| 51010 | Tuning Parameter 2A (Temperature peak-peak value) | FLOAT32 Read Only | °C | Returns the Temperature peak-peak value recorded while the Tuning Process was running. |
| 51011 | Tuning Parameter 2D (Control Variable peak-peak value) | FLOAT32 Read Only | % | Returns the Control Variable peak-peak value recorded while the Tuning Process was running. |
| 51012 | Tuning Parameter Ku (Ultimate gain) | FLOAT32 Read Only | %/°C | Returns the Ultimate Gain calculated based upon the 2A and 2D values. |
| 51013 | Tuning Parameter Tu (Ultimate period) | FLOAT32 Read Only | s | Returns the recorded Ultimate Period. |
| 51014 | PID Parameter Kp | FLOAT32 Read Only | %/°C | Returns the optimized Proportional Gain for the PID Controller. |
| 51015 | PID Parameter Ti | FLOAT32 Read Only | s | Returns the optimized Integral Time for the PID Controller. |
| 51016 | PID Parameter Td | FLOAT32 Read Only | s | Returns the optimized Derivative Time for the PID Controller. |
| 51022 | Slow PI Parameter Kp | FLOAT32 Read Only | %/°C | Returns the optimized Proportional Gain for the PID Controller. |
| 51023 | Slow PI Parameter Ti | FLOAT32 Read Only | s | Returns the optimized Integral Time for the PID Controller. |
| 51024 | PID D Part Damping PT1 Recommendation | FLOAT32 Read Only | .. | Returns a recommendation value for the PID D Part Damping. |
| 51017 | Coarse Temp Ramp | FLOAT32 Read Only | °C/s | Returns a recommendation value for the Target Temperature Ramp function. |
| 51018 | Proximity Width | FLOAT32 Read Only | °C | Returns a recommendation value for the Target Temperature Ramp function. |
| 51020 | Tuning Status | INT32 Read Only | .. | 0: Idle 1: Ramping to Target Temperature... 2: Preparing for Acquisition... 3: Acquiring Data... 4: Success. Tuning Complete! 10: Error. Check Error Number! |
| 51021 | Tuning Progress | FLOAT32 Read Only | 0 ... 100% | |

3.3.8.4 Lookup Table Control

The following parameters are volatile parameters.

| ID | Name | Format | Value Range | Description |
|-------|---|--------|---------------|---|
| 52000 | Lookup Table Start | INT32 | 1 | Writing 1 to this parameter initiates the Lookup process. |
| 52001 | Lookup Table Stop | INT32 | 1 | Writing 1 to this parameter cancels the Lookup progress process. |
| 52002 | Lookup Table Status | INT32 | .. | 0: Not initialized 1: Table Data not valid 2: Analyzing Data Table 3: Ready (Data Table OK) 4: Executing... 5: Max nr of Tables exceeded 6: Sub Table not found |
| 52003 | Lookup Table Status Current Table Line | INT32 | INT32 | Only valid if "Lookup Table Status" is "Executing...". Information about the currently executed Data Table Line. |
| 52010 | Lookup Table ID Selection | INT32 | INT32 | Selection of the Lookup Table part to be executed |
| 52012 | Nr Of Repetitions | INT32 | 0 ... 100'000 | Nr Of Executions of the REPEAT_MARK Elements |

3.3.8.5 PBC (Platform Bus Connector) RES1 ... RES8 Signal Control

The following parameters are volatile parameters.

This feature can be used to control the PBC reserve signals RES1 through RES8.

The particular pins are addressed by a bit field.

Example:

To configure RES3 and RES4 as Output Pins, and to set RES3 to High Level and RES4 to Low Level, use the following commands:

Set ID 52102 to 4 (Set Bit Number 2 to '1')

Set ID 52101 to 12 (Set Bit Numbers 2 and 3 to '1')

Set ID 52100 to 1 (Enable the Function)

This command order has been chosen to avoid spikes. After Reset, all values are set to 0.

Bit Field Description:

| Bit Number | Output Signal |
|------------|---------------|
| 0 | RES1 |
| 1 | RES2 |
| 2 | RES3 |
| 3 | RES4 |
| 4 | RES5 |
| 5 | RES6 |
| 6 | RES7 |
| 7 | RES8 |

| ID | Name | Format | Value Range | Description |
|-------|-------------------------|--------|-------------|---|
| 52100 | Enable Function | INT32 | 0 ... 1 | Enables the Output Signal control function. |
| 52101 | Set Output to Push-Pull | INT32 | 0 ... 255 | If a Bit is set to '0', the Output Signal is at High Impedance (used as input). If a Bit is set to '1', the Output Signal is driven. |
| 52102 | Set Output States | INT32 | 0 ... 255 | Sets the output states of driven signals. |
| 52103 | Read Input States | INT32 | 0 ... 255 | Reads the (input) states of all signals back. |

3.3.8.6 Set Actual Object Temperature from external

The following parameters are volatile parameters.

| ID | Name | Format | Value Range | Description |
|-------|-----------------------------|---------|-----------------|---|
| 52200 | External Object Temperature | FLOAT32 | <i>RNG_TEMP</i> | Initial Value will be NAN. NAN causes the temperature controller to Stop. This Value should be set every 100ms or faster. To enable this feature use Parameter 6300. If this Parameter is not being set for more than 5s, the value will automatically set to NAN. (This stops the temperature controller) |

4 Bootloader

The Bootloader can be controlled over a Control and Stream Command.

It is important to have the correct Command Sequence

1. Activate Bootloader
2. Clear Memory
3. Send Stream
4. ReBoot

If there is an Error restart the Update Process

4.1 Bootloader Control (BC?)

| Type | Mnemonic | Field 1 |
|-------|----------|------------------------------|
| Query | ?BC | UINT32 Bootloader Command |

| Type | Field 1 |
|----------|---|
| Response | UINT32 Bootloader Status Or Server Error Code |

4.1.1 Bootloader Command

| Bit | Description |
|-------|---|
| NoBit | (No bit set) No Operation. Can be used to read only the Bootloader Status |
| 0 | Bootloader Activate. Enable the Erase and Write Flash functions |
| 1 | Clear Memory. Clears the Update Memory. A response can take up to 8.5s |
| 2 | ReBoot. Reboots the Application and start the Update process. Only valid if there is a valid Application in the Update Memory |

4.1.2 Bootloader Status

| Bit | Description |
|-----|--|
| 0 | Bootloader is activated and running |
| 1 | Memory is cleared |
| 2 | Valid Application. There is a Valid Application in the Update Memory |
| 3 | Bootloader Error. There is an Error. Wrong Command Sequence, CRC Wrong.... |

4.2 Bootloader Stream (BS?)

| Type | Mnemonic | Field 1 |
|-------|----------|-------------------------------------|
| Query | ?BS | Data Stream Part of the Hex File |

| Type | Field 1 |
|----------|---|
| Response | UINT32 Bootloader Status Or Server Error Code |

4.2.1 Data Stream

The Data Stream command is used to send the Hex File content to the microcontroller.

Add a few Hex File lines to the Payload Field of the communication protocol frame and remove all '\n' and '\r' from the stream. (The Hex File lines are then only separated by the double dot).

The maximum size of the Payload Field is 512Bytes.

It is recommended to send 10 Hex File Lines in one package. This will not exceed the 512Byte limit.

4.2.2 Bootloader Status

See 4.1.2 Bootloader

5 Example Communication Strings

- If you have any questions, please do not hesitate to contact us under: contact@meerstetter.ch or www.meerstetter.ch
- The following Example Communication Strings have been captured with the MeComAPI ComLog.txt file.
- It shows the Serial Communication Data as it would appear on a normal Serial Terminal Program. Only the "OUT:" and "IN:" tags have been added by the MeComAPI. The End-of-Frame Byte is not shown, because it is a ASCII <CR> (Carriage Return, 0x0D).
- All the Frame data is colored to better understand what is going on:
 - **Control**
 - **Address** (Address 1 has been used)
 - **Sequence Number**
 - **Payload** / Other Payload part
 - **Checksum**

Get Firmware Identification String

OUT: #0115AA?IF257D
IN: !0115AA8065-TEC SW G01 342D
→ Result is "8065-TEC SW G01"

Get Device Type (Using Parameter Value Read)

Parameter ID: 100 (0x0064); Instance 1
OUT: #0115AB?VR006401FB61
IN: !0115AB0000044158DE
→ Result is 0x00000441 → 1089

Get Serial Number (Using Parameter Value Read)

Parameter ID: 102 (0x0066); Instance 1
OUT: #0115AC?VR006601FA44
IN: !0115AC000000702A4F
→ Result is 0x00000070 → Interpreted as an INT32: Decimal Value 112

Set TEC Output Stage Enable Status (Using Parameter Value Set Command)

Parameter ID: 2010 (0x07DA); Instance 1; New value is 2 (Live OFF/ON) as INT32
OUT: #0115AEVS07DA01000000025A61
IN: !0115AE5A61
→ As Result we get a ACK. The ACK sends the Checksum of the Set Command back.

Get TEC Object Temperature (Using Parameter Value Read)

Parameter ID: 1000 (0x03E8); Instance 1

OUT: #0115AB?VR03E801B97B

IN: !0115AB41CD2F2890A1

→ The Result is 0x41CD2F28 → Interpreted as an FLOAT32: 25.648026°C

You may use the tool: <http://www.h-schmidt.net/FloatConverter/> for tests.

Usually Microcontrollers do support float according to IEEE754 by an Hardware or Software FPU.

Set TEC Target Object Temperature (Using Parameter Value Set)

Parameter ID: 3000 (0x0BB8); Instance 1; New Value 21.750°C AS FLOAT32 according to IEEE754

The new Value 21.75 is being transmitted as Hexadecimal Representation 0x41AE0000.

You may use the tool: <http://www.h-schmidt.net/FloatConverter/> for tests.

Usually Microcontrollers do support float according to IEEE754 by an Hardware or Software FPU.

OUT: #0115B0VS0BB80141AE00001174

IN: !0115B01174

→ As Result we get a ACK. The ACK sends the Checksum of the Set Command back.

Querying a not available Parameter ID (Using Parameter Value Read)

Parameter ID: 1234 (0x04D2); Instance 1

OUT: #0115AC?VR04D201009F

IN: !0115AC+057509

→ As Result we get the Server Error Code 0x05 which means that this Parameter is not available.

6 Legacy Commands (Not Recommended for New Designs)

6.1 Set Commands

| Command | Mnemonic | Arguments / Description | | | |
|--------------------|----------|-------------------------|-----|--------|---|
| | | Type | Min | Max | Description |
| Enable TEC 1 | E1 | UINT4 | 0 | 1 | 0 → Disable Temperature regulation 1 → Enable Temperature regulation |
| Enable TEC 2 | E2 | UINT4 | 0 | 1 | 0 → Disable Temperature regulation 1 → Enable Temperature regulation |
| Nominal Temp TEC 1 | N1 | UINT16 | 0 | 65'000 | Sets the nominal temperature for TEC 1. 123 = 1.23°C (Saved to Flash) |
| Nominal Temp TEC 2 | N2 | UINT16 | 0 | 65'000 | Sets the nominal temperature for TEC 2. 123 = 1.23°C (Saved to Flash) |

6.2 Query Commands

| Request | Mnemonic | Description | Server Response | |
|-----------------------------|----------|---|-----------------|---|
| | | | Type | Description |
| Version Information | ?VI | Returns the software version | UINT16 | SW Version: 100 equals 1.00 |
| | | | UINT16 | Build Number. |
| Error | ?ER | Returns the current error number. | UINT8 | 0 → No Error. For all other numbers check the error list (TBD) in the appendix. |
| Device Status | ?DS | Returns the device status | 8 bit UINT8 | Status numbers TBD |
| Temperatures TEC 1 | ?T1 | Returns the actual Temperatures for TEC1 | UINT16 | TEC 1 Object Temperature (123 = 1.23°C) |
| | | | UINT16 | TEC 1 Sink Temperature (123 = 1.23°C) |
| Temperatures TEC 2 | ?T2 | Returns the actual Temperatures for TEC2 | UINT16 | TEC 2 Object Temperature (123 = 1.23°C) |
| | | | UINT16 | TEC 2 Sink Temperature (123 = 1.23°C) |
| Base plate Temperature | ?BT | Returns the base plate temperature | UINT16 | Temperature (4312 = 43.12°C) |
| Actual output current TEC 1 | ?C1 | Returns the actual output current of the TEC1 | INT16 | 16 Bit signed Value in mA. Positive value means heating. |
| Actual output current TEC 2 | ?C2 | Returns the actual output current of the TEC2 | INT16 | 16 Bit signed Value in mA. Positive value means heating. |

7 Change Log

| Changed by | Dok | STM32 SW Version | Change Log |
|----------------------|-----|------------------|--|
| 03.04.12 ML | A | | <ul style="list-style-type: none"> 2.2 Query Commands: Query ?BT, ?C1, ?C2 added. |
| 08.05.12 ML | B | 0.41 | <ul style="list-style-type: none"> 2.1 Set Commands: Set ET added. |
| 21.05.12 ML | C | 0.50 | <ul style="list-style-type: none"> Add: Bootloader Add: Chapter Service Software Parameters |
| 03.07.12 ML | D | 0.60 | <ul style="list-style-type: none"> Add: 3.3.4.4 ID 5034 (Positive current is: Cooling / Heating) |
| 10.07.12 ML | D | 0.61 | <ul style="list-style-type: none"> Add: 2.1 Set Command "RS". Del: 2.1 Set Command "ET" |
| 12.07.12 ML | F | | <ul style="list-style-type: none"> Measurement System simplified Expert Settings added Mod: 2.2 Query Commands: ?IF (String changed) Mod: All Temperature Ranges -50 ... 200 °C |
| 16.08.12 ML | G | 0.70 | |
| 22.08.12 US | H | 0.70 | <ul style="list-style-type: none"> Mod: RS485 Interface: 'Channel 1' / Default Baud rate: '57600' |
| 01 Oct 2012 ML | I | 1.00 | <ul style="list-style-type: none"> Add: Auto Tuning Mod: 3.3.4.1 CHx Nominal Temperature: Ramp function changed Add: Device Type dependent Limits Add: 3.3.2.13 Object Temperature Stability Detection Add: 3.3.5.4 CH1 Object Temperature Stability Indicator Settings |
| 28 Nov 2012 ML | J | 1.10 | <ul style="list-style-type: none"> Add: 2.2 Query Commands: ?LT (Lookup Table Download added) Add: 3.3.8.2 Temperature Regulator additional Parameters 3.3.8.4 Lookup Table Control |
| 22 Jan 2013 ML | K | 1.30 | <ul style="list-style-type: none"> Add: Parameter ID 1081 (Parameter System Flash Status) Add: Parameter ID 6013 (Sink Temperature VPS) Add: ES Command (Emergency Stop) Mod: Parameter ID 2010 (Power Supply Enable) Mod: Parameter ID 2000 (Power Supply Input Selection) |
| 18 Feb 2013 ML | L | 1.31 | <ul style="list-style-type: none"> Add: Parameter ID 104 (Device Status) Add: Parameter ID 105 (Error Number) |
| 11 March 2013 ML | M | 1.40 | <ul style="list-style-type: none"> Mod: Parameter names changed (as it is called in Service Software) Mod: Parameter ID 2040 (General Operating Mode) Add: Parameter ID 1090 (Parallel Output Stage Monitoring) Add: SA and ?SD Command |

| Changed by | Dok | STM32 SW Version | Change Log |
|-------------------|-----|------------------|---|
| 10 April 2013 ML | N | 1.41 | <ul style="list-style-type: none"> Add: 3.3.8.5 PBC (Platform Bus Connector) RES1 ... RES8 Signal Control Add: Parameter ID 106 (Error Instance) Add: Parameter ID 107 (Error Parameter) |
| 17 June 2013 ML | O | 1.50 | <ul style="list-style-type: none"> Add: Command ?VL (Parameter Limit Read) |
| 27 June 2013 ML | P | | <ul style="list-style-type: none"> Add: 5 Example Communication Strings |
| 14 August 2013 ML | Q | 1.60 | <ul style="list-style-type: none"> Add: Monitor: 3.3.2.4 CHx FAN Controller Add: 3.3.7.2 Sub Tab: Display Add: 3.3.7.3 Sub Tab: PBC Add: 3.3.7.3.2 CHx Change Target Temperature Buttons Add: CHx Pump Control pSub Tab: FAN Mod: General Temperature Range set to -273 ... +1000°C Add: Parameter: 108 (Save Data to Flash) Add: Parameter: 109 (Parameter System: Flash Status) Add: Parameter: 6300 (Actual Object Temperature Source Selection) Add: Parameter: 52200 (External Actual Object Temperature) Add: Parameter: 2010 (Enable) Option 3 (HW Enable) |
| 15 Oct 2013 ML | R | 1.70 | <ul style="list-style-type: none"> Add: Value Ranges for TEC-1091 Add: Parameter 6100: New "TEC Error", and "CHx Rmp/Stable" Add: Parameter 4042 Max stabilization Time Add: Parameter 6310 Delay till Restart |
| 12 Dec 2013 | S | 1.80 | <ul style="list-style-type: none"> Mod: Parameter 6100: <ul style="list-style-type: none"> Add: Option TEC Run and CHx Not Stable Add: Option CHx Temp Up/Down Mod: Parameter 6021, 6022 Value Range extended to 0 ... 27 |
| 21 Feb 2014 | T | 1.91 | <ul style="list-style-type: none"> Mod: Parameter 2021, 2031, 2033, 50002 <ul style="list-style-type: none"> Voltage Range for -SV and -HV Version changed Add: Parameter 6110 – 6112 (CHx Change Target Temperature Buttons) Add: Parameter 6225 (Bypassing FAN Speed Controller) |
| 7 Aug 2014 | U | 2.00 | <ul style="list-style-type: none"> Bug: Value Ranges removed for selective parameters Mod: Auto Tuning: Add Par: 51002, 51022, 51023, 51024 Add: PID Parameters: New Parameter: 3013 |
| 24 Nov 2014 | V | 2.10 | <ul style="list-style-type: none"> Add: 3.3.3.8 Communication Watchdog Add: General Serial Interface Specs |
| 2 Feb 2015 | W | 2.20 | <ul style="list-style-type: none"> Add: Command ?TT Add: Description about Flash and RAM parameters Add: Parameter 6320 (CHx Output Stage Controller Limit Error Delay) |

| Changed by | Dok | STM32 SW Version | Change Log |
|---------------|-----|------------------|--|
| 16 March 2015 | X | 2.30 | <ul style="list-style-type: none"> • Mod: Parameter ID 1061: New Name: Medium Internal Supply • Add: Parameter ID 1044: Sink Sensor Temperature |
| 15 July 2015 | Y | 2.40 | <ul style="list-style-type: none"> • Add: Parameter ID 6120 – 6122 (Pump Control) • Mod: Parameter ID 6100 (Add Pump selection) |
| 16 Sept 2015 | Z | 2.41 | <ul style="list-style-type: none"> • Bug: Parameter ID 52101 Example: Bug fixed |
| 29 Dez 2015 | AA | 2.50 | <ul style="list-style-type: none"> • Add: Parameter ID 1045 (Object Temperature Measurement) • Mod Parameter ID 6300 (Take Temp of CH2 for CH1) • Mod: TEC maximum output voltages modified • Add: Parameter ID 1110 (Maximum Device Temperature) • Add: Parameter ID 1111 (Maximum Output Current) • Add: Parameter ID 6330 (Device Temperature Mode) |
| 21 April 2016 | AB | 2.60 | <ul style="list-style-type: none"> • Add: Parameter ID 6226 (FAN Surveillance Disable option) • Mod: ?VL command documentation optimized |
| 3 June 2016 | AC | 2.70 | <ul style="list-style-type: none"> • Add: Parameter ID 5032 (Sink Upper ADC Limit Erro) • Add: Parameter ID 6006 (Object Measurement Rp) |