Communication Protocol TEC Controller

TEC-Family

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

1 General Description

If you have any questions, please do not hesitate to contact us under:
contact@meerstetter.ch or www.meerstetter.ch

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.
- There are some Domo Applications which 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 an other value by using the corresponding command. The new baud rate will be saved to the non volatile memory
    - The Default Address is 2. It is possible to use 255 as broadcast
- Interface USB:
    - All commands are also accessible through the USB Interface
    - The baud rate is fixed to 57600
    - Address is like RS485. Additional the address 0 is also used as broadcast

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: • 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.

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	0: Float 1: Integer 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 … 5	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 … 1	0: Enabled 1: Disabled (All Parameters can then be used as RAM Parameters)
109	Parameter System: Flash Status	INT32	0 … 1	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	

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	10V Internal Supply	FLOAT32	V	
1062	3.3V Internal Supply	FLOAT32	V	
1063	Base Plate Temperature	FLOAT32	°C	

3.3.2.9 Error Status

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

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 Driver Status

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

3.3.2.12 Object Temperature Stability Detection

ID	Name	Format	Value Range	Description
1200	Temperature is Stable	INT32	0 .. 2	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 … 2	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 … 2	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	0V … 19V	

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	0V … 19V	
2032	Current Error Threshold	FLOAT32	1091: 0A … 5.6A 1089 / 1122: 0A … 14A 1090 / 1123: 0A … 20A	
2033	Voltage Error Threshold	FLOAT32	0V … 24V	

3.3.3.5 General Operating Mode

ID	Name	Format	Value Range	Description
2040	General Operating Mode	INT32	0 … 2	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	

3.3.4 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	

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	FLOAT32	0.1A … 1000A	
3031	Maximal Voltage	FLOAT32	0.1V … 1000V	
3032	Cooling Capacity Qmax	FLOAT32	1W … 1000W	
3033	Delta Temperature dTmax	FLOAT32	1°C … 200°C	
3034	Positive Current is	INT32	0 … 1	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	*RNG_TEMP*	
4011	Upper Error Threshold	FLOAT32	*RNG_TEMP*	
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	*RNG_TEMP*	
4021	Lower Point: Resistance	FLOAT32	1Ohm … 1MOhm	
4022	Middle Point: Temperature	FLOAT32	*RNG_TEMP*	
4023	Middle Point: Resistance	FLOAT32	1Ohm … 1MOhm	
4024	Upper Point: Temperature	FLOAT32	*RNG_TEMP*	
4025	Upper Point: Resistance	FLOAT32	1Ohm … 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	*RNG_TEMP*	
5011	Upper Error Threshold	FLOAT32	*RNG_TEMP*	
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	*RNG_TEMP*	
5021	Lower Point: Resistance	FLOAT32	1Ohm … 1MOhm	
5022	Middle Point: Temperature	FLOAT32	*RNG_TEMP*	
5023	Middle Point: Resistance	FLOAT32	1Ohm … 1MOhm	
5024	Upper Point: Temperature	FLOAT32	*RNG_TEMP*	
5025	Upper Point: Resistance	FLOAT32	1Ohm … 1MOhm	

3.3.6.4 CHx Sink Temperature Source Selection

ID	Name	Format	Value Range	Description
5030	Sink Temperature Selection	INT32	0 … 1	0: External 1: Fixed Value
5031	Fixed Temperature	FLOAT32	*RNG_TEMP*	

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 … 8	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 … 7	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℃ … 1E5℃	
6004	ADC Calibration Gain	FLOAT32	0.5℃/℃ … 2.0℃/℃	
6005	Sensor Type Selection	INT32	0 … 2	0: NTC 1: Pt100 2: Pt1000

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℃ … 1E5℃	
6012	ADC Calibration Gain	FLOAT32	0.5℃/℃ … 2.0℃/℃	

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 … 1	0: OFF 1: OLED 2x16
6021	Display Line 1 / 2 Default Text	INT32	0 … 23	See TEC Family User Manual
6022	Display Line 1 / 2 Alternative Text	INT32	0 … 23	See TEC Family User Manual
6023	Display Line 1 / 2 Alternative Mode	INT32	0 … 3	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 … 10	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

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 … 1	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 … 1	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

3.3.7.4.4 FAN General Settings

ID	Name	Format	Value Range	Description
6230	FAN PWM Frequency	INT32	0 … 1	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 … 1	0: Internal (On Board Hardware) 1: External (Over Parameter 52200)

3.3.7.5.2 Parameter System Save to Flash Configuration

ID	Name	Format	Value Range	Description
108	Save Data to Flash	INT32	0 … 1	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	

3.3.8 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 … 1	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	0V … 19V	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 … 1	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 … 1	0: Taken form Parameter ID 3000 (Reset State) 1: Taken form Parameter ID 50012
50012	Object Target Temperature	FLOAT32	*RNG_TEMP*	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.
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.
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	-	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

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 …4	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

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 4 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 (PULSE)
7	RES8 (ENABLE)

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

ID	Name	Format	Value Range	Description
52200	External Object Temperature	FLOAT32	*RNG_TEMP*	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 an 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 Filed 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
  - Cecksum

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: #0115AEVS07DA0100000002 5A61

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		• 2.2 Query Commands: Query ?BT, ?C1, ?C2 added.
08.05.12 ML	B	0.41	• 2.1 Set Commands: Set ET added.
21.05.12 ML	C	0.50	• Add: Bootloader • Add: Chapter Service Software Parameters
03.07.12 ML	D	0.60	• Add: 3.3.4.4 ID 5034 (Positive current is: Cooling / Heating)
10.07.12 ML	D	0.61	• Add: 2.1 Set Command “RS”. • Del: 2.1 Set Command “ET”
12.07.12 ML	F		• 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	• Mod: RS485 Interface: 'Channel 1' / Default Baud rate: '57600'
01 Oct 2012 ML	I	1.00	• Add: Auto Tuning • Mod: 3.3.4.1 CHx Nominal Temperature: Ramp function changed • Add: Device Type dependent Limits • Add: 3.3.2.12 Object Temperature Stability Detection • Add: 3.3.5.4 CH1 Object Temperature Stability Indicator Settings
28 Nov 2012 ML	J	1.10	• 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	• 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	• Add: Parameter ID 104 (Device Status) • Add: Parameter ID 105 (Error Number)
11 March 2013 ML	M	1.40	• 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	• 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	• Add: Command ?VL (Parameter Limit Read)
27 June 2013 ML	P		• Add: 5 Example Communication Strings
14 August 2013 ML	Q	1.60	• 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: 3.3.7.4 Sub 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	• 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