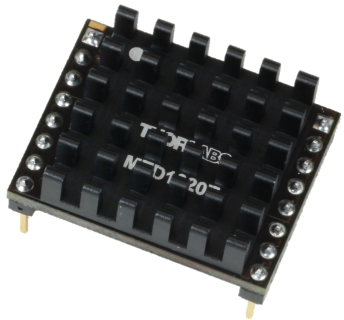
THORLABS

Data Sheet
Miniature Temperature Controller
MTD1020T



Features

- Small, safe and very high accuracy complete single-module controller
- High speed, ultra stable digital PID Loop
- Up to ± 2.0 A TEC current with 10.0 V TEC output compliance voltage
- Up to 20 W output power
- Very low output current noise
- Very small footprint (27.0 x 21.0 mm²), package height 10.3 mm (w/o pins)
- Supports widely used 10 kΩ thermistor temperature sensors

Applications

- Active cooling and temperature stabilization for a wide range of laser modules and diodes
- WDM, DWDM Laser-Diode Temperature Control
- EDFA Optical Amplifiers
- Temperature stabilization of photo detectors and photodiodes
- Automated Test Equipment (ATE)

Short Description and Typical Application Circuit

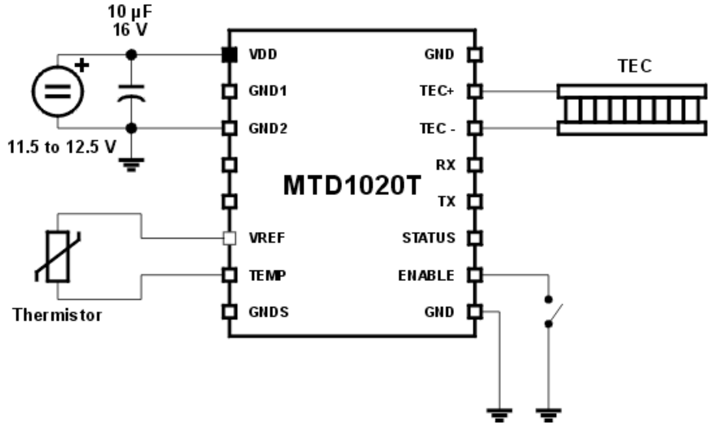
The MTD1020T is a compact and highly integrated temperature controller optimized for use in high performance thermoelectric temperature control applications.

The on-chip power stage and the thermal control loop circuitry minimize external components while maintaining high efficiency.

The output current is directly controlled to eliminate current surges. An adjustable TEC current limit provides the highest level of TEC protection.

The MTD1020T is operated from a single power supply and provides a bipolar ±2.0 A output by connecting the TEC to the output of a bipolar power stage. True bipolar operation ensures temperature control without "dead zones" or other nonlinearities at low TEC current values.

The digital control interface allows quick access to all system parameters as well as to digital measurement data, this way enabling a simple integration into different systems.



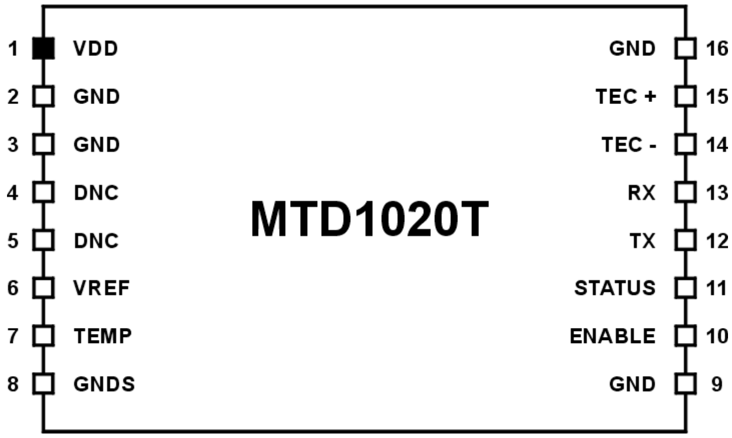
MTD1020T Typical Application Circuit

Revision History

Revision	Changes with respect to previous revision
1.0	Initial Release
1.1	• Section Electrical Characteristics: Noise and Ripple (typ.): changed from < 10mA to 150 mA (PeakPeak) or 87 mA RMS • Section Electrical Characteristics: Temperature Stability: short term: 100 mK

Contents

1 Pin Configuration and Functions



Pin	Name	Description
1	VDD	**Supply Voltage Input** Connect a 11.5 V to 12.5 V power supply to VDD.
2	GND	**Supply Voltage Ground** Connect the power supply ground connections to GND.
3	GND	**Supply Voltage Ground** Connect the power supply ground connections to GND.
4	DNC	**Do Not Connect** Do not connect this pin to any signal or potential. This pin is used for manufacturing and test purposes.
5	DNC	**Do Not Connect** Do not connect this pin to any signal or potential. This pin is used for manufacturing and test purposes.
6	VREF	**Reference Output Voltage for Thermistor Temperature Sensor** Connect this reference voltage output (1.24 V) to one end of the 10 kΩ thermistor.
7	TEMP	**Thermistor Temperature Sensor Input** Connect this pin to the other end of the 10 kΩ thermistor.
8	GNDS	**Temperature Sensor Ground** Can be used for shielding purposes or left open.
9	GND	**Supply Voltage Ground** Connect the power supply ground connections to GND.
10	ENABLE	**Enable Signal Input (Low-Active)** Enable Input (Low = enabled, High = Disabled), can be connected directly to GND.
11	STATUS	**Status Signal Output (Can be left floating)** Status Signal (High = temperature within defined temperature window, Low = Temperature outside programmed temperature window or an error occurred).
12	TX	**Digital Interface Transmit Signal** UART Transmit Asynchronous Data Output. Connect this pin to the RX pin of your application.

Pin	Name	Description
13	RX	**Digital Interface Receive Signal** UART Transmit Asynchronous Data Input. Connect this pin to the TX pin of your application.
14	TEC -	**TEC Element negative connection** Connect this pin to the negative terminal of the TEC element. [1])
15	TEC +	**TEC Element positive connection** Connect this pin to the positive terminal of the TEC element. [1])
16	GND	**Supply Voltage Ground** Connect the power supply ground connections to GND.

[1]) Please consider that the polarity of the TEC element depends on the physical mounting direction of the TEC element in your application. The (+) and (-) terminals described here assume the TEC element has been mounted with the cold side in contact with the device being temperature controlled and a positive voltage is sourced to the TEC element.

2 Technical Data

2.1 Absolute Maximum Ratings

Supply Input Voltage	11.5 V to 13.0 V
Supply Input Current	2.3 A
TEC Output Current	-2.0 A to 2.0 A
TEC Compliance Voltage	10.0 V
Maximum Output Power	20.0 W
Power Dissipation	4.0 W
Pin Voltage Range [1]) VDD ENABLE, RX, TX TEC- to TEC+ TEMP	 -0.3 V to 13.0 V -0.3 V to 3.6 V 0.0 to 13.0 V -0.3 V to 3.3 V
Maximum Output Current STATUS, TX	10 mA
Maximum Input Current ENABLE, RX	10 mA
Operating Temperature	-40 °C to + 70 °C

[1]) All voltages with respect to network ground terminal.

Notes

(1) Above specifications are given for the free-air operating temperature range unless otherwise noted.

(2) Stresses beyond those listed above may cause permanent damage to the product. These are stress ratings only; functional operation of the MTD1020T at these or any other conditions beyond those indicated under *Recommended Operating Conditions* and *Electrical Characteristics* is not implied.

(3) Operation beyond the maximum rated conditions for extended periods may affect product reliability.

2.2 Recommended Operating Conditions

Supply Voltage	11.5 to 12.5 V at 10.0 V TEC Compliance Voltage
Operating Temperature	-20 to + 60 °C

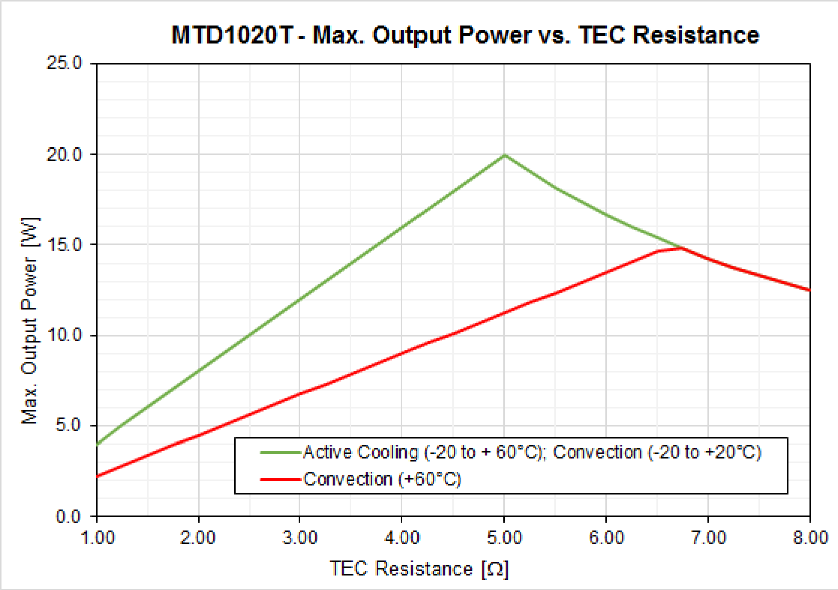
2.3 Electrical Characteristics

TEC Current Output	
Output Current	up to ± 2.0 A into 5 Ω TEC (see diagram on page.)
Compliance Voltage	10.0 V
Output Power	up to 20.0 W
Measurement Resolution	better than 10 mA, typ. 5 mA
Measurement Accuracy	± 50 mA
Noise and Ripple (typ.)	150 mA (PeakPeak) or 87 mA RMS
TEC Current Limit	
Setting Range	0 to 2.0 A
Setting Resolution	1 mA
Setting Accuracy	± 50 mA
Temperature Sensor	
Supported Sensor	10 kΩ Thermistor [4])
Maximum Temperature Control Range [2])	+ 5 °C to + 45 °C
Temperature Setting Resolution	1 mK
Temperature Measurement Resolution [3])	better than 10 mK; typ. 3 mK
Absolute Temperature Accuracy [2])	± 0.5 °C
Temperature Stability, typ. [1])	100 mK
Temperature Coefficient	< 20 mK/°C
Programming Interface	
Type	UART
Voltage Level	3.3 V Logic Level; input 5 V tolerant
Data Rate	115.200 bps; 8 Data Bits, 1 Stop Bit
General Data	
Safety Features	• TEC Current Limit • Sensor Fault Protection • TEC Open Circuit Protection • Temperature Setpoint Limit • Temperature Window Protection Delay • Over Temperature Protection
Operating Temperature	-20 °C to +60 °C, non-condensing
Storage Temperature	-40 °C to +100 °C, non-condensing
Warm-Up Time for Rated Accuracy	10 min
Dimensions (W x H x D)	27.0 x 21.0 x 10.3 mm³ (without pins)
Approx. Weight	0.008 kg

[1]) Better temperature stability can be achieved with optimization. Please contact OEM sales
[2]) Control range and thermal stability based on standard thermistor parameters: 10kΩ resistance at 25 °C ($R_{25°C}$), B constant [25/85°C] = 3950 K.
[3]) Maximum measurement resolution depends on cycle time settings. Please refer to Programmers Reference.
[4]) Calibrated for thermistors with 10kΩ resistance at 25 °C ($R_{25°C}$), B constant [25/85°C] = 3950 K. Resistance Measurement Range: 4.2 to 29 kΩ.

All technical data are valid at 23 ±5 °C and 45 ±15% rel. humidity (non condensing)

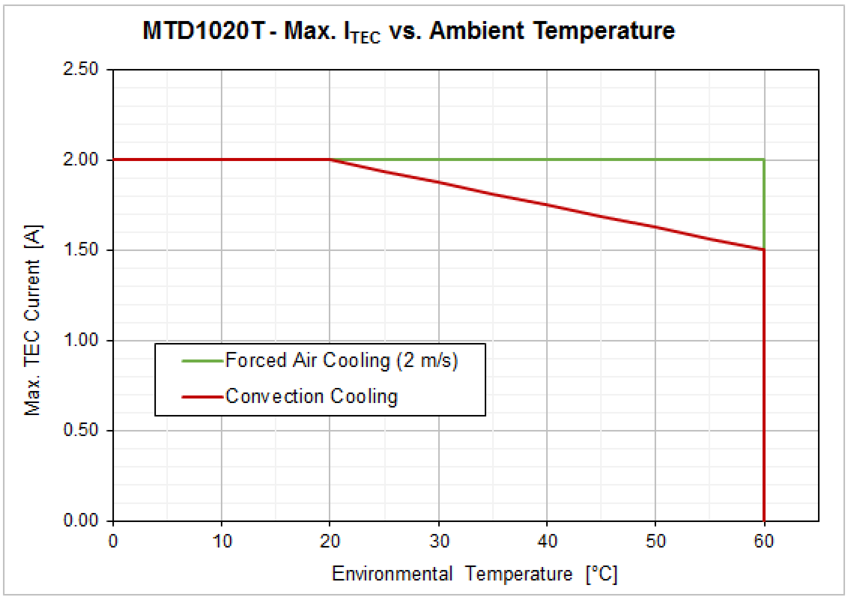
3 Typical Output Characteristics



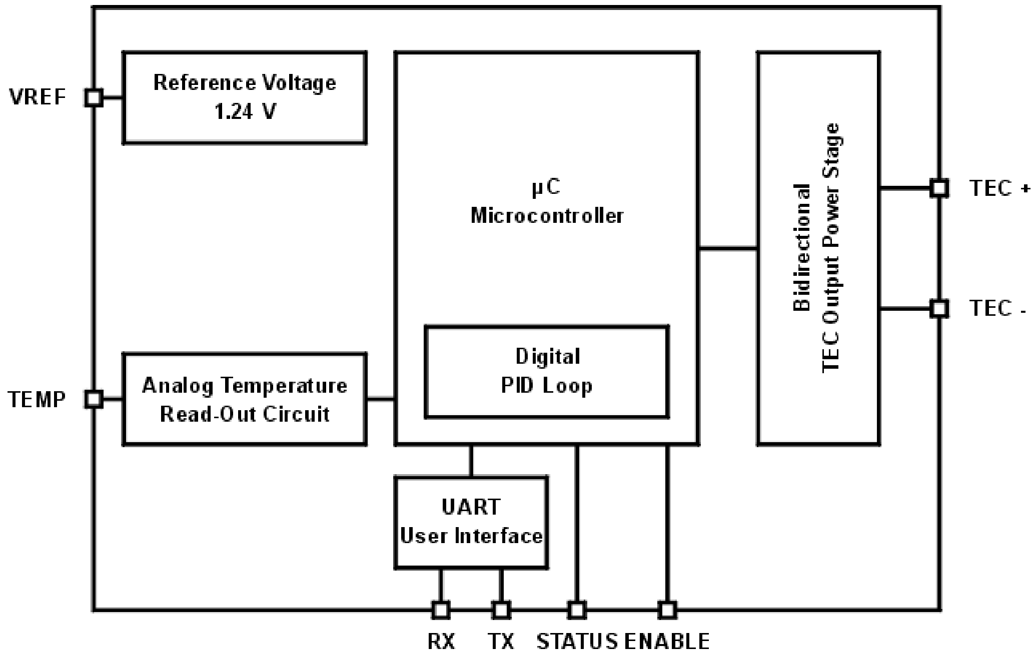
Note

The maximum output power of 20 W can be delivered into a load resistance of 5.0 Ω and depends on the ambient temperature as well as on the cooling mode, as shown in above diagram.

The maximum TEC current of 2.0 A can be delivered up to an ambient temperature of 20 °C. At higher temperatures, it depends on the cooling. See the diagram below.

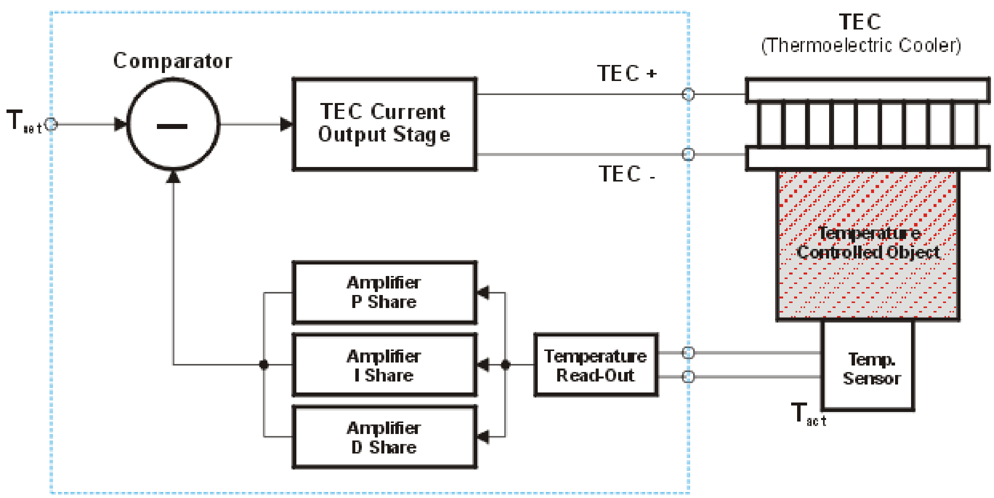


4 Functional Block Diagram



Functional Block Diagram MTD1020T

Principle of Operation



In general, a temperature controller (within the blue frame) is a closed loop system. A temperature sensor measures the temperature of the controlled object (e.g., a laser diode). This **actual temperature** signal is amplified and compared with the **temperature set value**. The differential signal out of the **comparator** controls then the current of the **thermoelectric cooler** in order to maintain the temperature of the object constant. Ideally, the temperature settling is carried out in the shortest times, with minimum settling error and without temperature overshoots.

A thermoelectric cooler is a Peltier element that produces a positive or negative temperature gradient, depending on the current direction trough the TEC. To enable heating and cooling, the TEC current must be capable of bidirectional flow. In order to adapt the control loop to different thermal loads, and to optimize the temperature controller's response characteristics, a PID amplifier is used. For detailed information, please see the PID Tutorial (page)

Functional Description

The MTD1020T is a miniature, closed-loop temperature controller module. It is compatible with a 10 kΩ NTC (thermistor) temperature sensor and its output is designed for control of thermo-electric coolers (TEC).

The MTD1020T delivers a TEC current up to 2.0 A at 10.0 V compliance voltage.

Power Supply

The supply voltage ranges from 11.5 V to 12.5 V. From the supply voltage, the internal supply voltage for the microcontroller is derived. Further, a reference voltage for the temperature sensor is generated (**VREF**; 1.24 V).

TEC Current Control

The TEC element is connected between **TEC+** and **TEC-**. A correct connection is essential to avoid wrong temperature correction.

The MTD1020T allows to limit the maximum TEC current. Lowering the TEC current limit might be helpful for control loop optimization in the case of low thermal loads, as it lowers the maximum rate of temperature change driven by the MTD1020T .

Micro-controller

The functions of the microcontroller are:

- Comparison of the actual temperature with the set temperature;
- Generation of the control signal for the TEC output stage with respect to the comparator signal;
- PID loop control for optimization of the temperature settling time and for minimizing the final temperature error.

All parameters (TEC current limit, set temperature, temperature window, PID share settings etc.) are programmed via the **UART** user interface. Detailed information about how to program the MTD1020T can be found in the section Programmers Reference on page .

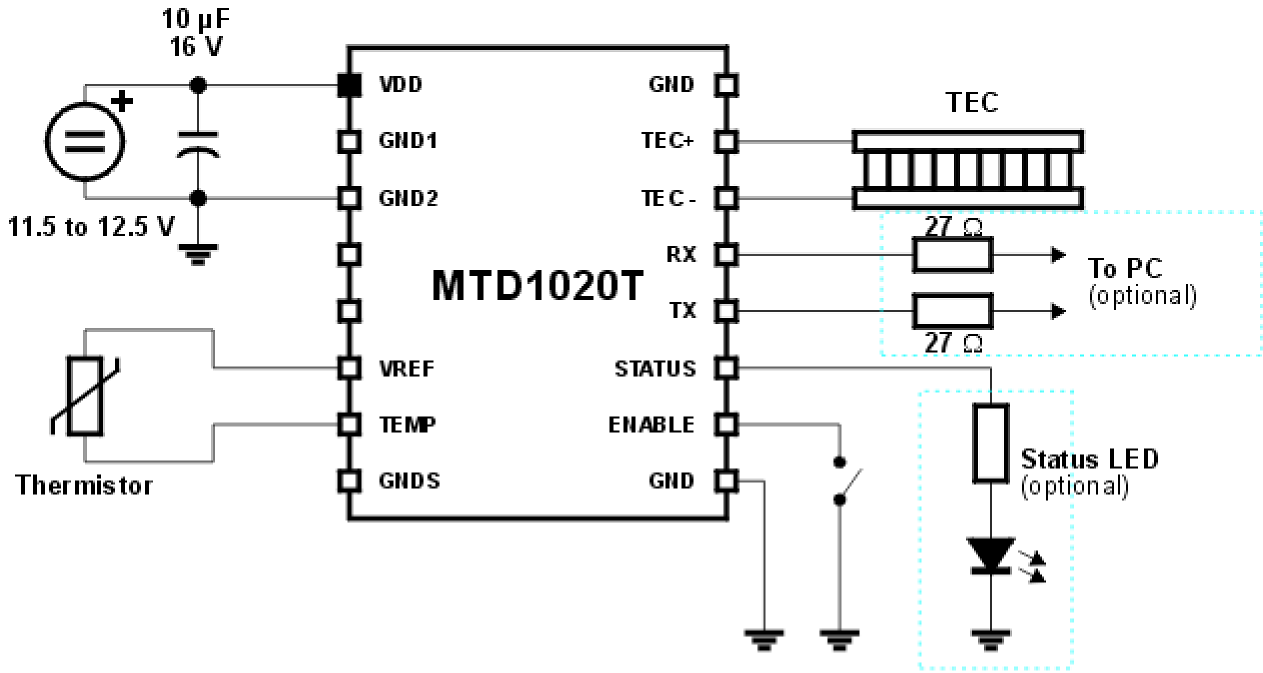
Note

The **UART** interface uses 3.3 V logic level. Connect the **UART** to a PC only using an appropriate converter, e.g., a commercially available UART-to-USB cable.

The **St**atus signal signal indicates whether the MTD1020T is operating correctly.

The temperature control is activated by setting the **Enable** pin to low.

5 Typical Application



6 Programmers Reference

6.1 Nomenclature

Program messages are written in quotation marks:	**"A?"** **"Lx"** (**x** - Parameter)
Response messages are written in brackets:	**[-800 <LF>]**
Data Format	Numerical value with sign in integer notation: **-220** or **16789432**.
Command /response Terminator:	Line Feed (**<LF>**)

6.2 Command Description

6.2.1 General Commands

Command	Explanation Response Example
"m?"	Reads the version of hardware and software **[MTD1020 FW0.6.8]**

Command	Explanation Response Example
"u?"	Reads the UUID (Universal Unique Identifier) of the MTD1020T **[045F778655FDE5118ED499C9B4521485]**

Command	Explanation Response Example
"E?"	Reads the Error Register. For responses see section Error Register and Safety Bitmask
"c"	Resets the Error register

Note

The MTD1020T has a non-volatile memory (flash) that stores the setting parameters. This memory has a limited number of erase / write cycles. In order to protect the flash memory, changes to setting parameters are not stored automatically. If you want to keep parameter changes after power-down of the MTD1020T , save them to the flash memory using the "**M**" command. This command saves the T, W, L, d, G, O, P, I, D, C and S parameters at a time.

6.2.2 TEC Commands

Command	**Explanation** **Response Example**
Programming	
"Lx"	Sets the TEC current limit to **x** *) Value range **x**: **200** to **2000** [mA]
Reading	
"L?"	Reads the TEC current limit **[x<LF>]**[mA]
"A?"	Reads the actual TEC current **[x<LF>]**[mA] x < 0: Heating; x > 0: Cooling
"U?"	Reads the actual TEC voltage **[x<LF>]**[mV]

*) This set value remains during the actual power-on cycle. Use the "**M**" command to save it to the non-volatile memory.

6.2.3 Temperature

Command	**Explanation** **Response Example**
Programming	
"Tx"	Sets the set temperature to **x** *) Value range **x**: **5000** to **45000** [10^{-3} °C]
Reading	
"T?"	Reads the set temperature **[x<LF>]** Value range **x**: **5000** to **45000** [10^{-3} °C]
"Te?"	Reads the actual temperature **[x<LF>]**

Command	**Explanation** **Response Example**
Programming	
"Wx"	Sets the set temperature window to **x** *) Value range **x**: **1** to **32000** [mK]
Reading	
"W?"	Reads the temperature window **[x<LF>]**[mK]

Command	**Explanation** **Response Example**
Programming	
"dx"	Sets the delay time between reaching the temperature window and activating the **Status** output pin to **x** *) Value range **x**: **1** to **32000** [sec]
Reading	
"d?"	Reads the delay time between reaching the temperature window and activating the **Status** output pin **[x<LF>]**[sec]

*) This set value remains during the actual power-on cycle. Use the "**M**" command to save it to the non-volatile memory.

6.2.4 Control Loop

Loop Test

Command	**Explanation** **Response Example**
Programming	
"Gx"	Sets the critical gain to **x** *) Value range **x**: **10** to **100000** [mA/K]
Reading	
"G?"	Reads the critical gain **[x<LF>]**[mA/K]

Command	**Explanation** **Response Example**
Programming	
"Ox"	Sets the critical period to **x** *) Value range **x**: **100** to **100000** [msec]
Reading	
"O?"	Reads the critical period **[x<LF>]**[msec]

PID Settings

Command	**Explanation** **Response Example**
Programming	
"Cx"	Sets the cycling time to **x** *) Value range **x**: **1** to **1000** [msec]
Reading	
"C?"	Reads the cycling time **[x<LF>]**[msec]

Command	**Explanation** **Response Example**
Programming	
"Px"	Sets the P Share to **x** *) Value range **x**: **0** to **100000** [mA/K]
Reading	
"P?"	Reads the P Share **[x<LF>]**[mA/K]

*) This set value remains during the actual power-on cycle. Use the "**M**" command to save it to the non-volatile memory.

Command	**Explanation** **Response Example**
Programming	
"Ix"	Sets the I Share to **x** *) Value range **x**: **0** to **100000** [mA/(K*sec)]
Reading	
"I?"	Reads the I Share **[x<LF>]**[mA/(K*sec)]

Command	**Explanation** **Response Example**
Programming	
"Dx"	Sets the D Share to **x** *) Value range **x**: **0** to **100000** [(mA*sec)/K]
Reading	
"D?"	Reads the D Share **[x<LF>]**[(mA*sec)/K]

*) This set value remains during the actual power-on cycle. Use the "**M**" command to save it to the non-volatile memory.

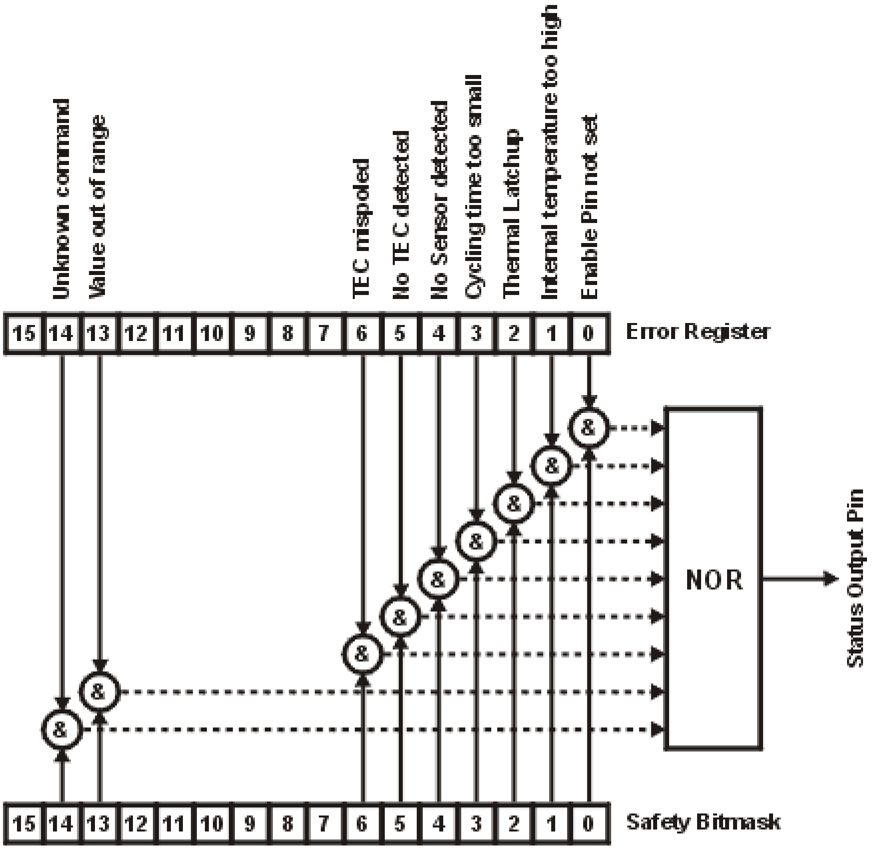
6.2.5 Save Settings

Command	**Explanation** **Response Example**
"M"	Saves the setup. The actual parameters that have been set using the commands T, W, L, d, G, O, P, I, D, C and S, are saved to the nonvolatile memory.

6.2.6 Factory Default Settings

Parameter	**Explanation**	**Factory Default**
L	TEC current limit	2000 mA
T	Temperature set value	25 °C
W	Temperature window	1000 mK
d	Temperature window delay	10 sec
C	Cycle time PID loop	100 msec
P	P share PID loop	1000 mA/K
I	I share PID loop	200 mA/(K*sec)
D	D share PID loop	100 (mA*sec)/K
G	Critical PID loop gain (Loop test)	2000 mA/K
O	Critical PID loop oscillation period (Loop test)	4000 msec
S	Value of the Safety Bitmask	255

6.3 Error Register and Safety Bitmask



The MTD1020T has an internal 16 bit error register:

Bit Number	Event
0	Enable pin not set to L (GND)
1	Internal temperature too high
2	Thermal Latch-Up (TEC current at limit without temperature improvement)
3	Cycling time too small
4	No Sensor detected
5	No TEC detected (connection open)
6	TEC mispoled
7	(not used)
8	(not used)
9	(not used)
10	(not used)
11	(not used)
12	(not used)
13	Value out of range
14	Invalid command
15	(not used)

The error register can be read out using the **"E?"** command. The error register can be reset using the **"c"** command or by setting the **Enable** pin to Off and On again.

Further, with default setting of the Safety Bitmask (value = 255), the states of bits 0 to 7 are handed over to the **Status** output pin - if any of the bits 0 to 7 is H, the **Status** level is "LOW" and the TEC Current Output is switched off.

The Safety Bitmask can be used to mask any desired error at the **Status** output pin.

Attention

Masking an error may lead to damage of the MTD1020T . For example, if bit 1 is masked, exceeding the internal temperature will **not be reflected** on the status pin as an error and the TEC output will not be disabled!

The safety bitmask can be programmed:

Command	**Explanation** **Response Example**
Programming	
"Sx"	Sets the Safety Bitmask to **x** Value range **x**: **0** to **255**
Reading	
"S?"	Reads the Safety Bitmask value. **[x<LF>]**

Note

If the safety bitmask should be saved for future use, it needs to be saved using the "**M**" command.

7 PID Tutorial

The general requirements of a temperature control loop are:

- fastest settling time after power on or changing the set temperature
- minimum residual temperature error
- settling without temperature overshoot
- fastest response to changes of the thermal load

It is necessary to include an amplifier and PID amplifiers fulfill these requirements. Without a PID amplifier, temperature control loops are comparatively slow; control oscillations appear with a frequency in the range of several Hz or parts of Hz. The PID adjustment can be used to optimize the dynamic behavior of the control loop.

The **P share** is the proportional share, or the gain of the amplifier, that defines the settling time. The higher the P share, the faster the settling and the less residual temperature error. The downside is that high P shares lead to oscillations.

The **I share** is the integrating share of the amplification, or the gain at low frequencies. It allows the residual temperature error to be minimized.

Optimal settings of the P and I shares result in a fast approach to the set temperature, without oscillations and with a minimum residual temperature error. However, such a loop is not able to quickly react to sudden changes of the thermal load, for example, if a thermally stabilized laser diode is set to a higher or lower output power that changes the laser's heat dissipation. The **D share** (differential share, or the gain at high frequencies) allows the system to quickly react to temperature changes, without generating oscillation of the temperature around the set point.

The MTD1020T microcontroller incorporates a digital PID controller. The P, I and D shares can be programmed manually or calculated automatically by the firmware by entering the results of a loop oscillation test. Below an example procedure is explained in detail.

Example of a PID adjustment

Pre-conditions:

- TEC current limit is set correctly
- all connections are made properly

In order to observe the temperature change, connect an appropriate instrument that can display the temperature change vs. time signal that is sent to the **TEMP** input of the MTD1020T .

1. Configure the PID loop:
   Set temperature = 25°C: "**`T25000`**"
   P share = 1000 mA/K: "**`P1000`**"
   I share = 0: "**`I0`**"
   D share = 0: "**`D0`**"
   Cycle time = 30 ms: "**`C30`**"
2. Enable the TEC. The actual temperature **`Te`** approximates the set value.
3. Now, find the critical P share (critical gain) value at which the system starts to oscillate for a minimum of 20 cycles without amplitude drop as a reaction to a changed set temperature. An example procedure is described below:
   - Set P to 10.000 mA/K: "**`P10000`**".
     In order to trigger loop oscillation, increase the set temperature for 0.1 K: "**`T25100`**"
   - Lower P to 5.000 mA/K: "**`P5000`**", decrease the set temperature for 0.1 K: "**`T25000`**" and observe the loop behavior.
   - If the loop still oscillates, lower the P share again, change the set set temperature for 0.1K and observe the loop behavior.

Example:
"**P3000**"; "**T25100**" -> the loop still oscillates
"**P2000**"; "**T25000**" -> the loop stopped oscillating

- If the loop stopped oscillating, increase the P share, change the set set temperature for 0.1K and observe the loop behavior.
  Example:
  "**P2500**"; "**T25100**" -> the loop oscillates again
- Repeat above steps.
  Example:
  "**P2200**"; "**T25100**" -> the loop stopped oscillating.
  "**P2300**"; "**T25000**" -> the loop oscillates again
  "**P2250**"; "**T25100**" -> the loop still oscillates
  "**P2200**"; "**T25000**" -> the loop stopped oscillating
- By this approximation of the P share, a value can be found at which the loop starts to oscillate.
  In our example, this happened at P = 2250 mA/K.
  Read the oscillation period at this value - for example, 5.58 sec.
  The critical gain and the critical oscillation period are found.

4. Program the MTD1020T with these values in order to trigger the calculation of the PID shares and the cycle time by the firmware:
   Program the critical gain to the found above value: "**G2250**"
   Program the critical oscillation period: "**O5580**"
5. The firmware calculates the parameters of the digital PID loop and applies them instantly. The calculated parameters can be read out using the following commands:
   "**P?**" "**[1350<LF>]**" -> P share = 1350 mA/K
   "**I?**" "**[483<LF>]**" -> I share = 483 mA/(K*sec)
   "**D?**" "**[941<LF>]**" -> D share = 941 (mA*sec)/K
   "**C?**" "**[88<LF>]**" -> Cycle time = 88 msec
6. Usually, at this point the PID optimization for the settling behavior is finished. If required, the PID values and the cycle time can be manually fine tuned in order to optimize the loop response to changes of the thermal load.
7. As a final step, save the settings to the non-volatile memory: "**M**"

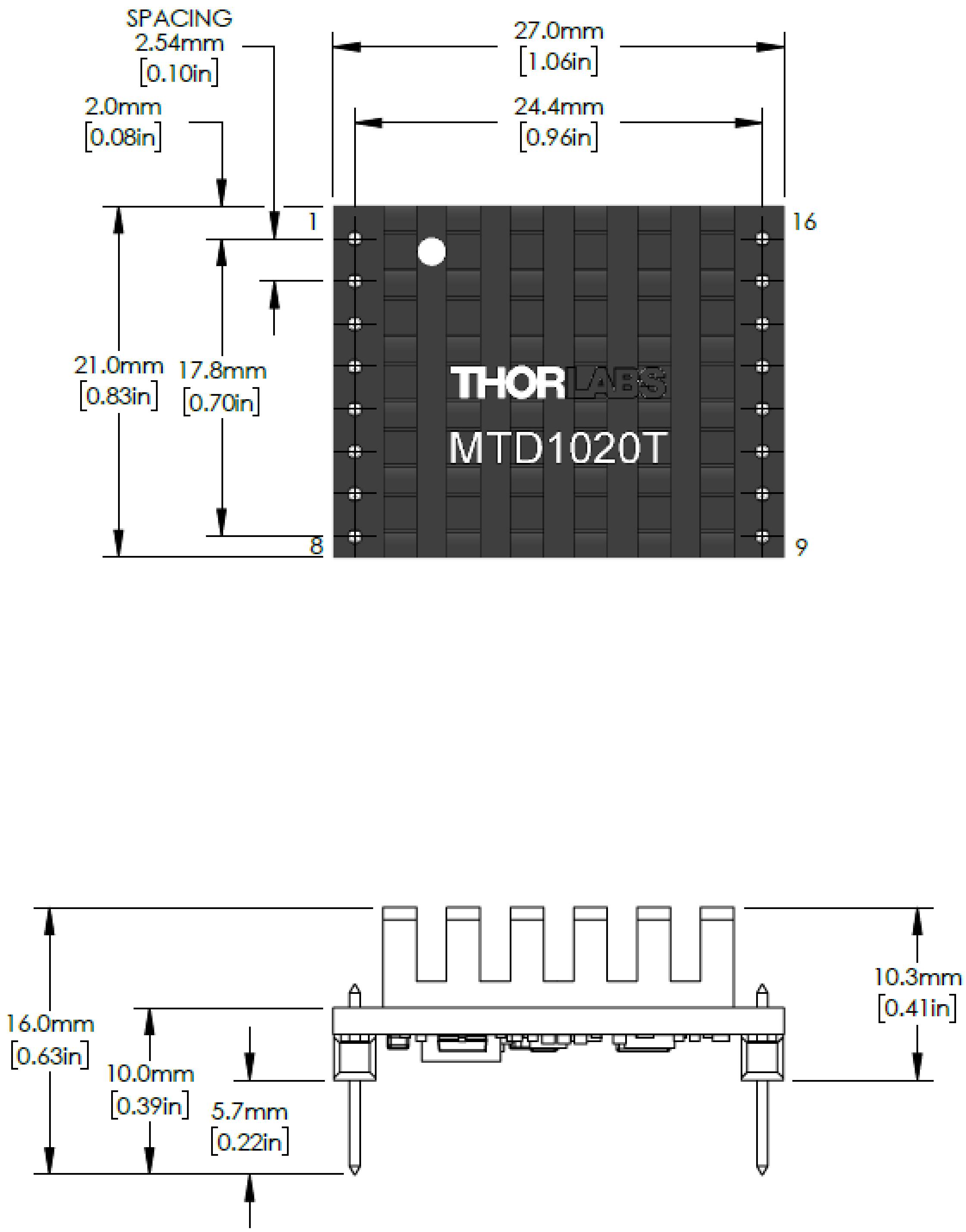
Notes

- The cycling time is the time base of the internal digital control loop and is calculated automatically by entering G (critical gain) and O (critical oscillation period).
- The optimized PID parameters are valid for a steady state that depends on the set temperature as well as on the ambient conditions (ambient temperature, temperature of the thermal drain side of the TEC). Any changes of the operating and/or environmental conditions may require a re-adjustment of the PID parameters.

8 Troubleshooting

If you experience any troubles with the MTD1020T , please contact Thorlabs.

9 Drawing



Drawing of MTD1020T

10 List of Acronyms

The following acronyms and abbreviations are used in this data sheet:

AC	Alternating Current
DC	Direct Current
GND	Ground
NTC	Negative Temperature Coefficient (thermistor)
PCB	Printed Circuit Board
SMT	Surface Mounted Technology
TEC	Thermoelectric cooler
UART	Universal Asynchronous Receiver Transmitter
WDM	Wavelength Division Multiplex
WDMA	Wavelength Division Multiple Access

11 Warranty

Thorlabs GmbH warrants material and production of the MTD1020T for a period of 24 months starting with the date of shipment. During this warranty period Thorlabs GmbH will see to defaults by repair or by exchange if these are entitled to warranty.

For warranty repairs or service the unit must be sent back to Thorlabs GmbH. The customer will carry the shipping costs to Thorlabs GmbH, in case of warranty repairs Thorlabs GmbH will carry the shipping costs back to the customer.

If no warranty repair is applicable the customer also has to carry the costs for back shipment.

In case of shipment from outside EU duties, taxes etc. which should arise have to be carried by the customer.

Thorlabs GmbH warrants the hard- and/or software determined by Thorlabs GmbH for this unit to operate fault-free provided that they are handled according to our requirements. However, Thorlabs GmbH does not warrant a fault free and uninterrupted operation of the unit, of the software or firmware for special applications nor this instruction manual to be error free. Thorlabs GmbH is not liable for consequential damages.

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The warranty mentioned before does not cover errors and defects being the result of improper treatment, software or interface not supplied by us, modification, misuse or operation outside the defined ambient stated by us or unauthorized maintenance.

Further claims will not be consented to and will not be acknowledged. Thorlabs GmbH does explicitly not warrant the usability or the economical use for certain cases of application.

Thorlabs GmbH reserves the right to change this instruction manual or the technical data of the described unit at any time.

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Under no circumstances can we guarantee that a particular objective can be achieved with the purchase of this product.

Insofar as permitted under statutory regulations, we assume no liability for direct damage, indirect damage or damages suffered by third parties resulting from the purchase of this product. In no event shall any liability exceed the purchase price of the product.

Please note that the content of this document is neither part of any previous or existing agreement, promise, representation or legal relationship, nor an alteration or amendment thereof. All obligations of Thorlabs GmbH result from the respective contract of sale, which also includes the complete and exclusively applicable warranty regulations. These contractual warranty regulations are neither extended nor limited by the information contained in this document. Should you require further information on this product, or encounter specific problems that are not discussed in sufficient detail in the document, please contact your local Thorlabs GmbH dealer or system installer.

13 Thorlabs 'End of Life' Policy

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs GmbH offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

This offer is valid for Thorlabs GmbH electrical and electronic equipment

- sold after August 13th 2005
- marked correspondingly with the crossed out “wheelie bin” logo (see figure below)
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated

As the WEEE directive applies to self contained operational electrical and electronic products, this “end of life” take back service does not refer to other Thorlabs GmbH products, such as

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- components
- mechanics and optics
- left over parts of units disassembled by the user (PCB’s, housings etc.).

Waste treatment on your own responsibility

If you do not return an “end of life” unit to Thorlabs GmbH, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

WEEE Number (Germany) : DE97581288

Ecological background

It is well known that waste treatment pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS Directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE Directive is to enforce the recycling of WEEE. A controlled recycling of end-of-life products will thereby avoid negative impacts on the environment.

Crossed out "Wheelie Bin" symbol

14 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.

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