

Licel PMT_TEC Datalogger

Licel GmbH

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1 Introduction

This Manual describes how to work with the temperature controller in Licel's *PMT_TEC Remote Control*. A *PMT_TEC Remote Control* integrates a PMT detector and a two stage Peltier cooler. The Peltier stages are driven by Meerstetter TEC controllers mounted inside Licel's PMT_TEC controller cassette. A PMT_TEC controller cassette is either equipped with two one-channel controllers TEC-1091 or one two-channel controller TEC-1161. The communication with the TEC controllers is achieved by using a Moxa NPort 5130 RS485 interface.

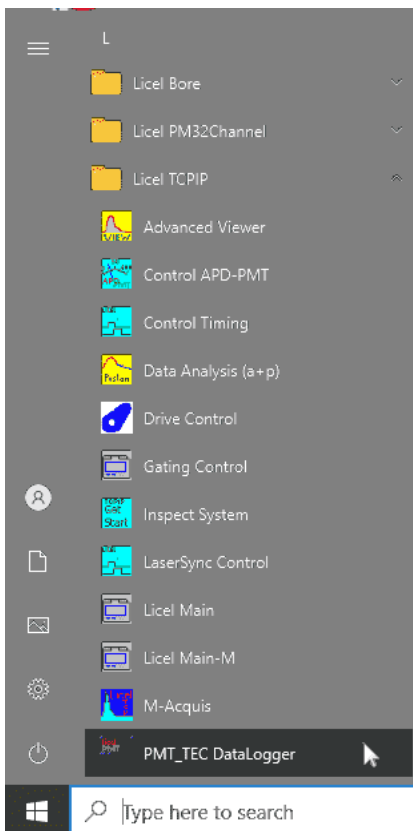
The *Licel PMT_TEC Datalogger* software package is used to monitor the Meerstetter TEC controllers the Moxa NPort 5130 controller using the TCP/IP protocol.

2 Software Installation

2.1 Windows Installer

The *Licel PMT_TEC Datalogger* software is part of the Licel TCP/IP Acquisition Windows installer and can be downloaded from https://licel.com/soft_man.html using the link of the [current TCP/IP Windows installer version](#). The Windows installer is used to install a bundle of Licel's TCP/IP acquisition software (like *TCPIP Acquis*, *Control APD-PMT*, ...), since January 203 *PMT_TEC Datalogger.exe* is installed, as well.

Please follow the instructions in [Licel's Ethernet manual](#) to install the software together with the *Licel PMT_TEC Datalogger*.



Once the installation has completed you will find a link to open the *Licel PMT_TEC Datalogger* in the Windows start menu as seen on the left.

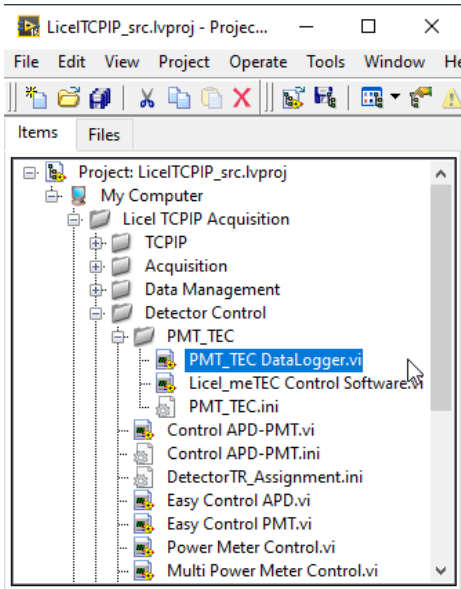
2.2 LabVIEW sources

There are 2 ways to get Licel's LabVIEW sources of the *Licel PMT_TEC Datalogger*:

2.2.1 As part of the Licel TCP/IP Acquisition LabVIEW Sources

The *Licel PMT_TEC Datalogger* is part of the Licel TCP/IP Acquisition LabVIEW Sources. They can be downloaded from https://licel.com/soft_man.html using the link of [the current TCP/IP LabVIEW sources version](#).

Please follow the instructions in [Licel's Ethernet manual](#) to install the LabVIEW sources together with the *Licel PMT_TEC Datalogger* sources.

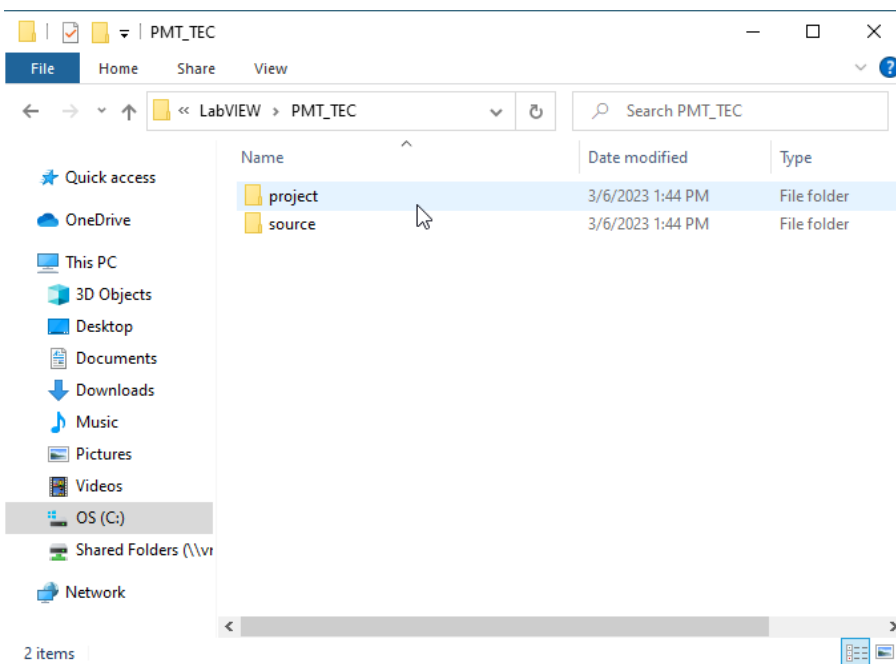


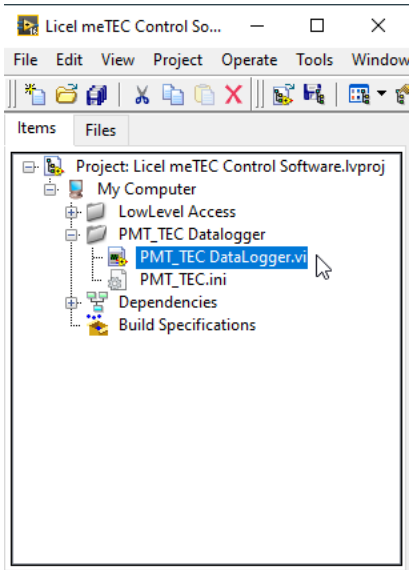
Once you are done with copying the sources to a target directory of your choice, open the LabVIEW project `LicelTCPIP_src.lvproj` in the sub folder `project`. Open the *Licel PMT_TEC Datalogger* by navigating to the corresponding entry *Licel PMT_TEC Datalogger.vi* and doubly clicking it.

2.2.2 As Stand-Alone Sources

The *Licel PMT_TEC Datalogger* may be delivered as stand-alone LabVIEW sources (i.e. without the complete Licel TCP/IP software sources) on request for customers who have their own LabVIEW software and do not need Licel's complete LabVIEW sources.

In that case you will get a zip file with two directories inside. Please copy the zip file's content to a directory of your choice, in this example we use `c:\LabVIEW\PMT_TEC\`:





Please open the LabVIEW project `project\Licel meTEC Control Software.lvproj` and navigate to the entry `PMT_TEC Datalogger.vi`, open the VI by doubly clicking the entry.

2.2.3 Considerations while using LabVIEW sources

Please care for the following hints when working with the LabVIEW sources:

1. Always work with a LabVIEW project. Add your main VIs to the `My Computer` section (or in a sub folder).
2. Do not make private copies of LabVIEW's system VIs, i.e. do not copy VIs from the LabVIEW installation directory to a different place. E.g. keep the `Simple Error Handler` at the location in the file system where it was placed by the LabVIEW installer.
3. When merging Licel's *PMT_TEC Standalone* software with other Licel VIs, keep the directory structure alive: copy LabVIEW projects to the sub folder `project` and copy other source files to the sub folder `source` while keeping the subdirectory structure unchanged.

2.3 Integration in Licel Main

Licel Main is part of the [Licel TCPIP Acquisition software for Windows](#) and of the [Licel TCP/IP Acquisition LabVIEW Sources](#). *Licel Main* is configurable by modifying its initialization file. By this means it is possible to integrate the *PMT_TEC Datalogger* into one of the tab pages in *Licel Main*. Please refer to our *Installation and Reference Manual* (https://licel.com/manuals/ethernet_pmt_tr.pdf#chapter.7). The *PMT_TEC Datalogger* can easily be integrated by adding the following text to the initialization file `Licel Main.ini`:

```
[Module<number>]
Active = TRUE
Path = PMT_TEC DataLogger.vi
Name = TEC Control
IndependentTCPIP = TRUE
```

The number in `[Module<number>]` must not be used by other software modules. The TCP/IP address has to be entered as described below, *PMT_TEC Datalogger* will handle the TCP/IP connection independently of *Licel Main*.

3 Setting up the Network

The *PMT_TEC Datalogger* software communicates with the TEC controllers via the Moxa RS485 interface using the TCP/IP protocol. For this the IP address of the Moxa controller has to be set so that it can be accessed from the PC. Then the datalogger software is able to monitor and control the TEC controllers.

The factory default IP address of the Moxa RS485 interface is 192.168.127.154. Licel may have set the IP address to a different one, please refer to the delivery documentation of the *PMT_TEC Remote Control*.

The final IP address should be set into the same address range of the PC. That is. The first three numbers in the IP address should be the same as in the IP address of the PC, and the fourth number must be different. Furthermore the IP address of the Moxa RS485 interface must be different from the one of the PMT remote control and of all other Licel controllers in use (and in general unique in your local network). In Licel's Ethernet manual you will find more information about setting the IP address of the PC and the PMT remote control (https://licel.com/manuals/ethernet_pmt_tr.pdf#Network.SETUP). In the following subsections we will assume that the PC has the IP address 10.49.234.230 and that the Moxa's IP address should be set to 10.49.234.240.

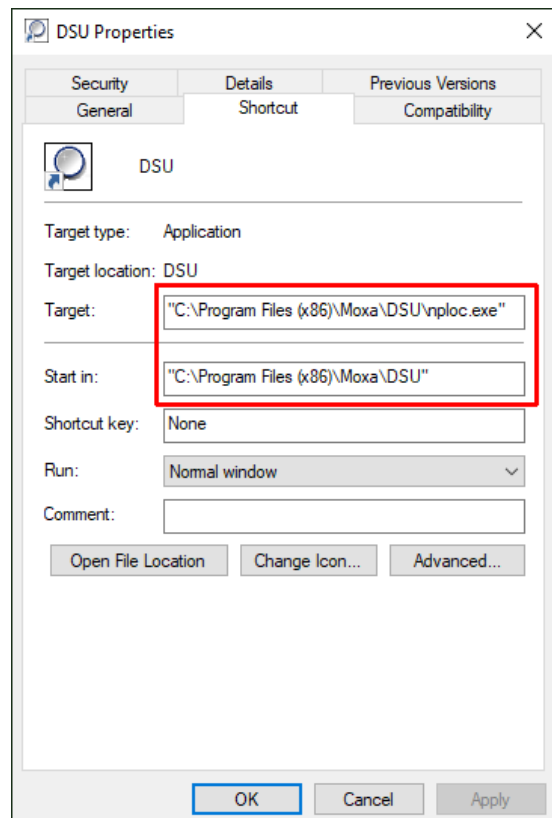
3.1 Change to IP address with the DSU utility

1. Install the moxa Device Search Utility (DSU) on your PC. Find the installer on the Licel CD in the folder `PMT_TEC_Config\MoxaDeviceSearchUtility`, run `dsu_setup_VerV.V_Build_dddddddd.exe` to install the DSU utility (V.V is a version number, dddddddd contains a date and build number).

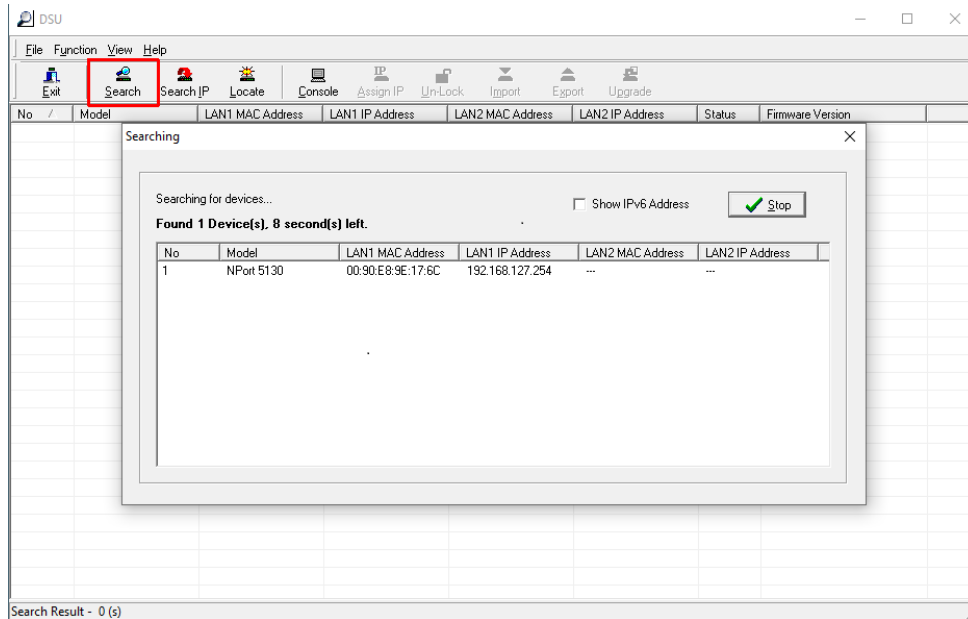
Start the DSU by clicking the desktop icon or by running `nploc.exe` from it's installation directory.



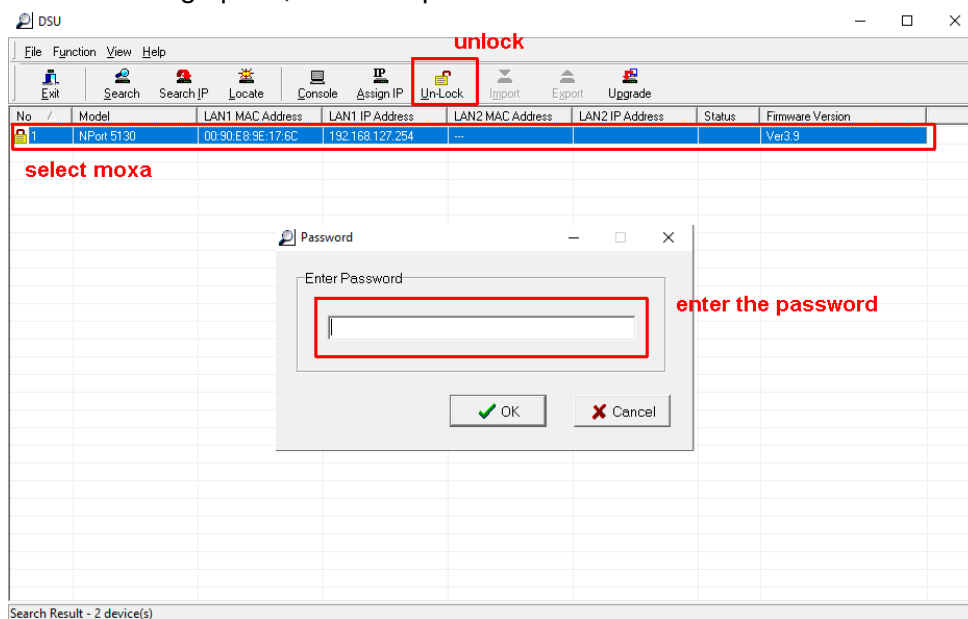
- 2.



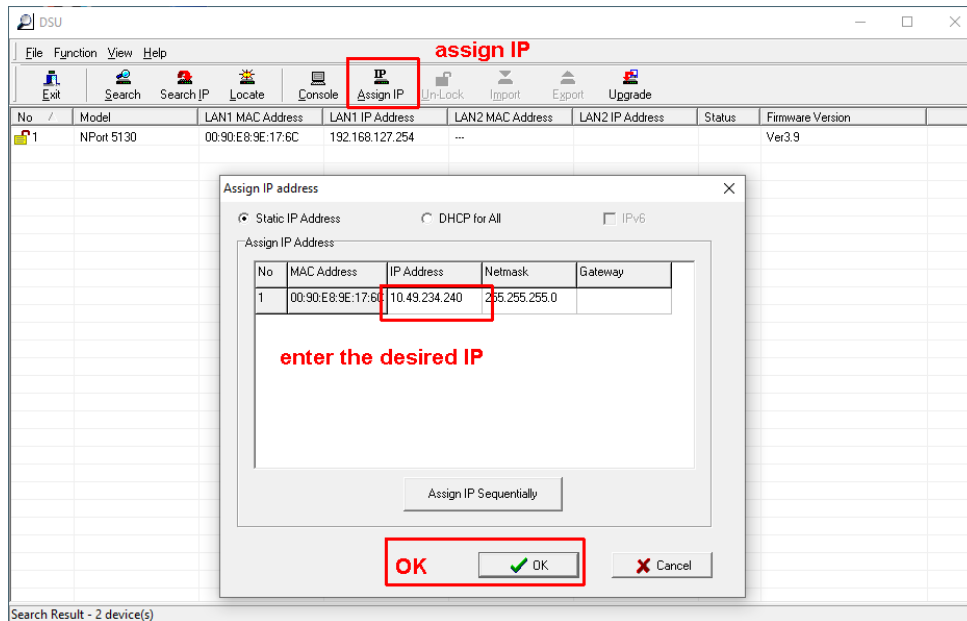
3. Click on *Search*, an extra progress window opens temporarily (and closes automatically).



4. Now select the line with the found Moxa.
5. The button *Unlock* will be available now, click it.
6. A further dialog opens, enter the password `moxa`.



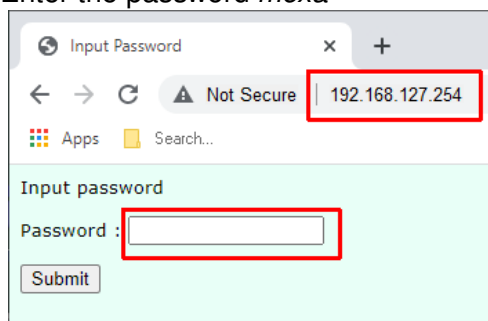
7. Select again the line with the found moxa.
8. The button *Assign IP* will be available now, click it.
9. A dialog opens, enter the desired moxa IP address which you are able to access.
10. Confirm by pressing *OK*.



3.2 Change to IP address By Browser Access

Once you have set the IP address using the DSU utility or you already know the Moxa's IP address you may access the moxa settings using your browser (Firefox, Chrome, ...):

1. Open your browser and enter the IP address into the URL field or double-click the corresponding line in the DSU search utility
2. Enter the password *moxa*



3. The network settings (except the IP address) should be like in the following screenshot,

MOXA www.moxa.com

Main Menu

- Overview
- Basic Settings
- Network Settings**
- Serial Settings
- Operating Settings
- Accessible IP Settings
- Auto Warning Settings
- Monitor
- Change Password
- Load Factory Default
- Save/Restart

Network Settings

IP address: 192.169.127.254

Netmask: 255.255.255.0

Gateway:

IP configuration: Static

DNS server 1:

DNS server 2:

SNMP Setting

SNMP: Enable Disable

Community name: (max: 31 characters)

Contact:

Location:

IP Address report

Auto report to IP:

Auto report to UDP port: 4002

Auto report period: 10 seconds

Submit

4. the serial settings like this (do not change at a working system!)

MOXA www.moxa.com

Main Menu

- Overview
- Basic Settings
- Network Settings
- Serial Settings**
- Operating Settings
- Accessible IP Settings
- Auto Warning Settings
- Monitor
- Change Password
- Load Factory Default
- Save/Restart

Serial Settings

Port 01

Port alias:

Serial Parameters

Baud rate: 57600

Data bits: 8

Stop bits: 1

Parity: None

Flow control: None

FIFO: Enable Disable

Interface: RS-485 2-Wire

Submit

5. and the operating settings like in the next picture (do not change at a working system!).

MOXA www.moxa.com

Main Menu

- Overview
- Basic Settings
- Network Settings
- Serial Settings
- Operating Settings**
- Accessible IP Settings
- Auto Warning Settings
- Monitor
- Change Password
- Load Factory Default
- Save/Restart

Operating Settings

Port 01

Operation mode: TCP Server Mode

TCP alive check time: 7 (0 - 99 min)

Inactivity time: 6000 (0 - 65535 ms)

Max connection: 1

Ignore jammed IP: No Yes

Allow driver control: No Yes

Data Packing

Packing length: 0 (0 - 1024)

Delimiter 1: d (Hex) Enable

Delimiter 2: 0 (Hex) Enable

Delimiter process: Do Nothing (Processed only when Packing length is 0)

Force transmit: 0 (0 - 65535 ms)

TCP Server Mode

Local TCP port: 50000

Command port: 966

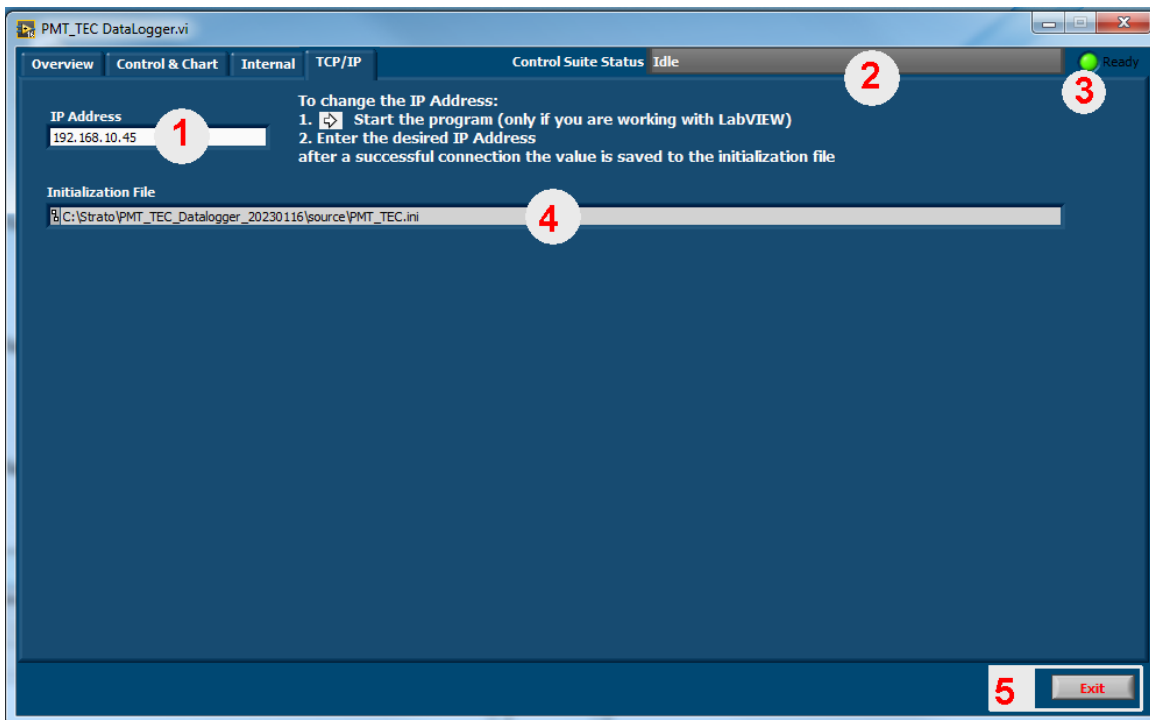
Submit

4 PMT_TEC Datalogger

As described above the *PMT_TEC Datalogger* is started by using the corresponding entry in the Windows start menu or by doubly clicking the item *PMT_TEC Datalogger.vi* in the LabVIEW project explorer.

4.1 Connecting to the Moxa controller

Once you have started the *PMT_TEC Datalogger* switch to tab page *TCPIP*.



1. Change the *IP Address* (1) if there is no connection yet. After a successful TCP/IP connection the value will be saved to the initialization file:

```
[TCPIP]
UseValues = TRUE
IPAddress = "192.168.127.254"
Port = 2055
```

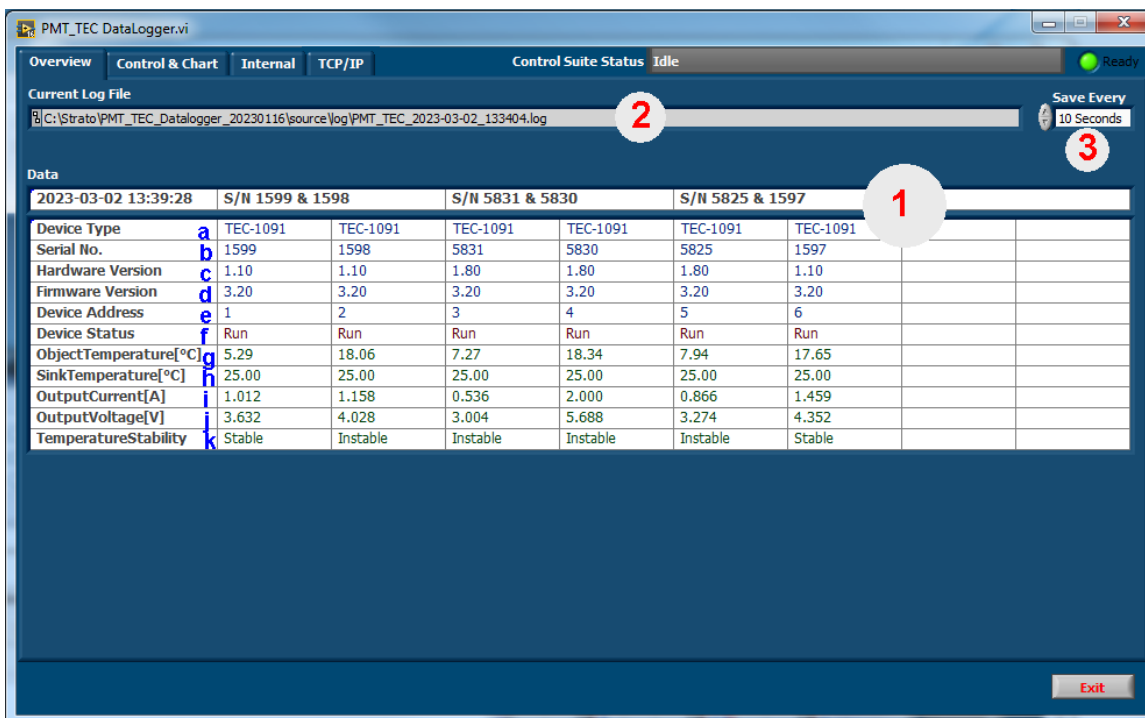
Here, the IP address equals the default address of the Moxa controller. Please note that the port value in the initialization file can be ignored.

2. Watch the *Control Suite Status* (2): it should change to *Idle* if the connection could be established and PMT_TEC controllers have been found.
3. Then the *Ready* LED (3) lights green.
4. The path of the *Initialization File* (4) is displayed below.
5. By clicking on *Exit* (5) the program stops, when running as a Windows application the program window will be closed.

The *Exit button*, the *Control Suite Status* indicator, and the *Ready* LED are accessible from all tab pages described below.

4.2 Overview

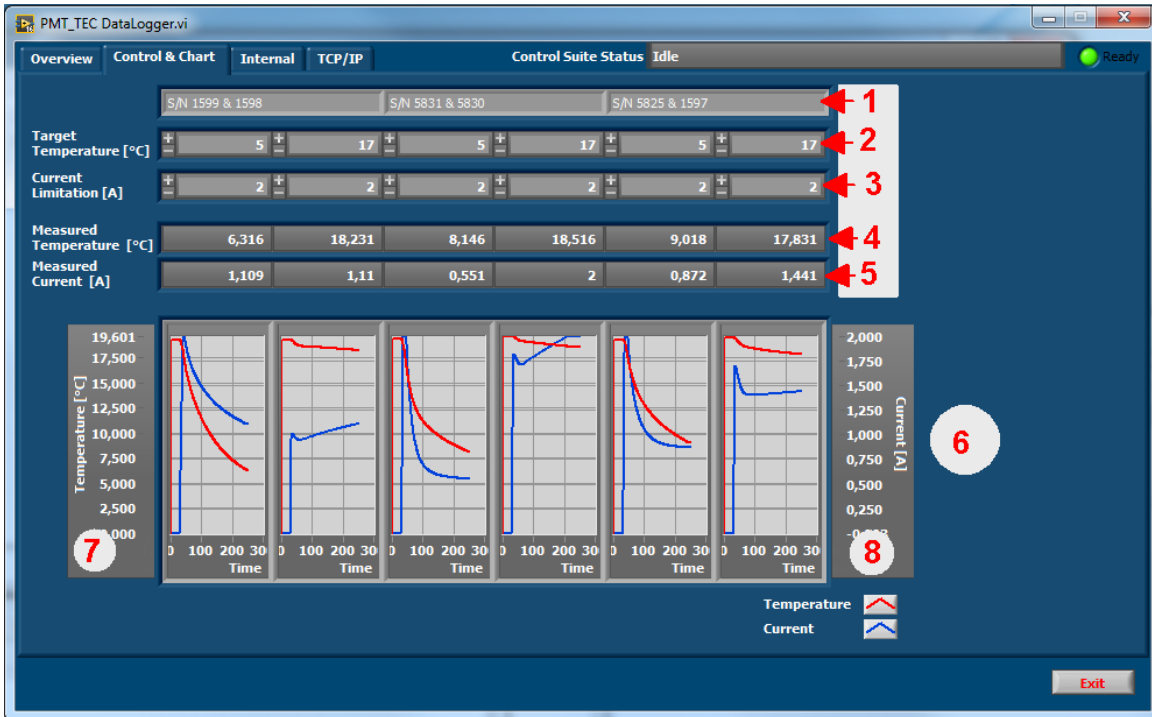
On the *Overview* page you will get an overview on all connected PMT_TEC controllers.



- In the *Data* table (1) certain controller information and values are displayed. The header line shows the date and time followed by the labels of the PMT_TEC cassettes. Note that each cassette contains either two PMT_TEC controllers *TEC-1091* or one two-channel PMT_TEC controller *TEC-1161* to achieve the two-stage cooling at a PMT detector. The following content is available in the table lines:
 - The *Device Types* (ether *TEC-1091* or *TEC-1161*) of the individual PMET_TEC controllers.
 - The serial numbers of the individual PMET_TEC controllers (*Serial No.*).
 - The *Hardware Versions* of the individual PMET_TEC controller.
 - The *Firmware Versions* of the individual PMET_TEC controller.
 - The *Device Addresses* of the individual PMET_TEC controller.
 - The *Device Status* is updated while the system is running. It should show *Run* in operation.
 - The *Object Temperatures*,
 - the *Sink Temperatures*,
 - the *Output Currents*,
 - the *Output Voltages*, and
 - the *Temperature Stability* status are displayed in the bottom part of the table and are frequently updated.
- The table *Data* is frequently written to the *Current Log File* (2). The log file format is described in the appendix [below](#).
- The write interval in seconds can be chosen (*Save Every* (3))

4.3 Control & Chart

On the *Control & Chart* page you will see the current values of the currents and temperatures in a graphic display.



← 1 The line corresponds to the [header line of the table](#).

← 2 Here, the *Target Temperatures* are displayed,

← 3 followed by the *Current Limitations*.

← 4 Finally, here the *Measured Temperatures* are displayed,

← 5 followed by the *Measured Currents*.

The *Measured Temperatures* (red) and the *Measured Currents* (blue) are displayed in graphic charts (8), as well. The scales on the left (7) and on the right (6) correspond to the temperatures and currents, respectively.

4.4 Internal

On the *Internal* tab page low level information about the hardware and the acquired data can be seen. This page is for service purposes and should only be used on request of a Licel service engineer.

The screenshot displays the PMT_TEC Datalogger software interface. The window title is "PMT_TEC DataLogger.vi" and the status bar shows "Control Suite Status Idle" and a "Ready" indicator.

The interface is divided into several sections:

- DeviceInfo:** A table showing details for three TEC-1091 devices.

Device Type	Device Type	Device Type
TEC-1091	TEC-1091	TEC-1091
Serial No.	Serial No.	Serial No.
1599	1598	5831
Hardware Version	Hardware Version	Hardware Version
1.10	1.10	1.80
Firmware Version	Firmware Version	Firmware Version
3.20	3.20	3.20
NumChannels	NumChannels	NumChannels
1	1	1
DeviceAddress	DeviceAddress	DeviceAddress
1	2	3
- ChannelData:** A table showing real-time data for three channels.

Object Temperature[°C]	Object Temperature[°C]	Object Temperature[°C]
4,997	17,989	6,970
Sink Temperature[°C]	Sink Temperature[°C]	Sink Temperature[°C]
25,000	25,000	25,000
Output Current[A]	Output Current[A]	Output Current[A]
0,978	1,177	0,532
Output Voltage[V]	Output Voltage[V]	Output Voltage[V]
3,591	4,081	2,997
Temperature Stability	Temperature Stability	Temperature Stability
Is stable	Is not stable	Is not stable
Device Index	Device Index	Device Index
0	1	2
Channel Number	Channel Number	Channel Number
1	1	1
- DeviceStatus:** A table showing the operational status of the three devices.

Device Status	Device Status	Device Status
Run	Run	Run
Error No.	Error No.	Error No.
0	0	0
Error Instance	Error Instance	Error Instance
0	0	0
Error Parameter	Error Parameter	Error Parameter
0	0	0

Additional controls and indicators include a "Meerstetter Low Level" button, a "Reset" button, and an "Exit" button in the bottom right corner.

Appendix A Log file format

The acquired data is logged to tab separated ASCII files. The files may easily be opened by other applications e.g. Libre Office or MS Excel.

The first four table lines **1a** – **1e** appear in the log file at the top position. Each column corresponds to a PMT_TEC channel.

The next line corresponds to the [header line of the table](#).

The following part is introduced by a line containing the column header `Date Time` and for each PMT_TEC channel the header entries

`Device Status, Object Temperature, Sink Temperature, Output Current, Output Voltage, and Temperature Stability.`

Then the updated data is written to the file according to the column headers.

The following example shows a log file for a single PMT_TEC cassette equipped with two PMT_TEC controllers TEC-1091. The first lines could be like:

```

Device Type      TEC-1091  TEC-1091
Serial No.       1799      1798
Hardware Version 1.10      1.10
Firmware Version 3.20      3.20
Device Address   1          2
    
```

... followed by ...

```

TEC-1091 (Serial 1799 Address 1) CH1
Date Time      Device Status  ObjectTemperature[°C]  SinkTemperature[°C]  OutputCurrent [A]  OutputVoltage[V]  TemperatureStability
2023-03-02 14:13:47  Run           5.294000              25.000000           1.012000           3.632000           Stable
2023-03-02 14:13:57  Run           5.284000              25.000000           1.012000           3.632000           Stable
2023-03-02 14:14:07  Run           5.282000              25.000000           1.012000           3.632000           Stable
2023-03-02 14:14:17  Run           5.279000              25.000000           1.011000           3.632000           Stable
2023-03-02 14:14:27  Run           5.280000              25.000000           1.012000           3.632000           Stable
    
```

... followed by the next columns on the right ...

```

TEC-1091 (Serial 1798 Address 2) CH2
Date Time      Device Status  ObjectTemperature[°C]  SinkTemperature[°C]  OutputCurrent [A]  OutputVoltage[V]  TemperatureStability
Run           5.294000              25.000000           1.012000           3.632000           Stable
Run           5.284000              18.060000           1.152000           4.028000           Instable
Run           5.282000              18.060000           1.158000           4.028000           Instable
Run           5.279000              18.070000           1.151000           4.028000           Instable
Run           5.280000              18.060000           1.152000           4.028000           Instable
    
```

Appendix B Monitoring and Controlling *PMT_TEC Control*

In this section the TCP/IP API for controlling the *PMT_TEC Control* software from outside is described. You may write a client for the TCP/IP API using any programming language which supports TCP/IP socket handling.

The API interface is similar to that described in the Installation and Reference Manual https://licel.com/manuals/ethernet_pmt_tr.pdf#section.9.5.

B.1 PMT_TEC Control

TCP/IP Server

The basic functions of the *PMT_TEC Control* software can be accessed from third party applications via TCP/IP. For this *PMT_TEC Control* implements a TCP/IP server listening on a defineable port. To activate the TCP/IP server the following initialization file keys in `PMT_TEC.ini` have to be aligned:

```
[TCPIP_API]
Active = TRUE
Port = 2088
```

If `Active` is set `TRUE` a listener will be started using the specified TCP/IP port (`Port = 2088`). If *PMT_TEC Control* is run within a sub panel of *Licel Main* (itself running a TCP/IP API server) and the key `TCPIP_API = TRUE` is set in the Module section of `Licel Main.ini`,

```
[Module0]
Active = TRUE
Path = PMT_TEC Control.vi
...
TCPIP_API = TRUE
```

the TCP/IP server of *PMT_TEC Control* is accessed automatically via *Licel Main* using a generated listener port. Whenever *Licel Main* receives an unknown TCP/IP API command while the active tab page contains *PMT_TEC Control*, the command is passed through to the *PMT_TEC Control* TCP/IP API server and handled there.

Command List

The following list contains the supported commands. The commands must be sent with an additional `<CRLF>` (0x0D0A) and the responses will end with a `<CRLF>`, as well.

- `PMT_TEC: VER?`
 - Parameters*
 - Description* Return the version number as displayed in the Windows title bar
 - Reply* VER <version>
- `PMT_TEC: STATUS?`
 - Parameters*
 - Description* Return the status of the *PMT_TEC Control* software.
 - Reply* STATUS READY=<0|>1. READY=0|1 indicates whether or not the software is completely initialized and the communication to the TEC devices is established (1) or not (0). Other commands should not be send when the STATUS has not yet respondet with Ready=1.
- `PMT_TEC: NUMTEC?`
 - Parameters*
 - Description* Return the number `numChannels` of the available TEC channels.
 - Reply* PMT_TEC: NUMTEC <numChannels>

- **PMT-TEC: TECSTATUS?**
 - Parameters* <chIndex>
 - Description* Return status information about the TEC channel at the index *chIndex*.
 - Reply* PMT-TEC: STATUS <deviceStatus> <enabled>
<temperatureStability> <setTemp> <currentLimit>
where *deviceStatus* is the device status of the TEC controller the channel belongs to. It can either be *Initializing*, *Ready*, *Run*, *Error*, *Bootloader*, or *Reset in Progress*. *enabled* can either be *0* (disabled) or *1* (enabled). The *temperatureStability* is *Inactive*, *Instable*, or *Stable*. The target temperature and the current limit of the channel are returned in *setTemp* and *currentLimit*, respectively.
- **PMT-TEC: SETTEMP**
 - Parameters* <chIndex> <setTemp>
 - Description* Set the target temperature of the channel at the index *chIndex* to *setTemp* degree Celsius.
 - Reply* PMT-TEC: SETTEMP executed
- **PMT-TEC: SETCURRENTLIMIT**
 - Parameters* <chIndex> <currentLimit>
 - Description* Set the target current limit of the channel at the index *chIndex* to *currentLimit* Amperes.
 - Reply* PMT-TEC: SETCURRENTLIMIT executed
- **PMT-TEC: TEMP?**
 - Parameters*
 - Description* Request the current temperatures of all channels.
 - Reply* PMT-TEC: TEMP <valueList> where *valueList* as a <SPACE>-separated list of temperatures in degree Celsius in %f format.
- **PMT-TEC: CURRENT?**
 - Parameters*
 - Description* Request the actual currents of all channels.
 - Reply* PMT-TEC: CURRENT <valueList> where *valueList* as a <SPACE>-separated list of currents in Amperes in %f format.
- **PMT: QUIT**
 - Parameters*
 - Description* exit the program, allowed only when the following key in *Control APD-PMT.ini* is set:
[TCPIP_API]
...
AllowQUIT = TRUE
and *Control APD-PM* is *not* run within *Licel Main*
 - Reply* PMT: QUIT executed or PMT: QUIT ERROR not allowed