VIGO SYSTEM S.A.

PTCC-01-ADV

Programmable ”SMART” TEC Controller
user's guide

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Warranty

VIGO System S.A. hereby represents and warrants all Products manufactured by VIGO and sold hereunder to be free from defects in workmanship or material during a period of twelve (12) months from the date of delivery save for products for which a special warranty is given. If any Product proves however to be defective in workmanship or material within the period herein provided VIGO System undertakes to the exclusion of any other remedy to repair or at its own option replace the defective Product or part thereof free of charge and otherwise on the same conditions as for the original Product or part without extension to original warranty time. Defective parts replaced in accordance with this clause shall be placed at the disposal of VIGO.

VIGO also warrants the quality of all repair and service works performed by its employees to products sold by it. In case the repair or service works should appear inadequate or faulty and should this cause malfunction or nonfunctioning of the product to which the service was performed VIGO shall at its free option either repair or have repaired or replace the product in question. The working hours used by employees of VIGO for such repair or replacement shall be free of charge to the client. This service warranty shall be valid for a period of six (6) months from the date the service measures were completed.

This warranty is however subject to following conditions:

- a substantiated written claim as to any alleged defects shall have been received by VIGO System within thirty (30) days after the defect or fault became known or occurred,
  and
- the allegedly defective Product or part shall, should VIGO so require, be sent to the works of VIGO or to such other place as VIGO may indicate in writing, freight and insurance prepaid, properly packed and labeled.

This warranty does not however apply when the defect has been caused through

1. normal wear and tear or accident;
2. misuse or other unsuitable or unauthorized use of the Product or negligence or error in storing, maintaining or in handling the Product or any equipment thereof;
3. wrong installation, assembly or failure to service the Product or otherwise follow VIGO's service instructions including any repairs or installation or assembly or service made by unauthorized personnel not approved by VIGO or replacements with parts not manufactured or supplied by VIGO;
4. modifications or changes of the Product as well as any adding to it without VIGO's prior authorization;
5. burned active element by irradiation above damage thresholds;
6. electrostatic discharges;
7. improper detector bias;
8. improper TE cooler bias (TE cooler damage or active element overheating);
9. other factors dependent on the Customer or a third party.

Notwithstanding the aforesaid VIGO System liability under this clause shall not apply to any defects arising out of materials, designs or instructions provided by the Customer.

This warranty is expressly in lieu of and excludes all other conditions, warranties and liabilities, expressed or implied, whether under law, statute or otherwise, including without limitation any implied warranties of merchantability or fitness for a particular purpose and all other obligations and liabilities of VIGO or its representatives with respect to any defect or deficiency applicable to or resulting directly or indirectly from the Products supplied hereunder, which obligations and liabilities are hereby expressly canceled and waived. VIGO's liability shall under no circumstances exceed the invoice price of any Product for which a warranty claim is made, nor shall VIGO in any circumstances be liable for lost profits or other consequential loss whether direct or indirect or for special damage.

RMA Request Instructions:

- No Product may be returned without first contacting VIGO for a Return Material Authorization ('RMA') number.
- Please obtain a RMA number from VIGO Support Team before returning any item. When requesting a RMA number, please state your order number, the product you wish to return and the reason for return. We will only accept returns which have an RMA number. Authorized returns are to be shipped according to received instruction from VIGO in appropriate shipping box. An unauthorized return, i.e. one for which an RMA number has not been issued and authorized returns however, shipped with incorrect customs documents - will not be accepted.
- Please print the RMA number clearly on the return label to avoid any delay in processing. Please send package to:

VIGO System S.A.
Sales Office, Building B
129/133 Poznanska St.
05-850 Ozarow Mazowiecki
POLAND

1. Description

PTCC-01-ADV is the programmable, precision, low noise, thermoelectric cooler controller designed to operate with VIGO IR detection modules. It is compatible with both classic (BIP, MIP, SIP, FIP) and new, programmable PIP preamplifiers, integrated with IR detectors.

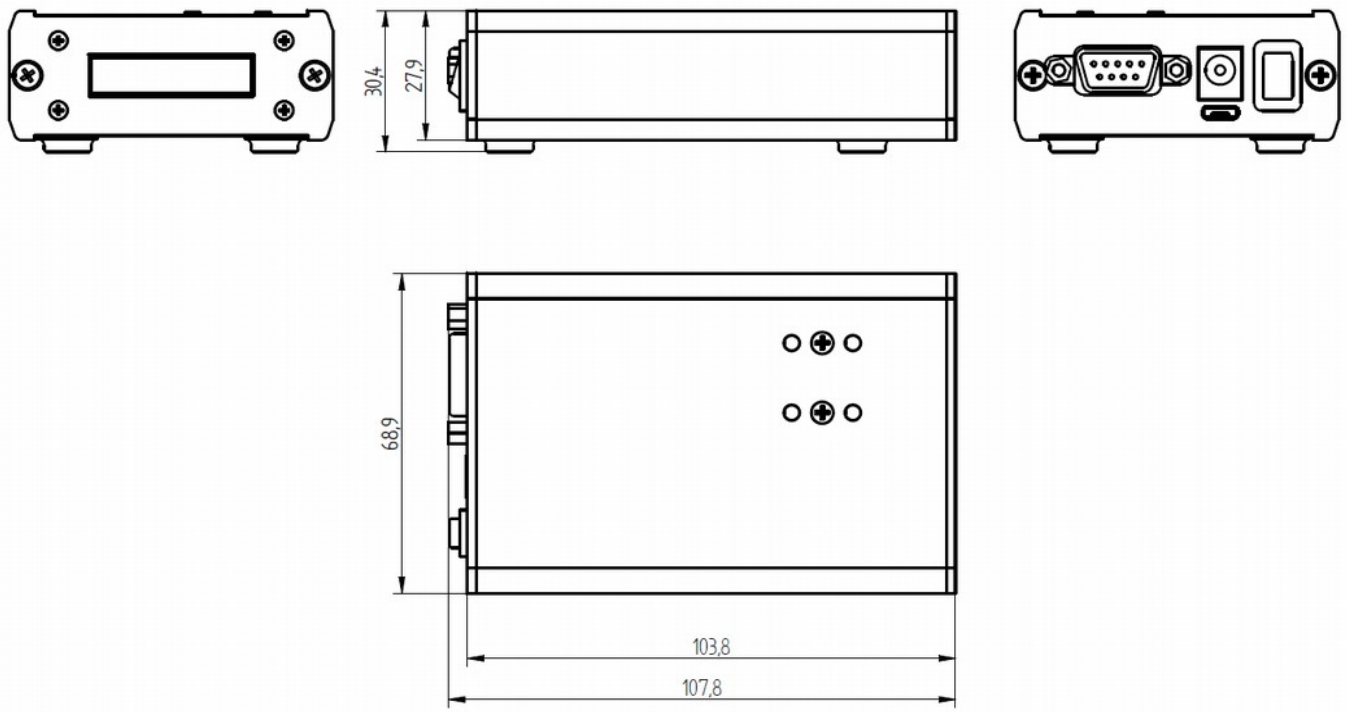
2. Features

- Low cost
- Easy to use
- Very small size
- Low power consumption
- High stability and precision
- Compatible with with 2-, 3- and 4-stage TE cooled detectors
- Compatible with every variant of programmable preamplifier PIP user can swap the modules and controllers
- Modern architecture with digitally performed PID temperature control
- Current, voltage and temperature monitor available with PC program
- Overcurrent, overvoltage and overheating protection
- Split grounds and filtering for EMC improvement
- Firmware upgrade option available
- Provides proper detector cooling
- Preamplifier supply included

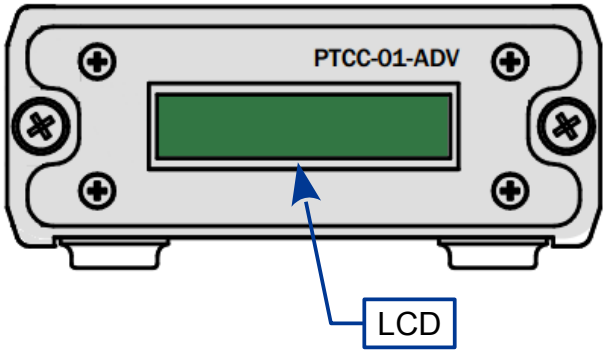
3. PTCC-01-ADV Physical Description

This chapter describes physical look of **PTTC-01-ADV**, like dimensions, location of ports, location of keys, etc.

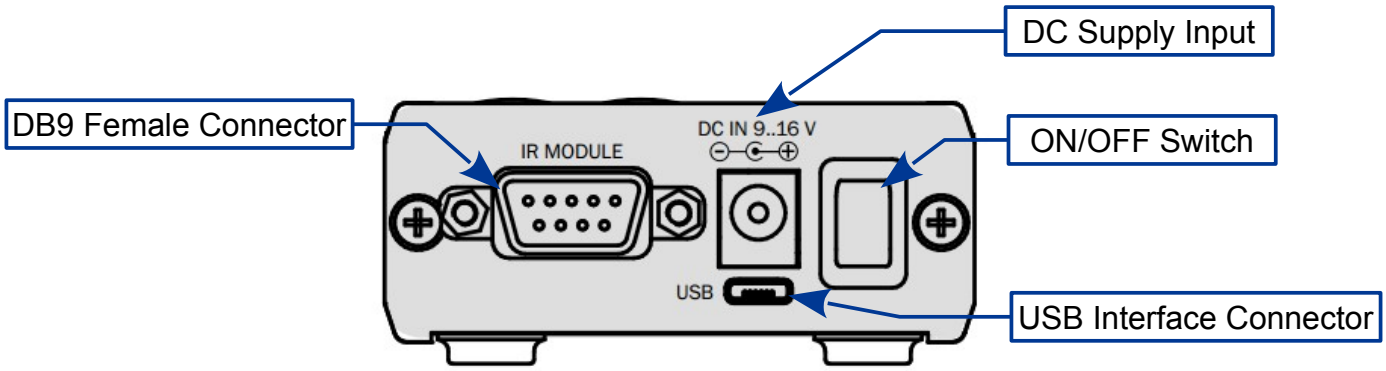
3.1. Physical Dimensions [mm]



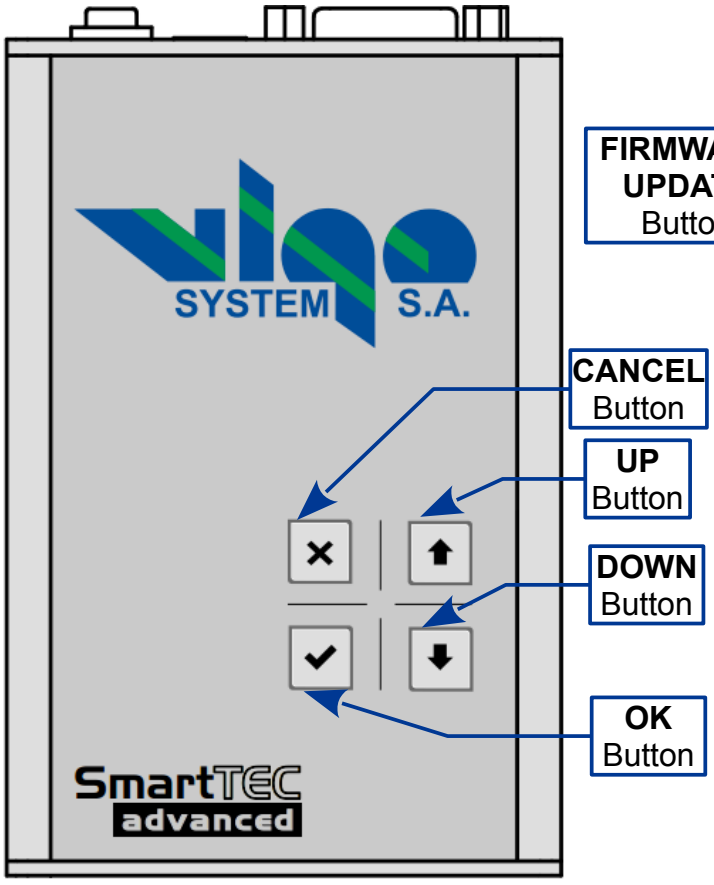
3.2. The Front Panel at a Glance



3.3. The Back Panel at a Glance



3.4. The Top Panel (Keyboard) at a Glance



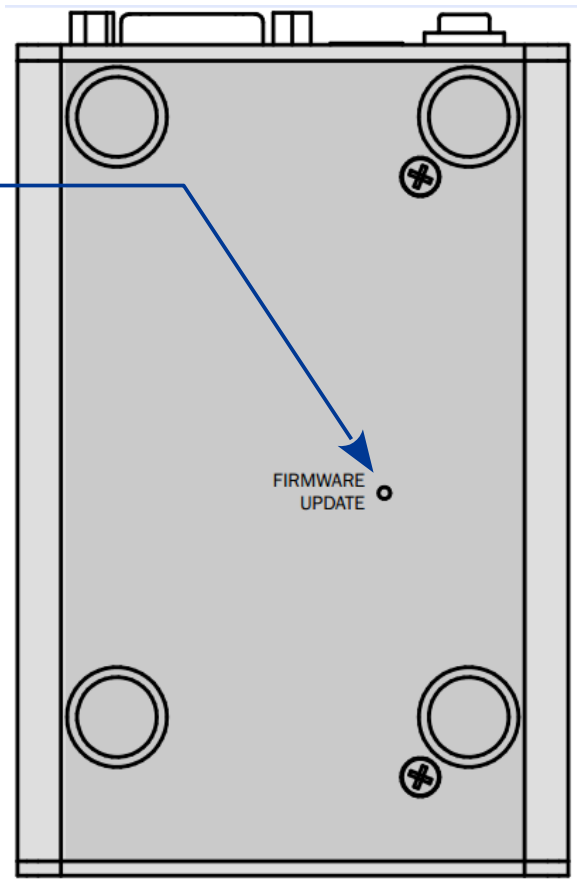
CANCEL Button

UP Button

DOWN Button

OK Button

3.5. The Bottom Panel at a Glance



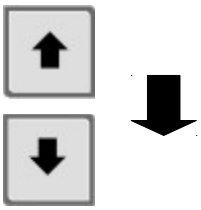
FIRMWARE UPDATE Button

4. PTCC-01-ADV Theory of Operation

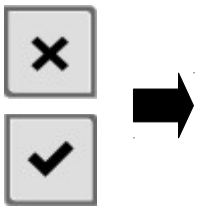
1. When the power supply is applied and IR detection KIT is turned on, **PTCC** probes the type of the connected IR detection module. When **PIPDC** or module containing internal 1-wire memory is found, the settings are downloaded, and, following the user settings, the hardware is set. If the **PTCC** cannot find any of the said above module types, and it is compatible with IR detection module with no memory, the **PTCC** internal settings are applied instead. If **PTCC** is not compatible with "no memory" modules, it indicates an error and finishes the operation.
2. If no error occurs, the detector is then being cooled down. It usually takes around 30 seconds until the valid detector temperature is reached, the power supply for the IR module is being turned on afterwards, and the module is ready to operate.
3. The controller instantly probes the in-circuit currents and voltages. If any abnormal behavior is recognized (meaning short or open circuit on the supply, TEC or thermistor lines, or the **PTCC** is unable to reach the set temperature of the detector within 2 minutes) the supply is being turned off and the error is indicated.
4. User can check the conditions of operation of the module and the controller using the user interface (the simplified keyboard and the LCD) or the PC and the software, which is available on the VIGO website:
http://www.vigo.com.pl/pub/File/download/SmartManager-setup.exe

5. PTCC-01-ADV Menu Structure

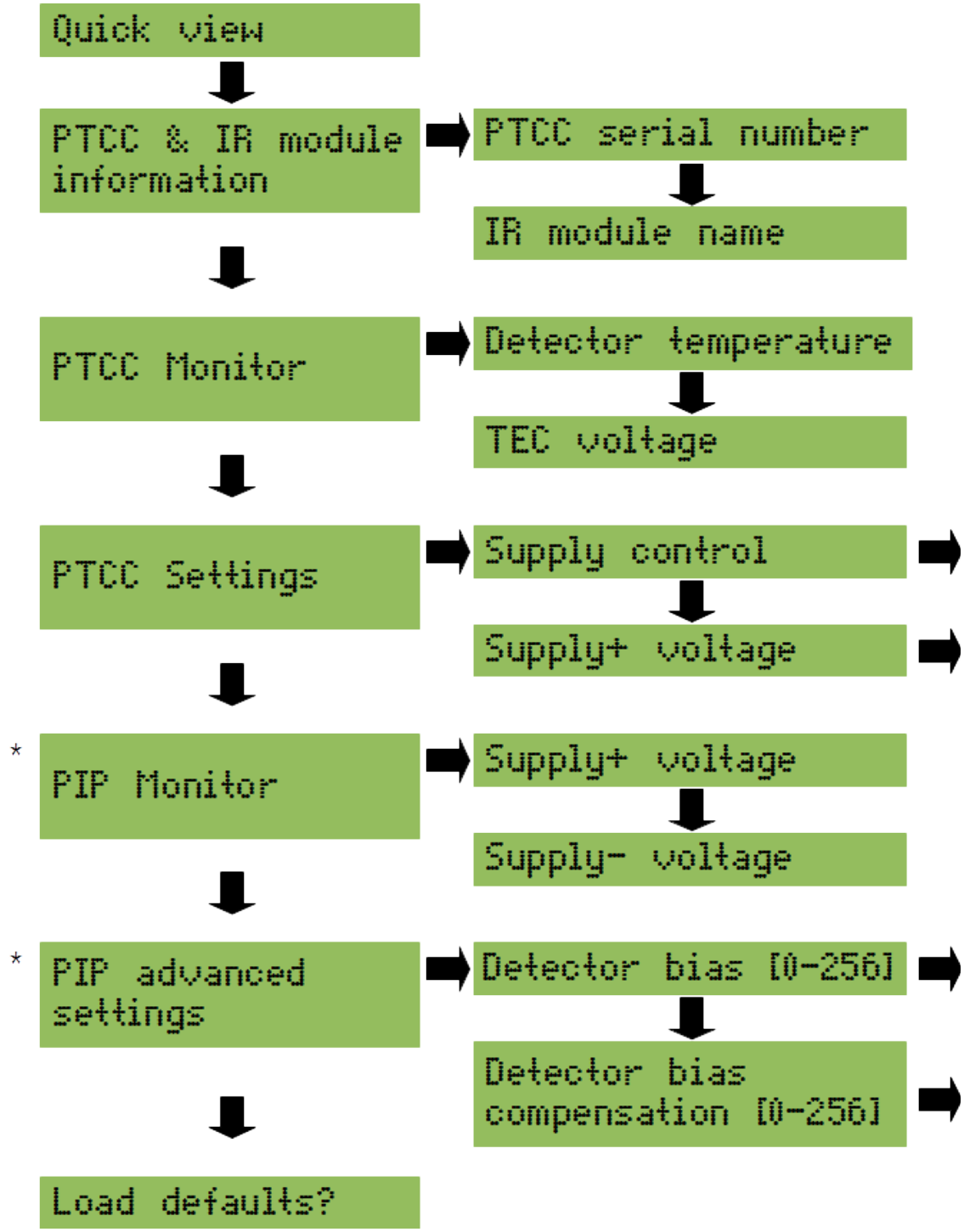
The menu is organized in three step circular menu. First step is main menu, second steps are submenus and third step is edition mode.



To move up or down in menu
To increase or decrease value of the parameter



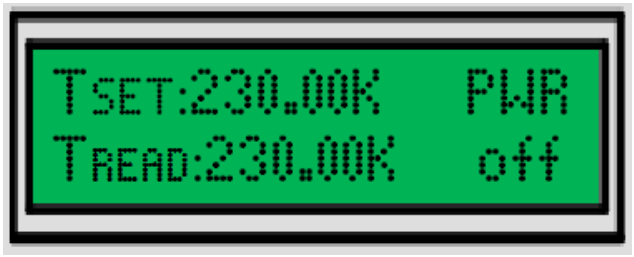
To move left or right in menu
To choose the parameter to edit
To cancel or accept



* available only when PIP module is connected.

6. Detailed Description of the Menu

6.1. Quick wiew of the most important parameters

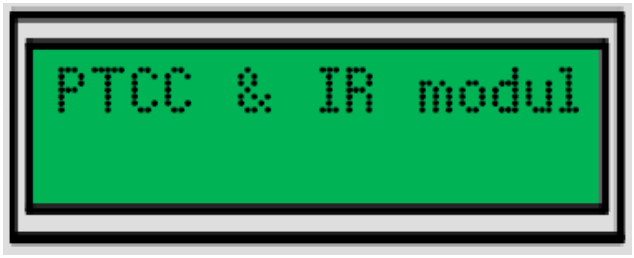


TSET set temperature

TREAD read temperature

PWR preamplifier module power on/off

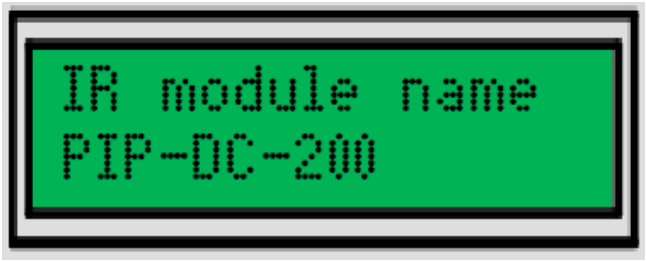
6.2. PTCC & IR module information



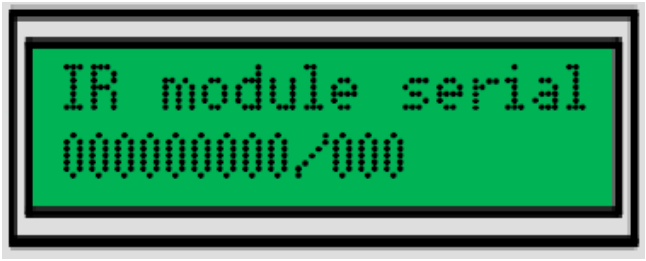
The information about PTTC, connected IR modul and IR detector.

6.2.1. PTCC serial number

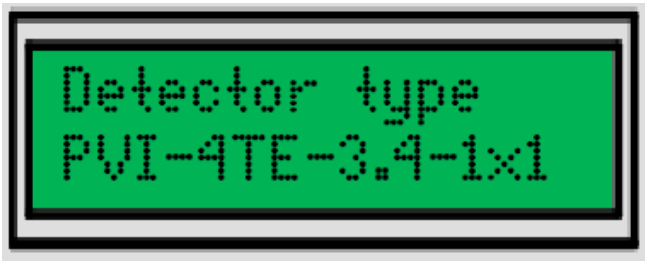
6.2.2. IR module name



6.2.3. IR module serial number



6.2.4. Detector type

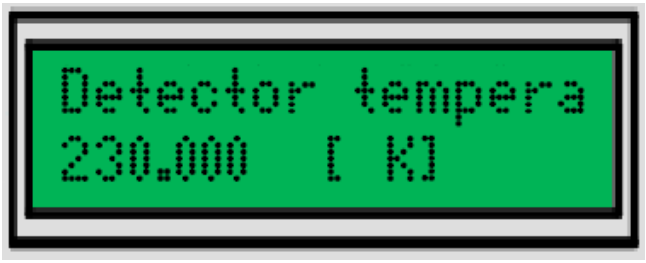


6.2.5. Detector serial number

6.3. PTCC Monitor

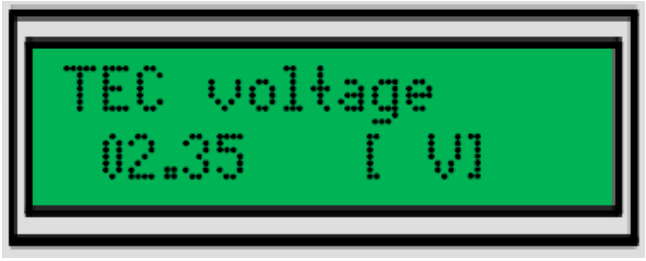
The PTCC parameters that are measured or read from the memory.

6.3.1. Detector temperature



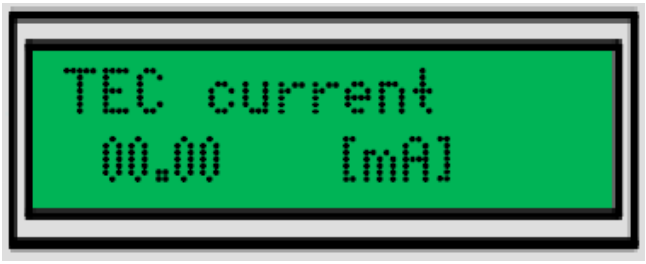
Detector temperature measured by PTTC-01-ADV.

6.3.2. TEC voltage



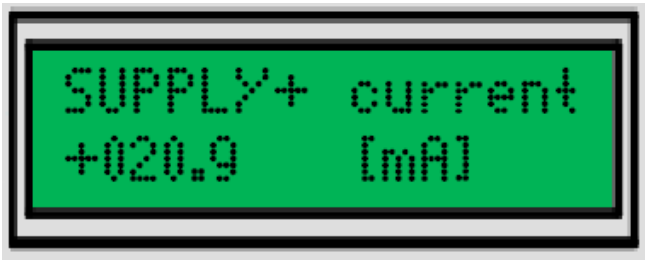
Thermoelectric cooler voltage measured by PTTC-01-ADV.

6.3.3. TEC current



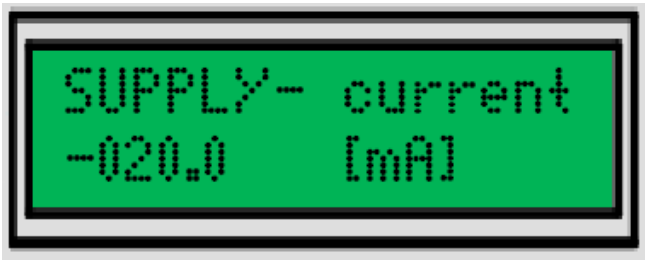
Thermoelectric cooler current measured by PTTC-01-ADV.

6.3.4. SUPPLY+ current



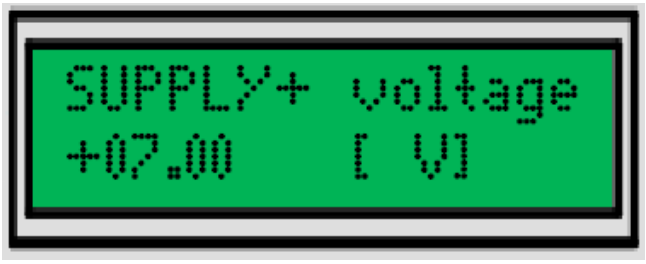
Current consumption from the supply positive line.

6.3.5. SUPPLY- current



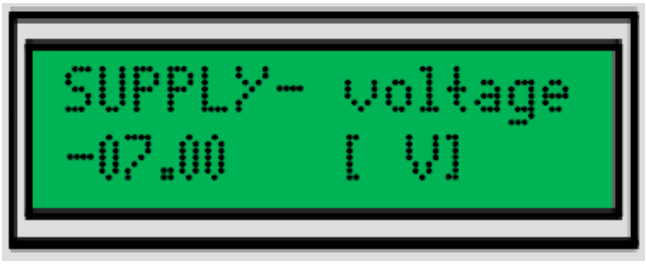
Current consumption from the supply negative line.

6.3.7. SUPPLY+ voltage



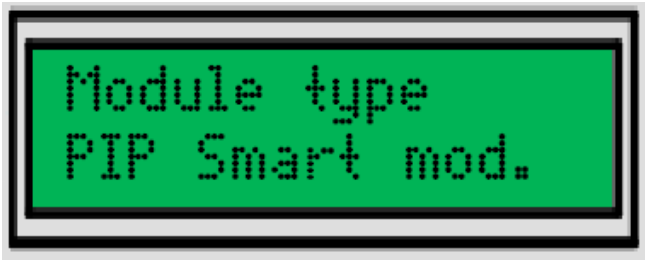
Positive supply line voltage.

6.3.8. SUPPLY- voltage



Negative supply line voltage.

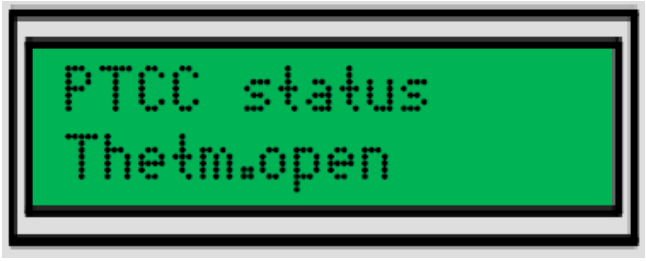
6.3.9. Module type



N.C.	- module not connected
No mem.	- module with no configuration memory
1-wire	- module with internal configuration memory
PIP Smart mod.	- programmable intelligent IR module

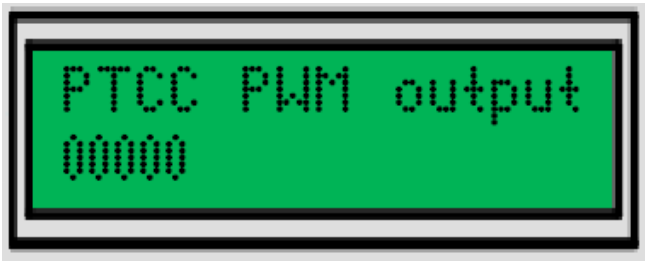
IR detection module type.

6.3.10. PTCC status



"Temp.loopl ocked"	STATUS - Detector temperature is equal(-/+ 1 K) to temperature defined by user.
"Cooling"	STATUS - During the cooling proces.
"Not cooling"	STATUS - The cooling is deactivated by user. Check PTTC settings.
"Det. Overheat"	ERROR - The set temperature could not be reached during 120 second.
"Over current"	ERROR - Measured current value is higher then maximum current value. Power is off.
"TEC open"	ERROR - TEC circuit open connection.
"TEC short"	ERROR - TEC circuit short connection.
"Therm.open"	ERROR - Thermistor circuit open connection.
"Therm.short"	ERROR - Thermistor circuit short connection.
"PTCC overheat"	ERROR - The temperature inside PTCC is higher than limit.
"No module"	ERROR - The connected modul without memory is not compatible or no module is connected.
"PIP data error"	ERROR - PIP memory was detected but there are some comunication problem.
"1-wire error"	ERROR - 1-wire memory was detected but there are some comunication problem.
"PTCC EEPR error"	ERROR - Invalid values of parameters in configuration memory.

6.3.11. PTCC PWM output



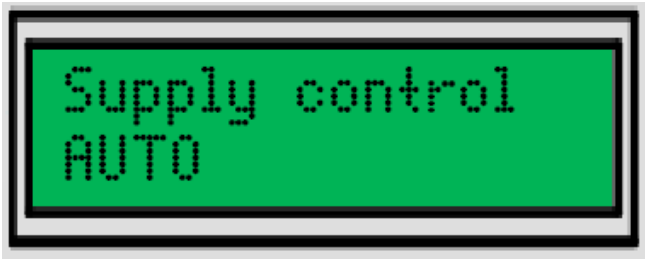
hardware min.: **0**
hardware max.: **65535**

Peltier element is driven by PWM based output stage. Minimum PWM value is 0 (meaning the TEC is not cooling) maximum is 65535 – Peltier is driven with maximum power.

6.4. PTCC Settings

The PTCC parameters available for adjustment.

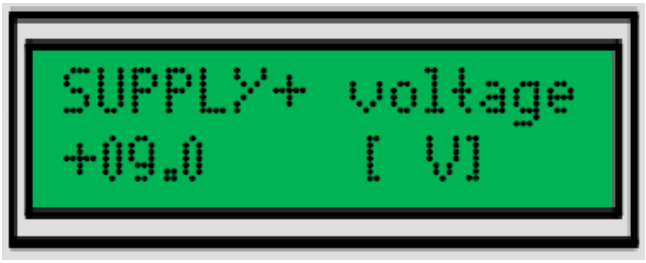
6.4.1. Supply control



AUTO the power supply for the module is turned on, when the valid detector temperature is reached (default)
ON the power supply is always active
OFF the power supply is always inactive

The parameter controls the moment of turning the IR module supply on to prevent powering the detector when not properly cooled down.

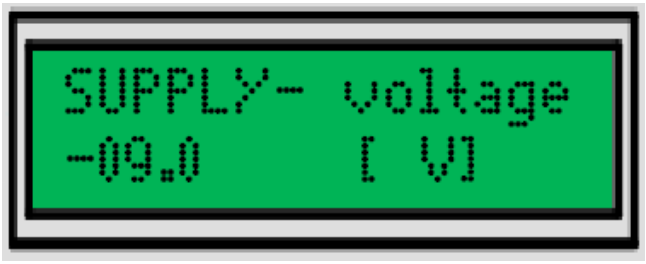
6.4.2. SUPPLY+ voltage



hardware min.: **+3V**
hardware max.: **+15V**

The following parameter establish the power supply value for the positive supply line. Hardware limit is + 3 … + 15 V and may be limited due to IR module safety.

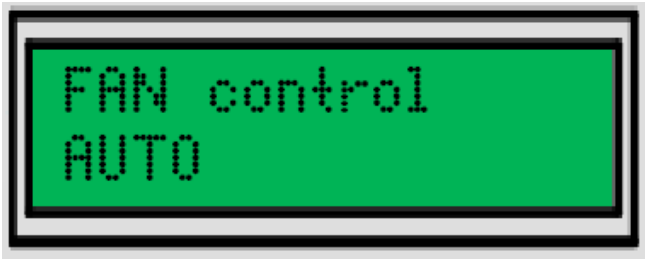
6.4.3. SUPPLY- voltage



hardware min.: **-3V**
hardware max.: **-15V**

The following parameter establish the power supply value for the negative supply line. Hardware limit is - 3 … - 15 V and may be limited due to IR module safety.

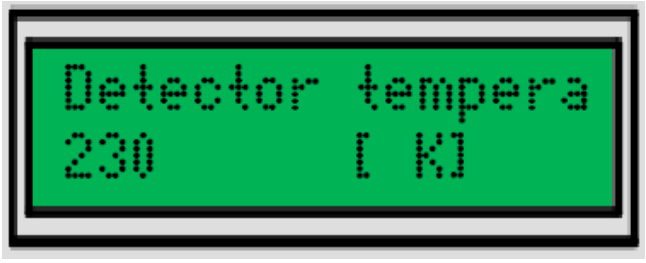
6.4.4. FAN control



AUTO auxiliary voltage is enabled (default)
ON auxiliary voltage is enabled
OFF auxiliary voltage is inactive

Manipulating this parameter, user can enable or disable the auxiliary +5 V supply used to power the cooling fan. When **PIP-DC** module is connected, the parameter is inactive (because auxiliary voltage, besides supplying the fan, is also used for supplying the microcontroller and therefore needed for normal operation).

6.4.5. Detector temperature



In general, the parameter is responsible for the detector temperature stabilized by the **PTCC** controller.

The lower temperature limit is due to the parameters of the Peltier element. It doesn't make sense to set 100 K, if Peltier element may achieve only 200 K. Establishing too low temperature is not risky, however, the **PTCC** would in this case try to cool down the detector for 2 minutes and afterwards will indicate an error and stop working – which may be confusing.

The upper limit is due to the detector safety reasons (for example, in very rare cases, if detector is biased, the bias current may rise above the safety margin in the room temperature and cause the detector overheat, which the limit will prevent). The controller is unable to warm up the detector, therefore there is no risk of heating up, instead of cooling.

6.4.6. TEC maximum current

hardware min.: **0 A**
hardware max.: **0.5 A**

Defining the exact Peltier element parameters is not always needed for the temperature control. However, depending on the Peltier element type, there's always necessary to setup its maximum current.

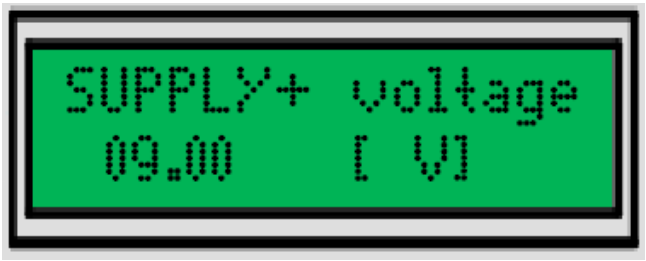
6.5. PIP Monitor

Parameters measured internally by the PIP-DC.

Some of the options included in this sub-menu are redundant to the options in PTCC monitor. Those repeated measurements help in finding weak connection (for example: supply voltages measured by PIPDC and PTCC may be compared to find weak connection).

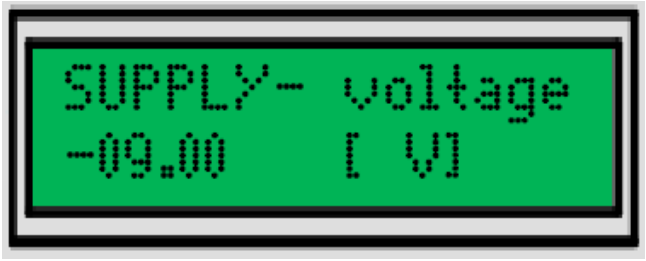
The tolerable and measurable input voltage ranges are matched individually for each monitor input to achieve proper dynamic range.

6.5.1. SUPPLY+ voltage



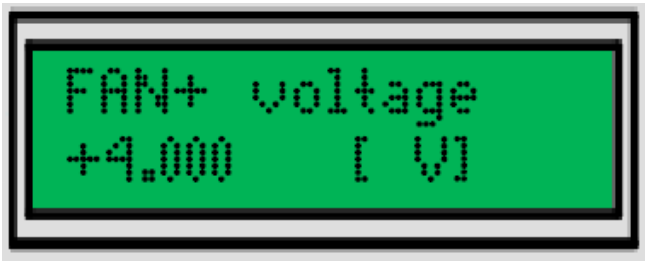
Positive supply line voltage.

6.5.2. SUPPLY- voltage



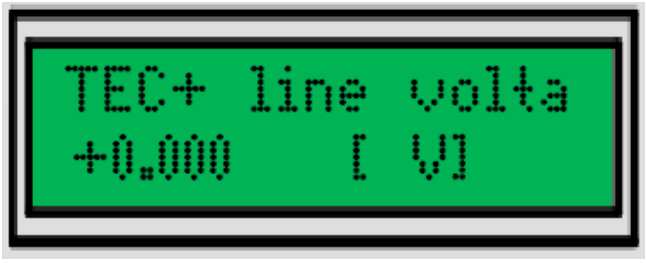
Negative supply line voltage.

6.5.3. FAN+ voltage



Auxiliary voltage (FAN & microcontroller).

6.5.4. TEC+ line voltage



The TEC is powered with negative voltage. This means, the voltage at positive line is close to 0 V (0 ... - 0.5 V).

6.5.5. TEC- line voltage

The TEC is powered with negative voltage. This means, voltage at negative line is higher in terms of absolute value, and in normal operation potential is lower than GND (-1 …. -9 V).

6.5.6. Thermistor line 1 voltage

During the normal operation, the voltage here depends on the temperature and should be between 0.5 V and 2 V.

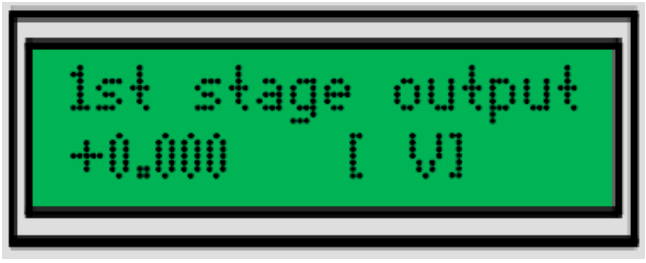
6.5.7. Thermistor line 2 voltage

This line is normally at ground potential. However, if the connection to the **PTCC** is weak, the line is pulled up by the thermistor and line 1, and the value is higher.

6.5.8. Detector bias voltage

This is the real measured voltage over the detector. This measurement is particularly useful for checking the results of coarse adjustment the detector bias voltage with the digital potentiometer.

6.5.9. 1st stage output voltage [DC monitor]



This measurement allows the user to check what is the DC IR radiation level, even when AC coupling to the second stage is chosen. This may be potentially useful in heterodyne detection.

By measuring the voltage at output of the 1st preamp stage, user can check, whether is the risk of preamp saturation and what is the source of output DC offset.

6.5.10. Output voltage

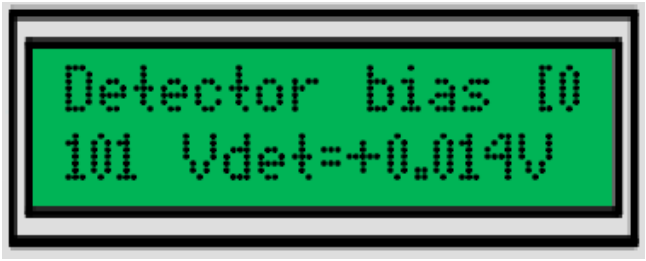
The output voltage measurement is useful especially, if it is not possible to validate the setup connection with the oscilloscope. It is also easy to perform an offset cancellation with no additional equipment.

6.6. PIP advanced settings

User settings of the PIPDC module.

The current chapter contains the information regarding the **PIP-DC** settings. As for the **PTCC** parameters, some of the parameter ranges may be limited due to the detector and IR detection module safety reasons.

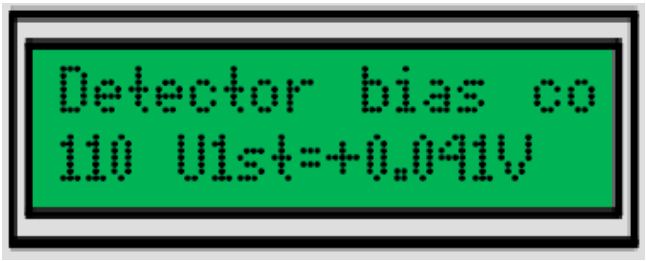
6.6.1. Detector bias [0-256]



hardware min.:	**0**	**0 V**
hardware max.:	**256**	**1 V**
Vdet:	bias voltage	

The value set here directly drives internal digital potentiometer. The dependence between the value and the bias voltage is linear.

6.6.2. Detector bias compensation [0-256]



hardware min.:	**0**	**0 mA**
hardware max.:	**256**	**10 mA**
U1st:		the voltage behind the first stage

The value set here directly drives internal digital potentiometer. The dependence between the value and the compensation current is linear.

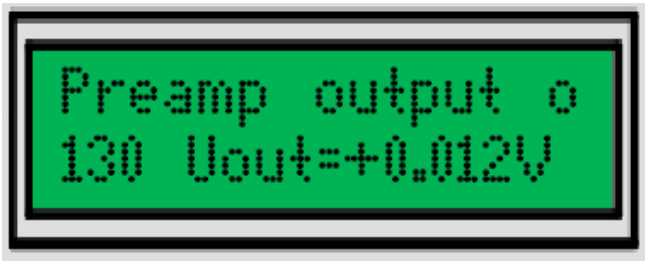
The bias current compensation is used to avoid first preamplifier stage saturation. It should be as close to zero volts as possible.

6.6.3. Preamp 2nd stage gain

The gain setting is responsible for the gain of the second stage. Please note, than the full output voltage range is available, when the gain is set between 5 V/V to 50 V/V.

Below 5 V/V, the output voltage range (+/- 1 V over 50 Ohm load) is reduced. The dependence between the potentiometer setting and the gain is linear in decibels.

6.6.4. Preamp output offset [0-256]

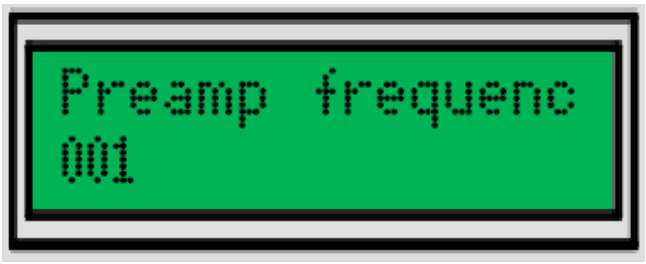


hardware min.: **0** **~ +1V**
hardware max.: **256** **~ -1 V**

Output voltage 0 V should appear at the output for the potentiometer setting close to the half of the range (128).

When it is unable to achieve 0 V, first stage offset is too high, and "Detector bias current compensation" must be adjusted to reduce it.

6.6.5. Preamp frequency compensation

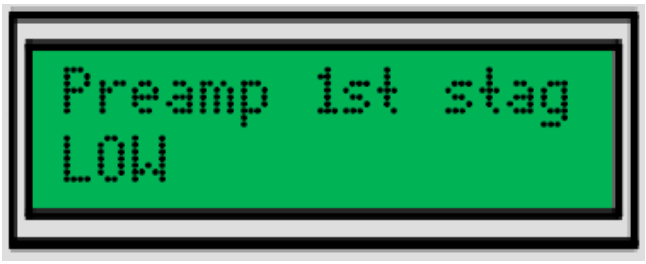


hardware min.: **0** maximum parallel capacitance, lowest top frequency
hardware max.: **4095** minumum parallel capacitance, highest top frequency

The parameter changes the frequency compensation for the preamplifier first stage. The lower value means the capacitance parallel to the feedback resistor is relatively high, and therefore the circuit might be over-compensated.

Higher value of the parameter gives weaker frequency compensation. Lower values leads to oscillation, higher – the circuit is stable, however the ringing behind the signal edges may be visible.

6.6.6. Preamp 1st stage transimpedance



LOW **1 kOhm**
HIGH **5 kOhm**

Higher transimpedance results in lower bandwidth (usually around 80 MHz, depending on detector type) and the frequency compensation should be weaker. Preamp is normally more stable and less noisy (5 pA/$\sqrt{Hz}$)

Lower transimpedance results in higher bandwidth (usually 220 MHz, depending on the detector parameters), frequency compensation should be stronger to avoid ringing. The input referred noise current density is higher (8 pA/$\sqrt{Hz}$).

Overall IR module transimpedance is calculated as a first stage transimpedance times second stage gain. Therefore for 1 kOhm, the transimpedance is 500 Ohm … 50 kOhm, and for 5 kOhm: 2.5 kOhm.... 250 kOhm.

The bandwidth doesn't depend on preamplifier second stage gain.

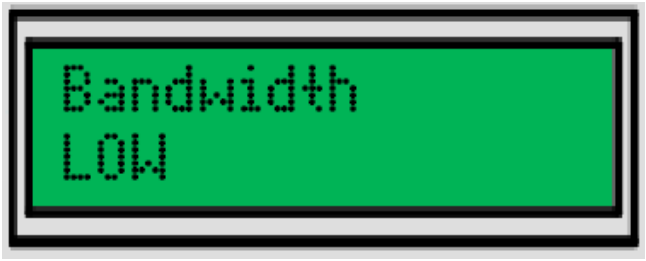
6.6.7. Coupling

AC
DC

AC coupling results in better output voltage stability, and in general, full gain range is then available and output voltage offset correction is simpler. The lower cut off frequency is around 1 kHz.

DC coupling allows the user to monitor the DC level IR radiation. The IR detection module is less stable in terms of output DC offset, and due to the instability, limited range of gain is convenient for usage.

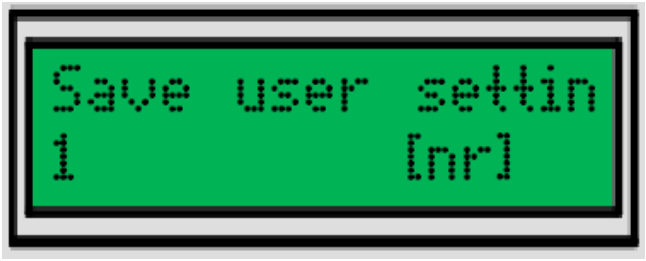
6.6.8. Bandwidth



It is possible to reduce the bandwidth down to 1.5 MHz or 15 MHz compared to the full bandwidth, this reduces the output noise and simplifies measurement when IR radiation level is weak.

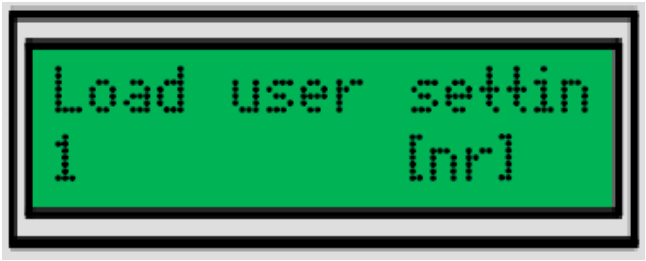
LOW 1.5 MHz
MEDIUM 15 MHz
FULL depends on detector parameters and first stage transimpedance

6.6.9. Save user settings



User can store the **PIP-DC** settings in one of four memory banks. When “Save user settings” is chosen, current configuration is saved.

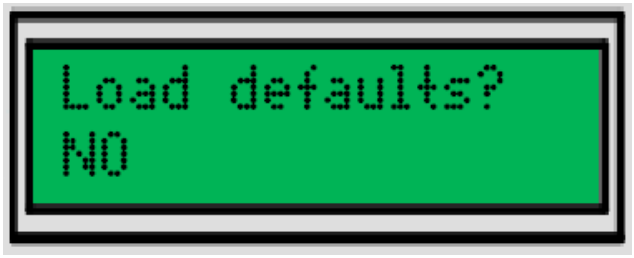
6.6.10. Load user settings



User can load the **PIP-DC** settings from one of four memory banks. Choosing “Load user settings” results in replacing current **PIP-DC** settings with the settings from the bank.

When IR detection kit is restarted, last **PIP-DC** configuration is restored.

6.7. Load defaults



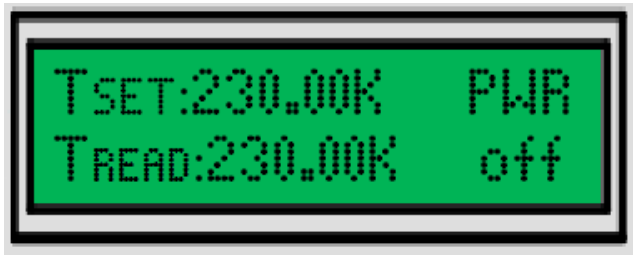
All parameters which can be changed by user have default values.

This option is loading default parameters values from device memory.

7. Example - How to Move About Menu

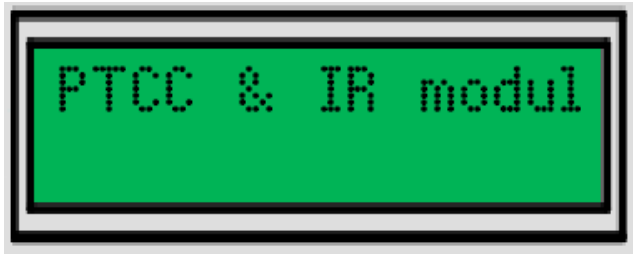
In this example You can see how to change "Supply control" setup in **PTTC** settings.

The default screen that You see on PTTC display is "**Quick view of the most important parameters**".



To move to PTTC settings menu You need to click "**down**" button.

Now You can see first position of main menu "**PTCC & IR module information**".



Click "**down**" button.

You can see "**PTCC Monitor**".

Click "**down**" button.

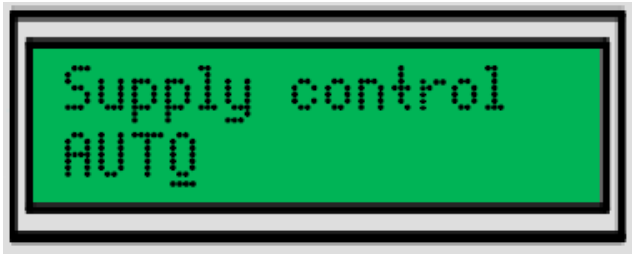
You can see "**PTTC settings**".

Click " OK button" to enter to the "**PTTC settings**" menu.

You can see "**Supply control**" submenu. As You can see Supply control is in AUTO mode.
In this example We want to change AUTO mode to ON mode.

Click "**OK**" button to go to the edition mode.

In the edit mode a fourth position in the second line is underscore and is blinking.



The AUTO mode is last position from this menu so "**down**" button is useless.
Click "**up**" button to change supply control mode to ON.

Click "**OK**" button to accept changes and exit from edition mode.

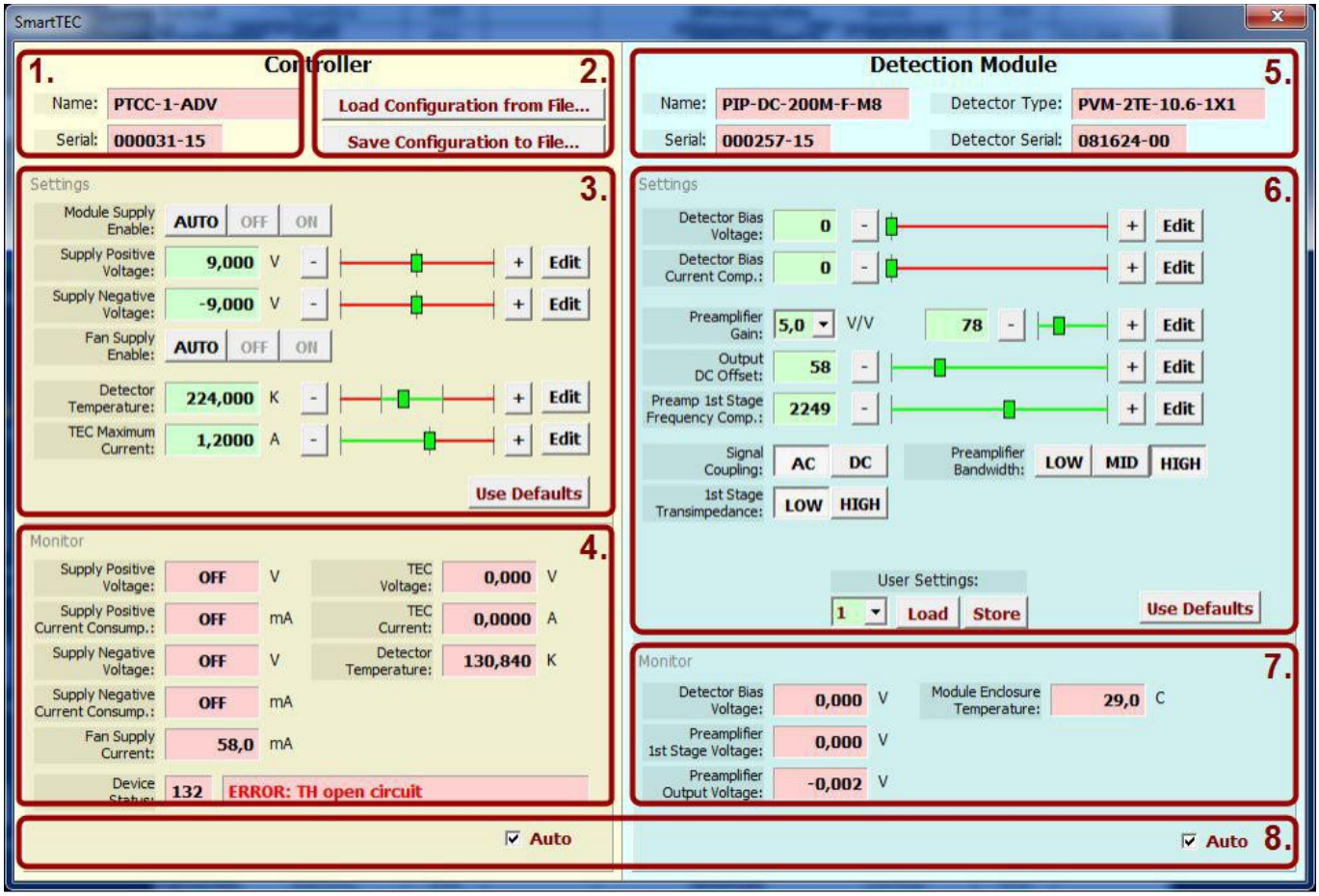
or click "**Cancel**" button co cancel changes and exit from edition mode.

8. PC Software Description "Smart Manager"

8.1. Program Description

Smart Manager is easy to use tool to control **PTTC** controller.

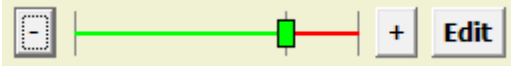
The PC software is showing all **PTTC-01-ADV** menus in one window.



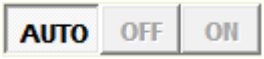
1. PTCC version & serial number
2. Storing/loading PTCC & IR detection module configuration data
3. PTCC settings
4. PTCC monitor
5. IR detection module & detector parameters
6. IR detection module settings (available only for PIP)
7. IR detection module (available only for PIP)
8. Automatic PTCC/PIP monitor update

Usually, user settings are available for the adjustment within factory limits (narrower than the hardware limits). For example, if the IR module power supply is +/- 9 V, then allowing the user to manipulate the supply voltage with no limits is considered as a potential source of the module damage. The limits are applied in the factory and user is unable to adjust the values in full range.

In the PC software, there is a green part of the slider showing the parameter range available for the user, or the buttons are clickable. Unavailable buttons are grayed instead.

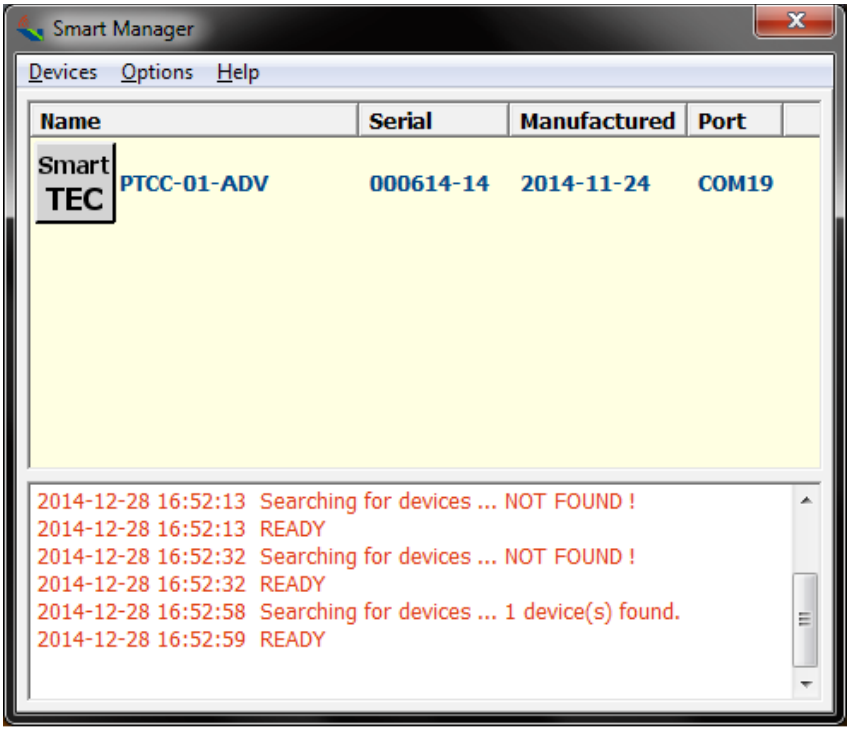


Unavailable buttons are grayed instead.

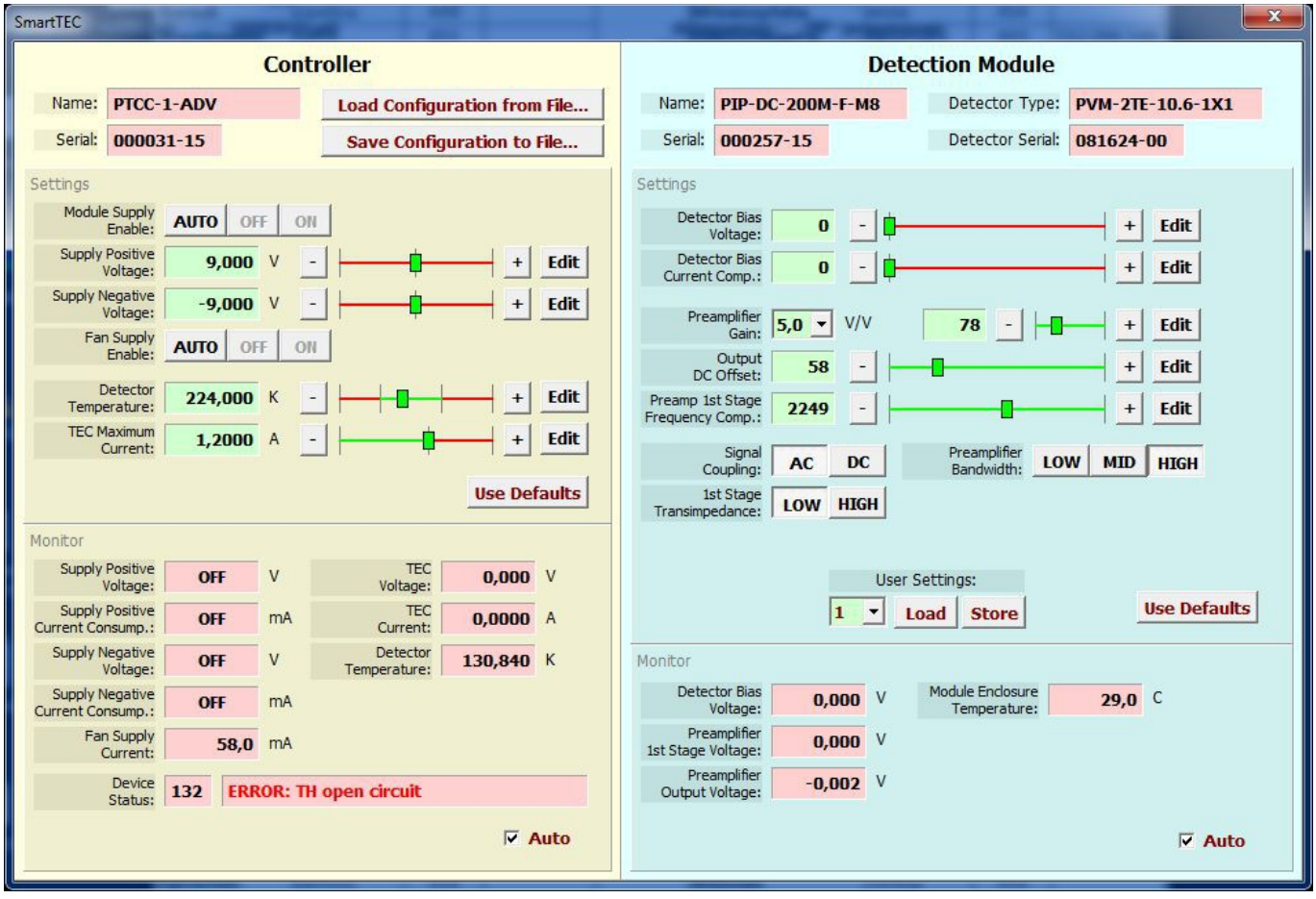


8.2. Smart Manager First Use

To start using the Smart Manager connect PTTC module to USB port in Your PC and open the Smart Manager.

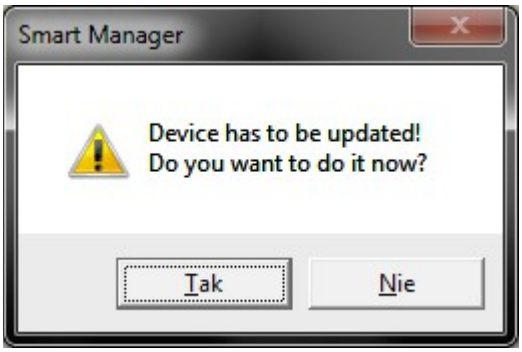


You can see a device list if the list is empty check USB connection and reload device list.
Devices >> Reload Devices List
Chose the devices that You want to control and click two times on chosen element.



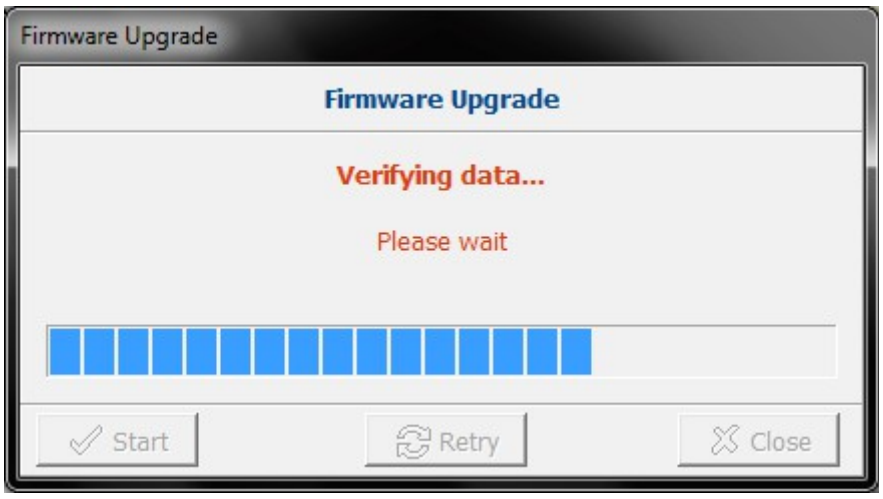
8.3. Update Procedure

Smart Manager automatically check if any updates to PTTC software are available. If software to update is available Smart Manager send communicate to user.



When user allow to update Smart Manager start update procedure.

User have to follow Instruction showed in Firmware Upgrade window.



9. Safety Instructions

To ensure safe and failure-free operation of the SmartTEC controller, comply with the following precautions:

- Before connecting the power supply to the mains, make sure it is compatible with the mains voltage and frequency.
- The power supply is intended for the indoor use.
- Do not use the controller if the temperature and the air humidity extends the values valid for the PTCC-01-ADV controller.
- Use the cables delivered by VIGO. In case of OEM systems, make sure the cables match the specification of the controller.
- Turn off the power supply before plugging/unplugging cables. Avoid static discharges.
- Use the proper cables to connect elements of the kit, dedicated for specified device only. Never cut or shorten any cable, it may cause damage to your device.