Field Manual

ClimaCheck

Performance Analyser

ClimaCheck PA Pro III *onsite*

i.e. part number 100111, 100112, 100222, 100232

Measuring and Analysing System for Refrigeration, Air-conditioning and Heat Pumps

Updated for software v5 and
PA Pro III internal application v4

2021-07-08

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Safety Precautions

Read the instruction manuals for all relevant equipment carefully before starting to use ClimaCheck Performance Analysing systems.

ClimaCheck PA Pro III is a measuring and analysing system developed to give detailed evaluation of refrigeration, air-conditioning and heat-pump systems in development laboratories, production tests and in the field.

If equipment is used in a way not specified by producer the protection and safety provided may be impaired.

Certifications/licenses are required in most countries for activities related to electrical systems, pressurised systems and systems charged with refrigerants that have environmental impacts and/or flammability.

ClimaCheck products are only intended for use by competent technicians/engineers complying with local requirements for certifications/licenses.

Any work with electricity, pressurised systems or refrigerant involves potential dangers to human health and system integrity if not conducted with caution. Always inspect the equipment for damaged cables or other components before use. For many installations loss of product or disturbances in operation incurs high costs. ClimaCheck assumes no responsibility for injuries or costs that may occur as a result of failures in connection with measurements. The user must evaluate whether an inspection can be carried out without risk of injury and/or damage. Measurements should only be carried out when it can be done under safe working conditions and without risks.

Note - additional manuals

Detailed Manuals for Hardware and Software is available under Help menu in ClimaCheck software.

These pdf files can also be found under the program files directory where ClimaCheck is installed. Path can be slightly different in different versions of Windows but typically program files\climacheck\help.

ClimaCheck Quick Guide

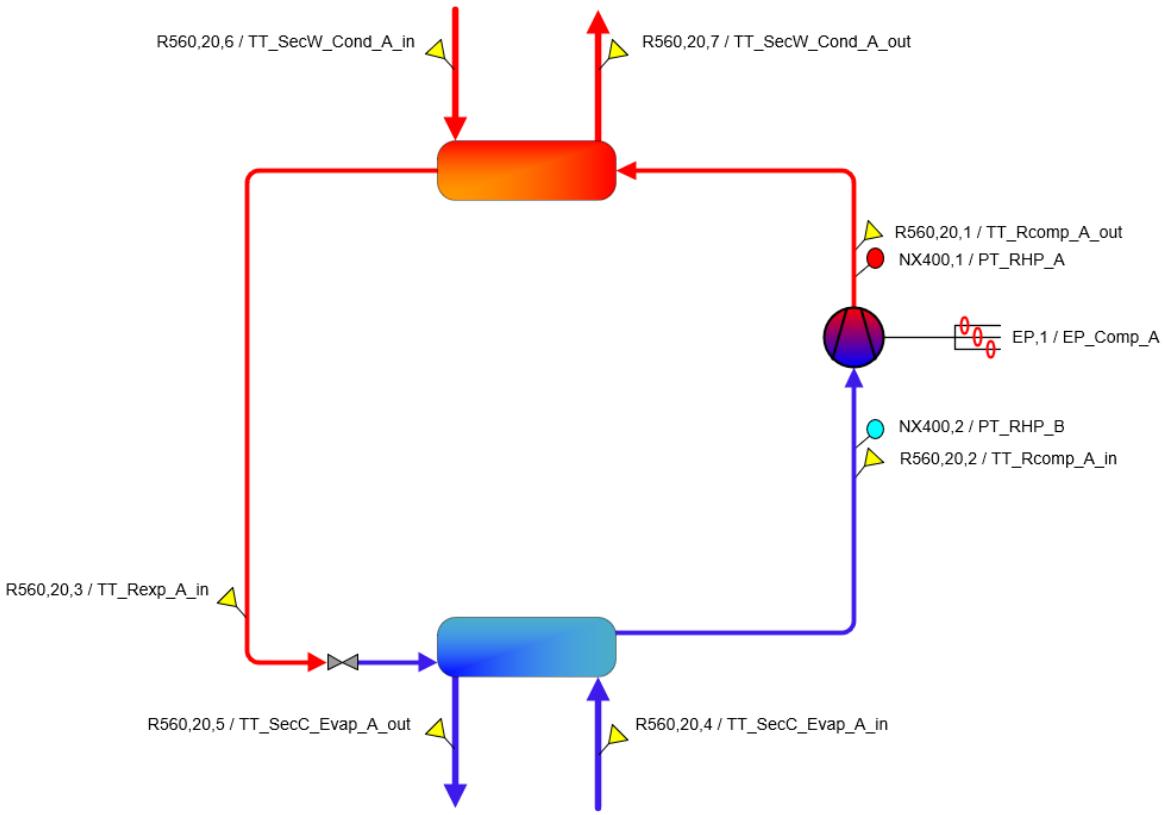

Figure 1

- Connect ClimaCheck PA Pro III to your PC with a USB cable.
- Start **ClimaCheck Standard** software from the desktop or the program menu.
- Enter the system information.
- Verify that correct Refrigerant is selected. If wrong, change under **Refrigerant** menu in toolbar.
- Select **File** > **Save ClimaCheck Work Book** and give the file a name.
- Select **Contact** > **Direct** to activate the connection to PA Pro III.
- Select desired scan interval. Select **Start** under Scanning in the toolbar.
- Check the sensors against atmosphere pressure and room temperature.
- Attach all temperature sensors with heat transfer paste, aluminium tape and insulation.
- Attach pressure sensors (check for correct pressure range).
- **Always attach cables between current clamps and Power meter, before connecting the current clamps around the voltage wires.** Check that the arrow on the clamp points to the compressor.
- Press **Clean up** button in toolbar to clear from old values.
- Adjust system/load for stable operation.
- Check sub-cooling, superheat, compressor efficiency.
- Check for stability and possibility to optimise.
- Select **File** > **Save ClimaCheck Workbook** to save your results.

Sensor application validation at start-up

Input	Sensor	Logical check	OK/ not OK
NX400,1	High pressure sensor e.g. condensing temperature	The condensing pressure is converted to condensing temperature in the software based on chosen refrigerant. For manual control use gauges/refrigerant "slides" or tables. If the system has fixed installed gauges/sensors compare value in ClimaCheck with gauges/sensors or service manifold. If no second meters are available check the condensing temperature versus specified or expected. This should typically be slightly above exiting air/water of condenser. If not correct, check that the right sensor is used (standard is 35 bar(g) otherwise configuration must be changed), correct refrigerant selected and if values are more or less fixed, check that Schrader or service valve is properly open.	
NX400,2	Low pressure sensor e.g. evaporation temperature	The evaporation pressure is converted evaporation temperature in the software based on chosen refrigerant. If the system has any fixed installed gauges/sensors compare value in ClimaCheck with gauges/sensors or service manifold. If no second meters are available check the evaporation temperature versus specified or expected. This should typically be slightly below exiting air/water of condenser. If not correct, check that the right sensor is used (standard is 10 bar(g) otherwise configuration must be changed), correct refrigerant selected and if values are more or less fixed, check that Schrader or service valve is properly open.	
R560,20,1	Discharge temperature	The discharge temperature is strongly dependent on operating conditions. To identify if this value is realistic either check with independent sensor/control system or check if compressor efficiency is realistic (typically 55-75% for semi- or hermetic compressors). If discharge is low and high efficiency is indicated, check that sensor is well applied and no sensors have been switched also check that there is super heat as liquid in the suction line will result in low discharge and high efficiency.	
R560,20,2	Suction temperature	The suction temperature is normally slightly above evaporation = the superheat. This is dependent on the expansion valve setting, suction line's temperature, length and insulation. Too low superheat might indicate liquid carry over or excessive oil transport. Check sensor, application if this value is not as expected.	
R560,20,3	Liquid temp.	The temperature is normally slightly below the condensing. This is dependent on the type of and distance to condenser and if there is a receiver as the sub-cool = 0 in the receiver. Check sensor, application and pressure drop if this value is not as expected.	
EP,1	Power input	Check that currents are correctly measured and agree with rated currents of motor/compressor. Fans and pumps should not be included. Check power factor and voltage on meter. If any currents are negative or uneven, power factor not between 0.70 and 0.95, caution should be taken to ensure correct connection. If magnitude of currents or other values are not correct check connection and ratio setting for clamps.	

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Note: Areas with red side marking are related to certification and should not be changed without new date here. Log on changes is kept separately. Current date of changes is 2021-05-19.

1 Introduction

1.1 ClimaCheck[1]

ClimaCheck is a measuring and analyzing system developed to give detailed evaluation of refrigeration, air-conditioning and heat-pump systems in development laboratories, production tests and in the field.

The method is based on measurements in the refrigeration circuit and does not require any fixed installation of metering equipment in the system. The advantages of easy connection, immediate and detailed information makes the ClimaCheck method superior for evaluating all refrigeration, air-conditioning and heat pump systems.

An increased focus on energy efficiency can be seen in the EU Directive 2002/91/Ec on the Energy Performance of Building and several other requirements on energy performance on other markets. This directive requires annual inspections with verifications of energy efficiency of all AC systems with more that 12 kW rated capacity. Measuring with ClimaCheck gives and excellent foundation for performance inspections.

The ClimaCheck Performance Analysing method allows **complete analysis** of energy performance as well as presenting all information to validate the individual components and their optimization without the requirement of any fixed equipment making it possible to immediately identify and locate any deficiencies in the system. The method was patented in 1986 and has since been used in Sweden and internationally in the Product ETM 1500, ETM 2000, ClimaCheck PA 8:7 and now ClimaCheck PA Pro.

The PC based evaluation software that can be used with direct or remote connection to the data logging device utilizes a modern spreadsheet interface and the globally accepted equations for refrigerant properties in RefProp established by NIST (National Institute of Standards and Technologies in USA).

The use of standard "templates" tailored to give a comprehensive evaluation of anything from a simple air-conditioning split to a complex industrial refrigeration plant new era in refrigeration service. The operator does not need know-how of the calculations. Users with advanced refrigeration competence can develop their own templates for any specific need.

ClimaCheck contains functions to store and print reports including data and graphs and there is also an export to Excel feature for further processing of data.

The ClimaCheck method is suitable for almost all compressor based refrigeration processes. All suction or discharge gas cooled hermetic and semi hermetic compressors can be fully evaluated without any compressor or system specific information. For open compressors the electrical motor efficiency is given as input and for compressors with external cooling of air, water, oil or liquid injection information on the cooling need to be entered to give a full capacity and COP accuracy. For many types of systems data on compressor cooling are well known and necessary parameters are known. ClimaCheck Specialists should be consulted to give advice on non-standard systems.

For in depth information please refer to *ClimaCheck Help* under the *Help* menu in the ClimaCheck Software or the Help folder in the ClimaCheck on your PC. These contains documents with detailed information about ClimaCheck software and hardware.

1.2 ClimaCheck license

ClimaCheck software is sold as a one-computer license and each installation will require a registration key from ClimaCheck. Please contact ClimaCheck for special offers on additional licenses within the same organization.

[1] ClimaCheck is a registered trademark.

1.3 Technical Specification PA Pro III

Inputs on main board:	4 x Analogue (0...10V or 4...20mA). Accuracy ±0.5% FS 1-wire temperature bus (-25 to 150°C). Accuracy ±0.5K (-20 to 80°C) 8 x Digital (wired to front)
Outputs:	8 x high-power solid-state Digital (2 wired to front)
Analogue input module:	8 x inputs configurable Pt1000, 0-10 V, 4-20 mA Accuracy Temperature input ± 0.25°C, Analogue ±0.1% FS
Modem:	Penta-band cellular modem, UMTS/HSPA
Communication:	Ethernet, WiFi, RS485x2, RS232x2, USB, Bluetooth classic/LE, CAN2.0B
Memory:	SD-card
Supply voltage:	24 VDC, 10W
Dimensions:	501 x 279 x 193 mm
Weight:	11 kg

2 Handling and safety

- The PA Pro III should only be supplied with CE/UL/CSA approved 24 volt direct current power supply supplied by ClimaCheck. The centre of the plug should have positive polarity. The current supply should not exceed 1 A. The mains supply voltage should be at least 100-240 VAC.

- Always place the equipment in a way ensuring that power can easily be disconnected if needed.

- Operating temperature range for the PA Pro III is -5 to +60 °C. Operating temperature range for the included power supply is 0 to +40 °C.

- Operating humidity is R.H. 5 – 90 % non-condensing.

- Maximum operating altitude: 2000 m.

- The equipment is designed for a maximum of Pollution Degree 2.

- The equipment should not be used in wet location.

- Always inspect the equipment for damaged cables or other components before use. If needed clean with a soft towel moistened with water and a mild detergent.

- The equipment enclosures have not been tested for UV-resistance and are thus not approved for outdoor use.

- The fuse on 24VDC s of the PA Pro should be 20x5 mm of the type **T 1 A L, 250 V**. Use only UL/CSA approved fuses.

- See Section 4 for important safety instructions when using the power meter EP Pro.

- If the instructions in this section and the rest of the manual are not observed, the protection provided by the equipment may be impaired.

3 Connectors overview

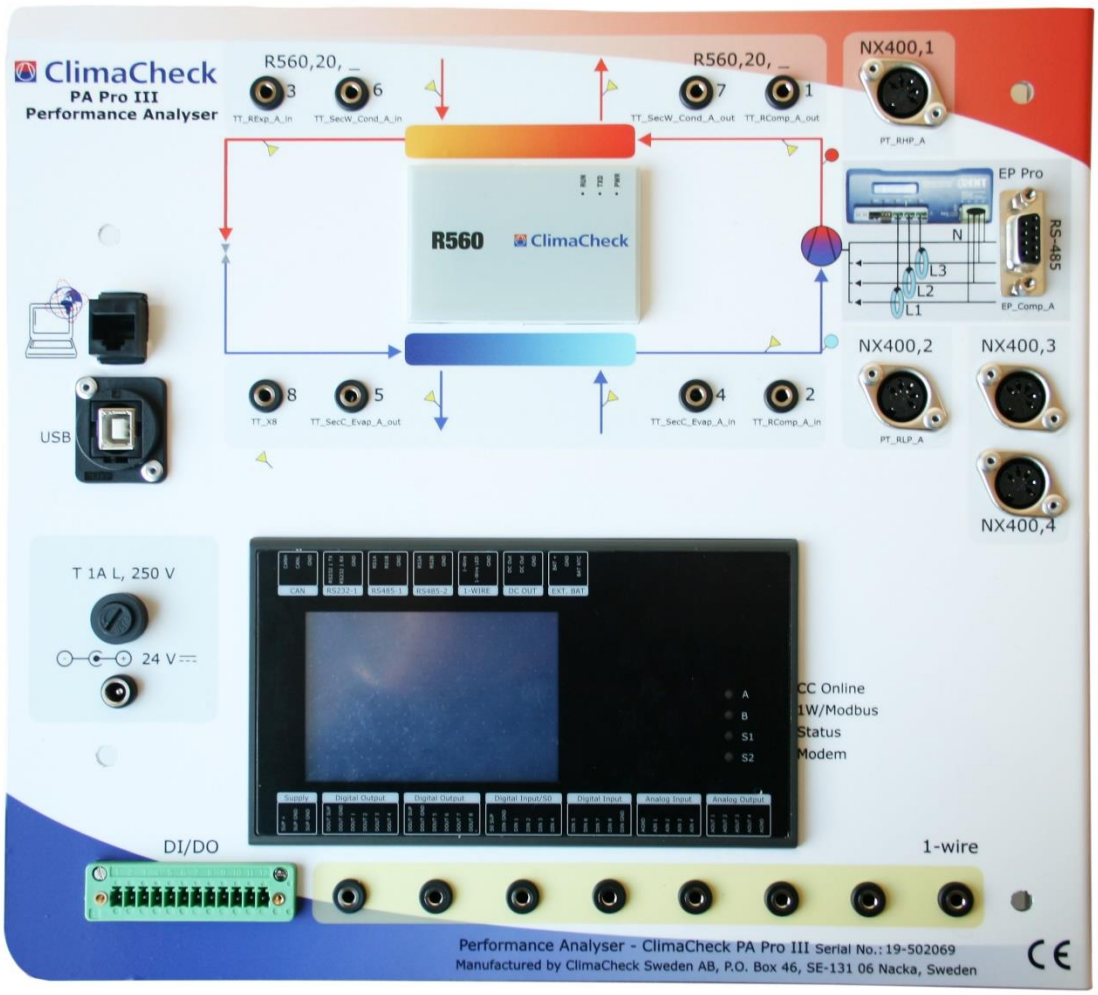

Figure 2

	Network socket.
USB	USB Type B socket. Use the supplied USB cable to connect directly to a PC.
24 V DC	24 V DC power supply. Use only approved 24 V DC supply with a maximum output of 1 A. Centre of connector should have positive polarity.
Fuse	Holder for 20x5 mm fuse of type T 1 A L, 250 V.
RS-485	Serial cable connection for EP Scout power meter and other external units. Also supplies 24 V DC. Two serial cables of different length are supplied as standard.
R560,20,1 to R560,20,8	3.5 mm sockets for Pt1000 sensors. The system is configured with a 0.35 K offset to compensate for the cables of the included sensors.
NX400,1 to NX400,4	Sockets for analogue connectors 1-10 V or 4-20 mA. Supplies 24 V DC. The two included pressure sensors are connected to AI_1 and AI_2.
1-wire	3.5 mm sockets for 1-wire temperature sensors.
DI/DO	Socket for digital inputs and outputs. Not used as standard. Compatible plug available at request.

For connectors on ClimaCheck power meters please refer to the corresponding manuals.

4 Connection of power measurement

Important!

Improper use of ClimaCheck power meters may cause high voltage build up that can be dangerous both for equipment and operators. Adhere to the practices below to avoid this, always refer to ClimaCheck EP Pro manual, and:

- **Always connect the current clamps to the power meter (EP Pro) before they are attached around a live wire.**
- **Always remove the current clamps from the live wire before the cables to the power meter are disconnected.**
- **Incorrect connection of voltage between phase and neutral will damage the equipment.**
- **Never use the current clamps on uninsulated wires or rails.**

In addition follow the steps below to assure proper power and energy readings:

- It is important to only measure the power to the compressor. Make sure the measurement is done after the point where circulation pumps and fans are connected.
- Make sure that the voltage and current for each phase corresponds with the markings on the measuring equipment and that the arrow on the current clamps are pointing in the direction of the current.
- Make sure that the current clamps are completely closed and that the contact areas are clean.
- Check that the connections are correct by reading the voltage, current and power on the display of the power meter. If you find a problem remove the clamps and attach L1 followed by a control and the repeat the process for L2 and L3.

When the ClimaCheck EP Pro II is connected to a powered up ClimaCheck PA Pro III it is not necessary to connect it to a separate power supply. The unit will be powered over the serial cable. A separate power supply is only necessary when using the meter on its own. In advanced applications with several power meters or long serial cables it may be necessary to connect a second power supply to ensure sufficient power.

For more information about the ClimaCheck EP Pro II, see section ClimaCheck EP Pro II Manual.

5 Electrical Drawing

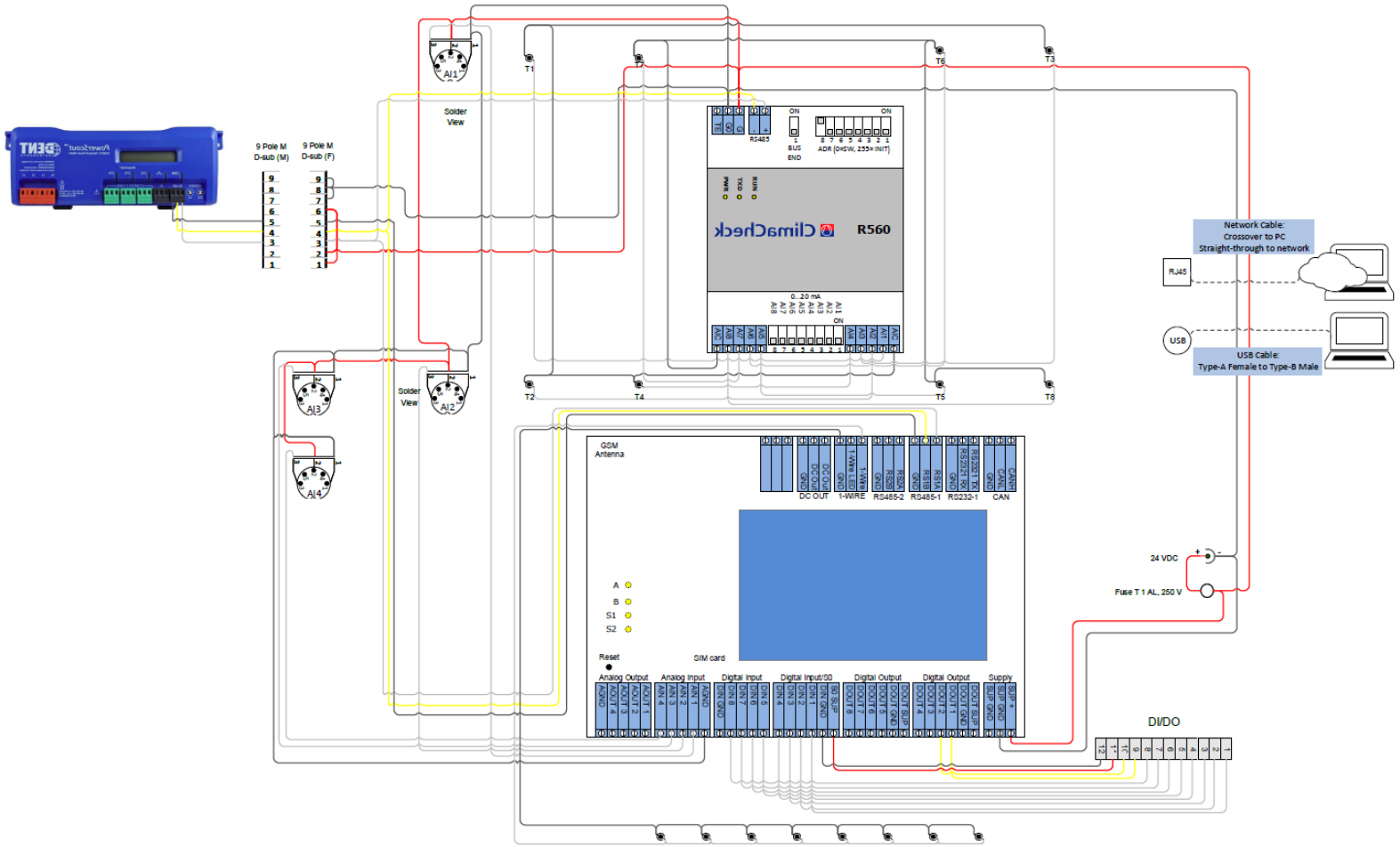

Figure 3

6 Connection of sensors

Sensors should be placed in accordance with each template. All sensors should be checked against room temperature and atmospheric pressure before being attached. If you have never worked with your ClimaCheck, assemble the entire system including software at the office to minimize the number of problems in the field.

6.1 Mounting of pressure transmitters/transducers

Pressure should be registered as close as possible to the compressor inlet and outlet. Pressure drop between sensor and compressor will affect the accuracy.

The AI channels are pre-configured as below:

- NX400,1: 35Bar, 0-10V
- NX400,2: 10Bar, 0-10V
- NX400,3: 35Bar, 0-10V
- NX400,4: 10Bar, 0-10V

6.2 Mounting of temperature sensors

Temperature sensors may be mounted on the outside of piping with the ClimaCheck method due to the inherent low sensitivity to temperature errors. This is a critical advantage compared to traditional methods but should not be taken as an excuse to not follow the recommended procedures below.

Temperature sensors should be mounted:

- 10-20 cm from the compressor, flanges, valves or other objects that can act change the surface temperature compared to the inner temperature of the tube.

- Maximum contact should be ensured by:
  - Removal of any insulation and paint on the tube.
  - When mounted in pockets the sensor must be securely pressed against the wall of the pocket.
  - Heat transfer paste should always be used for surface and "pocket" mounted sensors.

- Aluminium tape should always be used for surface mounting.

- Insulation should be carefully done and diffusion tight if the surface/object is cold. The openings of dip tubes/pockets should be sealed/covered with insulation.

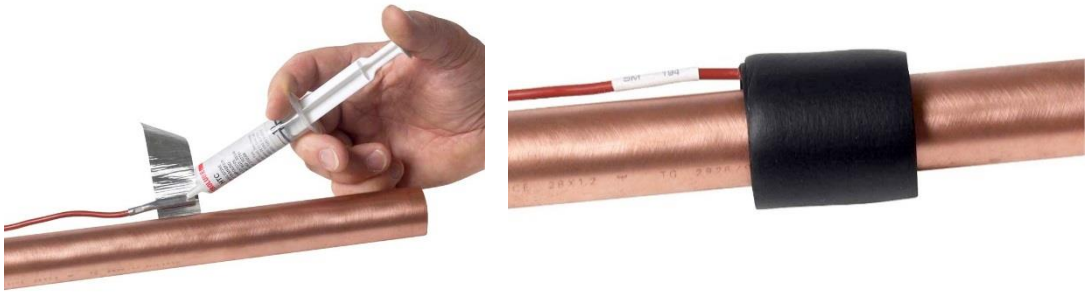

Figure 4 - Apply sensors with heat transfer compound, Aluminium and insulation

6.2.1 Required insulation

Many factors have an impact on required insulation to achieve good accuracy:

- dT to ambient
  High dT obviously increases the error from poor insulation.

- Radiation from surrounding hot/cold surfaces.

- Material type in tube
  Good heat transfer decreases the error caused by the wall from best to worse copper - iron - stainless – plastic.

- Material thickness in tube
  Dimension, pressure and material define thickness thicker tube wall increase need of insulation.

- Condensation
  It is important to avoid condensation on or near sensor as this will have a significant impact on temperature reading.

- Ice formation
  If ice is allowed to form around sensors (condensation on cold tubes) this creates an insulation.

Importance of accuracy

A service check can allow a higher tolerance for errors than an inspection to validate that performance is according to contract.

Note that even if temperatures on secondary side do not have any impact on capacity and COP of refrigeration process, they will, if nominal data is taken from manufacturers, strongly impact these reference data.

We advise common sense to be applied, with special attention to discharge and suction line sensor on the refrigerant side due to high dT and risk of condensation.

For best accuracy, remove dirt, paint and corrosion, and avoid pushing sensors inside existing insulation - cut a hole in insulation instead. Always use heat transfer paste and aluminium tape to make insulation on cold tubes so that condensation or ice formation cannot take place on sensor.

Smaller size copper tube	minimum 60 mm x 8 mm tight insulation pressed against tube (thickness 8 mm or 3 turns of insulation tape)
Larger size CU (> 35 mm/1.5")	minimum 100 mm x 8 mm tight insulation pressed against tube (thickness 8 mm or 3 turns of insulation tape)
Steel/plastic/stainless piping	minimum 15 cm x 8 mm insulation

6.2.2 Compensating for changes in Pt1000 temperature sensor cable length

No configuration has to be made if using the entire white 5 m cable, or the entire red 10 m cable, of a Pt1000 temperature sensor. If a cable is shortened or lengthened the change in resistance needs to be compensated for. The offset needs to be **increased for a longer cable** or **decreased for a shorter cable**. The white cable got a resistance of 0.07 K/m and the red cable 0.035 K/m (using all four leads in pairs).

For temporary compensation when using temperature sensor cable extensions, see Section 11.9.

6.2.3 1-wire temperature sensors

A 1-Wire temperature sensor is a bus sensor and unlike Pt1000 sensors the measured value of the sensor is not affected by the resistance in the cable between the master (PA Pro III) and the slave (sensor). Limitations in number of sensors and cable length as well as the preferred topology is described below.

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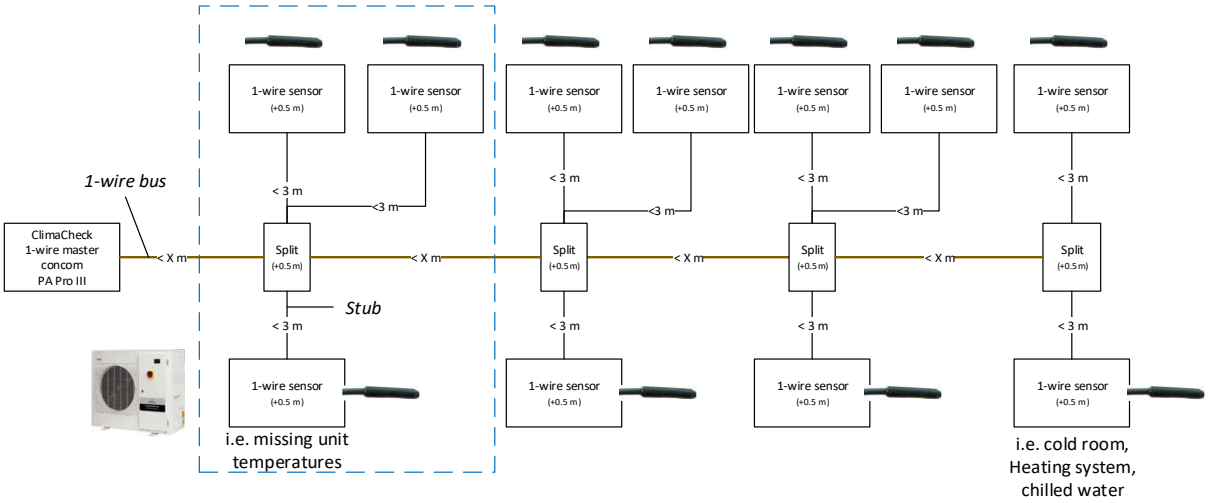


Figure 5 1-Wire preferred topology

The preferred topology, Figure 5, is with the PA Pro III connected at one end of the 1-Wire bus and each sensor connected to the bus with branches or "stubs" where each stub is less than 3m. The PA Pro III can handle a total of 16 sensors and a total "weight" of 65 m. The weight is the length of all cables + 0.5m per sensor + 0.5m per split.

Weight = total cable length + 0.5*sensor + 0.5*split
*Example: 3 sensors on 2 meter stubs that is located 5 meters from the PA Pro III with 1 split has a total weight of 0.5*3+(2*3+5)+0.5*1=14.*

Do not run signal wires in parallel with power cables.

6.3 Connection of power meter

Follow Section 4 for instructions on how to connect the power measurement.

To connect the ClimaCheck power meters to the ClimaCheck PA Pro III, use the provided serial cable. Attach one end to the power meter RS485 port and the other end to the PA Pro III RS485 port. Multiple power meters and other Modbus external units, such as a portable R560, can be connected in series with the provided serial cables.

The power meter can be used to measure the following electrical systems:

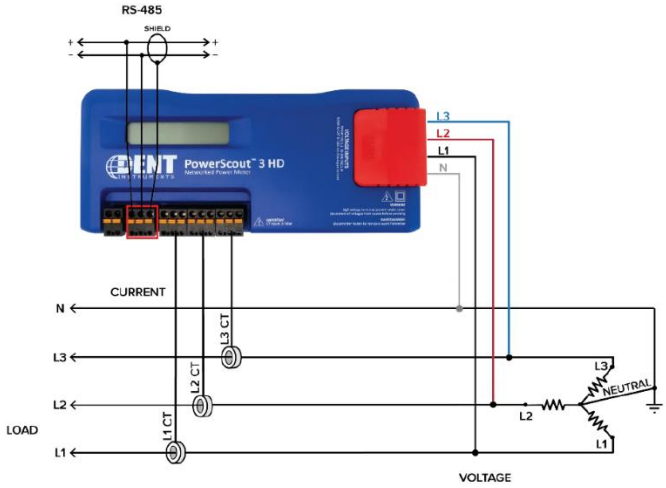
- 3-phase with zero
- 3-phase without zero
- 2-phase
- 1-phase

The current transformers and the voltage cables should be connected according to the electrical system diagrams below.

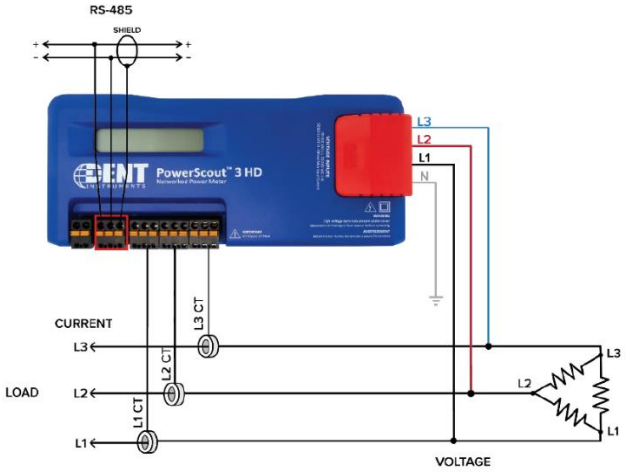
Always do a phase verification after connection, as described below.

6.3.1 CT and voltage connections of PowerScout 3HD

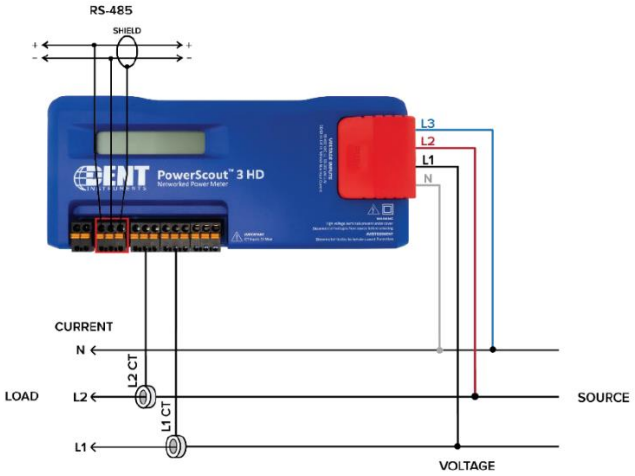
3-phase with zero



3-phase without zero



2-phase



1-phase

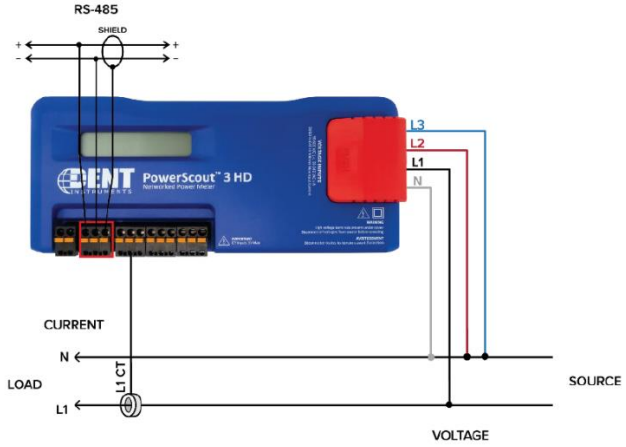
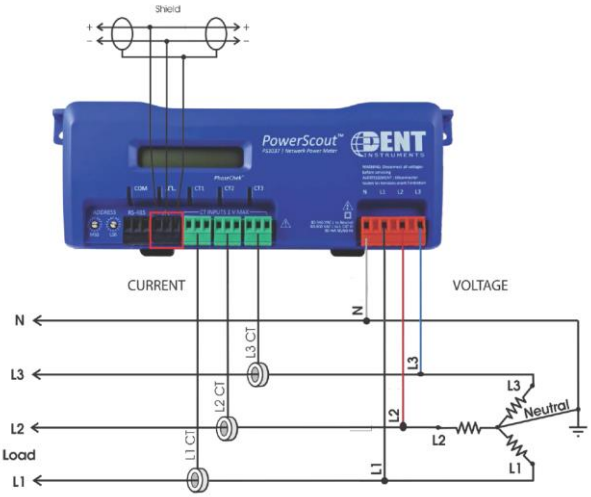


Figure 6

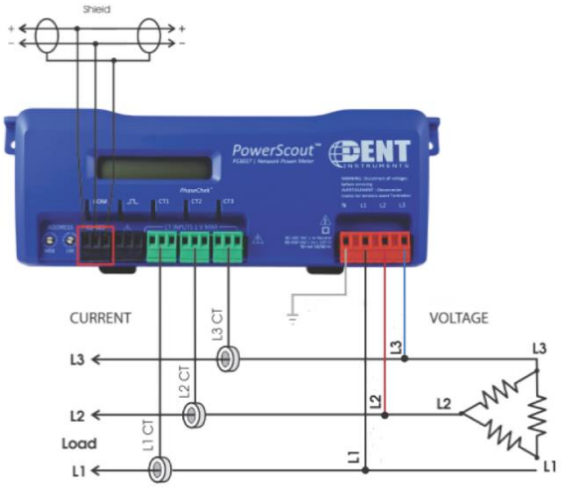
To do a phase verification, scroll the side button on the PowerScout 3HD until the display shows **PFCheck**. All measured phases should show **OK**. If a phase shows **Bad**, double check the connection and make sure each CT and corresponding voltage cable are measuring matching phases.

6.3.2 CT and voltage connections of EP Pro Scout

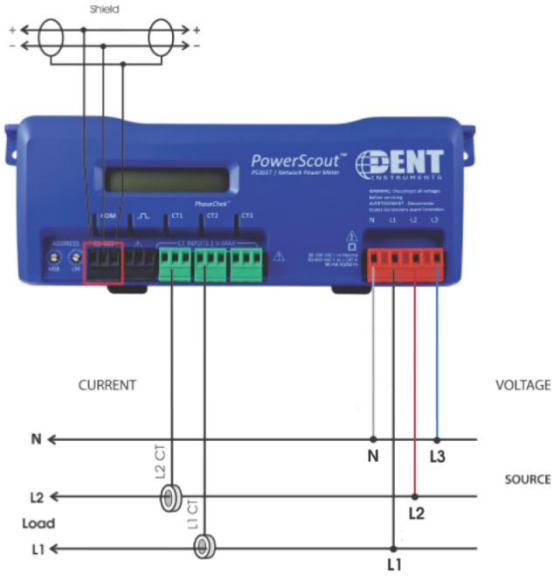
3-phase with zero



3-phase without zero



2-phase



1-phase

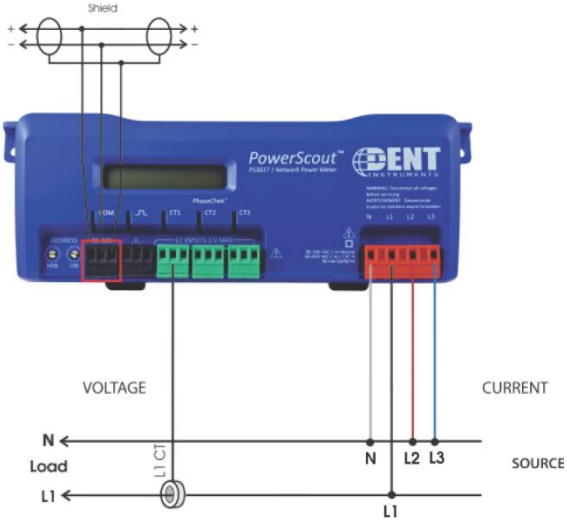


Figure 7

To do a phase verification, look at the CT1, CT2, CT3 LEDs on the EP Pro Scout. All measured phases should show **green**. If a phase shows **red**, double check the connection and make sure each CT and corresponding voltage cable are measuring matching phases.

6.4 Checking sensor readings

Before starting to analyse the setup the feasibility of all sensor readings should be checked. This is easiest to do under the **Input** tab. Incorrectly attached, mixed up or defect sensors will make it impossible to conduct a correct assessment of the refrigeration process.

7 Validation of measuring system

All measurement systems are dependent on good upkeep of measuring equipment and on operator not taking shortcuts when performing a performance and/or function control. ClimaCheck is designed to give the operator an easy to use system without requiring the operator to have detailed knowledge of the thermodynamic calculation method. It is recommended to check that sensors present the correct and expected values otherwise testing may have to be repeated due to uncertainty of input data.

National guidelines and sensor suppliers recommended calibration routines should be strictly followed and documented.

Simple controls can easily be done and are strongly recommended for each occasion the equipment is applied i.e.:

- Verify pressure transducers against atmospheric pressure, normally around 101 kPa(a). The low pressure transducer should be close to this (with allowance for atmospheric and altitude variations). The higher the range of the pressure transducer is the larger deviation in kPa is within tolerance. Sensors should be well within supplier specification before it is applied (1% of full scale is recommended maximum tolerance e.g. 10 kPa deviation for a 10 Bar(g) sensor see sensor specifications). Calibrations of offset can easily be done in ClimaCheck or logger depending on system.

- Temperature sensors should be connected before that they are applied to verify that they show the same or very similar values. The accuracy will be improved if the control is done with all sensors in water that is stirred. Recommended quality specification of temperature sensors are Pt1000 class A (approximately 0.15 K tolerance see sensor specification).

- Power transducers should display zero when current clamps are disconnected from lines. When in operation power should always be checked against name plate/catalogue data to identify any bad connections or malfunctions.

Any unexpected differences should be corrected before sensors are applied.

Calibration of all sensors should be done regularly according to routines set up by the user of the equipment. Calibration is normally done with known references (ice water or boiling water) and with accurate instruments that are regularly calibrated.

7.1 Locking the case when measuring

The ClimaCheck case has a removable panel in the middle of its long edge. This allows you to keep all sensors connected and still closing the lid. If needed the case can be secured with a pad lock, making sure no one tampers with the equipment when left unattended.

8 ClimaCheck PA Pro III Hardware

This section describes the ClimaCheck PA Pro III hardware. For more detailed information, please refer to the PA Pro III Hardware Manual.

8.1 LED indicators

The ClimaCheck PA Pro III has 4 LED indicators:

- A: ClimaCheck online
- B: 1-wire / Modbus
- S1: Status
- S2: Modem

The A LED indicates the status on contact with ClimaCheck online server.

A Led (CC Online)	Status
900ms on, 900ms off	Connection with ClimaCheck Online OK (Normal operation with internet connection)
Off	No connection with ClimaCheck Online (Normal operation without internet connection)
Fast blinking	Unsuccessful to send data to ClimaCheck Online

The B LED indicates the status of 1-wire and Modbus communication.

B LED (1W/Modbus)	Status
900ms on, 900ms off	All configured Modbus and 1-wire units OK (Normal operation)
400ms on, 400ms off	Modbus communication error
Continuous on, off	1-wire communication error

The S1 LED indicates the status on the PA Pro program.

S1 LED (Status)	Status
500ms on, 500ms off	PA Pro application running OK (Normal operation)
1500ms on, 500ms off	PA Pro application running OK, while charging the internal back-up battery.
500ms on, 500ms off	PA Pro application running OK, while connected to ClimaCheck software (Normal operation, while connected to software)
Fast blinking	The unit has been forced into recovery mode with the use of the system switch. The application is not executing.
Fastest blinking	The unit is initializing, preparing to start the application.
75ms on, 925ms off	Execution speed is different from full-speed.
Fast blinking	A runtime error has been detected in the program, contact ClimaCheck support
Alternating Fast/Slow	The unit has lost its firmware, contact ClimaCheck support

The S2 LED indicates the modem status.
Communication status is showed as an icon in the display and with the S2 LED, see table below.

S2 LED (Modem)	Status
Off	The GSM module is turned off.
600ms on, 600ms off	No SIM card inserted or no PIN code entered, or network search in progress, or ongoing user authentication, or network logon in progress.
Single 75ms on, 3s off	Logged to the network, no call in progress.
Double 75ms on 3s Off	A GPRS session is active. Bars indicate signal strength
Flashing	Indicates GPRS data transfer.

8.2 Start

ClimaCheck PA Pro starts directly when it is connected to the power supply. During start, a choice can be made to connect to ClimaCheck *online* or run offline measurements on the PC software. When the PA Pro asks **Connect to PC?** Press **Yes** to run offline measurements or **No** to connect to ClimaCheck *online*.

When the system is used offline the display shows **ClimaCheck PA Pro III**, the 6 digit ID, and the application version, after around half a minute, The unit can now be used.

If the system is connected to ClimaCheck Online with GPRS, LAN or Wifi the unit will try to connect to internet and send data. To change network interface, select **Network interface** from the menu. Check Section 8.3 for the correct location.

To reboot the unit, select **Restart/Reboot** from the menu. Check Section 8.3 for the correct location.

The unit can be turned off by disconnecting the power. The internal backup battery allows for a safe shut down.

8.3 Menus

There are 8 push buttons on the PA Pro touch screen. To open the main menu, press **Esc**. To open a sub menu, press **SEL.** To choose a function or confirm a configuration, press **OK**. To go back, press **ESC**. The menu structure is shown in the figure below.

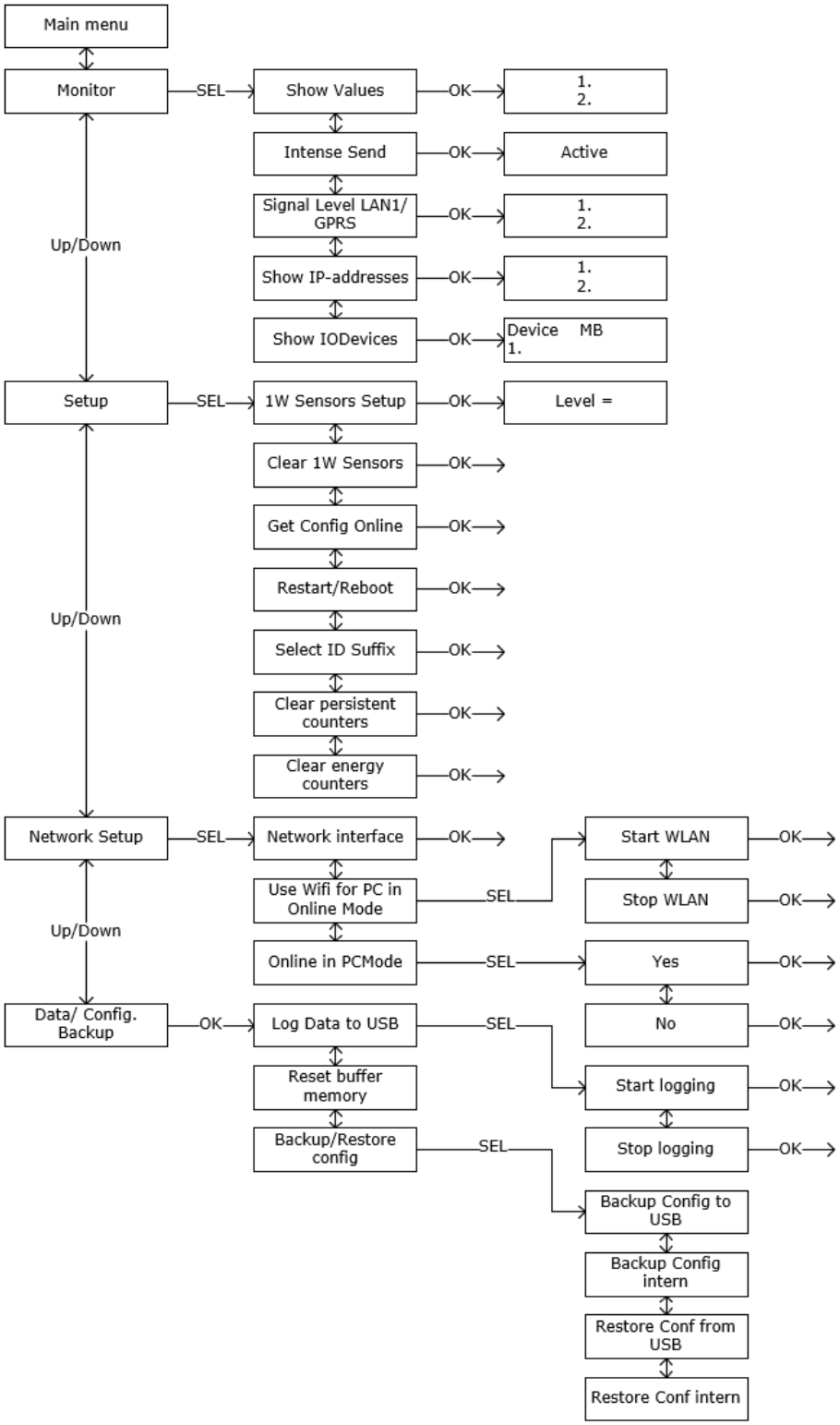


Figure 8 Menu structure

8.4 Monitor

All values from sensors and power meters can be seen under the Monitor menu. From the Monitor menu, the send interval to ClimaCheck online can also, temporarily, be changed.

8.4.1 View all values

To view all values:

- Press ESC to enter the Main menu
- Press Down until "Monitor" is shown in the display
- Press SEL to enter Monitor menu
- "Show values" appears in the display
- Press OK

Values are shown with a sensor/value number, a comment/description, the sensor reading, and a unit. Press Up/Down to step through the list of values.

8.4.2 Signal level

When using the PA Pro III with GRPS modem or Wifi, it is possible to check the signal level.

- Press ESC to enter the Main menu
- Press Down until "Monitor" is shown in the display
- Press SEL to enter Monitor menu
- Press down until "Signal Level" is shown in the display
- Press OK

8.4.3 IO Devices

The **Show IO Devices** menu shows the configured devices including the analog inputs and the Modbus units such as R560 and EP Scout. The menu shows if any of the devices are disabled because of communication errors. To reactivate all units, restart the PA Pro III.

8.5 Configuring 1-wire sensors

1-Wire sensors delivered with the system/logger will be configured and marked at shipment. Sensors added later have to be configured/connected.

8.5.1 Connecting sensors

The sensors need to be connected and configured **one at a time.** Use the following sequence to setup and connect the sensors:

- Press ESC to enter the Main menu
- Press Down until "Setup" is shown in the display
- Press SEL to enter setup menu
- "1W Sensor Setup" appears in the display
- Press OK to start setup

If this is the first setup, "T1 Sensor not conf" appears in the display. If sensors are already configured, they will be listed.

- With the up and down arrows go to the position you want to save a sensor to
- Press SEL
- "TX NEW=xxxxxx OK" is shown in the display, where TX is the position and xxxxxx is the ID number of the sensor
- Confirm with OK, "S-RID Saved" appears for 2 seconds
- Temperature reading and ID appears in the display "TX=XX.X ID=xxxxxx"
- Press up/down to continue with the next sensor or ESC 4 times to go back to the main menu.

If "No new s-r found" appears while setting up a new sensor, the PA Pro cannot find any sensor on the bus that is not already configured. Check the connection and make sure the sensor has not been configured already.

8.5.2 Replace a 1-wire senor

To replace a 1-wire sensor:

- Disconnect old sensor
- Press ESC to enter the Main menu
- Press Down until "Setup" is shown in the display
- Press SEL to enter setup menu
- "1W Sensor Setup" appears in the display
- Press OK
- Select the sensor number in the list, it will say "Sensor missing".
- Connect new sensor and press SEL,
- "Tx NEW=xxxxxx OK" is shown in the display
- Confirm with OK, "S-RID Saved" appears for 2 seconds
- Temperature reading and ID appears in the display "TX=XX.X ID=xxxxxx"
- Press ESC 4 times to go back to the main menu.

8.5.3 Clear all 1-wire sensors

To clear all configured 1-wire sensors:

- Press ESC to enter the Main menu
- Press Down until "Setup" is shown in the display
- Press SEL to enter setup menu
- Press down until "Clear 1W Sensors" is shown in the display
- Press OK
- "Clearing.." appears and then you're back in the setup menu

This will clear all 1-wire sensors including any preconfigured 1-wire sensors. You can now connect the sensors again, see Section 8.5.1.

8.5.4 Troubleshoot 1-wire sensors

Below are the possible error messages when connecting a 1-wire sensor.

"No tempsensors or conn. Wrong. OK?"
Check wiring and make sure all sensors are connected properly. If the wires from one sensor is mixed up, the whole 1-Wire bus stops.

"No new s-r found"
Check wiring and make sure sensor is not already connected/configured on a different position.

8.6 Data to different processes on ClimaCheck *online*

When sending data to ClimaCheck online, it is possible to choose which process the data should be sent to. This is done by checking the process ID on ClimaCheck online and choosing it from the PA Pro III display. The ID consists of the PA Pro III serial number and a suffix such as @1 or #1. From the **Setup** menu, choose **Select ID Suffix** and select the corresponding suffix.

8.7 Network interface

The PA Pro III can connect to ClimaCheck online through GPRS modem, LAN and Wifi. To choose the method of connection, go to the **Network Setup** menu, select **Network interface** and select the corresponding network.

If the PA Pro III is in PC/Offline mode, it still is possible to connect to ClimaCheck online by going to the **Network Setup** menu, selecting **Online in PCMode** and pressing **Yes**. The PA Pro III will then try to connect to ClimaCheck online through the selected network interface.

8.8 Log to USB

Data can be saved to a USB memory connected to the USB-port on the top side of the unit. Data is saved with the same interval that is used to send data to the ClimaCheck Online server i.e. once every minute when the compressor is running and every 5 minutes when it's off. The USB memory needs to be formatted with the file system FAT or FAT32.
To activate logging to USB:

- Shut off logger by disconnecting power
- Connect the USB memory to the USB-A port on the top side of the unit.
- Start logger by connecting power again. Wait for the unit to start.
- Press ESC to enter the Main menu
- Press down until "USB/Backup" appears in the display
- Press SEL to enter USB/Backup menu
- "Log data to USB" appears in the display
- Press SEL to enter the menu,
- Press Yes and then confirm with OK

A folder is created on the USB memory with the PAID as name and the data is saved in *.LOG files as comma separated values. A new file is created for each day and when the USB memory is full the logging stops.

For instructions on how to run *.LOG files in the ClimaCheck software please see the ClimaCheck Software manual.

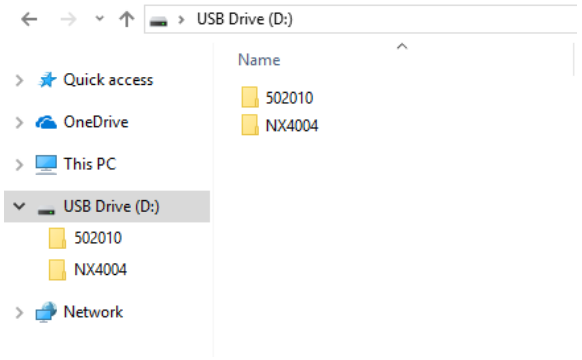


Figure 9 USB memory with data from two different Gateways

To deactivate logging to USB:

- Press ESC to enter the Main menu
- Press down until "USB/Backup" appears in the display
- Press SEL to enter USB/Backup menu
- "Logg data to USB" appears in the display
- Press SEL to enter the menu,
- Press No and then confirm with OK

8.9 Backup and restore configuration

It's possible to backup and restore the device configuration through the PA Pro III display. To backup the configuration, go to **Data/Config. Backup** menu, select **Backup/Restore Config** and select **Backup Config Intern**. This will save the configuration file in the internal memory. To restore the configuration, go to **Data/Config. Backup** menu, select **Backup/Restore Config** and select **Restore Config Intern**.

9 ClimaCheck software with PA Pro III

The following section describes the integration of the ClimaCheck software with PA Pro III.

9.1 Installing the ClimaCheck Software

When installing the ClimaCheck software make sure to follow these guidelines:

- Log in as an administrator.
- Have a working internet connection for registration.
- Install the software at the office to minimize the risk of problems at the site of measurement.
- The license number can be found on a copy of the delivery note attached at the end of this manual.

9.2 Connecting to PA Pro III

To connect the ClimaCheck software to PA Pro III and start the measurement, follow the steps below:

- Start the PA Pro III. Check Section 8.2 for more details.
- Connect the provided USB A to B cable to the PA Pro III and the PC.
- Start ClimaCheck Standard. A reminder of the refrigerant will be shown.
- Press contact and choose Direct on menu.

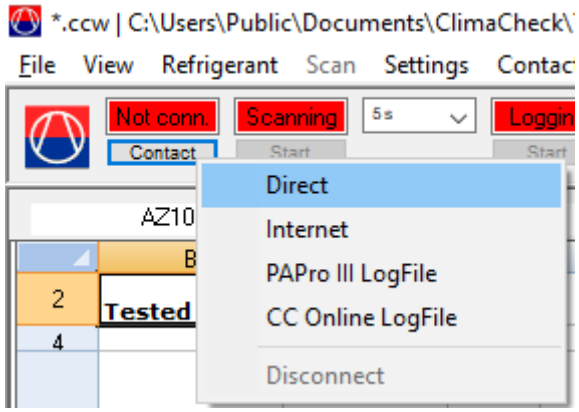


Figure 10

It is possible to get the question *"The channel names in this datasource are not the same as in the connected PA Pro or in the loaded PA Pro logfile. Connect anyway?"*. This means that the PA Pro does not currently use the exact same names for its data channels as the software does. This results from the hardware and software not being updated at the same time, or that either the hardware or the software got custom configurations. In either case, just click **Yes** to continue. The next window shows *"Do you want to update the datasource with the channel names from the connected PA Pro or loaded PA Pro logfile?"*. Click **Yes** here as well.

To not get this question on every start, make sure to save the updated datasource:

- Select **Settings** -> **Preferences** from the menu.
- Check the box **Advanced mode** and click **OK**.
- Select **File** -> **Save Datasource changes** from the menu.
- Disable advanced mode again to hide the extra options it enables.

9.3 Troubleshooting the connection

If you have problems getting contact with the PA Pro try the following:

- Make sure the USB cable is connected properly.

- Make sure the correct data source is chosen under **Settings** > **Preferences** > **Common** > **Default DataSource.** The default should **PA_Pro_III_Standard.ccd**.

- Restart the program.

10 PA Pro III configuration

The chapter describes how to use the PA Pro III configurator. For more detailed information, please refer to the Hardware Manual.

The PA Pro III Configuration tool can be found under the PA Pro III menu in the ClimaCheck software.

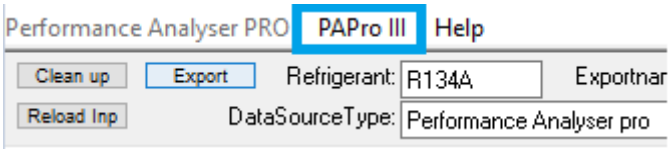


Figure 11

All ClimaCheck PA Pro III systems have their default configuration on the ClimaCheck Online server but with the configurator, settings can be changed without the need of an internet connection.

To exit the configurator, go to File menu and then Exit. The configurator will be stopped and the ClimaCheck software is opened again.

10.1 Edit PA Pro III input configuration

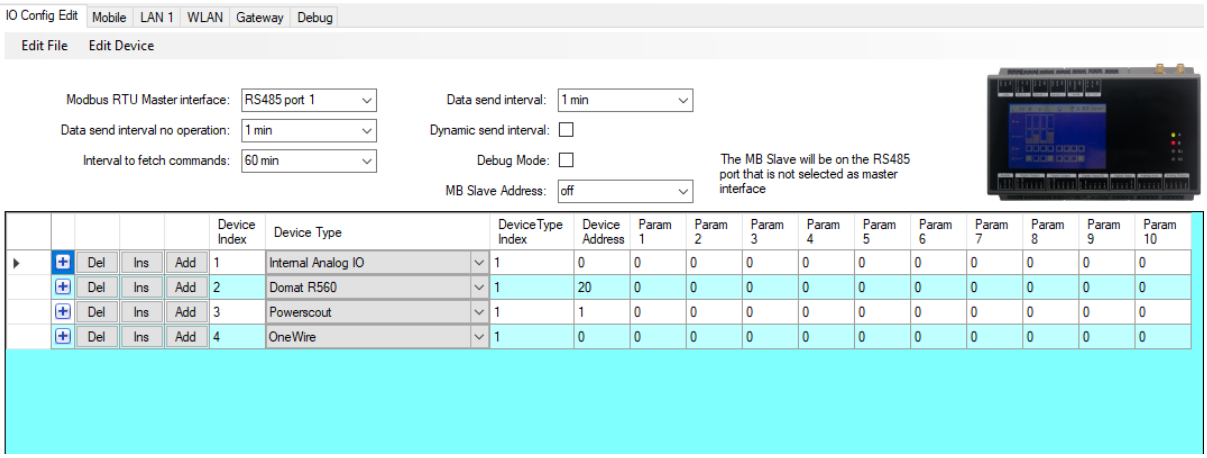


Figure 12 IO Config Edit tab with 4 external units

The analog inputs on the PA Pro III unit and Domat R560 module can be used for different 0-10V and 4-20mA sensors. To change the configuration, follow the steps below.

- Go to PAPro III menu and PA Pro III Configuration
- On the Action menu choose Connect to Device, in the lower right corner the PAID of the connected device can be seen.
- On the Action menu go to Unlock for write to device.
- Enter the user password and press OK. (default: ef56)
- On the IO Config Edit tab go to Edit Device and then Open Configuration in device

The configuration is loaded and all settings are displayed on the IO Config Edit tab.

- Open the list with inputs for a device with the + to the left, see Figure 13
- Select new sensor type on the drop-down menu
- Write a Comment for the new sensor, this name is what will be showed in the Data source.
- On the IO Config Edit tab go to Edit Device and then Save Configuration in device, the unit will reboot.

Note that the Sensor Type list is common for PA Pro III and R560 but the analog inputs on the PA Pro III can't handle Pt1000 sensors.

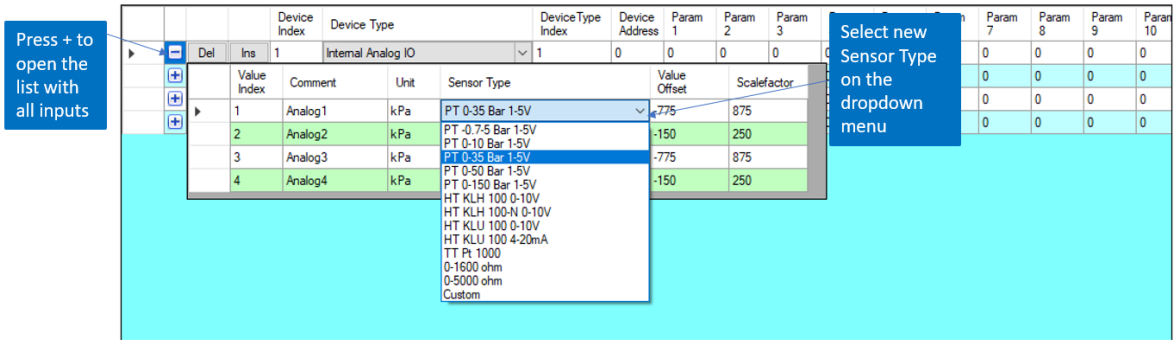

Press + to open the list with all inputs
Select new Sensor Type on the dropdown menu
Device Index
Device Type
DeviceType Index
Device Address
Param 1
Param 2
Param 3
Param 7
Param 8
Param 9
Param 10
Del
Ins
1
Internal Analog IO
1
0
0
0
0
Value Index
Comment
Unit
Sensor Type
Value Offset
Scalefactor
1
Analog1
kPa
PT 0-35 Bar 1-5V
-775
875
2
Analog2
kPa
-150
250
3
Analog3
kPa
-775
875
4
Analog4
kPa
-150
250
PT -0.7-5 Bar 1-5V
PT 0-10 Bar 1-5V
PT 0-35 Bar 1-5V
PT 0-50 Bar 1-5V
PT 0-150 Bar 1-5V
HT KLH 100 0-10V
HT KLH 100-N 0-10V
HT KLU 100 0-10V
HT KLU 100 4-20mA
TT Pt 1000
0-1600 ohm
0-5000 ohm
Custom

Figure 13

11 Basic Functions of the Software

The chapter describes basic functions of the Climacheck Software. For more detailed information, please refer to the Software Manual.

11.1 Tabs

The tabs contain different data and ways to display it.

Figure 14

- **Description** – Information about the measured system entered by the user. Not directly used by the program.
- **Report** – The standard tab containing current and previous data in a chart.
- **Constants** – Contains constants that can be modified by the user.
- **Input** – Shows the data supplied by the sensor. Convenient when troubleshooting the attachment of the sensors.
- **Custom** – Compare how the system runs before and after your adjustments. To select a reference point right-click on the row in the **Report** tab and select **Copy to CustomSheet**.
- **Flow chart** – Displays a flow chart overview of the system.
- **Graph-tabs** – Two tabs showing graphs over the systems values varying over time.

11.2 Choosing refrigerant

When starting the refrigerant will often be set to R134A automatically. To choose another refrigerant go to the menu **Refrigerant**. Always make sure the correct refrigerant is selected before starting the measurements.

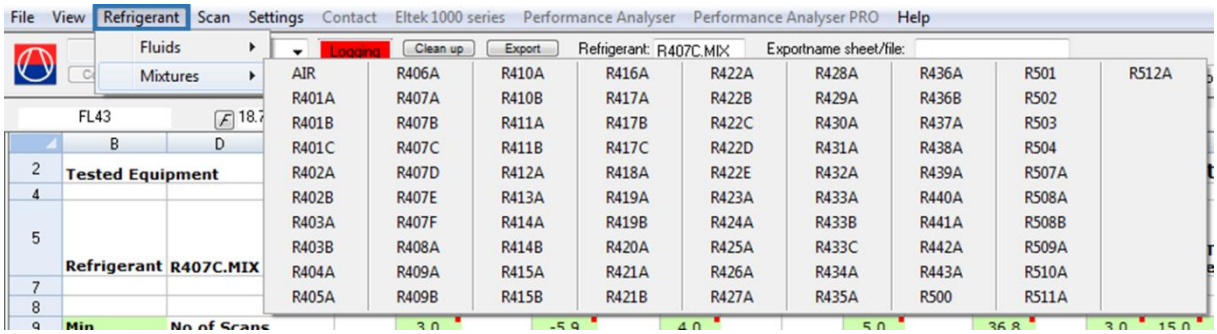


Figure 15

11.3 Choosing measuring interval

You choose how often measurements should be retrieved by selecting a value in drop down menu to the right of **Scanning.** On site 5 seconds is usually a good value, but if you are going to leave it for a time it is often better with 60 seconds.

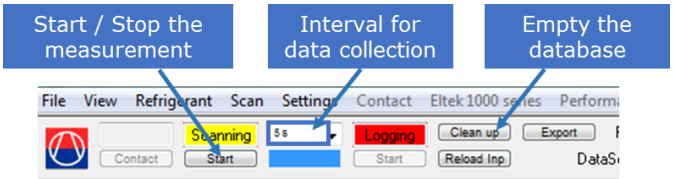


Figure 16

11.4 Starting the measurement

To start collecting data from the PA Pro click the **Start** button in the upper left corner. **Scanning** is shown against a green background and the logging starts automatically. To stop press the same button again.

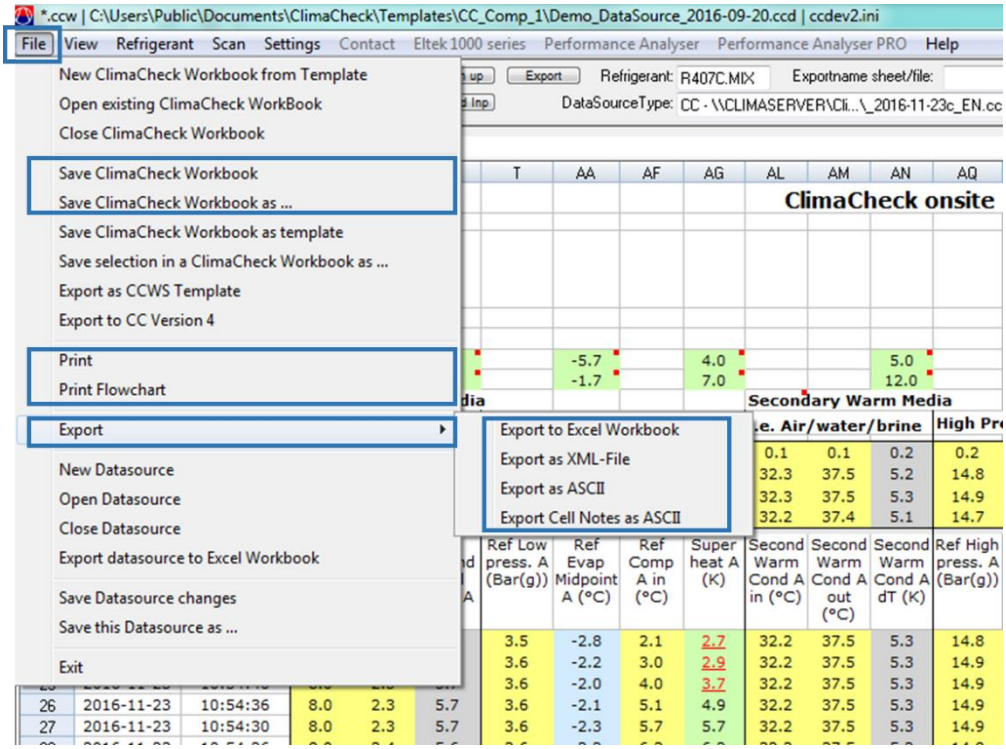


Figure 17

11.5 Printing the results

Start by selecting the tab you want to print and then choose **File** and **Print**. Start the printing by clicking **Options**. To print the flow chart you need to choose **Print Flowchart** directly under **File**. (Figure 17)

11.6 Exporting the results

Export your results to a file by selecting **File** and **Export**. You can choose among Excel, XML and ASCII. (Figure 17)

11.7 Saving

Save your data by selecting **File** and **Save ClimaCheck Workbook**. You can also save your changes as a new template by selecting **File** and **Save ClimaCheck Workbook as Template**. (Figure 17)

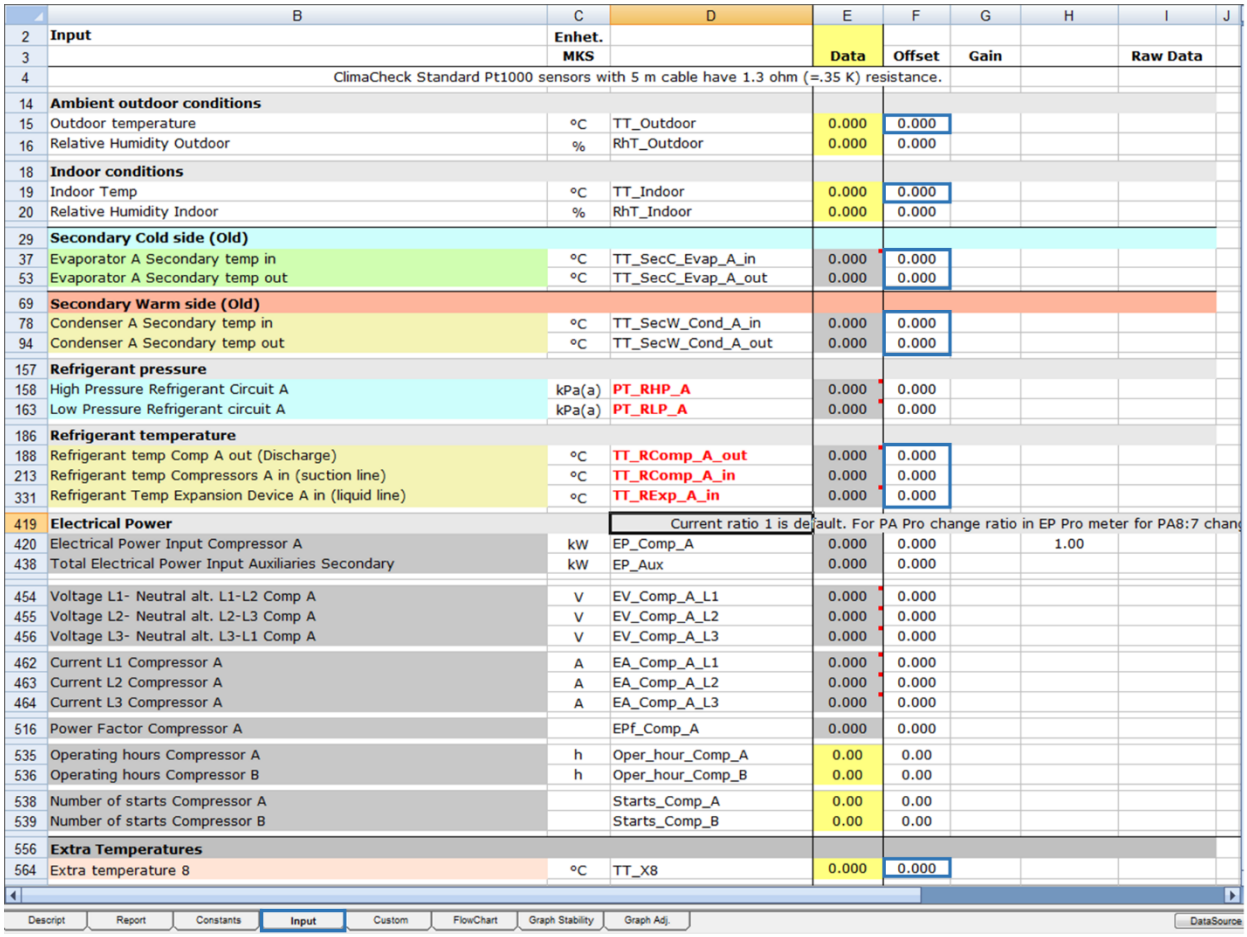
11.8 Emptying the database

Empty the database by clicking the **Clean up** button. (Figure 16)

11.9Adding offsets

When a temperature sensor is used with an extension cable, an extra resistance is added. This has to be compensated for in the software, by adding an offset to the measured value.

In the ClimaCheck software, choose the **Input tab** in the Workbook and enter the **offset** of the extension cable in Kelvin (a positive value). The fields in question (depending on which cables have been extended) are marked in red below:



	B	C	D	E	F	G	H	I	J
2	**Input**	**Enhet.**							
3		**MKS**		**Data**	**Offset**	**Gain**		**Raw Data**	
4	ClimaCheck Standard Pt1000 sensors with 5 m cable have 1.3 ohm (=.35 K) resistance.								
14	**Ambient outdoor conditions**								
15	Outdoor temperature	°C	TT_Outdoor	0.000	0.000				
16	Relative Humidity Outdoor	%	RhT_Outdoor	0.000	0.000				
18	**Indoor conditions**								
19	Indoor Temp	°C	TT_Indoor	0.000	0.000				
20	Relative Humidity Indoor	%	RhT_Indoor	0.000	0.000				
29	**Secondary Cold side (Old)**								
37	Evaporator A Secondary temp in	°C	TT_SecC_Evap_A_in	0.000	0.000				
53	Evaporator A Secondary temp out	°C	TT_SecC_Evap_A_out	0.000	0.000				
69	**Secondary Warm side (Old)**								
78	Condenser A Secondary temp in	°C	TT_SecW_Cond_A_in	0.000	0.000				
94	Condenser A Secondary temp out	°C	TT_SecW_Cond_A_out	0.000	0.000				
157	**Refrigerant pressure**								
158	High Pressure Refrigerant Circuit A	kPa(a)	PT_RHP_A	0.000	0.000				
163	Low Pressure Refrigerant circuit A	kPa(a)	PT_RLP_A	0.000	0.000				
186	**Refrigerant temperature**								
188	Refrigerant temp Comp A out (Discharge)	°C	TT_RComp_A_out	0.000	0.000				
213	Refrigerant temp Compressors A in (suction line)	°C	TT_RComp_A_in	0.000	0.000				
331	Refrigerant Temp Expansion Device A in (liquid line)	°C	TT_RExp_A_in	0.000	0.000				
419	**Electrical Power**		Current ratio 1 is de	ault. For PA Pro change ratio in EP Pro meter for PA8:7 chan					
420	Electrical Power Input Compressor A	kW	EP_Comp_A	0.000	0.000		1.00		
438	Total Electrical Power Input Auxiliaries Secondary	kW	EP_Aux	0.000	0.000				
454	Voltage L1- Neutral alt. L1-L2 Comp A	V	EV_Comp_A_L1	0.000	0.000				
455	Voltage L2- Neutral alt. L2-L3 Comp A	V	EV_Comp_A_L2	0.000	0.000				
456	Voltage L3- Neutral alt. L3-L1 Comp A	V	EV_Comp_A_L3	0.000	0.000				
462	Current L1 Compressor A	A	EA_Comp_A_L1	0.000	0.000				
463	Current L2 Compressor A	A	EA_Comp_A_L2	0.000	0.000				
464	Current L3 Compressor A	A	EA_Comp_A_L3	0.000	0.000				
516	Power Factor Compressor A		EPf_Comp_A	0.000	0.000				
535	Operating hours Compressor A	h	Oper_hour_Comp_A	0.00	0.00				
536	Operating hours Compressor B	h	Oper_hour_Comp_B	0.00	0.00				
538	Number of starts Compressor A		Starts_Comp_A	0.00	0.00				
539	Number of starts Compressor B		Starts_Comp_B	0.00	0.00				
556	**Extra Temperatures**								
564	Extra temperature 8	°C	TT_X8	0.000	0.000				

Descript | Report | Constants | Input | Custom | FlowChart | Graph Stability | Graph Adj. | DataSource

Figure 18

12 Configuration of Power Meter PowerScout 3HD

This section explains how to change the most common settings on the PowerScout 3HD.

12.1 Configuration of CT type

The PowerScout 3HD can be used together with 150A current clamps and Rogowski coils. To change the CT type, the power meter should be accordingly configured as follows:

- Connect the PowerScout 3HD to the computer via the provided USB cable.
- Open a browser and go to **169.254.1.5**.
- Leave the Password field empty and click on **Login**.

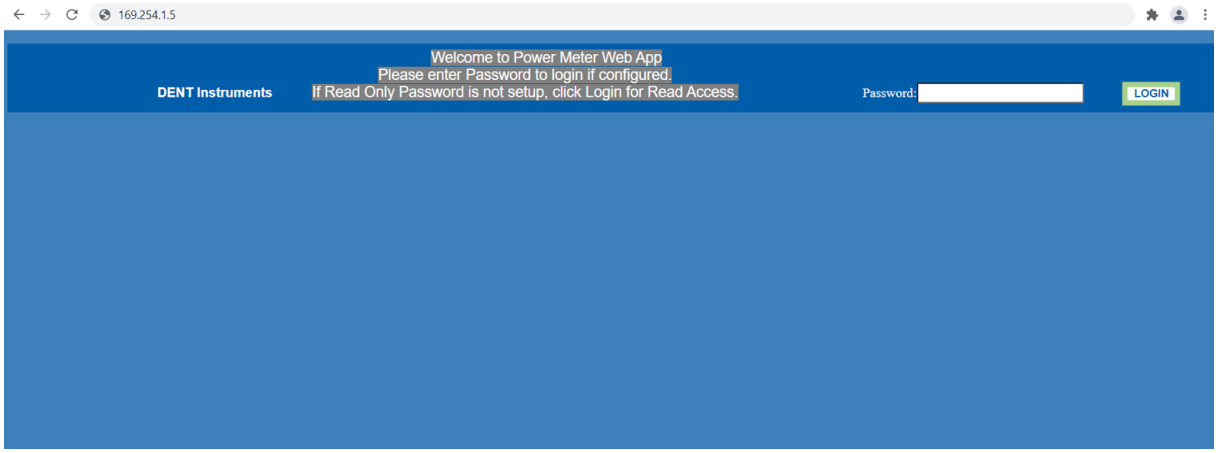


Figure 19

- Click on **Meter Setup**
- Adjust the Type, Range and Phase Shift:
  - For Rogowski coils:
    - Type: Rogowski
    - Range: 4000
    - Phase Shift: 0

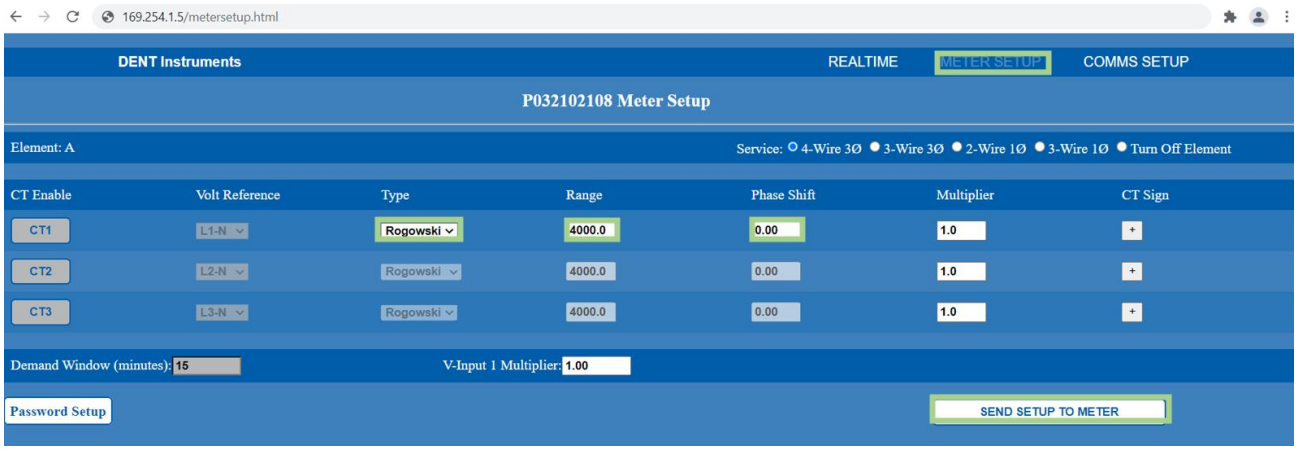


Figure 20

  - For 150A current clamps:
    - Type: millivolt
    - Range: 150
    - Phase shift: 2.05

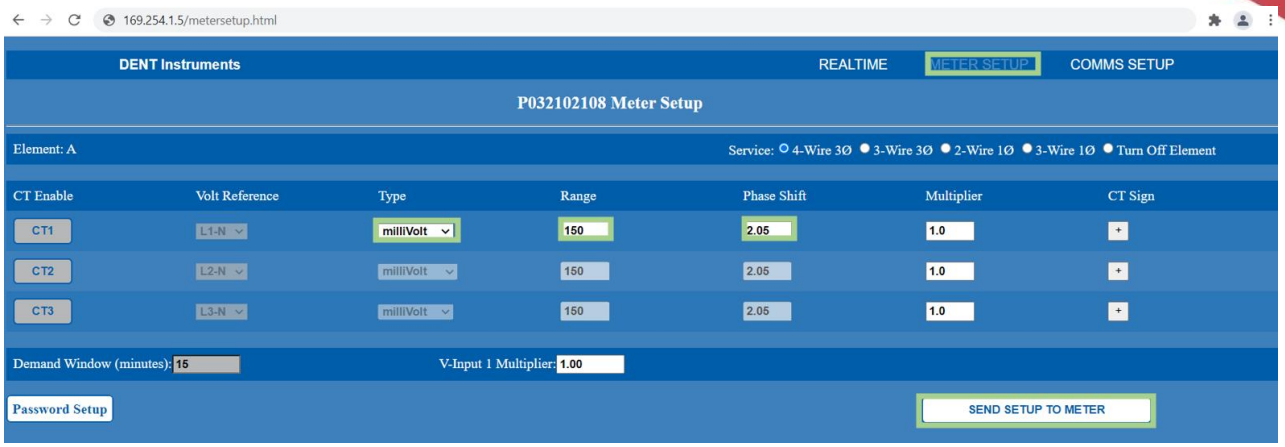


Figure 21

- For 50A snap on clamps:
  - Type: millivolt
  - Range: 50
  - Phase shift: 1.02
- For 20A snap on clamps:
  - Type: millivolt
  - Range: 20
  - Phase shift: 1.11

- Click on **Send Setup To Meter**

12.2 Changing Modbus address

Each power meter and other Modbus units (such as portable R560) has a Modbus address. When connecting more than one power meter each power meter needs a unique Modbus address and it might be necessary to change the Modbus address of the power meter.

- Connect the PowerScout 3HD to the computer via the provided USB cable.
- Open a browser and go to **169.254.1.5**.
- Leave the Password field empty and click on **Login**.
- Click on **Comms Setup**
- Click on **Read Comms Setup From Meter**.
- Adjust the address.
- Click on **Send Comms Setup To Meter**.

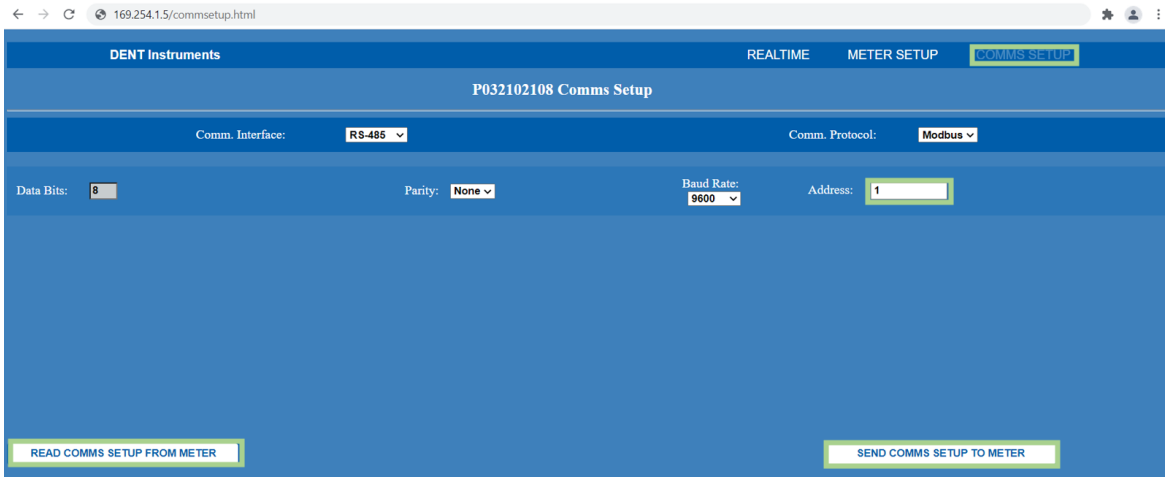


Figure 22

13 Configuration of Power Meter EP Pro Scout

This section explains how to change the most common settings on the EP Pro Scout.

13.1 Configuration of CT type

The EP Pro Scout can be used together with 150A current clamps and Rogowski coils. To change the CT type, the power meter should be accordingly configured as follows:

- Install the ViewPoint software found on the USB memory.
- Connect the EP Pro Scout to the computer via the provided USB cable.
- Launch the ViewPoint software.
- Select the correct PC COM Port which states "DENT USB"
- Click on the "Connect" button. The model number and the firmware version of the EP Pro Scout will be shown.

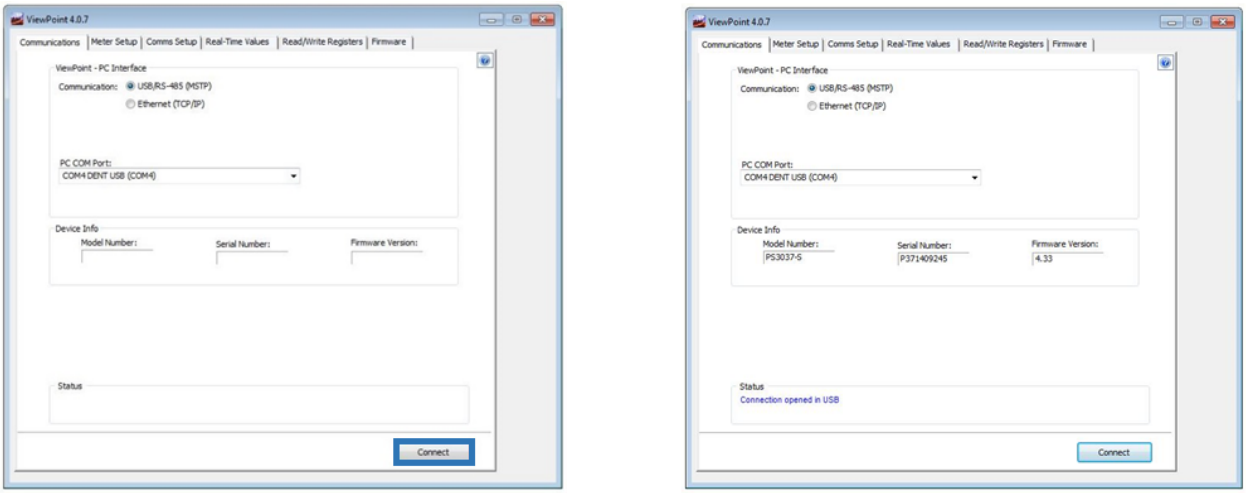


Figure 23

- Move to the "Meter Setup" page and click on "Retrieve Meter Setup".

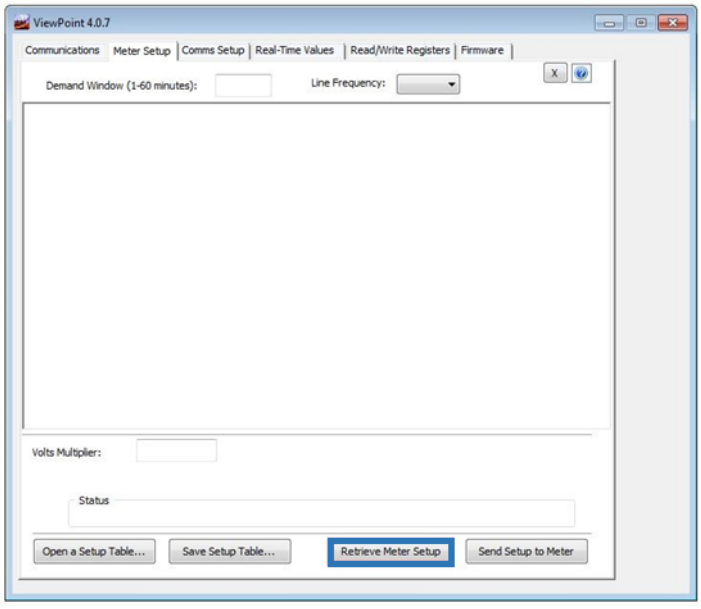


Figure 24

- Adjust the line frequency if required. Americas and parts of Asia use a frequency of 60Hz.
- Adjust the CT type: "RoCoil" for Rogoswki coils and "Millivolt CT" for current clamps. For the 150A current clamps provided, the "CT Amps" should be set to 150 and "CT Phase Shift" to 1.1, as shown in the figures below. For the 20A split cores, the "CT Amps" should be set to 20 and "CT Phase Shift" to 0.75.
- Click on "Send Setup to Meter" when finished.

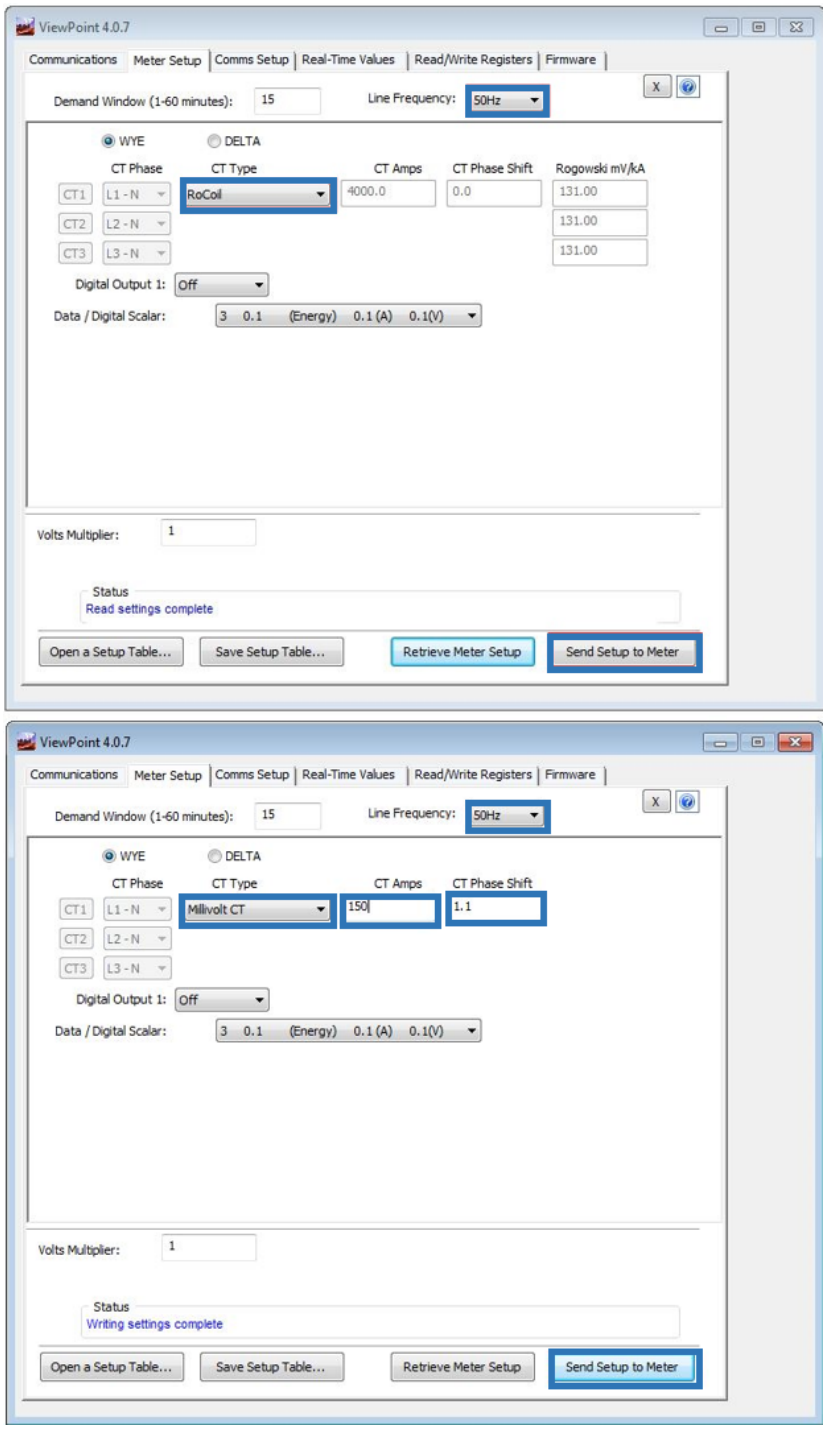


Figure 25

13.2 Resetting energy count

EP Pro Scout records and reports measured energy. This value will continue to increase with each use of the meter. If you want to reset this value back to zero, follow the steps below:

- Install the ViewPoint software found on the USB memory.
- Connect the EP Pro Scout to the computer via the provided USB cable.
- Launch the ViewPoint software.
- Click on the "Connect" button.
- Move to the "Read/Write Registers" tab and click on "Clear Totals" as shown below.

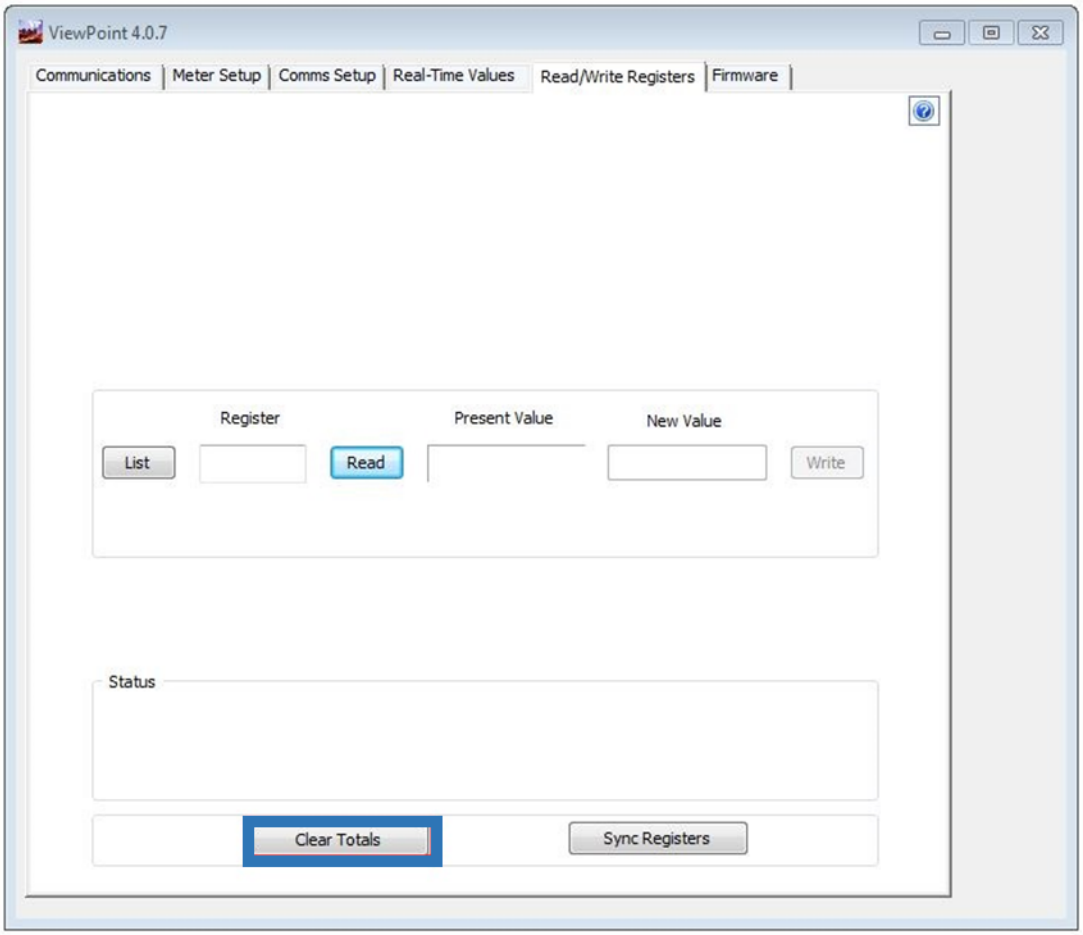


Figure 26

14 Standard content of the PA Pro case

The table below shows the standard content of the PA Pro case.

Part	Amount
PA Pro panel (mounted in case)	1
Power supply 24 VDC	1
USB A to B cable	2
PowerScout 3HD (Power Meter)	1
Current clamp/Rogowski coil	3
Voltage cable	1
Voltage clamp	4
Short serial cable for power meter	1
Long serial cable	1
Pt1000 Temperature sensor	8
Pressure sensor 10 bar	1
Pressure sensor 35 bar	1
Cable for pressure sensor	2
Heat transfer paste	1
Aluminium tape	1
Insulation tape	1
Insulation sheets	2
Clips for insulation	4
Extra fuses 1 A	10
USB flash drive	1
GPRS Antenna	1

Always packing the same way makes it easy to quickly check that all sensors are packed and avoid coming to site with an incomplete set of equipment.

Figure 27