

WE HAVE MORE THAN 30 YEARS OF EXPERIENCE, DEVELOPING DIRECT CURRENT COMPRESSORS AND HELPING CUSTOMERS BENEFIT FROM THE OPPORTUNITIES OF MOBILE REFRIGERATION TECHNOLOGY.

WITH A DEEP INSIGHT OF THE USAGE ACROSS VARIOUS APPLICATIONS WE HAVE EARNED A POSITION AS MARKET LEADER, WORKING WITH OEM-CUSTOMERS .

CONTROLLER FOR BD COMPRESSORS

SECOP

OPERATING INSTRUCTIONS 101N08xx Series, 12-24 V DC



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1. INTRODUCTION

1.1 Applications

The Secop BD compressors with 101N08xx Series 12-24V DC are designed for use in:

- Comfort cooling in parking anti-idle applications
- Spot and comfort cooling in buses, golf carts, smaller boats, forklifts, campers etc
- Cooling of switchboards and batteries in radio stations for cellular phones
- Mobile refrigeration applications
- Air cargo cooling
- Mobile cooling boxes of volume up to 1000L
- Mobile refrigeration applications

1.2 Capability

For R134a compressor variants:

One application module can control either single or twin compressor configurations.

The cooling capacity of the single compressor configuration is approx. 900 Watt @ Pe/Pc
~+15/+55°C

The cooling capacity of the twin compressor configuration is approx. 1800 Watt @ Pe/Pc
~+15/+55°C

The system is able to operate in ambient temperatures up to +55 °C.

The operating conditions are High Back Pressure (HBP).

For R404A/R507 compressor variants:

The cooling capacity of the compressor is approx. 380 Watt @ Pe/Pc ~-5/+55°C

The system is able to operate in ambient temperatures up to +55 °C.

The operating conditions are Low Back Pressure (LBP).

1.3 Functions

The main functions of the controllers are:

- Operation using either 12 V DC or 24 V DC
- Simultaneous and independent control of two compressors in twin configuration
- ECO function to optimize compressor speed for minimum power consumption
- Detailed error log
- Event log
- Motor / Compressor speed control
- Thermostat control (ON / OFF or electronic via NTC temperature sensor)
- Condenser fan control
- Evaporator fan control
- Communication interface
- Monitoring function
- Battery protection functions
- Main Switch
- Log of specific parameters
- Optimization of specific parameters via PC software before commencing mass production

1.4 Programming Interface

The controller can be accessed using either

- The Secop software tool Tool4Cool® LabEdition, or
- A custom interface. Please contact Secop for further information regarding custom interfaces

INSTALLATION

2.1 Checklist

Installation involves the following steps:

- Checklist
- Cable connection
- Software installation and configuration

Check that you have the following:

<p>BD Controller 101N08xx Series 12-24 V DC (modules and cables)</p> <p>Image shows compressor/application modules 101N08xx-series in twin compressor configuration with communication cable assembly</p>	
<p>Tool4Cool® LabEdition software download: www.secop.com/tool4cool.html</p>	
<p>NTC temperature sensor (alternative: mechanical thermostat)</p>	
<p>Product key for BD compressor controller</p>	<p>- on request -</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Alternative gateways</p> <p>Secop Bluetooth® gateway with USB power supply</p> <ul style="list-style-type: none"> • Gateway • USB power supply • Bluetooth® connection cable (must be ordered separately) 	
<p>Secop One Wire/LIN gateway with connection cables</p> <ul style="list-style-type: none"> • Gateway • One Wire/LIN gateway communication cable • USB 2.0 A/B cable 	

Ordering: See section 5.0

2.2

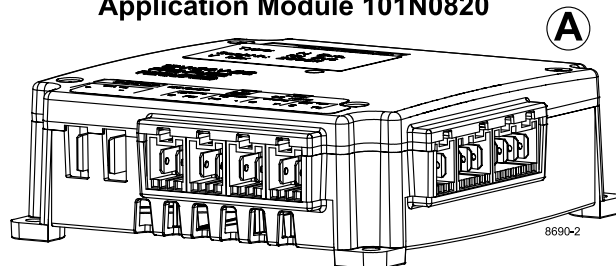
Connect Cables

Legend for 2.1 & 2.2

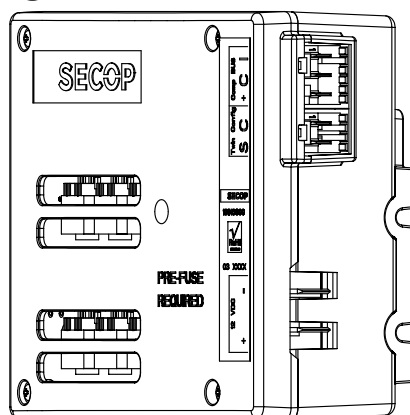
- A. Application module 101N0820
 - B. Compressor module 101N0800, 12 V DC / compressor module 101N0810, 24 V DC
 - C. Line cords
 - D. Single or twin compressor communication cable assembly
1. Mounting screws
 2. Battery
 3. Fuse
 4. Main switch
 5. Evaporator fan
 6. Condenser fan
 7. Mechanical thermostat
 8. NTC temperature sensor (electrical thermostat), alternative: mechanical thermostat
 9. NTC auxiliary temperature sensor
 10. Compressor(s)
 11. Secop One Wire/LIN gateway communication interface
 12. Modbus-compatible device
 13. Secop Bluetooth® gateway communication interface

See Instructions DES.I.100.H_02 for details.

Application Module 101N0820

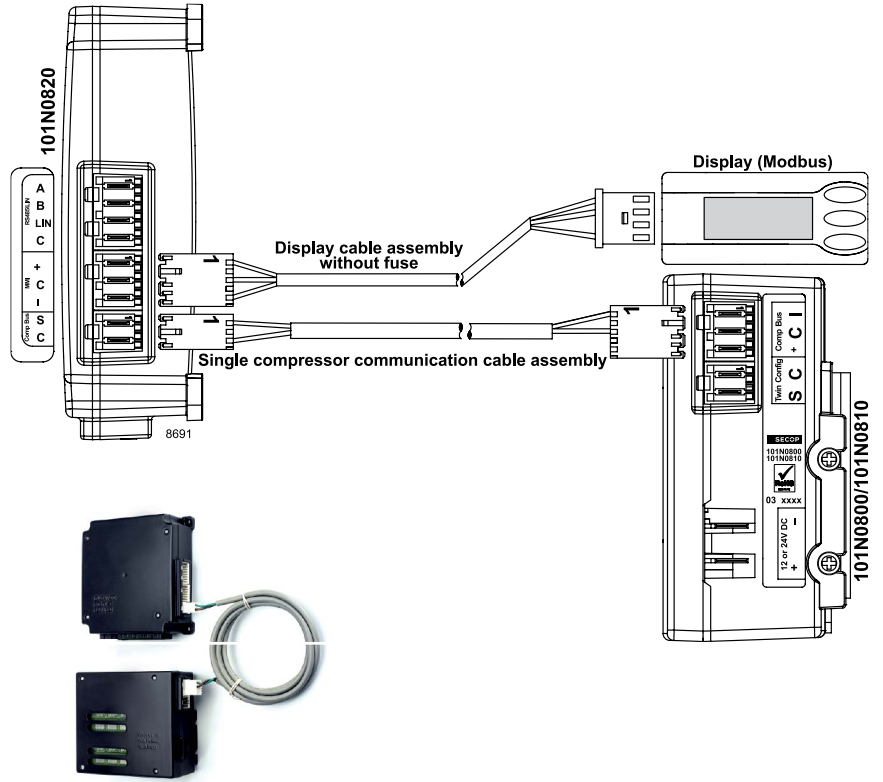


Compressor Modules 101N0800 & 101N0810

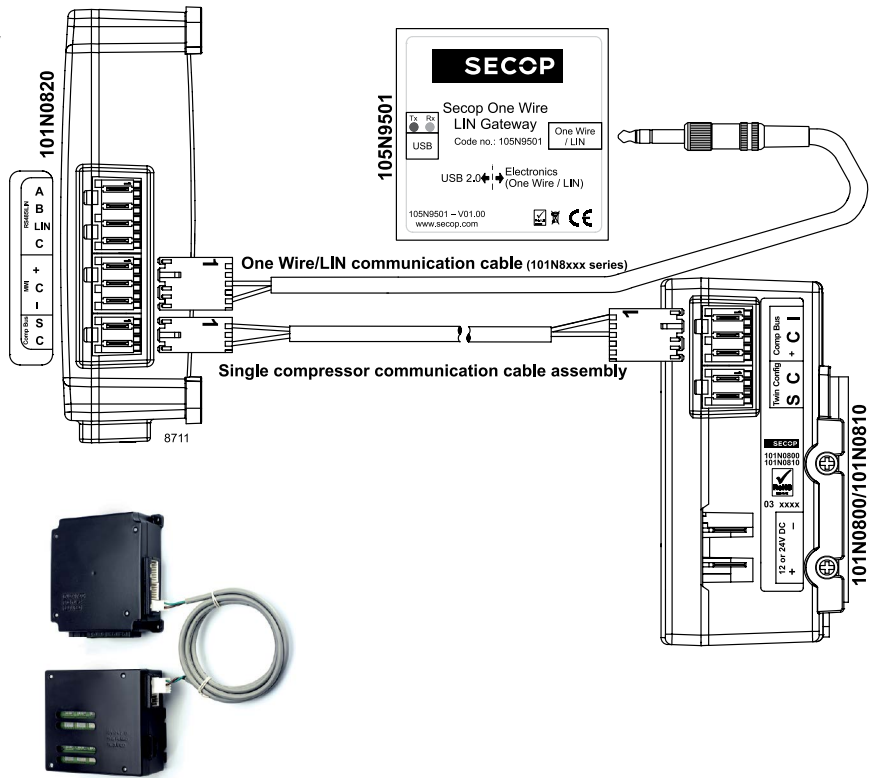


2.2.1 Single compressor configuration, 12 V DC or 24 V DC, connect cables as shown:

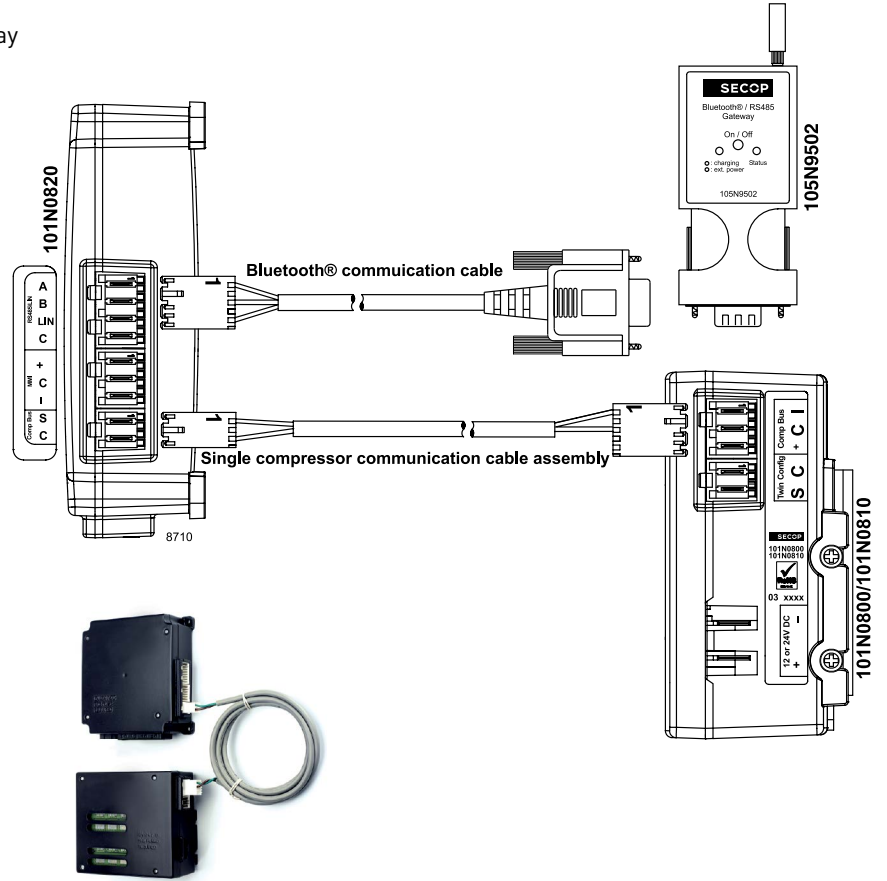
With Display Module



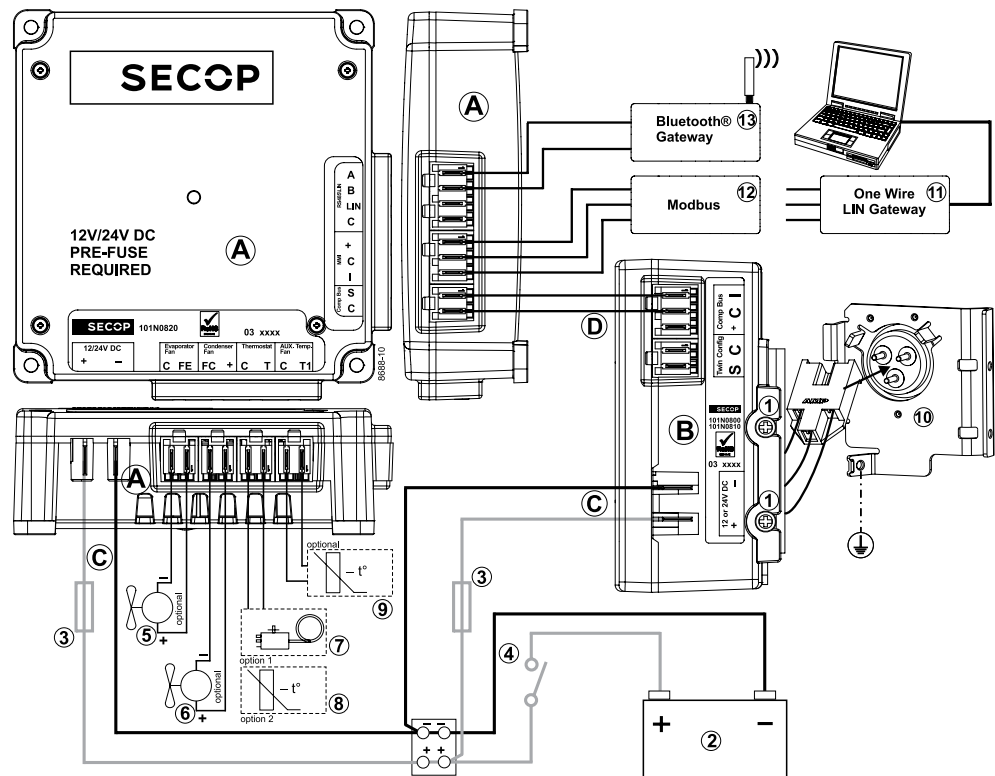
With One Wire Gateway



With Bluetooth® Gateway

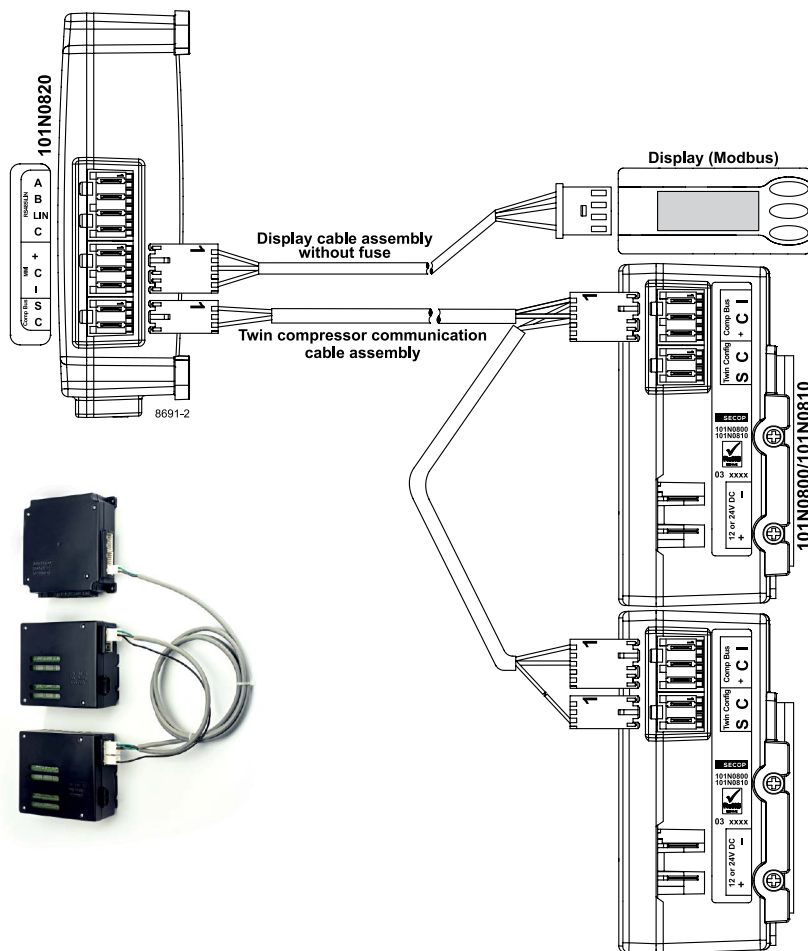


Wiring diagram

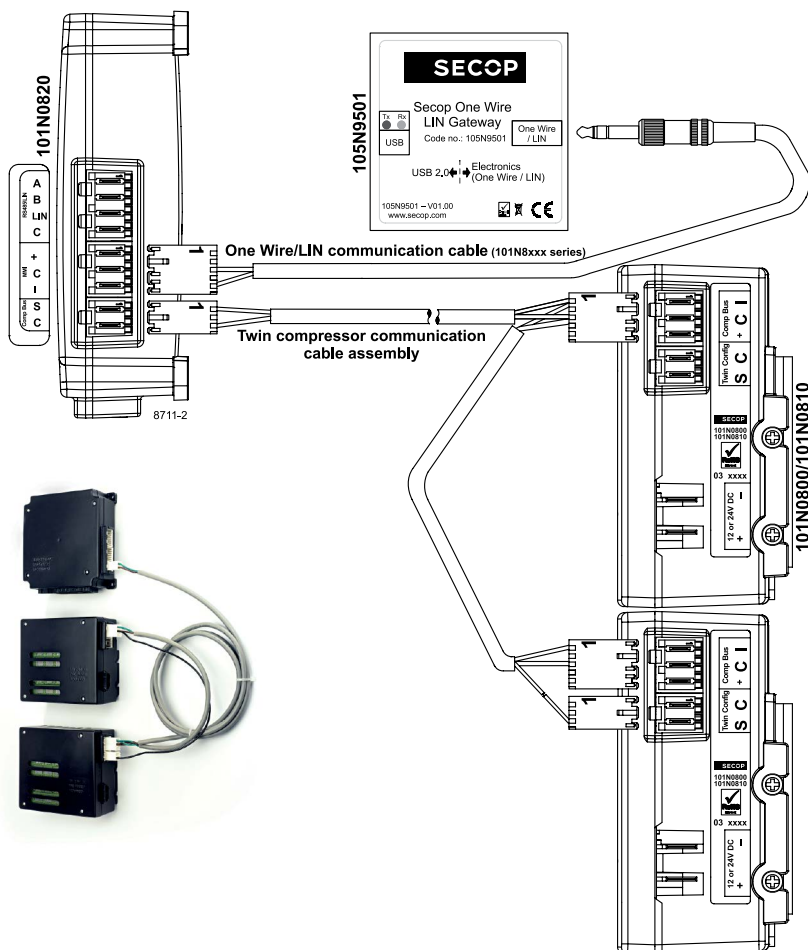


2.2.2 Twin compressor configuration, 12 V DC or 24 V DC, connect cables as shown:

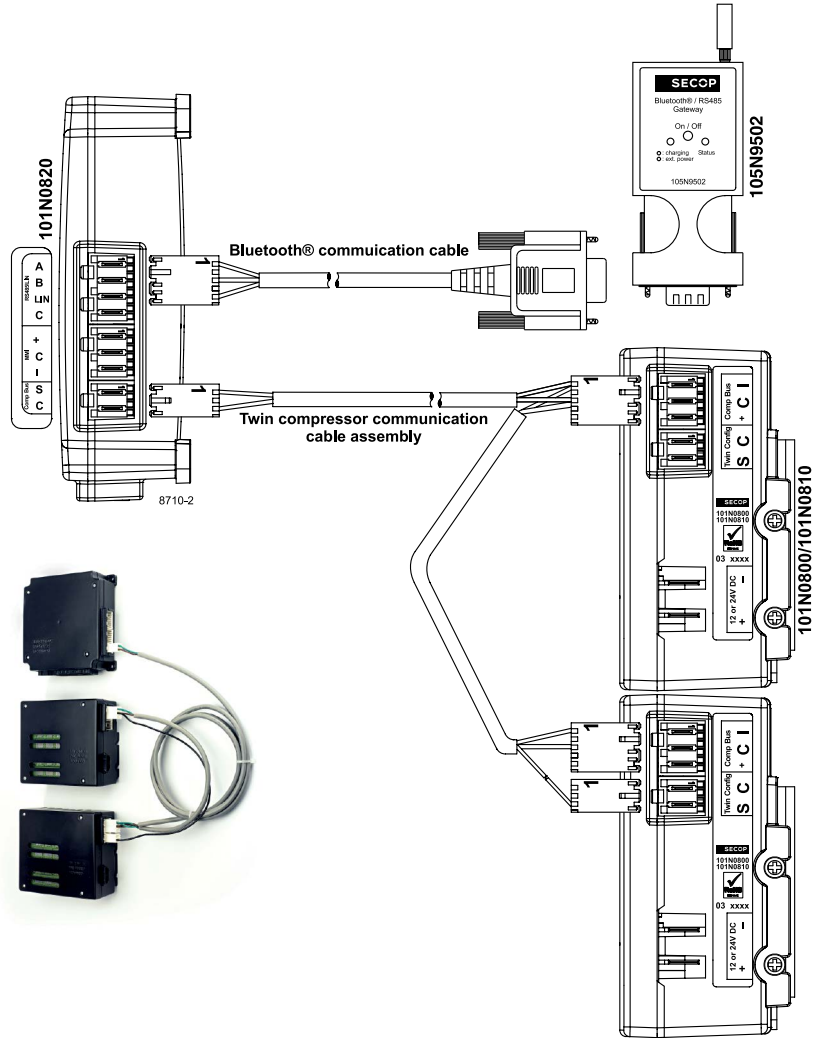
With Display Module



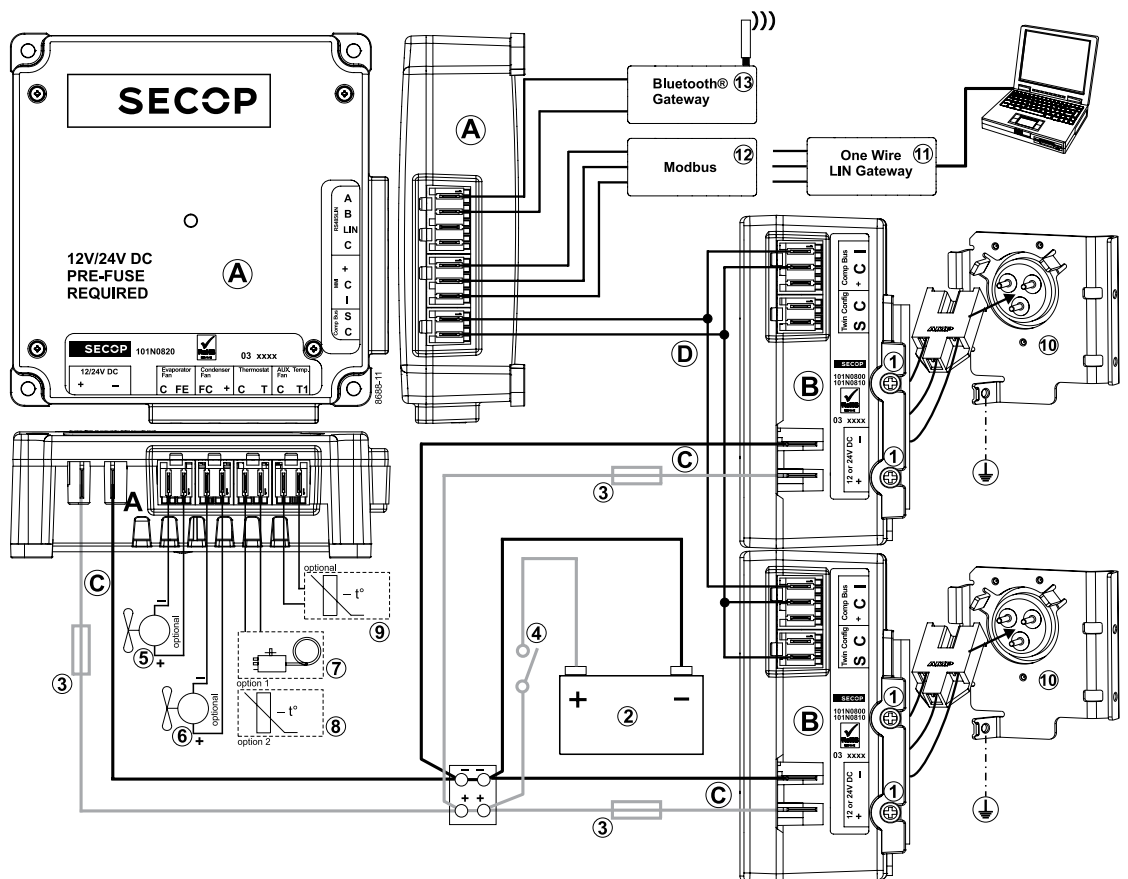
With One Wire Gateway



With Bluetooth® Gateway

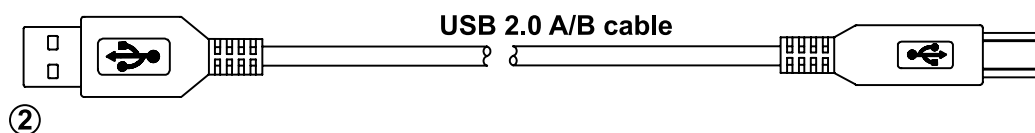
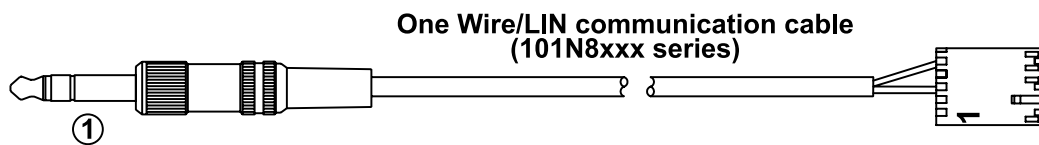


Wiring diagram

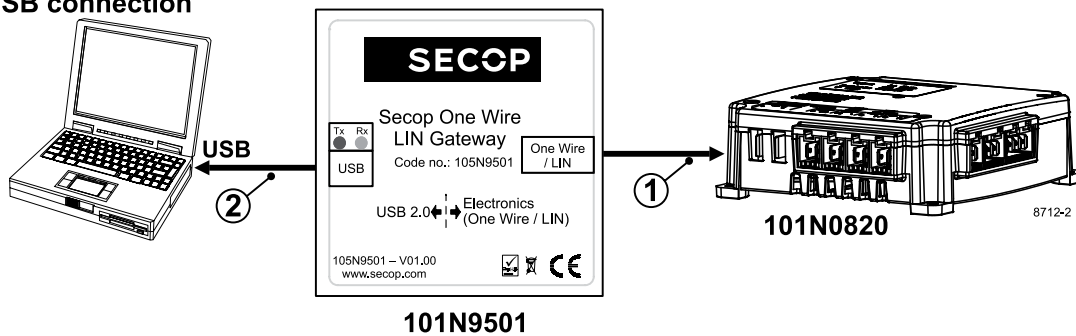


2.2.3 Connection between PC, one-wire gateway, and application module

Connect cables as shown:



USB connection




2.3 Install and Configure Software

2.3.1 Install Software

1. Check that you have the latest update of .NET Framework from www.windowsupdate.com.
2. Insert the Tool4Cool® installation CD.
This view will appear:

SETTING THE STANDARD **SECOP**

[Tool4Cool® Software Installation \(please click\) Version 2.01](#) 

Note: If above link fails to run setup, please run executable *setup.exe* in installation folder i.e. *default* folder of CD.


Minimum system requirements:


- PC with min. 1 GHz Intel Pentium III processor or equivalent, and min. 500MB available memory
- PC operating system: Microsoft Windows XP, Windows Vista or Windows 7 with the latest patches and updates for Windows released by Microsoft.
- .NET Framework with the latest patches and updates for .NET Framework released by Microsoft (www.microsoft.com/.NET). If .NET is not installed and if the PC is connected online Tool4Cool® will try to install it.

PDF Files:

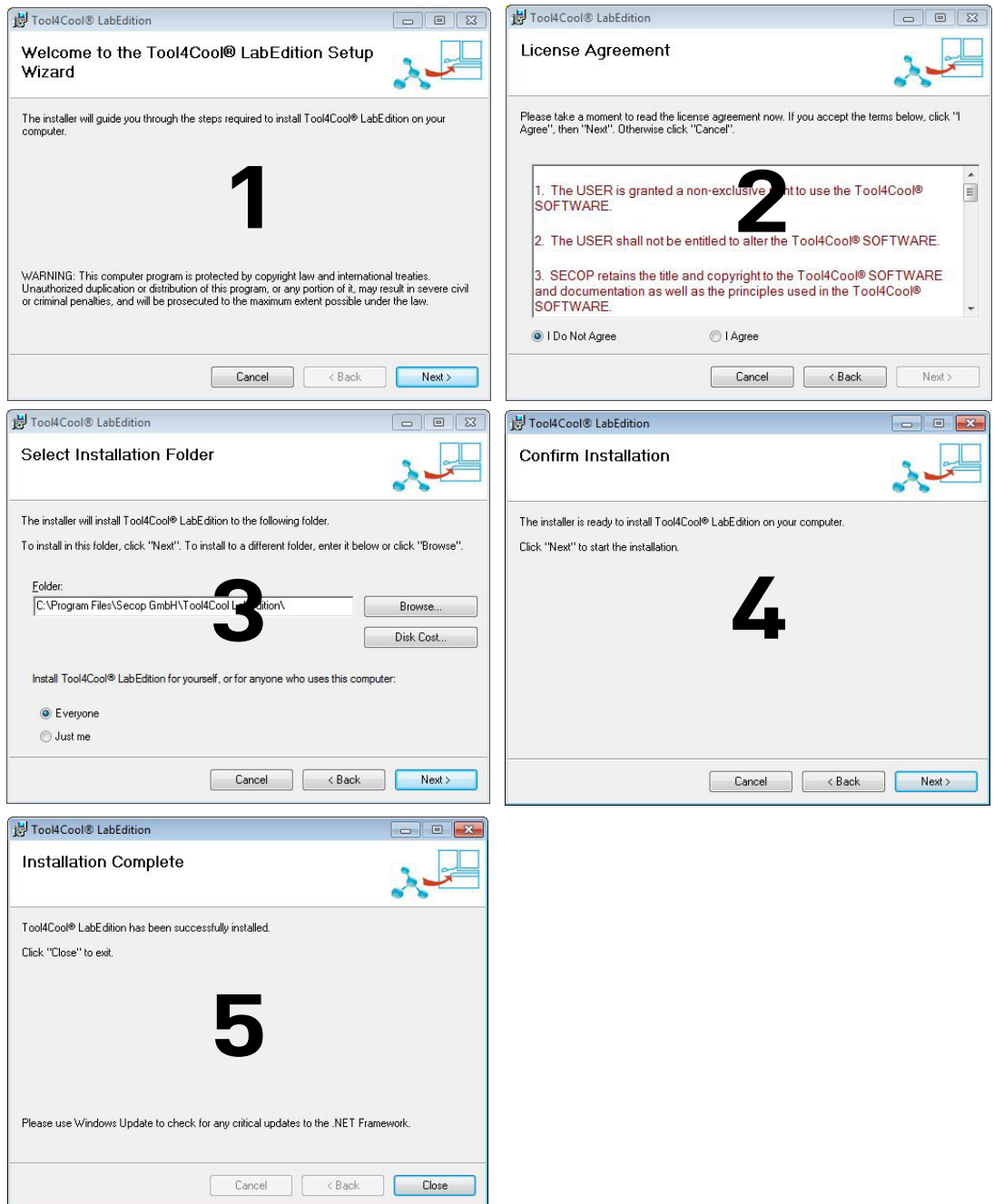
- [Tool4Cool® Software Disclaimer \(please read\)](#)
- [Tool4Cool® Operating Instructions](#)

Adobe® Acrobat Reader





3. Double-click Tool4Cool® Software Installation. Run the file setup.exe. Then follow the instructions in the Setup Wizard.



For detailed instructions please refer to Tool4Cool® LabEdition Operating Instructions. This manual is supplied with the Tool4Cool® software.

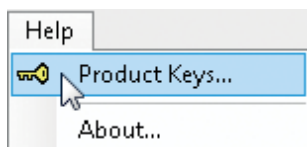
2.3.2 Install Product Key

1. Start Tool4Cool® LabEdition by double clicking on the icon on the desktop:

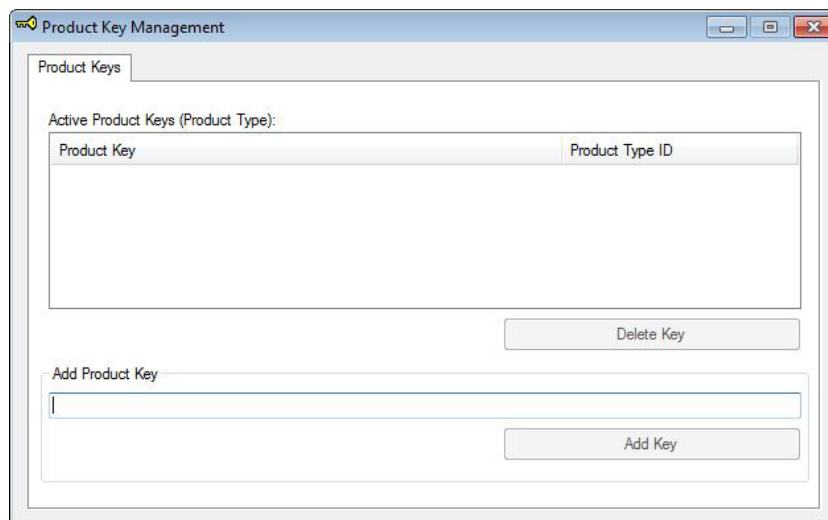


2. Select Help in the menu bar.

3. Select Product Keys from the drop-down menu:



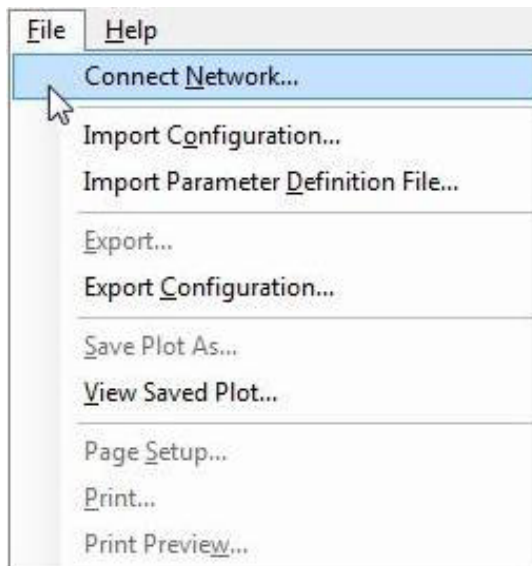
4. This dialog box will open:



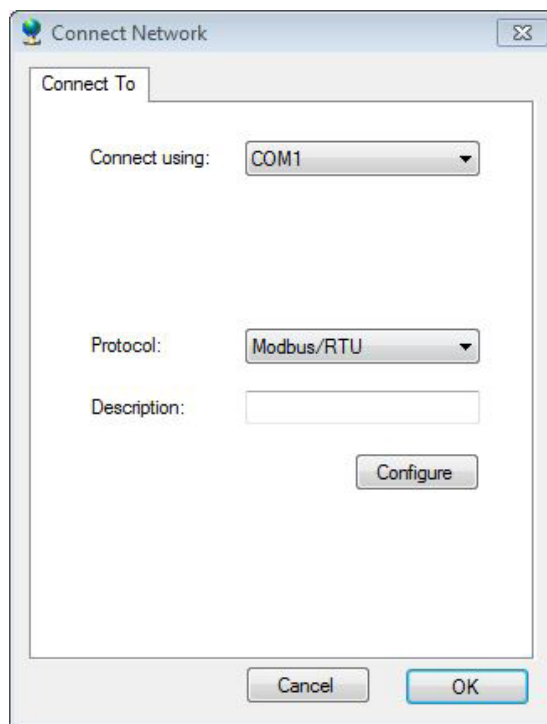
In the Add Product Key field, type the Product Key shown in Section 2.1: Checklist. Click the Add Key button. The Product Key is now active.

2.3.3 Connect to Network Through One-Wire Gateway

1. Select File in the menu bar.
2. Select Connect Network in the drop-down menu:



3. This dialog box will open:



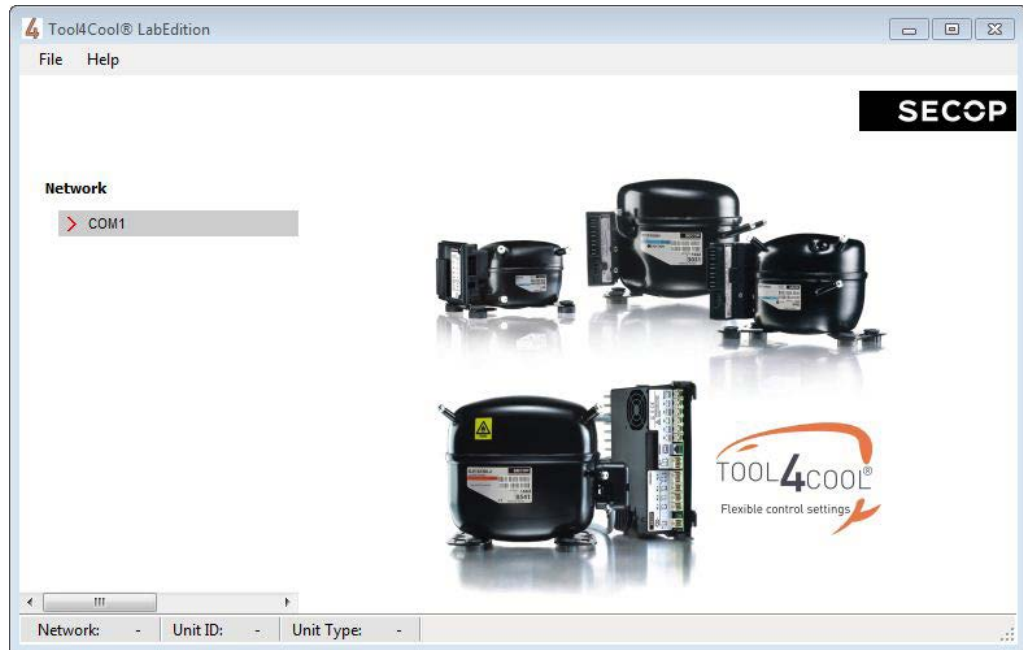
In the Connect using field, select the COM port to which the gateway is connected.

Fill in Description (optional).

Press OK.

Wait a short time. The LEDs on the gateway will flicker, then a red arrow will appear in front of the description (COM1).

The controller is now accessible via Tool4Cool®.



2.3.4 Connect to Network Through Bluetooth® Gateway

In order to communicate, Bluetooth® devices must first be paired. Pairing is performed before using the device for the first time. Pairing does not need to be repeated for subsequent use.

Please choose the operating system installed on your computer.

1. Attach or turn on the Bluetooth® radio adapter (transceiver) for your Windows XP computer.
2. Turn on the Secop Bluetooth® gateway by pressing briefly on the push button. The LED will blink green.

Please note!:

The gateway runs for 60 seconds before shutting down automatically.

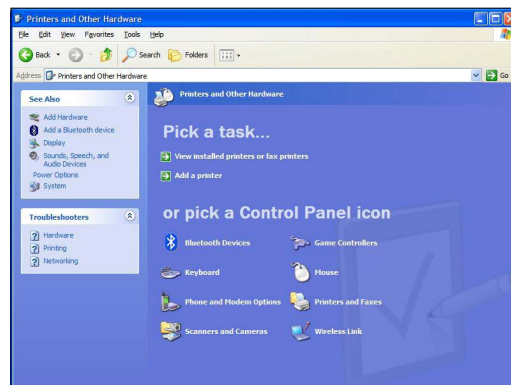
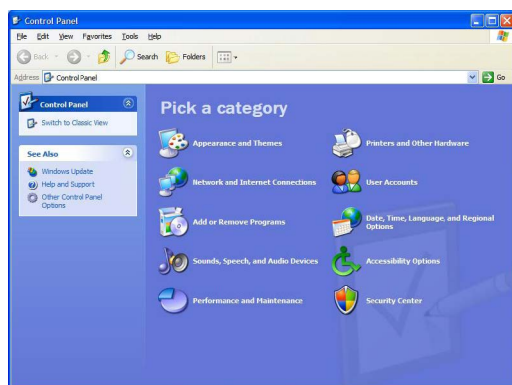
At each step of the pairing process, check that the LED is still blinking.

If one stage of the pairing fails, turn the gateway on again, and try again.

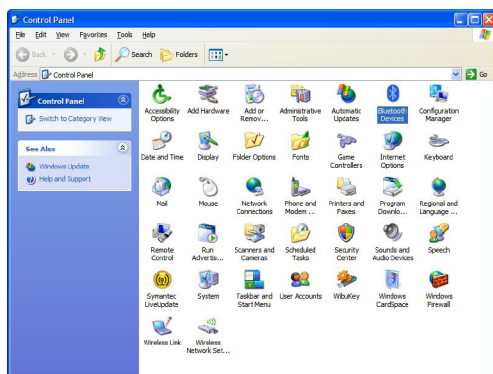
3. Open Bluetooth® Devices in Control Panel/Printers and Other Hardware (Category view) or Control Panel (Classic view).

Windows XP

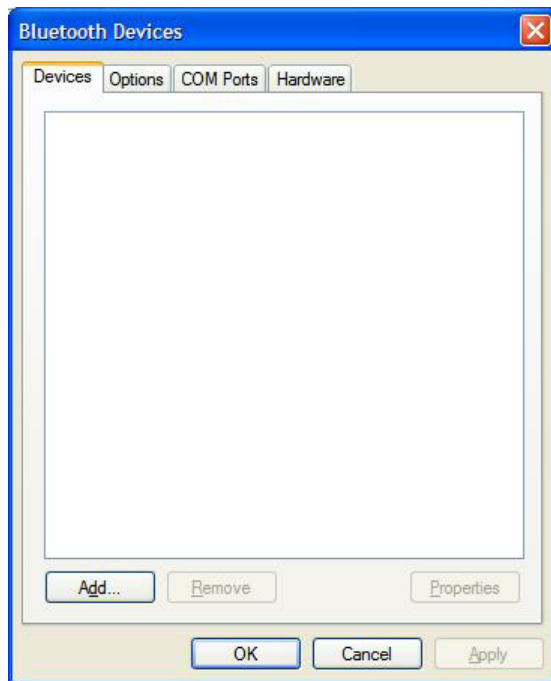
Control Panel Category View:



Control Panel Classic View:



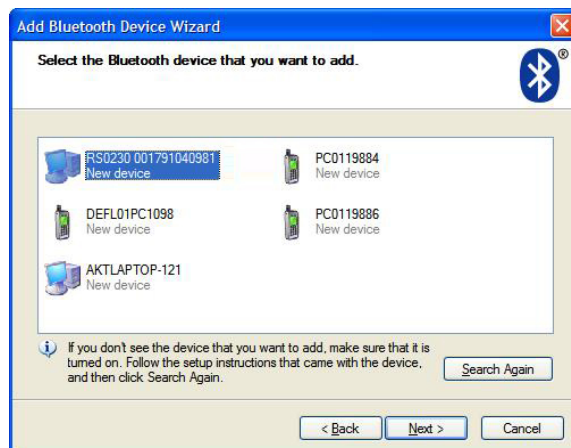
5. On the Devices tab, click Add.



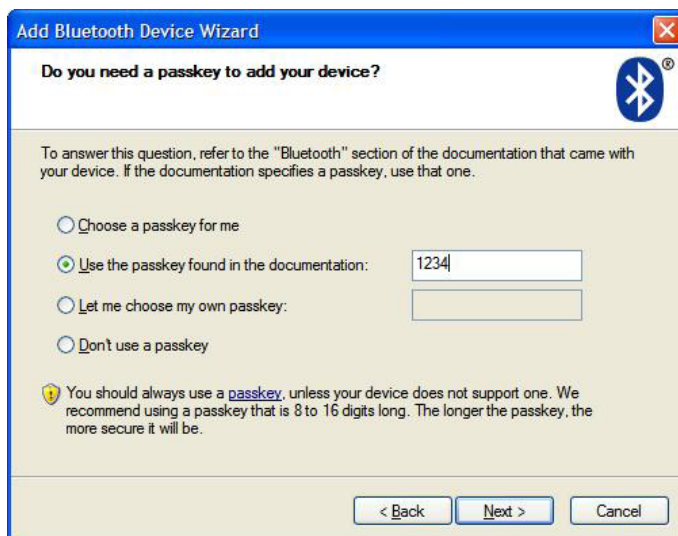
6. Select the My device is set up and ready to be found check box, and then click Next.



7. Click the Secop Bluetooth® gateway shown in the dialog, and then click Next.



8. Click Use the passkey found in the documentation, and then type the passkey: 1234.

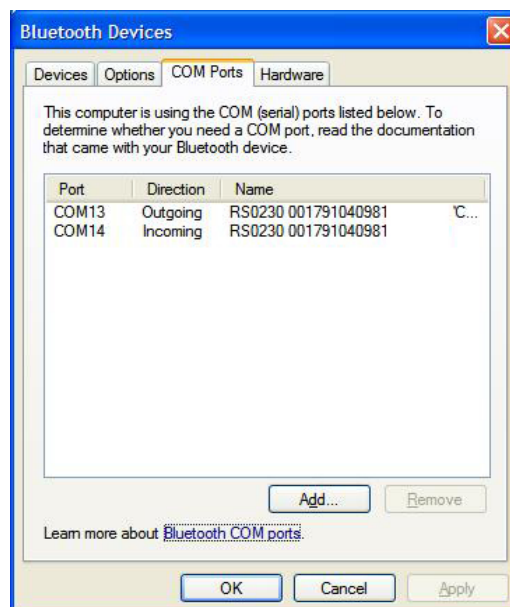
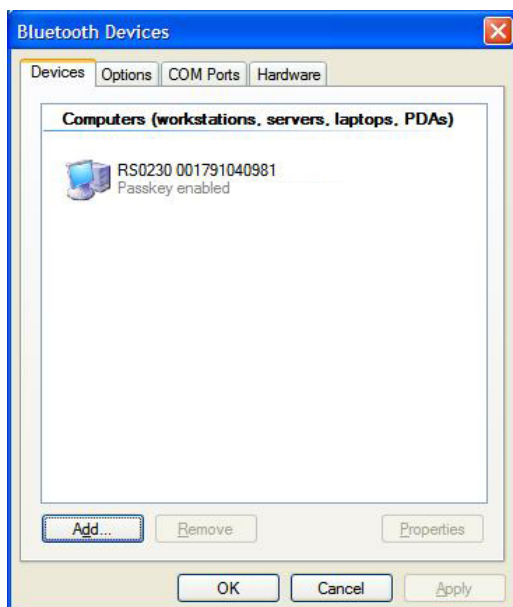


9. Note the outgoing COM port, in this example COM 13. Then click Finish to complete pairing.



10. The COM port can also be viewed in the COM ports tab of the Bluetooth® devices dialog

11. Make a note of the Outgoing COM port (in this example, COM 13):



Windows 7

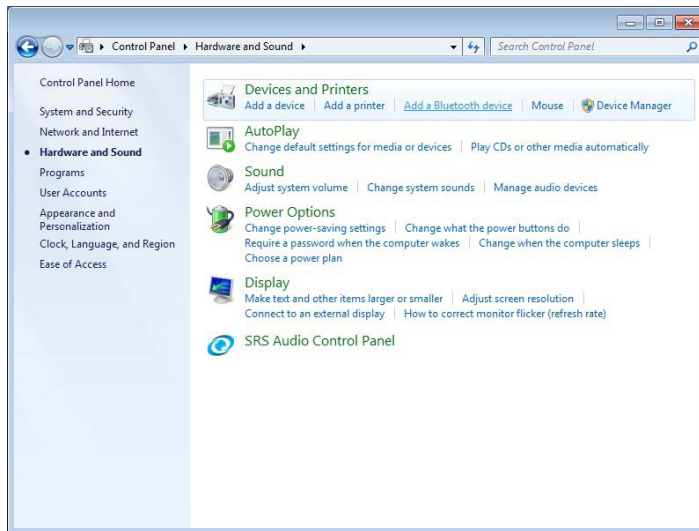
1. Attach or turn on the Bluetooth® radio adapter (transceiver) for your Windows 7 computer.
2. Turn the Secop Bluetooth® gateway on by pressing briefly on the push button. The LED will blink green.

Please note:

The gateway runs for 60 seconds before shutting down automatically.

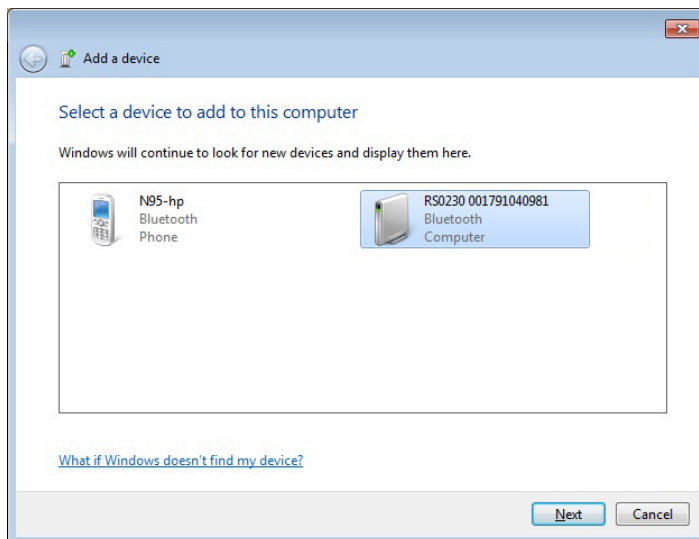
At each step of the pairing process, check that the LED is still blinking .
If one stage of the pairing fails, turn the gateway on again, and try again.

3. Add a Bluetooth® device from Control Panel/Hardware and Sound.

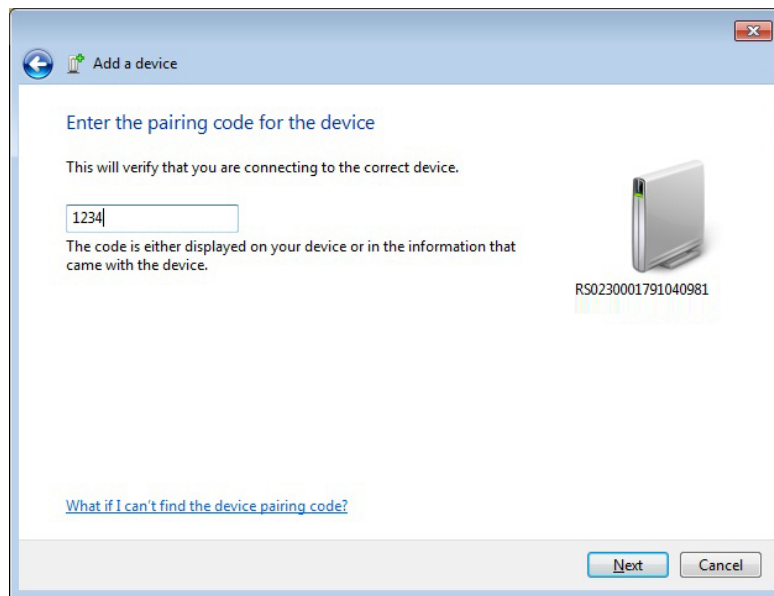


This shall search and display nearby Bluetooth® devices:

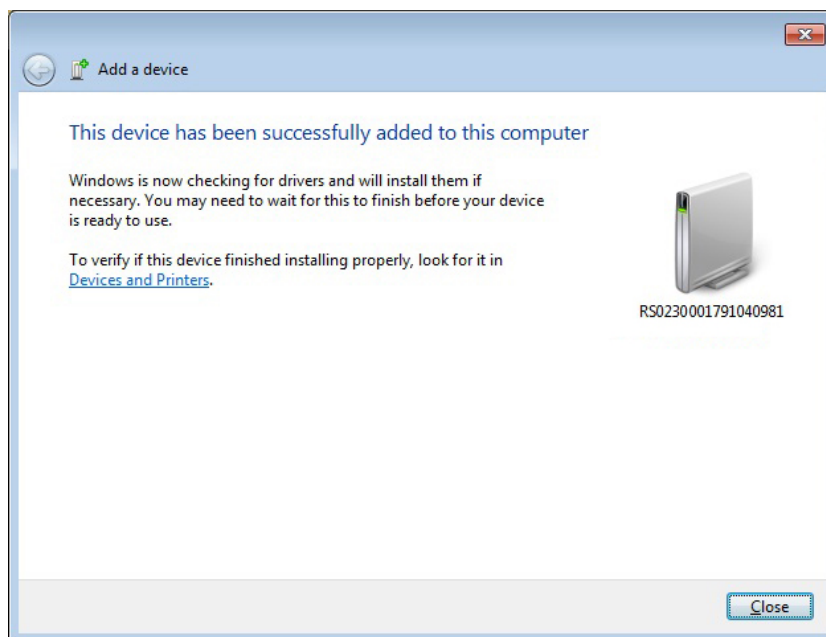
4. Select the Secop device, then click Next.



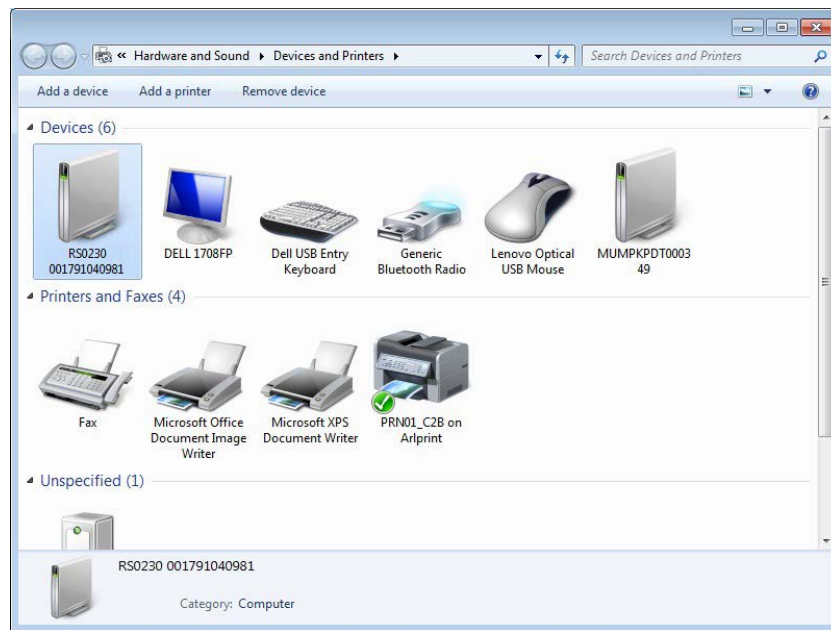
5. Enter the passkey 1234 as shown, then select Next.



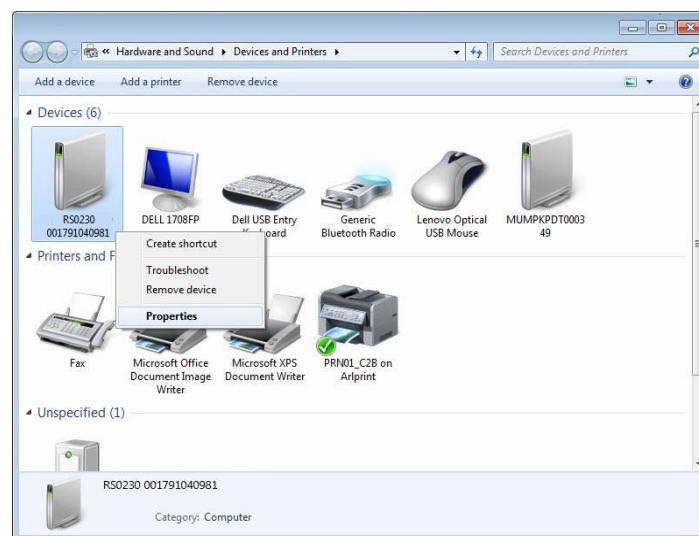
6. Select Close to complete the pairing.



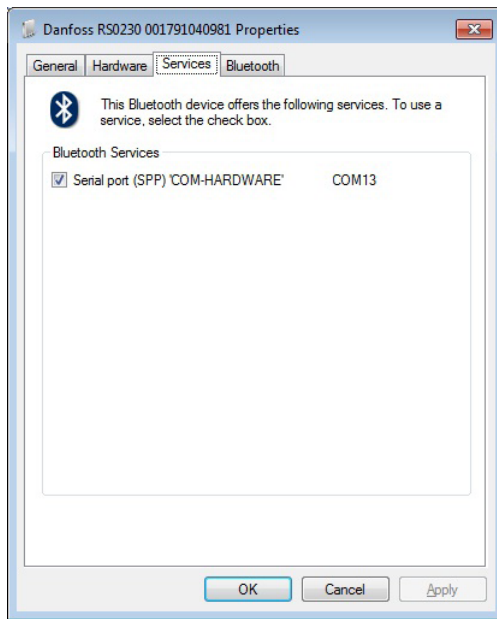
Now look at the Control Panel\Hardware and Sound\Devices and Printers, to confirm the Secop device is visible:



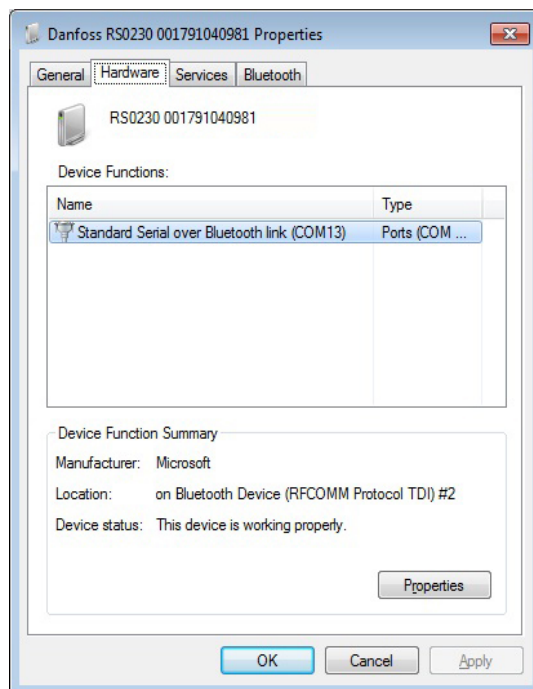
7. Select the Secop device, then select Properties as shown here:



8. Under the Services tab, make a note of the COM port to which the gateway is paired. In this example it is COM13:

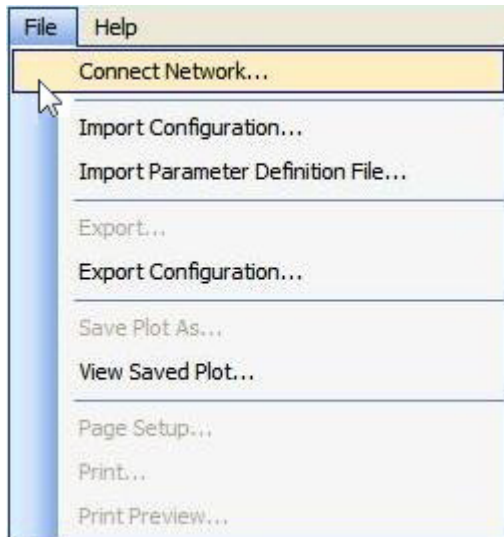


Alternatively, the COM port can be viewed in the Hardware tab of the Bluetooth® devices dialog. Make a note of the COM port:

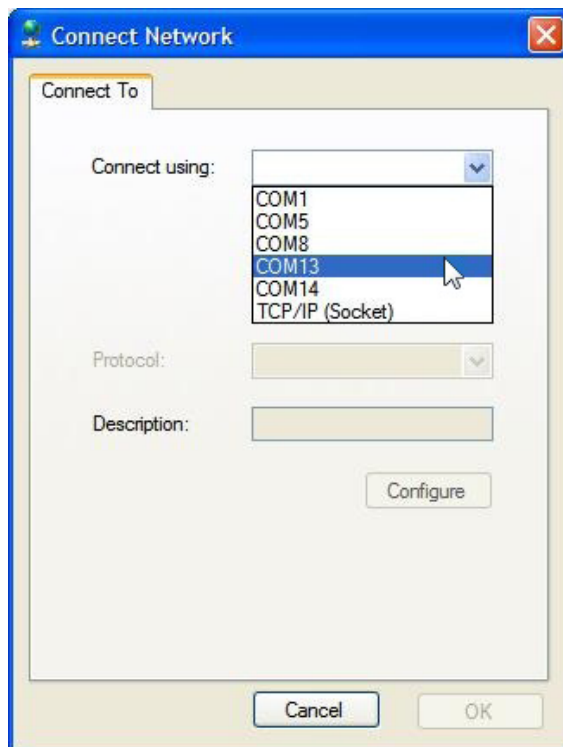


To connect to the Bluetooth® Gateway after it is paired, follow the below steps:

1. Start Tool4Cool®
2. Select File in the menu bar.
3. Select Connect Network in the drop-down menu:

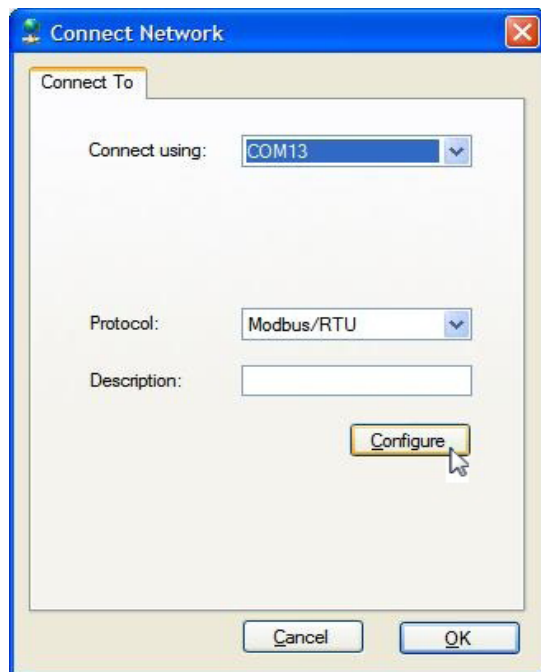


4. This dialog box will open:



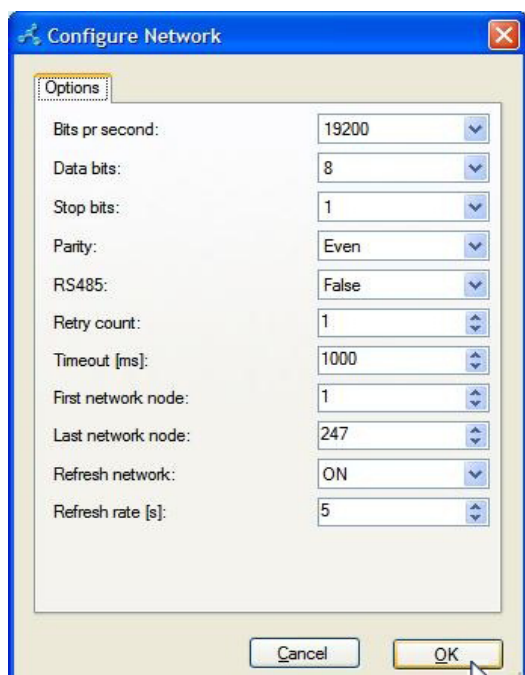
In the Connect using field, select the COM port to which the gateway is connected.
 Note!: This is the COM port you noted down in section 2.3.4.
 Fill in Description (optional).

5. Click the Configure button:

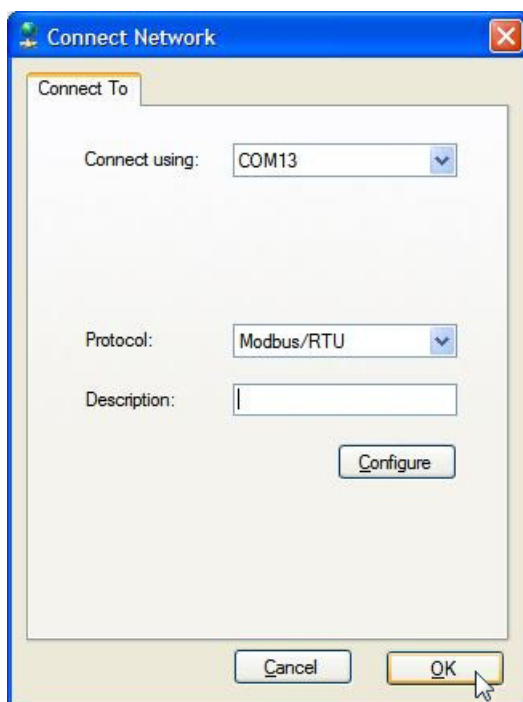


6. The Configure Network dialog box will appear.

7. Set the Refresh rate to ~5 times the number of addressable nodes, $5 \times [(Last\ network\ node + 1) - First\ network\ node]$
 This ensures that Tool4Cool® will prevent the Bluetooth® gateway from timing out and turning the power off. Tool4Cool® scans the network and detects changes.



Then click OK to return to the Connect Network dialog.

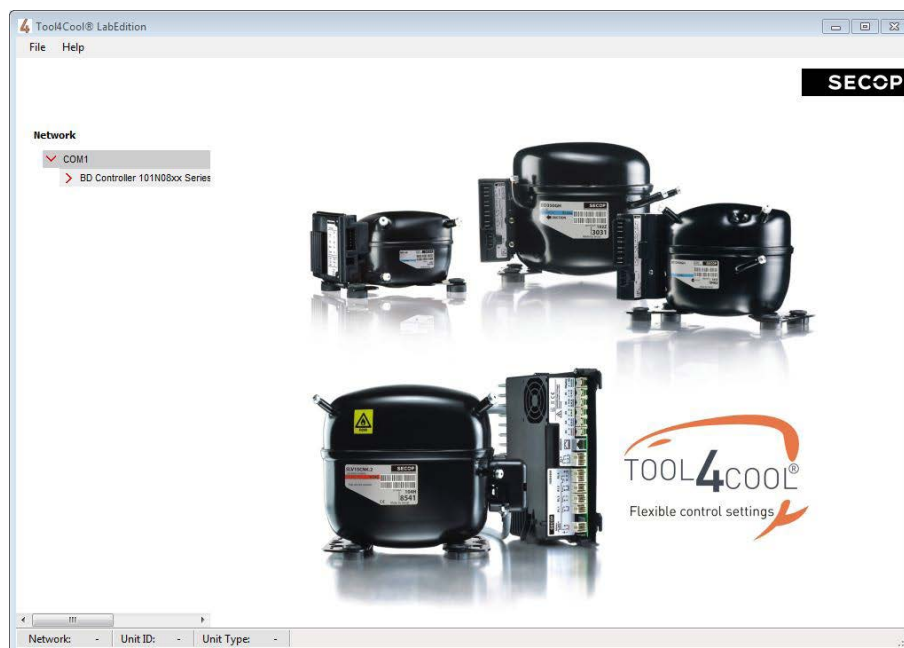


8. Check the gateway is turned on.
In the Connect Network dialog, click OK.
Wait a short time. A red arrow will appear in front of the description (COM13).
The controller is now accessible via Tool4Cool®.

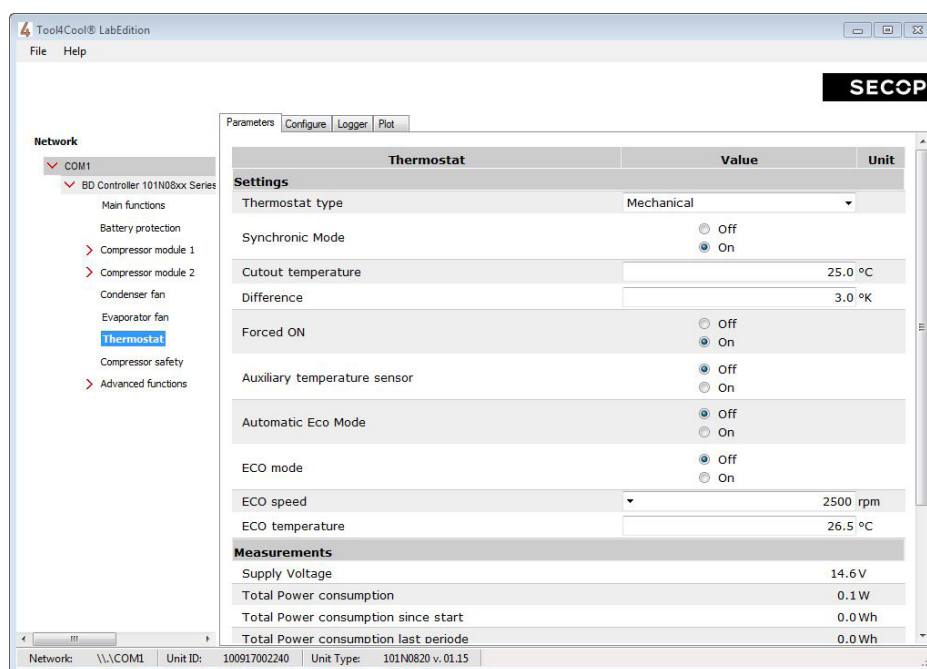


2.3.5 Ready to Operate

Click the red arrows to view the controller and its parameter groups:



Click a parameter group name to view details to the right of the screen:

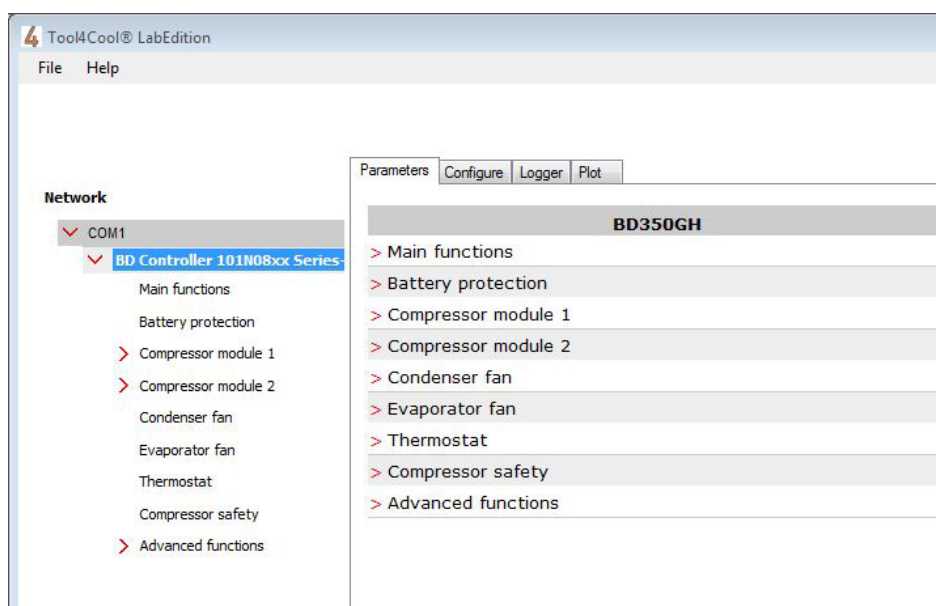


3. TOOL4COOL® SOFTWARE INTERFACE

3.1 User Interface

The controller can be programmed and optimized from a PC using the Tool4Cool® software. An example of the Tool4Cool® user interface showing the main parameter groups of the BD Controller 101N08xx Series 12-24 V DC is shown below.

Example:



3.2 Operation

The Tool4Cool® software enables the user to observe and document certain aspects of the compressor operation via the controller. The output of the software is in the form of data logs and plots.

Using Tool4Cool® the user can also change the settings of the controller parameters, and copy settings from one controller to another. Please refer to the Tool4Cool® LabEdition Operating Instructions for operation instructions.

PARAMETERS

The user can change settings and observe real-time measurements in the following parameters. The table in 4.1 Parameter Overview is intended for easy reference. For more detail, please refer to 4.2 Description of Parameters.

4.1

Parameter Overview

Parameter Group	Parameter text	Description	Default	Min value	Max value	Step size	Unit	Type
Main functions								
	Main switch	ON/OFF regulation of power supply to controller	0	0	1	1	0 = OFF 1 = ON	Setting
	Reset power consumption	Resets cumulative power consumption of the entire system to zero	0	0	1	1	0 = OFF 1 = ON	Setting
	Total power consumption	Real-time power consumption of the entire system		0	65535	10	W	Measurement
	Total power consumption since start	Cumulative power consumption of the entire system since the most recent startup		0	65535	10	Wh	Measurement
	Total power consumption last period	Cumulative power consumption of the entire system in the previous period		0	65535	10	Wh	Measurement
Main functions Compressor 1								
	Reset power consumption	Resets cumulative power consumption of Compressor 1 to zero	0	0	1	1	0 = OFF 1 = ON	Setting
	Total power consumption	Cumulative power consumption of Compressor 1		0	65535	10	W	Measurement
	Total power consumption since start	Cumulative power consumption of Compressor 1 since the most recent startup		0	65535	10	Wh	Measurement
	Total power consumption last period	Cumulative power consumption of Compressor 1 in the previous period		0	65535	10	Wh	Measurement

Parameter Group	Parameter text	Description	Default	Min value	Max value	Step size	Unit	Type
Main functions Compressor 2								
	Reset power consumption	Resets cumulative power consumption of Compressor 2 to zero	0	0	1	1	0 = OFF 1 = ON	Setting
	Total power consumption	Cumulative power consumption of Compressor 2		0	65535	10	W	Measurement
	Total power consumption since start	Cumulative power consumption of Compressor 2 since the most recent startup		0	65535	10	Wh	Measurement
	Total power consumption last period	Cumulative power consumption of Compressor 2 in the previous period		0	65535	10	Wh	Measurement
Battery protection								
12 V DC	Battery cutout level	Battery protection cut-out voltage level	10.4	9.6	17	0.1	V	Setting
	Battery cutin diff.	Battery protection cut-in	1.3	0.5	10	0.1	V	Setting
24 V DC	Battery cutout level	Battery protection cut-out voltage level	21.3	19.0	27.0	0.1	V	Setting
	Cutout delay	Time to cut-out when non-critical battery protection implemented	3	0	60	1	sec	Setting
	Cut-in level	Calculated value. Cut-in = Cut-out + Diff					V	Measurement
	Supply voltage	Real time voltage measured on + and - terminals					V	Measurement
Compressor 1								
	Requested speed	Compressor speed and therefore capacity definition	4000	2500	4000	1	rpm	Setting
	Start delay	Time to start after compressor is switched ON	4	2	240	1	sec	Setting
	Start Speed	Optional startup speed lower than Requested speed, during the period Start time	2500	2500	4000	100	rpm	Setting
	Start time	Period of time elapsing after startup of compressor until Requested speed is reached	30	0	600	5	sec	Setting
	Compressor speed	Real-time speed (+/- 10%)			100		rpm	Measurement
	Supply voltage	Real time voltage measured on + and - terminals					V	Measurement

Parameter Group	Parameter text	Description	Default	Min value	Max value	Step size	Unit	Type
Compressor 2								
	Requested speed	Compressor speed and therefore capacity definition	4000	2500	4000	1	rpm	Setting
	Start delay	Time to start after compressor is switched ON	8	2	240	1	sec	Setting
	Start Speed	Optional start-up speed lower than Requested speed, during the period Start time	2500	2500	4000	100	rpm	Setting
	Start time	Period of time elapsing after start-up of compressor until Requested speed is reached	30	0	600	5	sec	Setting
	Compressor speed	Real-time speed (+/- 10%)			100		rpm	Measurement
	Supply voltage	Real time voltage measured on + and - terminals					V	Measurement
Condenser fan								
	Condenser fan speed	Condenser fan speed synchronized with compressor operation	100	40	100	1	%	Setting
	Condenser fan start delay	Time to start as a function of Thermostat	0	0	240	1	sec	Setting
	Condenser fan stop delay	Time to stop as a function of Thermostat	0	0	240	1	sec	Setting
	Condenser fan forced ON	Force condenser fan continuously ON or OFF	0	0	1	1	0 = OFF 1 = ON	Setting
	Detect missing condenser fan	Detect whether condenser fan is connected	0	0	1	1	0 = OFF 1 = ON	Setting
	Condenser fan speed	Real-time condenser fan speed					%	Setting
Evaporater fan								
	Evaporator fan speed	Evaporator fan speed synchronized with compressor operation	100	40	100	1	%	Setting
	Evaporator fan start delay	Time to start as a function of Thermostat	6	0	240	1	sec	Setting
	Evaporator fan stop delay	Time to stop as a function of Thermostat	0	0	240	1	sec	Setting
	Evaporator fan forced ON	Force condenser fan continuously ON or OFF	0	0	1	1	0 = OFF 1 = ON	Setting
	Detect missing Evaporator fan	Detect whether condenser fan is connected	0	0	1	1	0 = OFF 1 = ON	Setting
	Evaporator fan speed	Real-time condenser fan speed					%	Measurement

Parameter Group	Parameter text	Description	Default	Min value	Max value	Step size	Unit	Type
Thermostat								
	Thermostat type	Detect mechanical or NTC sensor thermostat	2 (Auto)	0 (Mechanical)	2 (Auto)	1		Setting
	Cutout temperature	Compressor cuts out below cut-out temperature	25	-40	40	0.1	°C	Setting
	Difference	Compressor cuts in above cut-in(cut out+ difference) temperature	3	1	15	0.1	K	Setting
	Forced ON	Force thermostat operation to continuously ON or OFF	0	0	1	1	0 = OFF 1 = ON	Setting
	Cutout temperature 2	In a twin configuration, Compressor 2 cuts out below this temperature	25	-40	40	0.1	°C	Setting
	Difference 2	Compressor cuts in above cut-in(cut out+ difference) temperature	3	1	15	0.1	K	Setting
	Forced ON 2	Force thermostat operation to continuously ON or OFF	0	0	1	1	0 = OFF 1 = ON	Setting
	Auxiliary temperature sensor	0 - not connected 1 - connected	0	1	1	1	0 = OFF 1 = ON	Setting
	Runtime	During cooling OFF (Thermostat cut-out), the Runtime will show the duration of the last cooling period. Runtime is reset at cooling ON period. At power-up the reading is reset.				1	min	Measurement
	Actual temperature	Real-time air temperature when an NTC sensor is used. When a mechanical thermostat is used, only thermostat status ON or OFF is displayed.					°C	Measurement
	ECO mode	Turns the ECO mode on and off	off	off	on	on		Setting
	ECO speed	Speed applied when temperature falls below ECO temperature	4000	2500	4000	1	rpm	Setting
	ECO temperature	Temperature where ECO speed is applied	25	-40	40	0.1	°C	Setting
	Automatic ECO temperature	cut-out + cut-in / 2	1	0	1	1	0 = OFF 1 = ON	Setting
	Synchronic mode	In order to operate with only one set point during twin operation	1	0	1	1	0 = OFF 1 = ON	Setting

Parameter Group	Parameter	Description	Default	Min value	Max value	Step size	Unit	Type
Compressor safety								
	Restart delay	Delay before restart after short cycling	60	60	120	1	sec	
Communication								
	Node number (application module)	Modbus address	1	1	247	1		Setting
	Bits per second	Communication speed	19200 bps	9600 bps	19200 bps	1		Setting
	Set Main Switch to OFF when communication timeout occurs		0	0	1	1	0 = OFF 1 = ON	Setting
	Communication timeout	Maximum duration of each communication attempt.	900	15	7200	1	sec	Setting
	Settings protection code	Privacy function code must be entered twice	0	0	9999			Setting
	Settings protection status		0	1	0	1		Measurement
Product information application module								
	Unit name	The user's own identification for the unit can be entered here (optional)	0	0	250	1	characters	
	Product code (Code number)	Secop product code number						Measurement
	Firmware version	Application module software version						Measurement
	Unit ID	Secop unit ID						Measurement
	Production Date	Secop production date						Measurement
	Serial (Serial number)	Secop serial						Measurement
	Vendor name	Vendor name						Measurement
	ProdText (Text that appears on the label)							
	Product code	Secop product code number						Measurement
	Firmware	Compressor module software version						Measurement
	Production Date	Secop production date						Measurement
	Serial (Serial number)	Secop serial						Setting
	Vendor name	Vendor name						Measurement
	ProdText(Text that appears on the label)							

Parameter Group	Parameter	Description	Default	Min value	Max value	Step size	Unit	Type
Product information compressor module 1								
	Unit name	The user's own identification for the unit can be entered here (optional)						
	Product code	Secop product code number						Measurement
	Firmware	Compressor module software version						Measurement
	Production Date	Secop production date						Measurement
	Serial (Serial number)	Secop serial						Setting
	Vendor name	Vendor name						Measurement
	ProdText (Text that appears on the label)							
Product information compressor module 2								
	Unit name	The user's own identification for the unit can be entered here (optional)						
	Product code	Secop product code number						Measurement
	Firmware	Compressor module software version						Measurement
	Production Date	Secop production date						Measurement
	Serial (Serial number)	Secop serial						Setting
	Vendor name	Vendor name						Measurement
	ProdText(Text that appears on the label)							

Parameter Group	Parameter	Description	Default	Min value	Max value	Step size	Unit	Type
Custom registers								
	Register 1	Custom-designed interface parameter	65535	0	65535	1		Setting
	Register 2	Custom-designed interface parameter	65535	0	65535	1		Setting
	Register 3	Custom-designed interface parameter	65535	0	65535	1		Setting
	Register 4	Custom-designed interface parameter	65535	0	65535	1		Setting
	Register 5	Custom-designed interface parameter	65535	0	65535	1		Setting
	Register 6	Custom-designed interface parameter	65535	0	65535	1		Setting
	Register 7	Custom-designed interface parameter	65535	0	65535	1		Setting
	Register 8	Custom-designed interface parameter	65535	0	65535	1		Setting
	Register 9	Custom-designed interface parameter	65535	0	65535	1		Setting
	Register 10	Custom-designed interface parameter	65535	0	65535	1		Setting
BD Status								
	Actual error (application module)			0	40	1	0 = No error 1 = Battery protection failure 2 = Fan failure 3 = Motor failure 4 = Min. speed failure 5 = Thermal failure 6 = NTC failure 7 = Communication Error	
	Actual error (compressor module 1)			0	40	1	0 = No error 1 = Battery protection failure 3 = Motor failure 4 = Min. speed failure 5 = Thermal failure	
	Actual error (compressor module 2)			0	40	1	0 = No error 1 = Battery protection failure 3 = Motor failure 4 = Min. speed failure 5 = Thermal failure	

Parameter Group	Parameter	Description	Default	Min value	Max value	Step size	Unit	Type
Logs on application								
	Event log					1	0 = OFF 1 = ON	Measurement
	Clear event log		0	0	1	1		Setting
	Error log							Measurement
	Clear error log		0	0	1	1		Setting
Logs on Compressor 1								
	Event log					1	0 = OFF 1 = ON	Measurement
	Clear event log		0	0	1	1		Setting
	Error log							Measurement
	Clear error log		0	0	1	1		Setting
Logs on Compressor 2								
	Event log					1	0 = OFF 1 = ON	Measurement
	Clear event log		0	0	1	1		Setting
	Error log							Measurement
	Clear error log		0	0	1	1		Setting

4.2
Description of
Parameters

4.2.1 Main Functions

Main switch

In order to start and stop the compressor the Main Switch can be set to On or OFF .

OEMs making an interface with custom design electronics via Modbus must be able to control the CCU ON / OFF via the Main Switch.

ON: All functions are active.

OFF: All main functions are inactive, however

- Battery monitoring active
- NTC temperature sensor monitoring active
- Auxiliary temperature sensor monitoring active
- PCB inverter temperature monitoring inactive

Power consumption monitoring

Compressor power consumption is monitored at 10 minute intervals. The following information can be viewed via the Tool4Cool® interface:

For single configuration, individual compressor power consumption

For twin configuration, combined compressor power consumption (application module + 2 compressor modules)

Power consumption for each compressor can also be logged.

Cumulative power consumption since startup

Cumulative power consumption last period

The user can reset power consumption to zero using the Reset power consumption function

Settings:

Name	Default	Min value	Max value	Step	Unit
Main switch	OFF	OFF	ON	1	-
Reset power consumption	0	0	1	1	-

Measurement:

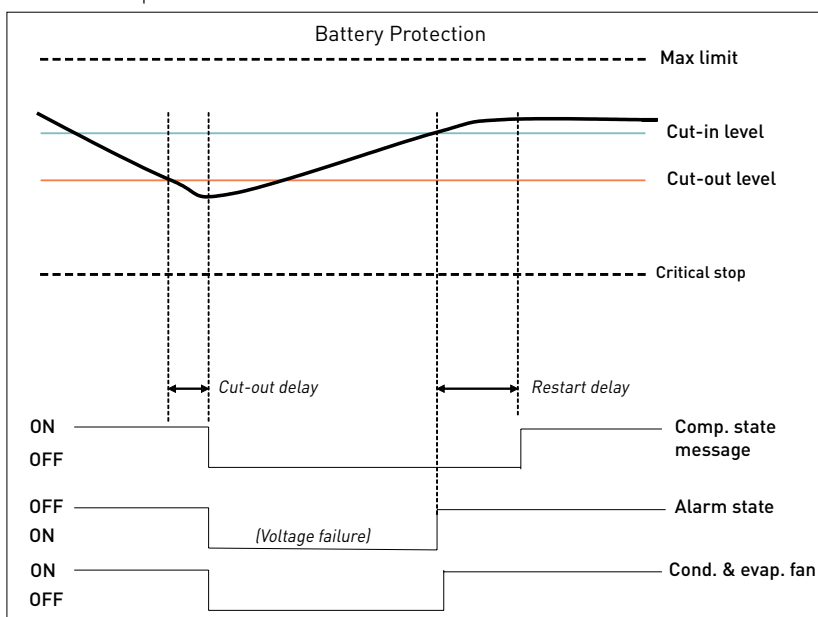
Name	Default	Min value	Max value	Step	Unit
Power consumption		0	65535	10	W
Power consumption since start		0	65535	10	Wh
Power consumption last period		0	65535	10	Wh

4.2.2 Battery protection

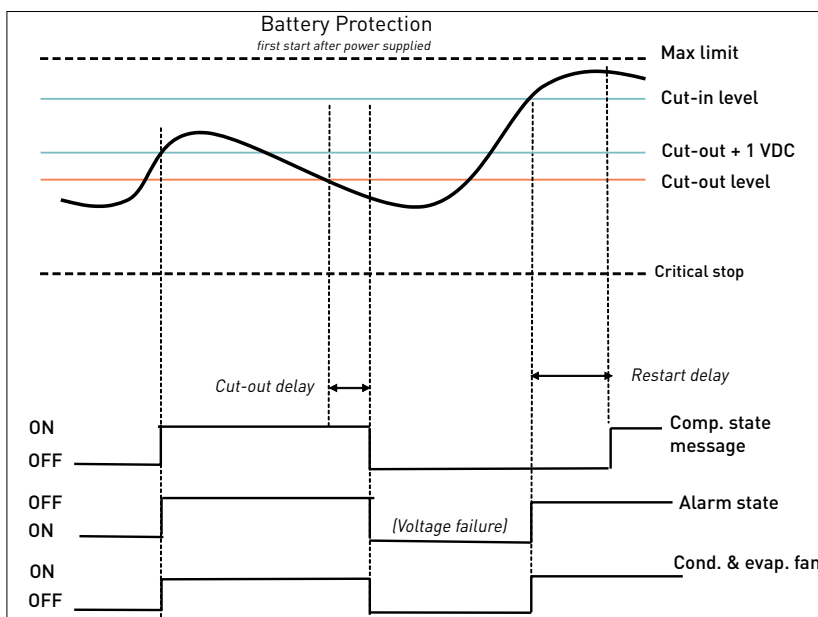
The battery protection serves to avoid permanent damage to the battery by discharge.

For 12V DC systems, the setting range is 9.6-15 V DC, with critical stop without delay if voltage stops, below 8 V DC. The setting range for 24 V DC systems is 19 to 27 V DC, with critical stop without delay if voltage drops below 15 V DC or exceeds 31.5 V DC. Tolerances are ± 0.30 V DC.

For normal operation:



For initial startup after power ON, extra protection has been provided by allowing cut in only when the voltage exceeds cut out + 1 V DC :



Settings:

Name	Default	Max value	Min value	Step	Unit
Battery cut-out level 12 V DC power supply	10.4	17.0	9.6	0.1	V DC
Battery cut-out level 24 V DC power supply	21.3	27.0	19.0	0.1	V DC
Battery cut-in difference power supply	1.3	10.0	0.5	0.1	V DC
Cut-out delay	3	60	0	1	sec

Measurements:

Name	Description	Step	Unit
Cut-in level	Calculated value. $Cutin = Cutout + Diff.$	0.1	Volt
Supply voltage	Real-time - voltage measured on + & - terminals	0.1	Volt

4.2.3 Compressor

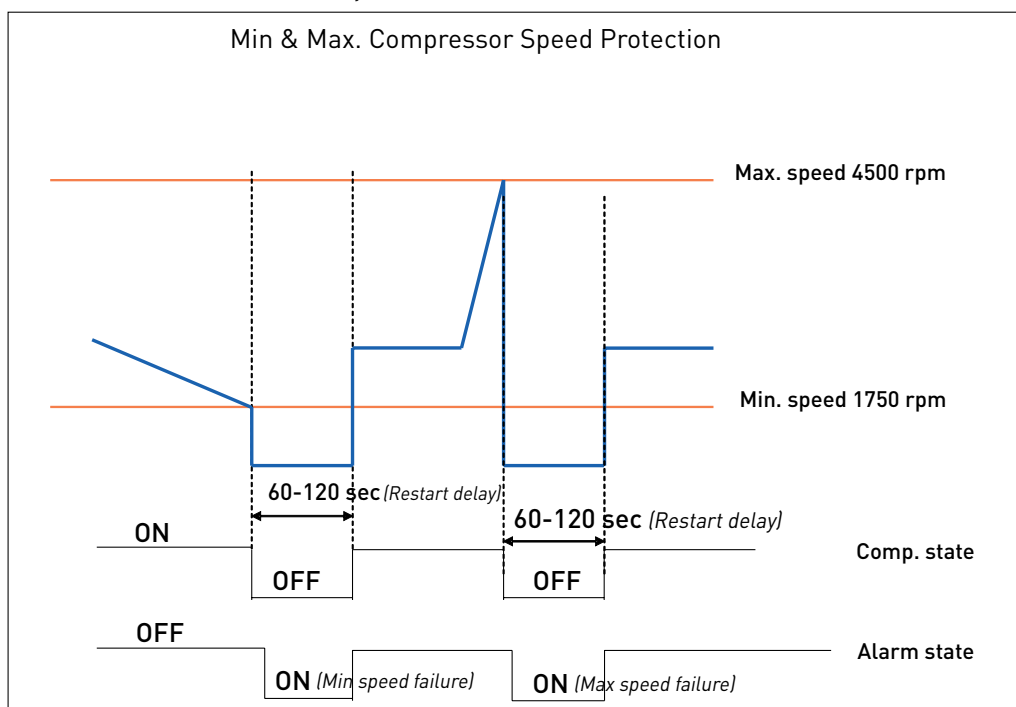
The speed and thereby the capacity of the compressor is set using the Requested speed parameter.

During start up, the compressor can be run at a lower speed, Start speed, than Requested speed. The duration of the period running at Start speed is set using the Start time parameter.

The compressor is protected against operation below minimum speed. Lubrication of the compressor will be very poor at excessively low speed and therefore low speed operation can lead to destruction of the compressor. Speed limits are: min 1850 rpm; max speed 4300 rpm.

If the compressor speed falls below the minimum or exceeds the maximum speed, the compressor will stop and an alarm Min speed failure or Max. speed failure will be sent. The compressor will try to restart after the set Restart time. The Restart time default is 60 sec.

In the event of failure the entire system will shut down (all 3 modules)



Settings:

Name	Default	Max value	Min value	Step	Unit
Requested speed	4000	4000	2500	100	rpm
Start delay	4	240	2	1	Seconds
Start speed	2500	4000	2500	100	rpm
Start time	30	600	0	1	Seconds

Measurements:

Name	Description	Step	Unit
Compressor speed	Real-time compressor speed(+/-10%)	1	rpm

4.2.4 Condenser fan

The speed of the condenser fan can be controlled in order to save energy, reduce noise and optimize the fan operation.

The fan is synchronized with the compressor operation.

Start and stop delays can be set up as a function of the state of the parameter Thermostat.

Furthermore, the fan can be set to run continuously (forced ON operation).

Some fan defects are detectable, and are displayed in the parameter Error.

The speed of the fan can be controlled in the range from 40% to 100%.

For 12 V DC systems 12 V DC fans should be used, and correspondingly for 24 V DC systems, 24 V fans should be used.

Settings:

Name	Default	Max value	Min value	Step	Unit
Fan speed	100	100	40	10	%
Fan start delay	0	240	0	1	Seconds
Fan stop delay	0	240	0	1	Seconds
Fan forced ON	OFF	ON	OFF	1	-
Detect missing fan	OFF	ON	OFF	1	-

Measurements:

Name	Description	Step	Unit
Fan speed	Actual fan speed	1	%

4.2.5 Evaporator fan

The speed of the evaporator fan can be controlled in order to save energy, reduce noise and optimize the fan operation.

The fan is synchronized with the compressor operation.

Start and stop delays can be set up as a function of the state of the parameter Thermostat.

Furthermore, the fan can be set to run continuously (forced ON operation).

Some fan defects are detectable, and are displayed in the parameter Error.

The speed of the fan can be controlled in the range from 40% to 100%.

For 12 V DC systems 12 V fans should be used, and correspondingly for 24 V DC systems, 24 V fans should be used

Settings:

Name	Default	Max value	Min value	Step	Unit
Fan speed	100	100	40	10	%
Fan start delay	0	240	0	1	Seconds
Fan stop delay	0	240	0	1	Seconds
Fan forced ON	OFF	ON	OFF	1	-
Detect missing fan	OFF	ON	OFF	1	-

Measurements:

Name	Description	Step	Unit
Fan speed	Real-time fan speed	1	%

4.2.6 Thermostat

Thermostat type

Two types of thermostat can be utilized for temperature control.

Electronic thermostat (NTC sensor)

The electronic thermostat provides active temperature control.

Disconnected sensor error alarm (NTC sensor failure) is sent when the measured temperature is $>+100^{\circ}\text{C}$

Short circuited sensor error alarm (NTC sensor failure) is sent when the measured temperature $<-50^{\circ}\text{C}$

Mechanical thermostat

A mechanical ON/OFF thermostat can be connected at terminals C & T.

No detection of faulty thermostat is provided when an ON/OFF thermostat is used.

Automatic thermostat selection

The Thermostat parameter displays the type of thermostat connected to the controller: either a mechanical thermostat or NTC temperature sensor.

An NTC sensor is recommended for the temperature range -50°C to $+100^{\circ}\text{C}$

A mechanical thermostat is recommended for temperatures below -50°C and above $+100^{\circ}\text{C}$

Note: An NTC sensor error is not detectable when the NTC sensor is operating in automatic thermostat selection mode.

An over temperature alarm (NTC sensor failure) is raised if the measured temperature exceeds $+100^{\circ}\text{C}$

An under temperature alarm (NTC sensor failure) is raised if the measured temperature drops below -10°C

Settings:

Name	Default	Max value	Min value	Step	Unit
Thermostat type	Auto	Electronic	-	-	-
Cutout temperature	+ 25	+ 40	-40	1	Celsius ($^{\circ}\text{C}$)
Difference	3	15	1	1	Kelvin (K)
Forced ON	OFF	ON	OFF	1	-
Cutout temperature 2	25	40	-40	0.1	$^{\circ}\text{C}$
Difference 2	3	15	1	0.1	K
Forced ON 2	0	1	0	1	0 = OFF 1 = ON
Synchronic mode	1	1	0	1	0 = OFF 1 = ON

Measurements:

Name	Description	Step	Unit
Runtime	Runtime is provided to record cooling-time (thermostat cut-in period). The runtime is updated during cooling, starting with 0 at start of cooling. During cooling OFF (Thermostat cut-out), the Runtime parameter will show the time for the last cooling period. Runtime is reset at the beginning of a cooling ON period, and at power-up.	1	Minutes
Actual temperature	Real-time air temperature when a NTC sensor is used. When a mechanical thermostat is used, only thermostat status ON or OFF is displayed.	-	$^{\circ}\text{C}$

4.2.7 ECO function

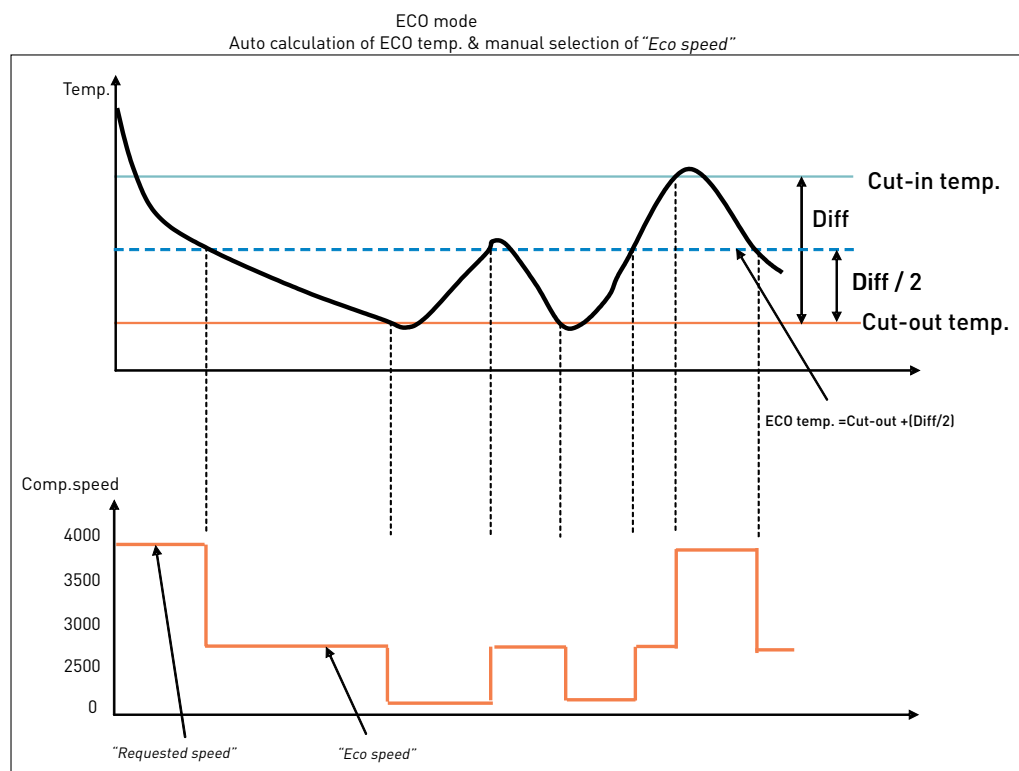
Operation in ECO mode reduces energy consumption and noise by controlling compressor speed as a function of temperature. ECO mode can be selected only when using an NTC temperature sensor.

It is only possible to select ECO mode when running a single configuration or a twin configuration with Synchronic mode turned ON.

In case of switching from selectable ECO mode to non selectable ECO mode, the ECO function is going to be switched OFF automatically.

In ECO mode,

- when operating below ECO temperature, compressors run at the set ECO speed, and the Start speed setting will be overruled, if it differs from ECO speed.
- when operating above ECO temperature, the compressors run at Requested speed.

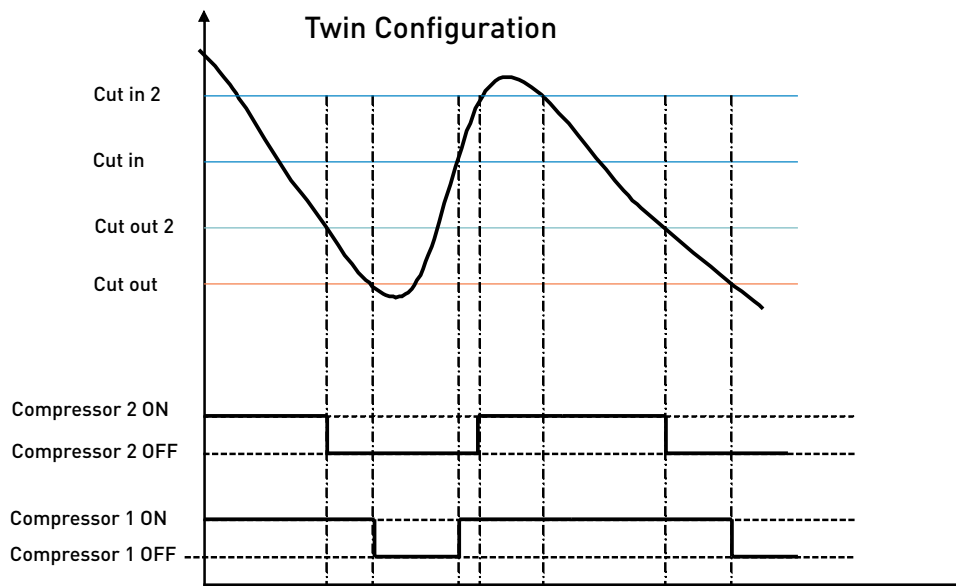


Settings:

Name	Default	Max value	Min value	Step	Unit
ECO mode	OFF	ON	OFF	1	
ECO speed	2500	4000	2500	1	rpm
ECO temperature	25	40	-40	0.1	Celsius (°C)
Automatic ECO temperature	1	1	0	1	0 = OFF 1 = ON

4.2.8 Twin function

When operating in twin configuration, the thermostat cut-in and cut-out settings for each of the two compressors can be established independently. In Synchronic mode only one set point is valid for both compressors.



4.2.9 Communication

Lost communication

The unit will automatically detect if an external MMI has been connected to the application module. Once it has been detected it will ensure that the system will not continue to run, when the communication has been lost.

When the communication is lost the entire system will stop and a communication error will be prompted. The communication will stay off until there will be a valid frame on the bus. The error will be erased and the system will start to run again.

Set main to off when communication is lost.

When choosing this setting the main will be set to off when the communication is lost. Through that the system will stop. The system will remain off until the MMI has set the main switch to on again.

Protection of settings

A coded privacy function protects customers' settings from being read by third parties. The code must be verified by entering twice.

Settings:

Name	Default	Min value	Max value	Step	Unit
Node number	1	1	247	1	-
Bits per second	19200	19200	9600	9600	0 = Disabled 1 = Enabled
Communication	0	0	1	1	Seconds
Communication timeout	900	15	7200	1	-
Setting protection code & status	0	0	9999	1	-

4.2.10 Compressor safety

In order to prevent the compressor from short cycling a minimum restart time is built in. After timeout of Compressor restart time a new start of the compressor is permitted.

Settings:

Name	Default	Max value	Min value	Step	Unit
Compressor restart tme	60	120	60	1	Seconds

4.2.11 Product information

Settings:

Name	Description
Unit name	Possible to fill in customer name for the unit when presented in PC software programme Tool4Cool®

Measurements:

Product code (Code number)
Firmware version
Unit ID
Production Date
Serial (Serial number)
Unit name
Vendor name
Supplier data
Production location
FFT date
Supplier part number
ProdText (Text that appears on the label)

4.2.12 Customer register

The customer register enables the user to set and change values in custom-designed interface modules.

These parameters are visible even when in protected mode.

Contact Secop for further information.

Settings:

Name	Default	Max value	Min value	Step	Unit
Register 1	65535	65535	0	1	-
to					
Register 2	65535	65535	0	1	-

4.2.13 Actual error

The alarm function notifies the user when an error arises in the system, and implements measures which prevent damage to the refrigeration system.

When an error occurs it is indicated at the PC in the software tool interface.

This parameter is on view in all parameter groups.

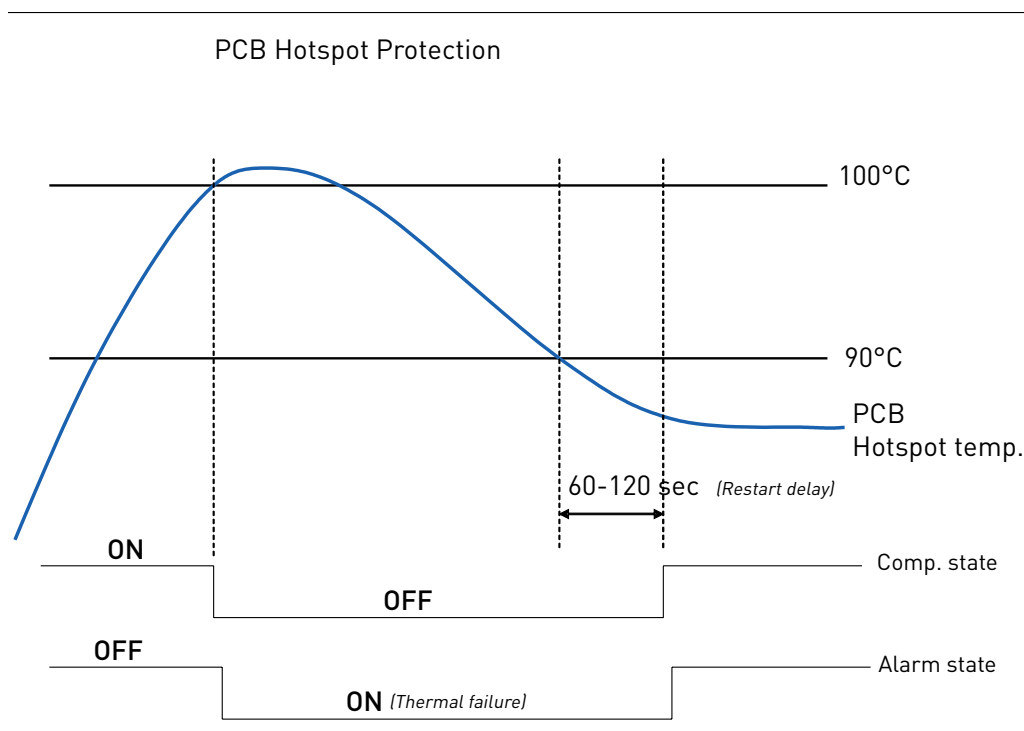
Output:

Name	Description
Actual error (application module)	0 = No error 1 = Battery protection failure 2 = Fan failure 3 = Motor failure 4 = Min. speed failure 5 = Thermal failure 6 = NTC failure 7 = Communication Error
Actual error (compressor module 1)	0 = No error 1 = Battery protection failure 3 = Motor failure 4 = Min. speed failure 5 = Thermal failure
Actual error (compressor module 2)	0 = No error 1 = Battery protection failure 3 = Motor failure 4 = Min. speed failure 5 = Thermal failure

4.2.14 Inverter Temperature (PCB)

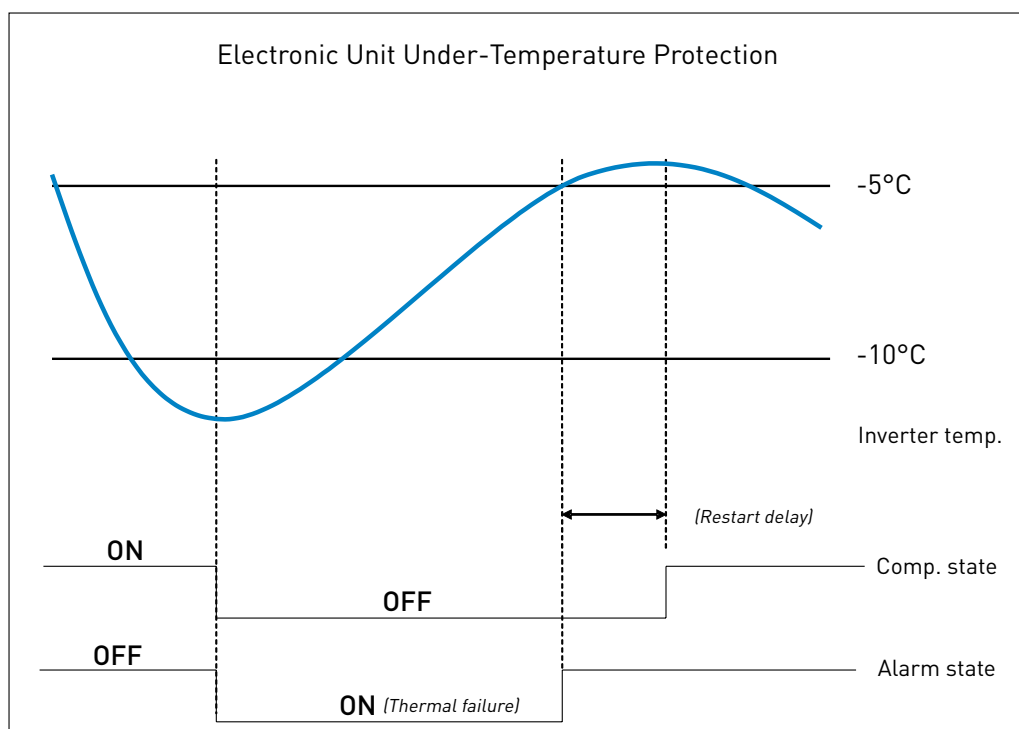
Electronic unit overheating protection

The controller overheating protection system ensures that the controller does not operate at extremely high temperatures, because under these conditions the quality of the soldered joints will be endangered. When the unit reaches 100 °C the system will shut down and an alarm error (Alarm 5: Thermal failure) will be sent. The system restarts automatically after the temperature has dropped below 90 °C. Hereafter the set delay Compressor restart delay must be terminated. The default duration is 60 sec.



Electronic unit under-temperature protection

The protection system ensures that the compressors, including the magnets in the motor, are not damaged by excessively low temperatures.



4.3 Error and Event Logs

4.3.1 Error log

The error log records the following data for each error arising:

- Time of occurrence related to compressor power up, with 1 sec as sample time
- The sequence of occurrence
- Number of occurrence (when no value is related to the parameter)
- Error name
- Sub Error name
- The value of the parameter which caused the failure (if connected to a parameter)
- Event list reference (changes which caused the failure if a parameter change caused the failure)

The error log can be cleared using the clear function.

4.3.2 Event log

The event log records the following parameter and event data to assist in service situations:

- Parameter changes (Parameters defined in the parameter)
- Power up
- Start/Stop signal from application module

The following information is recorded for each event:

- Time of occurrence related to compressor power up, with 1 sec as sample time
- The sequence of occurrence (Event list reference)
- Parameter/Event description
- The value of the parameter
- Number of occurrence (when no value is related to the parameter)

5. ORDERING

	Model	Code no	Description
Compressors	BD350GH 12 V DC supply	102Z3015	
	BD350/350GH 12 V DC supply - twin compressor	102Z3018	
	BD350GH 24 V DC supply	102Z3016	
	BD350/350GH 24 V DC supply - twin compressor	102Z3017	
	BD220CL 12 V DC supply	102Z3020	
Single-Pack	Compressor module 12 V DC	101N0800	used together w. 101N0820
	Compressor module 24 V DC	101N0810	used together w. 101N0820
	Application module 12 & 24 V DC	101N0820	used together w. 101N800/810
	Temperature sensor, 470 mm, spade connectors	105N9612	accessories
	Temperature sensor, 1000 mm, spade connectors	105N9614	accessories
	Temperature sensor, 1500 mm, spade connectors	105N9616	accessories
	Secop One Wire/LIN gateway with cables & driver	105N9501	accessories
	One Wire/LIN gateway communication cable	105N9524	accessories (101N8xxx series)
	Secop Bluetooth® gateway with power supply	105N9502	accessories
	Bluetooth® gateway communication cable	105N9525	accessories
Industrial-Pack (I-Pack)	Compressor module 12 V DC	101N0801	30 pcs.
	Compressor module 24 V DC	101N0811	30 pcs.
	Application module 12 & 24 V DC	101N0821	24 pcs.
	Compressor communication cable assembly 1500 mm	105N9553	80 pcs.
	Compressor communication cable assembly 3000 mm	105N9554	45 pcs.
	Twin compressor communication cable assembly 800 mm	105N9561	65 pcs.
	Twin compressor communication cable assembly 1500 mm	105N9555	65 pcs.
	Twin compressor communication cable assembly 3000 mm	105N9556	40 pcs.
	Temperature sensor, 470 mm, spade connectors	105N9613	200 pcs.
	Temperature sensor, 1000 mm, spade connectors	105N9615	100 pcs.
	Temperature sensor, 1500 mm, spade connectors	105N9617	100 pcs.
	Display cable assembly without fuse 1500 mm	105N9557	65 pcs.
	Display cable assembly without fuse 3000 mm	105N9558	35 pcs.
Software Package	Tool4Cool® LabEdition	free of charge	www.secop.com/tool4cool.html

TOOL4COOL® SOFTWARE - FLEXIBLE CONTROL SETTINGS

TOOL4COOL® is a unique PC software tool that enables you to precisely configure your Secop compressors to your cooling systems.

Via microprocessor-based controllers, TOOL4COOL® gives you easy access to all parameters. These can be changed, monitored, downloaded or uploaded to get the optimum performance out of your cooling system.

TOOL4COOL® covers a wide range of applications within parking cooling, light commercial cooling and transport cooling and much more. Using TOOL4COOL®, you can determine the basic specifications of your product, giving you the ability to clearly differentiate yourself in the market.



OUR JOURNEY SO FAR

1956 Production facility and headquarters in Flensburg, Germany founded	1970 Introduction of SC compressors. The birth of a standard setting platform in the light commercial market.	1990 Introduction NL compressors.	1992 Introduction PL compressors.	1999 Start of production with natural refrigerant R290 (Propane).	2005 Introduction GS compressors.	2008 Production facility in Wuqing, China founded.	2013 Introduction of the XV compressor. Opening a new chapter in refrigeration history.
1958 Start up production of PW compressors.	1972 Introduction FR compressors.	1977 Introduction TL and BD compressors.	1993 Start of production with natural refrigerant R600a (Isobutane) Production facility in Crnomelj, Slovenia founded.	2002 Production facility in Zlate Moravce, Slovakia founded.	2010 Introduction SLV-CNK.2 and SLV-CLK.2 variable speed compressors. Introduction BD1.4F Micro DC compressor. Introduction of DLX and NLU compressors.		



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