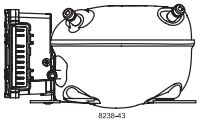


TOOL4COOL®

Instructions

Electronic Unit for BD1.4F-VSD Compressor, 101N2130, 12-24V DC

SECOP

Fig. 1

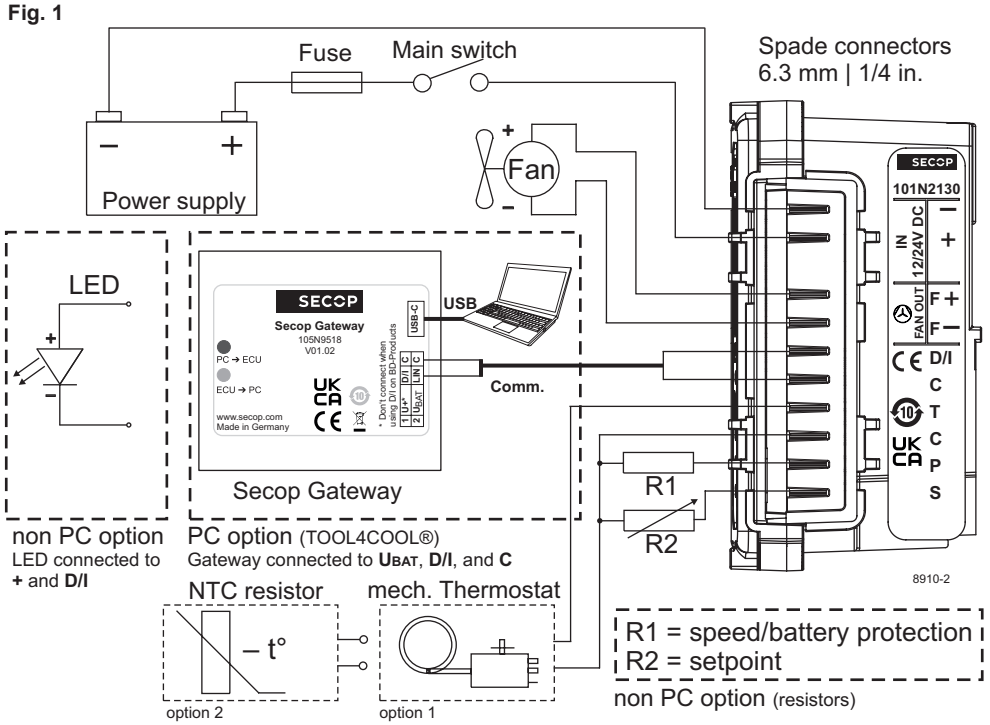


Fig. 7

Operational errors (PC or non PC option)

Error code or LED flashes	Error type Can be read out in the software **TOOL4COOL®**
6	**Thermostat failure** (If the NTC thermistor is short-circuit or has no connection, the electronic unit will enter manual mode).
5	**Thermal cut-out of electronic unit** (If the refrigeration system has been too heavily loaded, or if the ambient temperature is high, the electronic unit will run too hot).
4	**Minimum motor speed error** (If the refrigeration system is too heavily loaded, the motor cannot maintain minimum speed at approximately 1,850 rpm).
3	**Motor start error** (The rotor is blocked or the differential pressure in the refrigeration system is too high (>5 bar)).
2	**Fan over-current cut-out** (The fan loads the electronic unit with more than 0.65A_{peak}).
1	**Battery protection cut-out** (The voltage is outside the cut-out setting).

ENGLISH

The electronic unit is a dual voltage device. This means that the same unit can be used in 12V or 24V power supply systems. Maximum voltage is 17V for a 12V system and 34V for a 24V power supply system. Max. ambient temperature is 55°C. The electronic unit has a built-in thermal protection which is actuated and stops compressor operation if the electronic unit temperature gets too high (100°C/212°F on the PCB). It can be connected to a PC through the *Secop Gateway* communication interface on the terminal D/I and C (Fig. 1). Communication gateway modules incl. communication cables can be ordered at Secop (code no. 105N9518).
The PC interface allows you to configure and measure compressor parameters by using the software tool TOOL4COOL® supplied by Secop.

Installation (Fig. 3)
Mount the electronic unit directly on the compressor plug and fix it with at least 2 screws.

Power supply (Fig. 1)
The electronic unit must always be connected directly to the battery poles. Connect the battery to + and battery minus to –. The electronic unit is protected against reverse battery connection but can only operate in the described polarity. A fuse must be mounted in the + cable as close to the battery as possible. A 15A fuse must be used in 12V and 24V systems. If a main switch is used, it should be rated to a current of min. 20A.
The wire dimensions in Fig. 4 must be observed. Avoid extra junctions in the power supply system to prevent voltage drop from affecting the battery protection system

Battery protection (Fig. 2)
The compressor stops and restarts again according to the designated voltage limits measured on the + and – terminals of the electronic unit. The standard settings for 12V and 24V power supply systems are shown in Fig. 2. **(PC option)**
Other settings are (Fig. 5) optional if a connection which includes a resistor (R1) is established between terminals C and P **(non PC option)**.

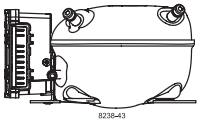
Thermostat (Fig. 1)
The thermostat is connected between the terminals C and T. Either a NTC (electrical thermostat) or a mechanical thermostat can be connected. Three different thermostat modes can be chosen via communication interface or TOOL4COOL® - *Auto* (both NTC and mechanical), *NTC* or *Mechanical*. Standard setting is *Auto*. In case of using a NTC the set point in the range between -40ºC and 40ºC is set via software. When using the *Auto* setting in the software it is not possible to obtain NTC failures, so it is recommended to set the thermostat mode to *NTC* when using a NTC.

Setpoint selection (Fig. 6)
A temperature setpoint selection is possible in order to utilize the fully intergrated temperature control. To configure the temperature shut off setpoint without a communication interface a 10kΩ potentiometer can be connected between P-Input and C, as shown in Fig. 1 (R2). The potentiometer moves the compressor shut off setpoint between -20°C and 10°C, it will restart once the temperature raised 3K (Kelvin) (eq. +1kΩ on NTC) **(non PC option)**.

Speed selection (Fig. 5)
In factory default settings the compressor will run with a fixed speed of 4,000 rpm when the thermostat is switched on.
Other fixed compressor speeds and start speeds in the range between 2,000 and 4,000 rpm can be obtained when changing the speed settings in the software **(PC option)** or resistor R1 **(non PC option).**
A start delay in the range from 0-240 sec. (factory default 4 sec.) after thermostat cut-in can also be chosen. By default the compressor will start with a speed of 2,500 rpm for the first 30 seconds.

Fan (Fig. 1)
A fan can be connected between the terminals +(F) and F. Connect fan plus to +(F) and fan minus to F. The output voltage between the terminals +(F) and F is always regulated to 12V, a 12V fan must be used for both 12V and 24V power supply systems. The fan output can supply a continuous power of 6W_{avg}. A higher current draw is allowed for 2 seconds during start.
Fan settings can be adjusted via TOOL4COOL®. Per factory default a missing fan is not detected, but the detection is configurable via communication interface or TOOL4COOL®.
The unit has to be restarted when fan related settings have been changed. If a fan is used without changing the TOOL4COOL® settings, the fan will run but no error signal will be sent in case of fan failure. It is also possible to set a start delay on the fan in the range from 0 – 240 sec. which is only applied if the fan is not running when the compressor starts. Factory default setting for fan start delay is 0 seconds. Fan speed can be adjusted from 40 – 100%.

Error handling (Fig. 7)
If the electronic unit detects an operational error, it is accessible via the software **(PC option)**. Error codes are defined as shown in Fig. 7.
A 10mA LED can alternatively be connected between the terminals D/I and +. In case the electronic unit records an operational error, the diode will flash a number of times. The number of flashes depends on what kind of operational error was recorded. Each flash will last ¼ second. After the actual number of flashes there will be a delay with no flashes. The sequence for each error recording is repeated every 4.2 seconds **(non PC option)**.



TOOL4COOL®

Instructions

Electronic Unit for BD1.4F-VSD Compressor, 101N2130, 12-24V DC

SECOP

Fig. 2

Battery protection settings

Voltage (0.1 steps)				Min. value	Default	Max. value
12V	± 0.3V DC, all values	Cut out	V DC	9.6	10.4	17
		Cut in diff.	V DC	0.5	1.3	10
24V	± 0.3V DC, all values	Cut out	V DC	19	21.3	27
		Cut in diff.	V DC	0.5	1.3	10

Fig. 3

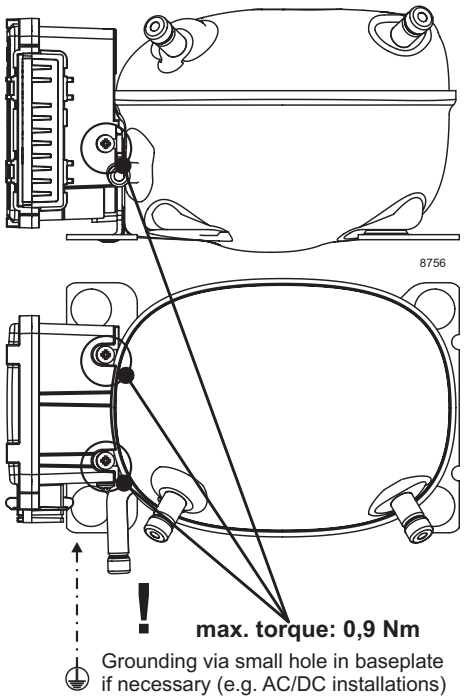


Fig. 4

Wire Dimensions DC

Size		Max. length* 12V operation		Max. length* 24V operation	
Cross section	**AWG**				
[mm²]	[Gauge]	[m]	[ft.]	[m]	[ft.]
2.5	12	2.5	8	5	16
4	12	4	13	8	26
6	10	6	20	12	39
10	8	10	33	20	66

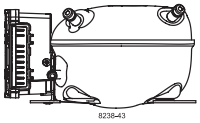
*Length between battery and electronic unit

Fig. 5

R1 [kΩ]	Duty Cycle [%]	Speed [RPM]	Cut in level [V]	Cut out level [V]	Cut in level [V]	Cut out level [V]	
open	0	Maintain	Maintain current value. Can be changed via Modbus				
220	3	-	Maintain current value. Can be changed via Modbus				
130	6	-	Maintain current value. Can be changed via Modbus				
91	9	-	Maintain current value. Can be changed via Modbus				**ECO**
68	12	-	Maintain current value. Can be changed via Modbus				**ECO off**
51	15		9.6 - 34 V DC				**Solar**
43	18		Default				**Solar off**
36	21		Reset battery only				
30	24		Reset battery and speed to default value				
27	27	4000	Maintain current value. Can be changed via Modbus				
22	30	4000	10.9	9.6	22.6	21.3	
20	33	4000	11.4	10.1	23.6	22.3	
18	36	4000	12.4	11.1	24.6	23.3	
15	39	4000	13.4	12.1	25.6	24.3	
13	42	3500	Maintain current value. Can be changed via Modbus				
12	45	3500	10.9	9.6	22.6	21.3	
11	48	3500	11.4	10.1	23.6	22.3	
9.1	51	3500	12.4	11.1	24.6	23.3	
8.2	54	3500	13.4	12.1	25.6	24.3	
7.5	57	3000	Maintain current value. Can be changed via Modbus				
6.2	60	3000	10.9	9.6	22.6	21.3	
5.6	63	3000	11.4	10.1	23.6	22.3	
5.1	66	3000	12.4	11.1	24.6	23.3	
4.3	69	3000	13.4	12.1	25.6	24.3	
3.9	72	2500	Maintain current value. Can be changed via Modbus				
3.3	75	2500	10.9	9.6	22.6	21.3	
2.7	78	2500	11.4	10.1	23.6	22.3	
2.2	81	2500	12.4	11.1	24.6	23.3	
1.8	84	2500	13.4	12.1	25.6	24.3	
1.5	87	2000	Maintain current value. Can be changed via Modbus				
1.0	90	2000	10.9	9.6	22.6	21.3	
0.68	93	2000	11.4	10.1	23.6	22.3	
0.36	96	2000	12.4	11.1	24.6	23.3	
0.051	99	2000	13.4	12.1	25.6	24.3	

Fig. 6

Set point [°C]	R2 [Ω]
-20	0
-19	330
-18	670
-17	1000
-16	1330
-15	1670
-14	2000
-13	2330
-12	2670
-11	3000
-10	3330
-9	3670
-8	4000
-7	4330
-6	4670
-5	5000
-4	5330
-3	5670
-2	6000
-1	6330
0	6670
1	7000
2	7330
3	7670
4	8000
5	8330
6	8670
7	9000
8	9330
9	9670
10	10000



TOOL4COOL®

Instructions

Connecting TOOL4COOL® to Electronic Unit 101N2130

SECOP

The communication port of the electronic unit (terminal D/I and C) has two functions:

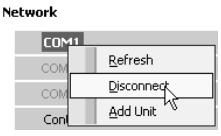
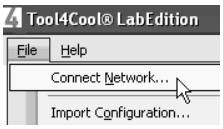
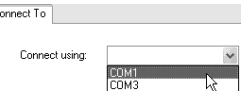
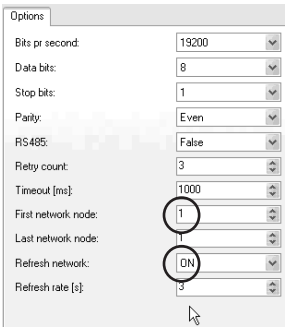
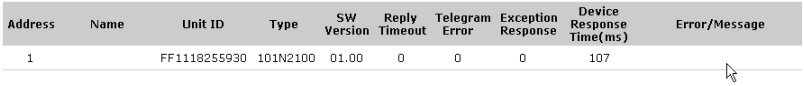
1. Communication mode (PC option):
The first 15 seconds after power up/wake up, both devices (compressor & PC) try to establish a communication.
In case a successful connection is made, the port will stay in communication mode until next power up/ wake up.
2. Diode output mode (non PC option):
After 15 seconds with no communication link successful established, the unit switches to diode output mode.
No communication is possible until next power up/ wake up.

To ensure a trouble free connection using TOOL4COOL®, the following method is recommended:
Change the default TOOL4COOL® network setup to allow TOOL4COOL® to search for the electronic unit every 3 seconds. While TOOL4COOL® is searching, power up the electronic unit and wait for a connection.
The following shows how to arrange this setup.

Preconditions:
The electronic unit is physically connected via the gateway to the PC, **but the power to the electronic unit is <u>not</u> yet switched on.**

In the example to the right, the electronic unit is connected to the *COM1* network.

Note:
The Secop LIN gateway has two LEDs which allow debugging of the communication:
RED LED (TX): blinks when TOOL4COOL® sends a command to the electronic unit.
This must blink every second while TOOL4COOL® is trying to establish a connection with the electronic unit.
GREEN LED (RX): blinks when the electronic unit responds to a TOOL4COOL® command.
The node address of the electronic unit must match the command from TOOL4COOL®
(The network setting above tells TOOL4COOL® to search for unit node address 1 every 3 sec.).

Step	Description / Display	
1	Do not power up the electronic unit at this stage. If already powered up, remove the supply voltage and allow 5s to power off.	
2	Start TOOL4COOL®	
3	In case the network is already connected, disconnect it first via right-click on the specific COM-Port and option *Disconnect* in context menu.	
4	Allow up to 5s to release the COM-Port from the network, then select *Connect Network* (below the *File* menu).	
5	Select the correct port from the dropdown menu, in this example *COM1* is used.	
6	Cick *Configure*.	
7	Change *Last network node* address to *1* and change *Refresh rate* to *3*. Leave the other settings at their default value and click *OK* twice. Now TOOL4COOL® will only try to establish a connection to an electronic unit with address 1, but every 3 seconds. This will ensure that the connection is established within the 15 second time limit after powering up the unit. Leave all other options unchanged.	
8	Power up the electronic unit	
9	The first time the unit is connected, TOOL4COOL® needs to obtain the parameter file from the unit before a connection is shown by the red arrow. Allow a few minutes for this task to complete. You also can read the current status by selecting the network and then select the tab *Unit Status*.	
10	Look under *Error/Message*  In this example, no errors or messages appear and the unit is working properly.	
11	If the parameter file was already loaded into TOOL4COOL®, a connection should be visible in less than 10 seconds. A red arrow is added before the network name to indicate that a unit is ready.	 Click the red arrow to open the menu of the electronic unit.

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