Instructions

Electronic Unit for BD1.4F-VSD Compressor, 101N2100, 12-24V DC

Fig. 1

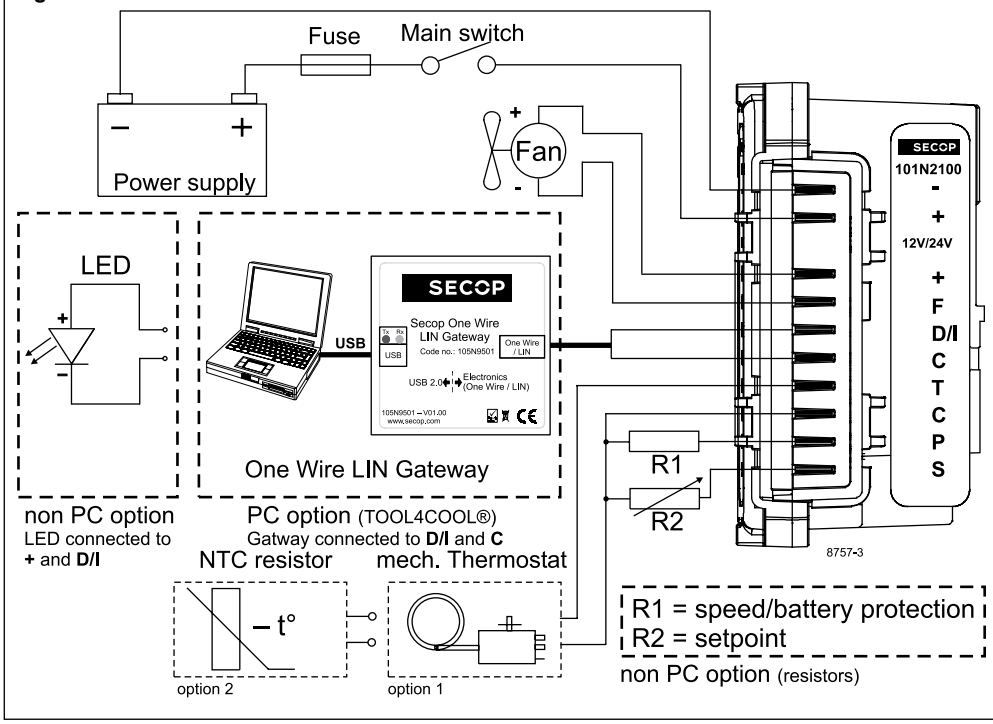


Fig. 7

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 One Wire/LIN Gateway* communication interface on the terminal D/I and C (Fig. 1). Communication gateway modules incl. communication cables can be ordered at Secop.
The PC interface allows you to create different settings and reads out several measurements 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 screws.

Power supply (Fig. 1)
The electronic unit must always be connected directly to the battery poles. Connect the plus to + and the minus to –, otherwise the electronic unit will not work. The electronic unit is protected against reverse battery connection. For protection during installation, a fuse must be mounted in the + cable as close to the battery as possible. A 15A fuse for 12V and a 15A fuse for 24V circuits are recommended.
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 setting.

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)**.

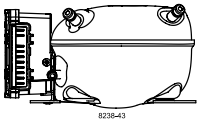
Thermostat (Fig. 1)
The thermostat is connected between the terminals C and T. Either a NTC (electrical thermostat) or a mechanical thermostat can be connected. Three different thermostat modes can be chosen in the software - *Auto* (both NTC and mechanical), *NTC* or *Mechanical*. Standard setting is *Auto*. In case of using a NTC the set point in the range between -40ºC and 40ºC is set with the software and the temperature can also be seen by using the interface. 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)
In order to utilize the finally intergrated temperature control. You can connect a 10kΩ potentiometer between S and C (R2). Via this resistor a temperature setpoint between -20°C and 10°C can be selected. The compressor will stop when the set point is measured on the NTC and restart at set point +1kΩ or 3K (Kelvin) **(non PC option)**.

Speed selection (Fig. 5)
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 with the resistor **(non PC option).**
A start delay in the range from 0-240 sec. (factory setting 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 the plus to +(F) and the minus to F. Since 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®. The factory default setting in the controller is:
Detect missing fan - Disabled.
The unit has to be restarted when these settings have been changed. If a fan is used without adapting 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. but only if a fan is connected and not running.
Factory default setting for a fan is 0 seconds.
Fan speed can be adjusted through the interface from 40 – 100%.

Error handling (Fig. 7)
If the electronic unit records an operational error, the error can be read out in the software **(PC option)**. Error codes are defined as shown in Fig. 7.
A 10mA light emitting diode (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, so that the sequence for each error recording is repeated every 4 seconds **(non PC option)**.



TOOL4COOL®
Flexible control settings

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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

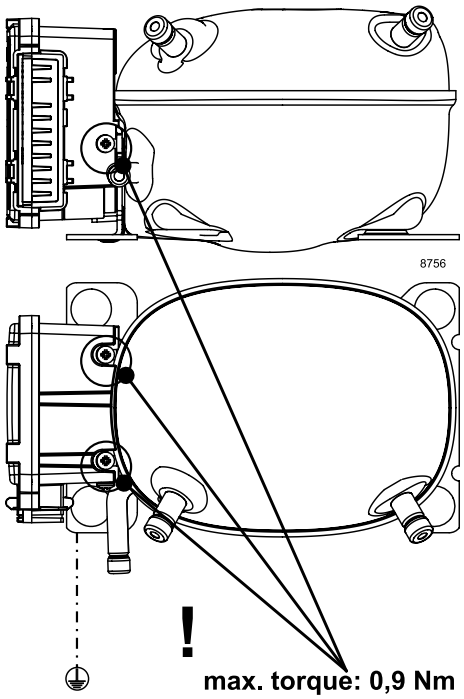

Fig. 4

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

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Connecting TOOL4COOL® to Electronic Unit 101N2100

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

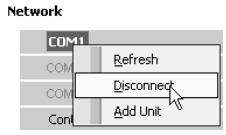
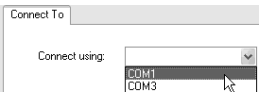
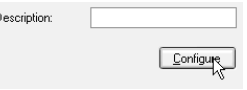
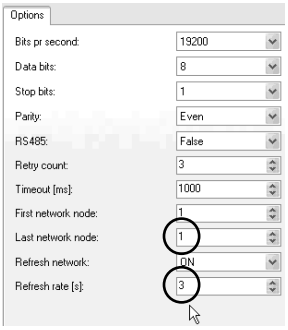
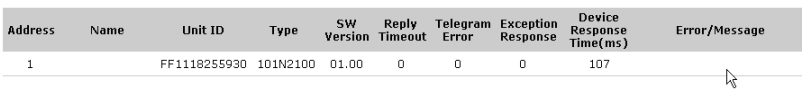
1. Communication mode (PC option):
The first 15 seconds after power up/wake up, both devices (compressor & PC) try to communicate.
In case a successful connection is made, the port will stay in communication mode until next power up/ wake up.
2. Diode output mode (non PC option):
After 15 seconds with 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:
Next to the USB connector of the gateway, there are also two LED's visible:
RED LED: 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: 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.	
2	Start TOOL4COOL®	
3	In case the network is already connected, disconnect it first using on screen network option.	
4	Wait a few seconds, then select *Connect Network* (below the *File* menu).	
5	Select the correct port, 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 look for 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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