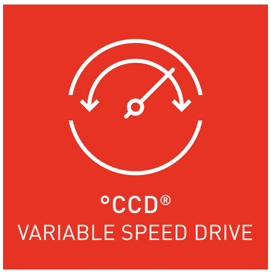
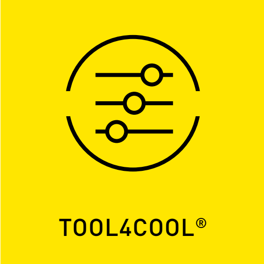
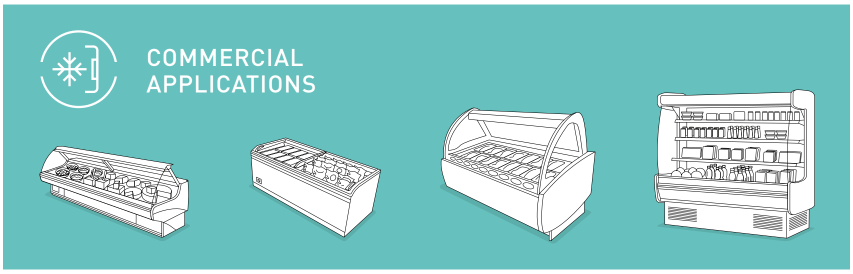
Operating Instructions

CONTROLLERS FOR SLVE-CN COMPRESSORS

105N4730 Standard · 208–240 V | 50/60 Hz







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1 INTRODUCTION

Compressors are a vital element in cooling appliances, ensuring that the entire system runs smoothly and efficiently. Looking into the core of any machine, the effectiveness of a compressor is the optimization of all components, including motor type, pump type, and controller type.

When it comes down to compressors, a variable speed drive control is almost exactly the same as a variable frequency drive (VFD) in the way it controls a DC motor. However, variable speed compressors utilize a brush-less permanent magnet motor for improved efficiency and longevity.

Full load operation is rare in most cooling applications, restricted to a few days per year.

Since a compressor must fulfill the full load operation, a standard compressor is far too big for normal conditions, leading to poor energy efficiency.

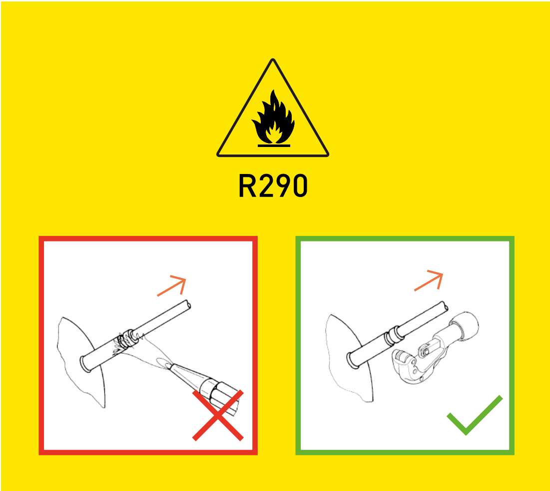
The variable speed technology makes capacity adapt to your actual requirement. The compressor runs at low speed most of the time, minimizing energy consumption.

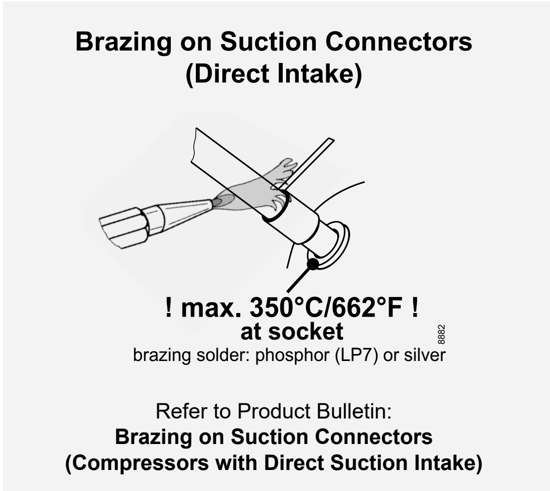
In addition to this, system efficiency is greatly improved thanks to reduced loss when less heat is transferred via the evaporator and condenser. Altogether, substantial energy savings can be achieved.

Secop SLVE variable-speed compressors are designed for refrigeration systems using the designated refrigerants R290 (propane).

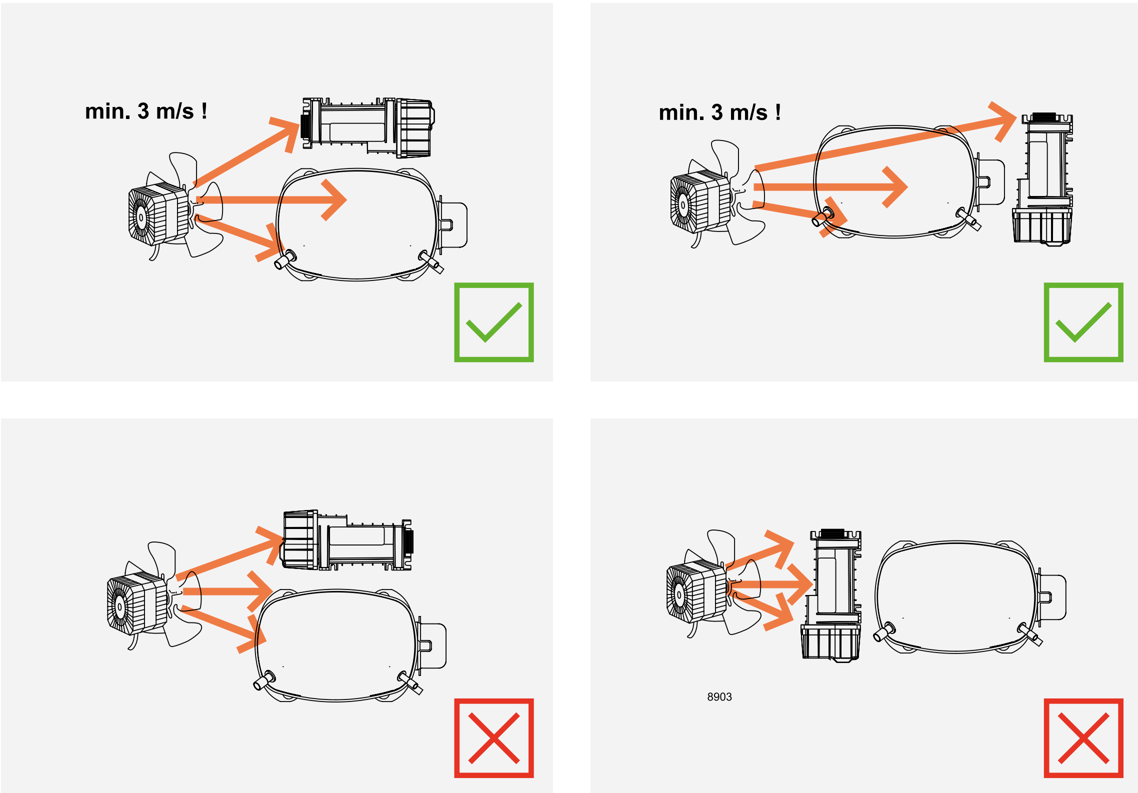
2 INSTALLATION

WARNING!



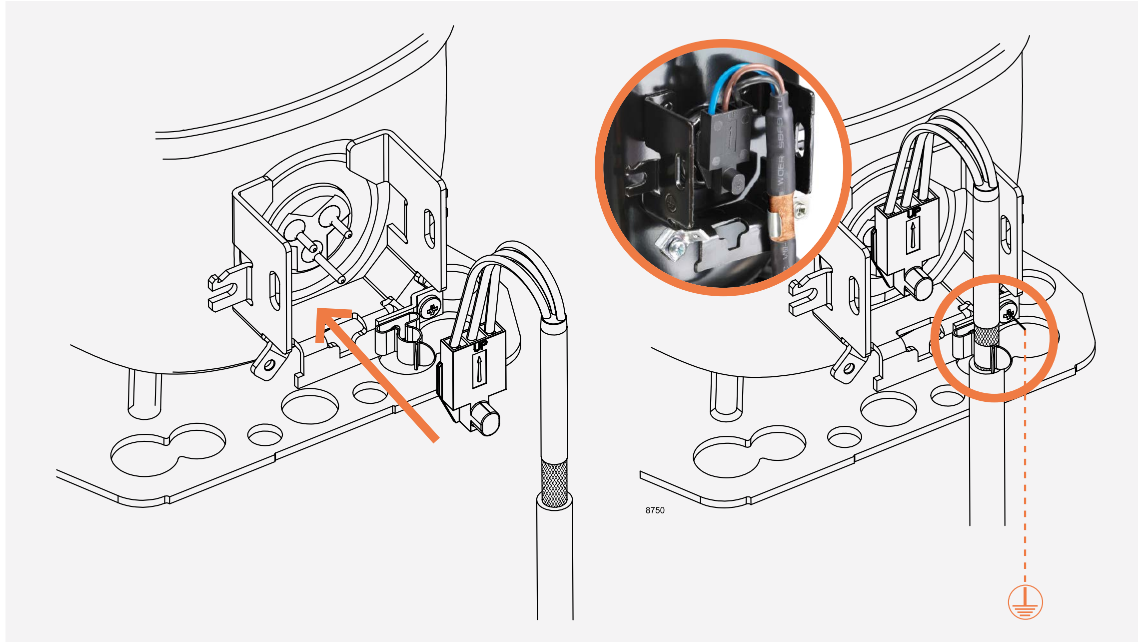


2.1 AIRFLOW



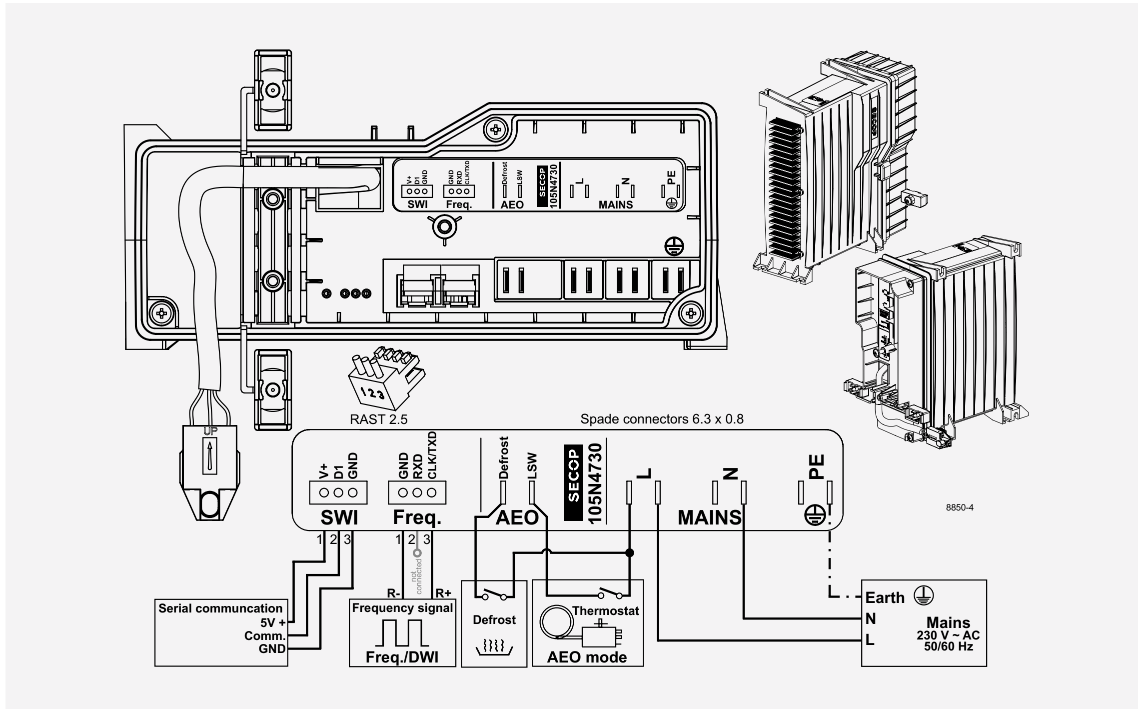
Ensure proper airflow of 3 m/s at both compressor and electronic unit.

2.2 EARTHING THE COMPRESSOR AND CONTROLLER



- For optimum EMC performance, the copper shield of the controller cable must be fastened properly in the clip at the compressor.
- Compressor and controller must be connected to PE (Protective Earth) to avoid risk of electrical hazard.
- All protective earth lines, PE, in the application must be collected to one star point. This prevents loop currents which could cause problems concerning the electronic components, communication lines and sensors. The star-point is normally a screwed terminal on the chassis

2.3 WIRING DIAGRAM



- Installation must only be done by trained personal.
- Do not remove cover of the controller when the unit is powered on.
- Disconnect from power and wait 30 seconds before accessing terminals.
- The maximum cable length should not exceed 3 meters for signal connections. A cable length of more than 3 m could alter the EMI performance.
- Signal lines must be separated from power lines.

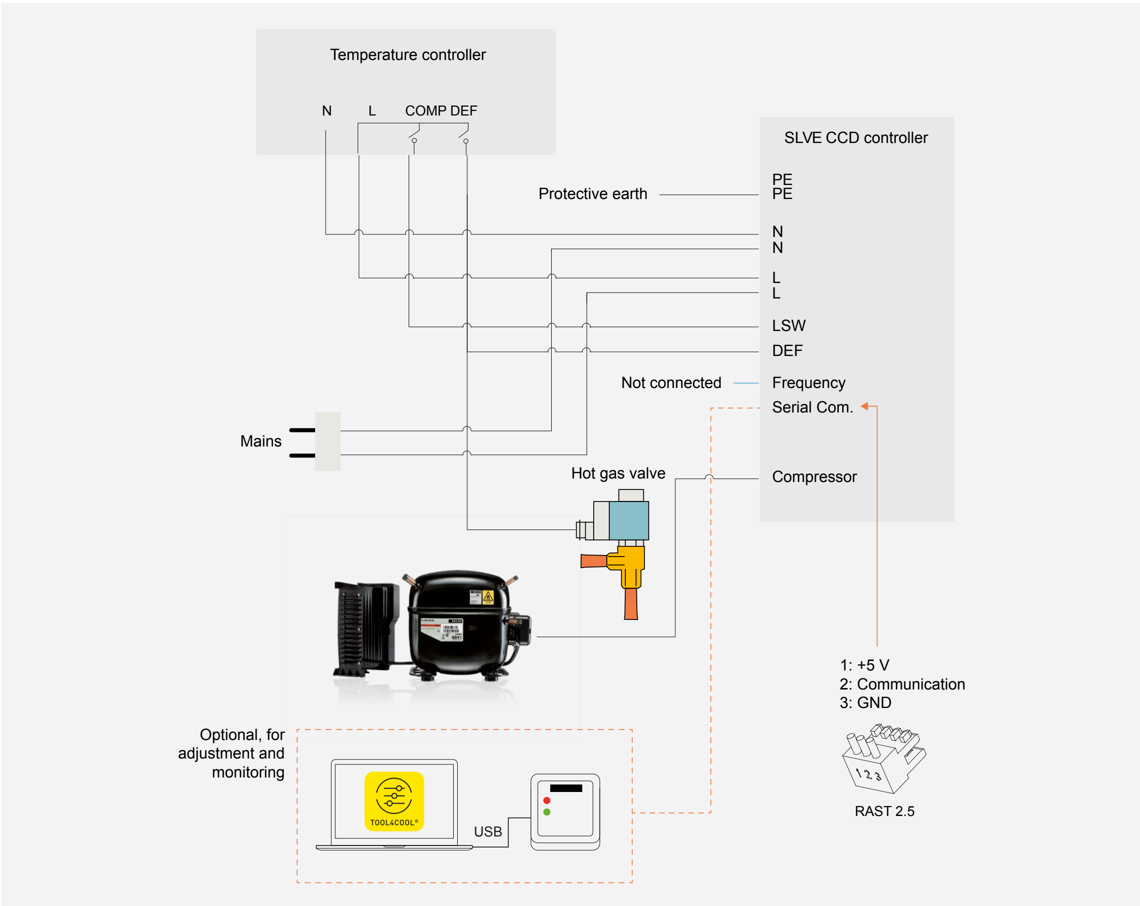
2.4 CONNECTIONS

1. 2x Protective Earth
2. 2x Neutral
3. 2x Line
4. Thermostat/AEO
5. Defrost
6. Frequency and DWI Communication Input
7. SWI Serial Communication

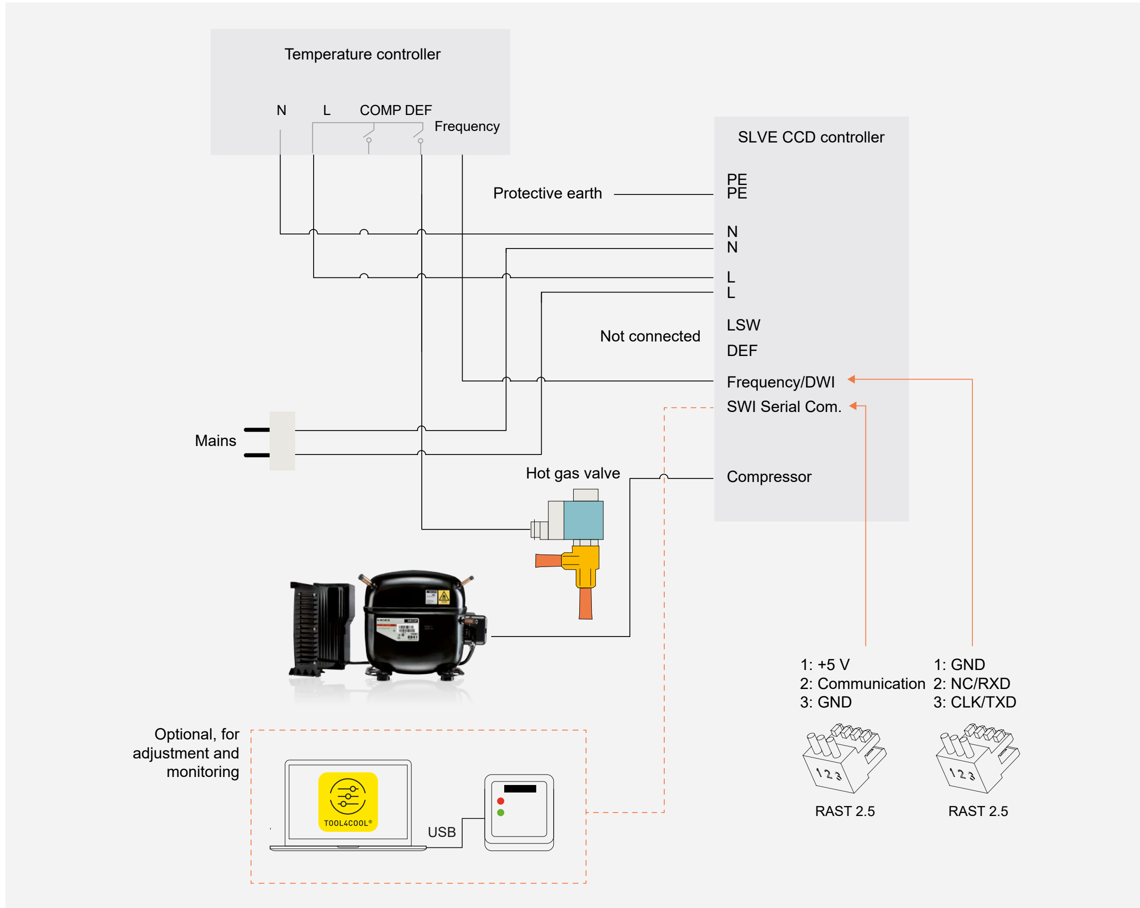
No.	Description	Type	Note
1	Protective Earth	FASTON 6.3 mm x 0.8 mm	Mandatory. Must be connected.
2	Neutral	FASTON 6.3 mm x 0.8 mm	Mandatory. Must be connected.
3	Line	FASTON 6.3 mm x 0.8 mm	Mandatory. Must be connected.
4	Thermostat	FASTON 6.3 mm x 0.8 mm	For AEO only (see chapter 2.5 , 3.1)
5	Defrost	FASTON 6.3 mm x 0.8 mm	For AEO and defrost only (see chapter 2.5 ,3.2)
6	Frequency/DWI	RAST-2. 5, Ex: Lumberg 3521 03 K00	For frequency or DWI only (see chapter 2.6, 3.3, 3.4)
7	SWI Serial comm.	RAST-2. 5, Ex: Lumberg 3521 03 K00	For Tool4Cool®, or SWI only (see chapter 2.7, 3.5)

2.5 WIRING FOR THERMOSTATIC OPERATION

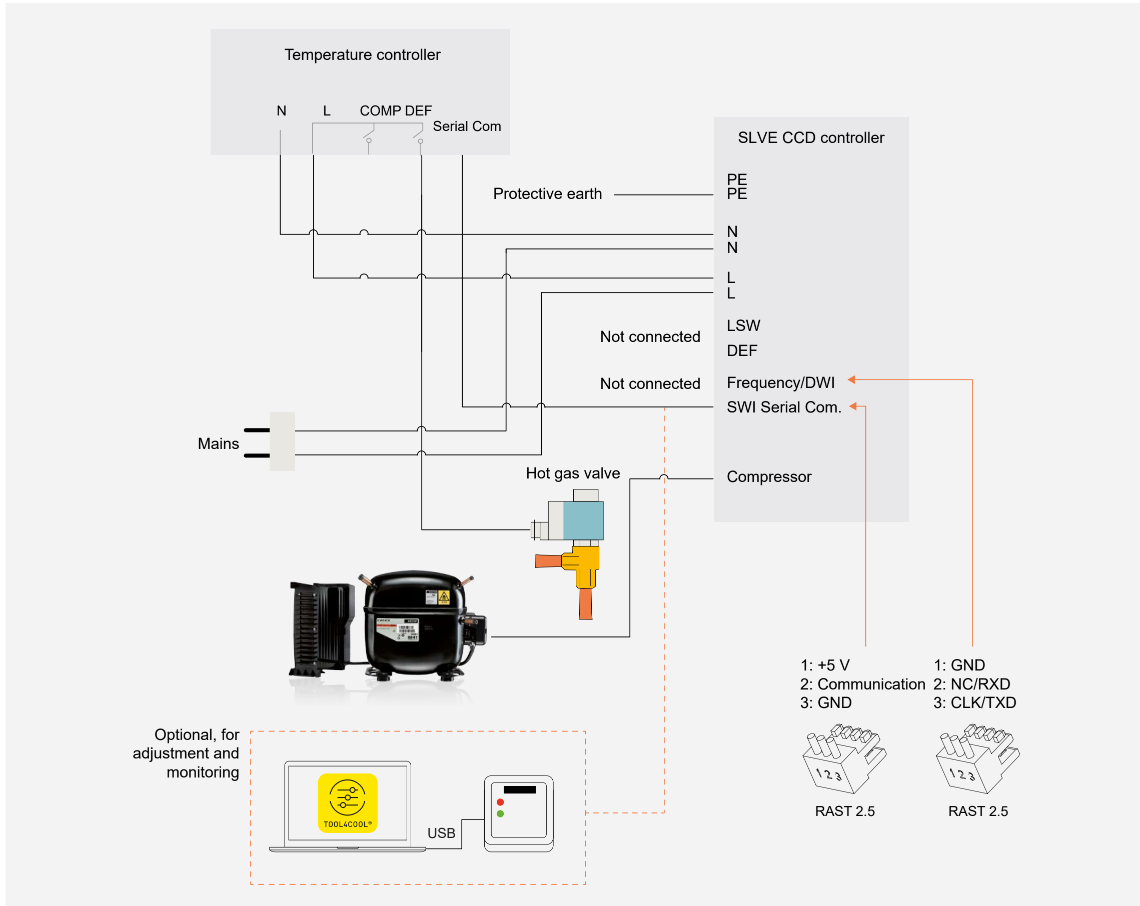
For optimal hot-gas defrost performance, the relay output of the controller should be connected to the DEF input of the controller. This ensures that the compressor operates at full speed when the hot-gas valve is activated.



2.6 WIRING FOR FREQUENCY OPERATION/DWI COMMUNICATION



2.7 WIRING FOR SWI COMMUNICATION



3 SPEED CONTROL

The Secop °CCD® controller is equipped with four different inputs for speed control to ensure easy integration.

Almost any temperature controller can be used to control the speed without needing to change the setup.
The °CCD® controller has automatic input detection and will automatically select the input which is active.

1. DWI, Dual Wire Interface with separated RX and TX lines
2. Frequency signal
3. Thermostatic operation with AEO, Adaptive Energy Optimization.
4. SWI, Single Wire Interface w. Modbus protocol

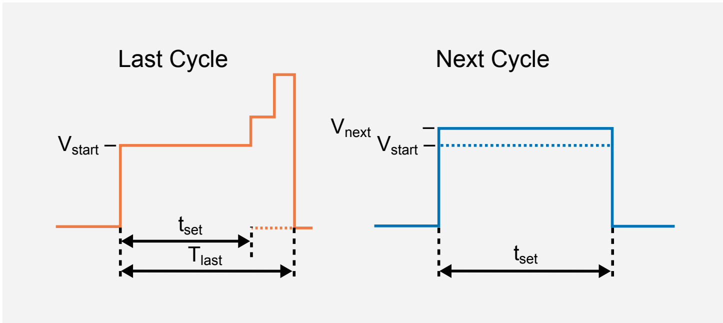
→ If more signals are connected, the input with highest priority (1–4) will be used.

→ Modbus input has the lowest priority and can be used for monitoring in combination with the other inputs.

→ If Tool4Cool® sends an active start command, the Modbus input will change priority to 1 and overrule all other input signals. The Modbus input will then remain selected until Tool4Cool® is closed.

°CCD®
VARIABLE
SPEED DRIVE

3.1 THERMOSTATIC OPERATION WITH AEO



% Runtime	% Speed
100	105
110	110
120	120
140	130
160	140
190	180
220	225

AEO is the only control mode where there is no direct relation between speed and input signal. The speed is automatically calculated based on the runtime (time between cut-in and cut-out).

The AEO can be interfaced by a normal thermostat or relay.

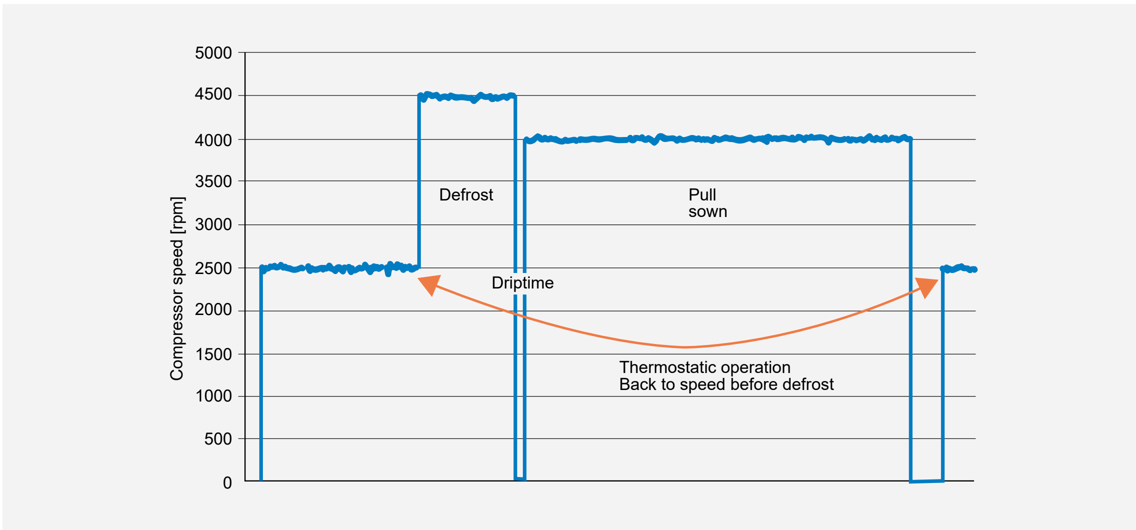
Advantages of the AEO:

→ Easy to interface
→ Electromechanical thermostat
→ Electronic control with relay output
→ Perfect for applications with stable conditions, such as freezers, catering equipment

The AEO operates with a target runtime and will automatically adapt the speed until the target runtime is met.

→ If the compressor runtime is shorter than the target time, the speed in the next cycle will be reduced
→ If the runtime is longer than the target time, the speed in the current cycle will be increased until the cut-out is reached. The next cycle is calculated as the average speed for the last cycle.
→ Settings can be changed by Tool4Cool®

3.2 DEFROST CONTROL WITH AEO



When variable speed compressors are used in self-adapting capacity modes, defrosting might not work properly since the compressor speed cannot be controlled during defrost: The compressor lacks capacity for hot gas and the following pull-down.

To improve defrost when AEO is used, the °CCD® controller has an extra input that can be connected to the defrost relay output of the temperature controller.

→ Hot-gas defrosting: When the defrost and AEO input are activated simultaneously, the °CCD® controller switches to a defined fixed speed, maximum 4500 rpm

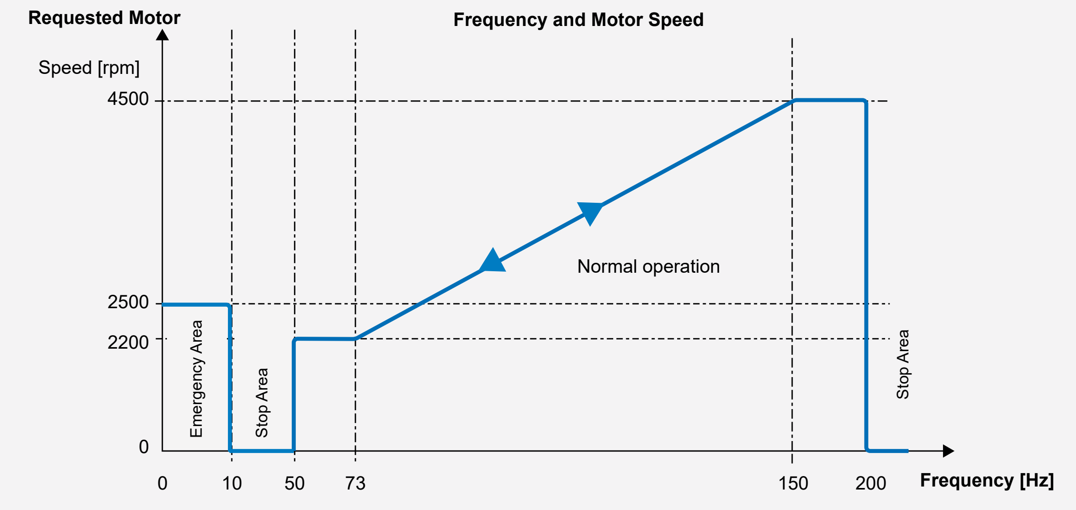
→ Electrical defrosting: When only the defrost input is activated, the compressor will remain stopped, but the information is used to trigger pull-down after defrosting.

→ After defrosting, the °CCD® controller will run the first cycle at high speed to ensure that the heat is removed as fast as possible.

→ After the pull-down it reverts to the speed it had before defrost.

→ Settings can be changed by Tool4Cool®

3.3 FREQUENCY SPEED CONTROL

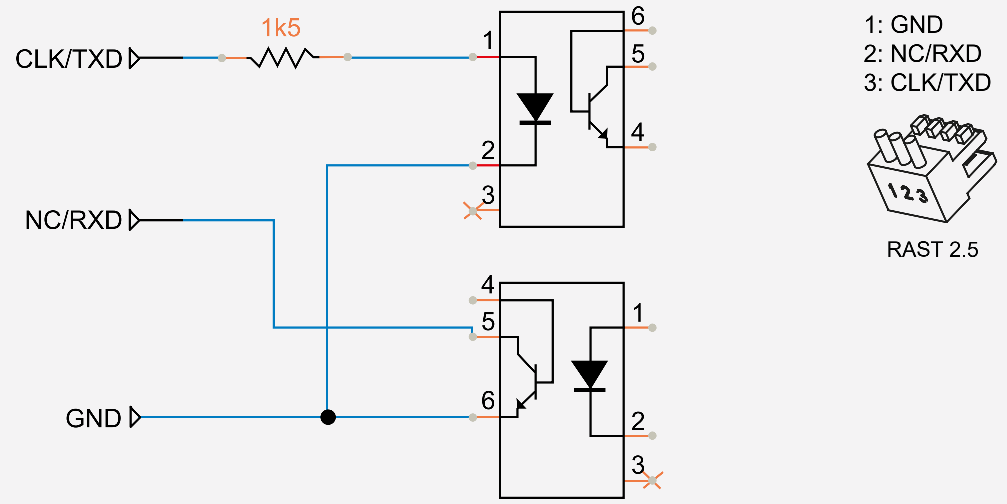


Parameter/Limiting values	Min.	Max.	Typical	Unit
Signal Amplitude (high level)	4.5	12	5	V DC
Signal Amplitude (low level)	-5	1	0	V DC
Signal Current	2.5	8	3	mA
Signal Max. Rise and Fall Time	0	50	—	µs
Minimum Pulse Length	1.5	—	—	ms

The speed can be controlled by applying a low voltage frequency signal to the frequency input

- → The speed is changed linearly between 66 Hz and 150 Hz.
- → 73 Hz corresponds to 2200 rpm, 150 Hz to 4500 rpm
- → If the frequency is below 50 Hz, the compressor stops.
- → A frequency of 25-30 Hz must be applied during stop.
- → If the frequency is lower than 10 Hz, the signal is considered faulty and the compressor will go into emergency mode and operate at a fixed speed or switch to AEO (default disabled)
- → The parameters for the frequency are fully programmable and can easily be changed by Tool4Cool®

3.4 DWI SERIAL COMMUNICATION



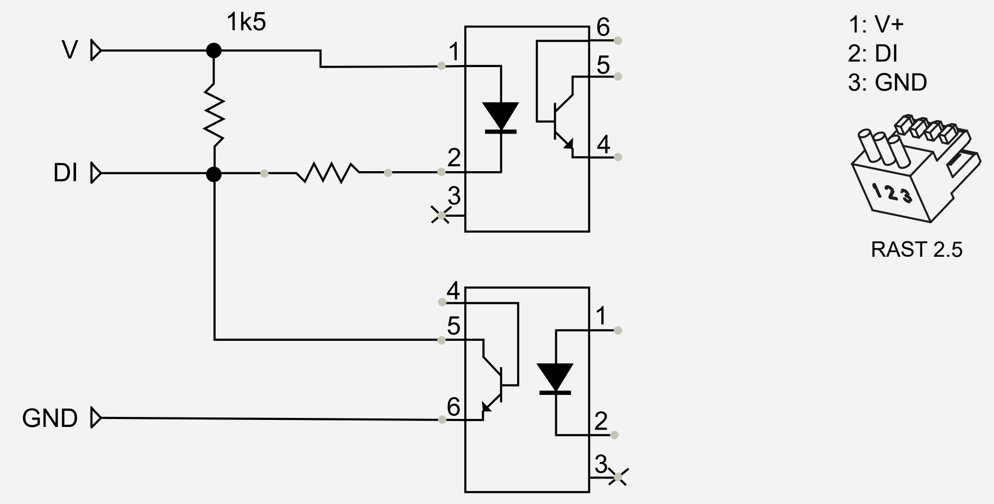
Communication Specification	
Baud Rate:	600 Baud
Start Bits:	1
Data Bits:	8
Stop Bits:	1
Parity:	No
Frame Size:	5 Bytes
Appliance Controller:	Master
Compressor Controller:	Slave
Start Bit:	1 --> 0 (logic level)
Data Bits:	Inverted logic (0V --> "1")
Stop Bit:	0 --> 1 (logic level)
Control Mode:	Half duplex

The DWI, Dual Wire interface, is a bidirectional communication protocol that allows the temperature controller to communicate with the compressor controller.

Beside speed, the temperature controller can get different information from the controller, like power-consumption, actual speed, electronic temperature, and fault status.

The communication interface is shared with the frequency interface. A full description of the interface and a list of supported commands can be requested at Secop.

3.5 SWI SERIAL COMMUNICATION



The serial communication is implemented as a single wire half-duplex line—transmitting and receiving on the same line.

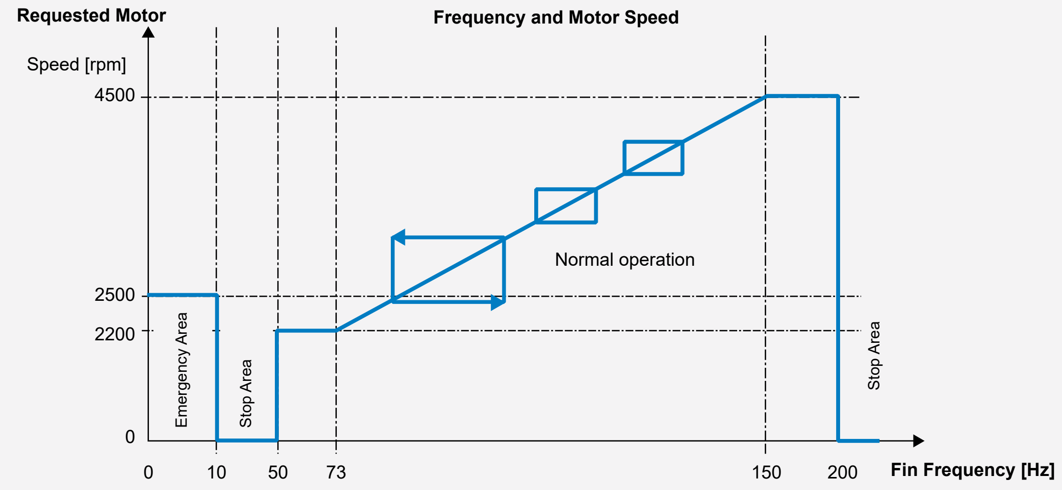
The input port is galvanic isolated from the controller and must be supplied from the application board by a 5 V to 12 V DC. The signal level follows the supply voltage.

Up to 3 units can be wired in parallel for multi-compressor systems, but it must be ensured that the controller has sufficient drive capability.

- → The communication is based on the MODBUS Serial Line protocol.
- → The °CCD® controller operates as a slave. A slave node will never transmit data without receiving a request from the master node.
- → Only one master can be connected to the bus, and up to 3 °CCD® controllers' slave nodes can be connected to the same serial bus.
- → Each °CCD® controller must have an individual address which is unique. The °CCD® controllers will never communicate with each other.
- → The master must always send a message which includes an address – even if only one unit is connected to the bus.
- → The slave will always return a reply message to the master (unless it is a broad cast message).
- → All Modbus transactions consist therefore of two messages—a request from the master and a reply from the °CCD® controllers.
- → The communication must be refreshed every 10 seconds for safety reasons. If this is not done, the communication is considered lost and the compressor will stop or go into emergency mode where it will run with a preset capacity.

A full description of the interface and a list of supported commands can be requested from Secop.

3.6 AVOIDING RESONANCE



- → In some situations vibration at certain speeds can make the tubes and plates rattle and vibrate
- → Those speeds can be blocked by defining "forbidden speeds" at which the compressor is not allowed to operate.
- → If the tubes have a resonance point at 2500 rpm, a minimum speed and a maximum speed must be defined for the area. For instance from 2400 to 2600 rpm.
- → Up to 3 speeds can be programmed.

4 TECHNICAL DATA

4.1 CONTROLLER DATA

		Electronic unit	105N4730
Power supply		Nominal voltage	220 - 240 V AC
		Minimum operating voltage	160 V AC
		Minimum starting voltage	180 V AC
		Maximum voltage	270 V AC
		Frequency	50–60 Hz
		Max power input	1400 W
		Power Factor Corrector	Yes, active, PF ≥ 0.95
		Motor cable length	700±20 mm / 26.8-28.3 in.
Environment		IP class	IP54
		Humidity	30–90 % rH
		Maximum operating temperature	50 °C / 120 °F
		Minimum operating temperature	0 °C / 32 °F
		Storage temperature	- 30 to 70 °C / -22 °F to 158 °F
Approvals/Safety		Compressor protection	Internal in compressor
		Safety Approval	EN 60335-2-34 with Annex AA, CCC, UL 60335-2-34 with Annex AA
		EMC conformity	According to 2004/104/EC
		RoHs Conformity	2011/65/EU
Speed-Control		Frequency input	5–12 V, max. 8 mA, 0–200 Hz Galvanic isolated, short and reverse protected
		AEO Thermostat input (Lsw)	150–264 V AC, non-isolated
		AEO Defrost input (Def)	150–264 V AC, non-isolated
		RX/TX interface (DWI)	5–12 V, max. 8 mA, 600 baud galvanic isolated
		Single Wire Interface (SWI)	Modbus Communication port , 9600 Baud galvanic isolated

4.2 COMPRESSOR DATA

	SLVE18CN		Standard
Compressor	Application		LBP/MBP
	Evaporating temperature	°C °F	-45 to 10 -40 to 45
	Voltage range/frequency	V/Hz	180–270/50/60
	Speed range	rpm	2200-4500

4.3 CAPACITY AND PERFORMANCE DATA SLVE18CN

Performance data:
See datasheet

LBP: ASHRAE	230V, 50/60Hz, fan cooling F_2							
Speed (rpm)	2200	2400	2600	2800	3000	3500	4000	4500
Capacity [W]	663	720	772	820	868	955	1043	1130
Capacity [BTU/h]	2263	2458	2637	2801	2964	3262	3561	3859
Power cons. [W]	389	417	445	473	501	562	623	684
Current cons. [A]	1.81	1.98	2.13	2.25	2.36	2.61	2.85	3.09
COP [W/W]	1.70	1.73	1.74	1.73	1.73	1.70	1.67	1.65
EER [BTU/Wh]	5.81	5.89	5.93	5.92	5.92	5.81	5.72	5.64

Test conditions		
Evaporation pressure	-23.3°C	-10°F
Condensing presssure	54.4°C	130°F
Liquid temperature	32.2°C	90°F
Return gas temp.	32.2°C	90°F

LBP: CECOMAF	230V, 50/60Hz, fan cooling F_2							
Speed (rpm)	2200	2400	2600	2800	3000	3500	4000	4500
Capacity [W]	494	537	576	611	647	711	774	837
Capacity [BTU/h]	1687	1832	1966	2088	2210	2427	2643	2859
Power cons. [W]	375	401	428	455	482	539	597	655
Current cons. [A]	1.74	1.91	2.06	2.17	2.29	2.51	2.74	2.96
COP [W/W]	1.32	1.34	1.34	1.34	1.34	1.32	1.30	1.28
EER [BTU/Wh]	4.50	4.56	4.59	4.59	4.59	4.50	4.43	4.37

Test conditions		
Evaporation pressure	-25°C	-13°F
Condensing presssure	55°C	131°F
Liquid temperature	55°C	131°F
Return gas temp.	32°C	90°F

LBP: EN12900	230V, 50/60Hz, fan cooling F_2							
Speed (rpm)	2200	2400	2600	2800	3000	3500	4000	4500
Capacity [W]	350	387	417	440	462	504	546	–
Capacity [BTU/h]	1196	1323	1425	1501	1578	1720	1863	–
Power cons. [W]	265	283	302	321	340	376	411	–
Current cons. [A]	1.25	1.39	1.51	1.62	1.72	1.83	1.94	–
COP [W/W]	1.32	1.37	1.38	1.37	1.36	1.34	1.33	–
EER [BTU/Wh]	4.52	4.67	4.71	4.67	4.64	4.58	4.53	–

Test conditions		
Evaporation pressure	-35°C	-31°F
Condensing presssure	40°C	104°F
Liquid temperature	40°C	104°F
Return gas temp.	20°C	68°F

MBP: ASHRAE	230V, 50/60Hz, fan cooling F_2							
Speed (rpm)	2200	2400	2600	2800	3000	3500	4000	4500
Capacity [W]	1194	1296	1390	1477	1563	1737	1911	2085
Capacity [BTU/h]	4079	4426	4747	5043	5339	5933	6526	7120
Power cons. [W]	547	586	625	664	703	797	891	985
Current cons. [A]	2.52	2.73	2.90	3.04	3.17	3.59	4.00	4.42
COP [W/W]	2.18	2.21	2.22	2.22	2.22	2.18	2.14	2.12
EER [BTU/Wh]	7.46	7.55	7.60	7.59	7.59	7.44	7.32	7.23

Test conditions		
Evaporation pressure	-6.7°C	20°F
Condensing presssure	54.4°C	130°F
Liquid temperature	46.1°C	115°F
Return gas temp.	35°C	95°F

MBP: CECOMAF	230V, 50/60Hz, fan cooling F_2							
Speed (rpm)	2200	2400	2600	2800	3000	3500	4000	4500
Capacity [W]	950	1031	1106	1175	1244	1380	1516	1652
Capacity [BTU/h]	3245	3521	3777	4013	4248	4713	5178	5644
Power cons. [W]	521	558	596	633	670	758	847	935
Current cons. [A]	2.40	2.61	2.78	2.91	3.04	3.43	3.81	4.20
COP [W/W]	1.82	1.85	1.86	1.86	1.86	1.82	1.79	1.77
EER [BTU/Wh]	6.23	6.31	6.34	6.34	6.34	6.21	6.12	6.04

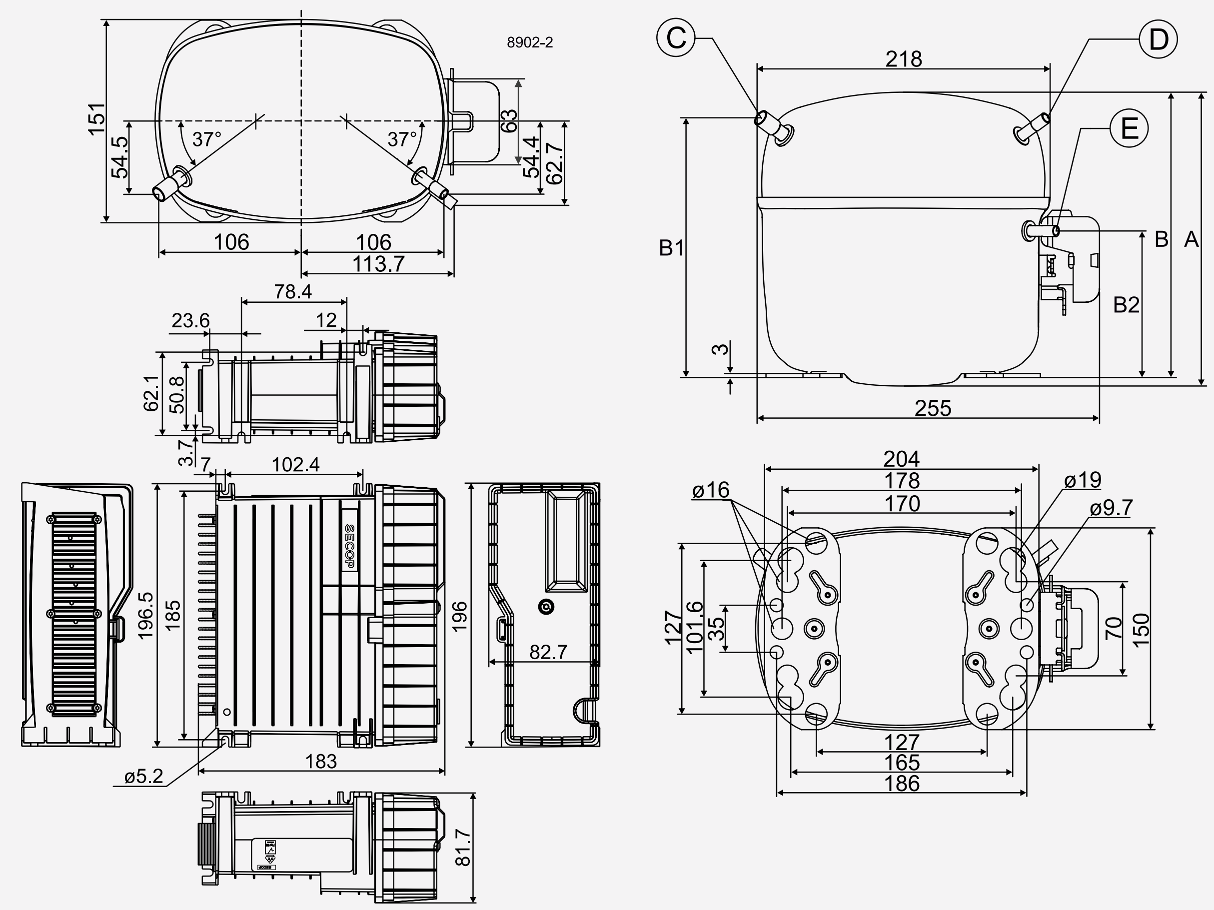
Test conditions		
Evaporation pressure	-10°C	14°F
Condensing presssure	55°C	131°F
Liquid temperature	55°C	131°F
Return gas temp.	32°C	90°F

MBP: EN12900	230V, 50/60Hz, fan cooling F_2							
Speed (rpm)	2200	2400	2600	2800	3000	3500	4000	4500
Capacity [W]	1037	1127	1209	1283	1357	1508	1659	1810
Capacity [BTU/h]	3540	3849	4130	4381	4633	5150	5666	6183
Power cons. [W]	468	501	535	568	602	682	761	841
Current cons. [A]	2.16	2.36	2.52	2.64	2.77	3.11	3.45	3.79
COP [W/W]	2.22	2.25	2.26	2.26	2.25	2.21	2.18	2.15
EER [BTU/Wh]	7.56	7.68	7.72	7.71	7.70	7.56	7.44	7.35

Test conditions		
Evaporation pressure	-10°C	14°F
Condensing presssure	45°C	113°F
Liquid temperature	45°C	113°F
Return gas temp.	20°C	90°F

5 DIMENSIONS

Compressor dimensions SLVE18CN			104H8841
Height	mm	A	219
		B	213
Suction connector	location/I.D. mm | angle	C	10.2 | 37°
	material | seal		Copper | Rubber plug
Process connector	location/I.D. mm | angle	D	6.2 | °37
	material | seal		Copper | Rubber plug
Discharge connector	location/I.D. mm | angle	E	6.2 | 37°
	material | seal		Copper | Rubber plug
Connector tolerance	I.D. mm		±0.09



6 ORDERING

	Item	Code No.	Comment
Con-troller	Electronic controller (°CCD®), 220–240 V AC	105N4730	single unit
		105N4731	industrial pack
Compressor/Accessories	SLVE18CN compressor	104H8841	
	Fusite cover for compressor	103N2008	
	Bolt joint for one compressor	118-1958	
	Bolt joint in quantities	118-1961	
	Snap-on in quantities	118-1962	
	RAST-2.5 connector 1 pcs	105B4232	Lumberg 3521-03
Lab tool	Tool4Cool® (free of charge)	https://www.secop.com/tool4cool	
	Secop Gateway	105N9518	USB communication interface
Literature	Compressor data sheet	https://selector.secop.com/data-sheet-search	
	°CCD® interface description	on request	
	Tool4Cool® Operating Instructions	https://www.secop.com/tool4cool	

TOOL4COOL®

SOFTWARE DOWNLOAD

Tool4Cool® Flexible Control Settings

www.secop.com/tool4cool

SLVE WITH INTELLIGENT CONTROLLER

Secop's variable speed SLVE-CN propane compressor solution provides perfect cooling efficiency, tailor-made features, and easy integration within a single unit while ensuring considerable energy savings.

It is the right choice if you are looking for a green solution using the environmentally-friendly refrigerant propane (R290) with a low global warming potential (GWP 3).

The new °CCD® controller features a high IP54 protection class and easy integration by using speed control through Adaptive Energy Optimization (AEO), frequency signal or serial communication.

The controller also provides a high starting torque and can start against a differential pressure.

Only the variable speed design can obtain energy savings of up to 40% when compared to fixed speed compressors in on/off operation mode.

SECOP GROUP: AROUND THE WORLD

SECOP

12
international partners for advanced developments

33
laboratories located in Austria, Germany, Slovakia, China, US, and Turkey

180
R&D engineers and technicians

440
patents globally

50+
countries with customer support

Secop is the expert for advanced hermetic compressor technologies and cooling solutions in commercial refrigeration. We develop high performance stationary and mobile cooling solutions for leading international commercial refrigeration manufacturers and are the first choice when it comes to leading hermetic compressors and electronic controls for refrigeration solutions for light commercial and DC-powered applications.

Secop has a long track record of successful projects to adopt energy efficient and green refrigerants that feature innovative solutions for both compressors and control electronics.

- **Flensburg:** Sales and R&D
- **Turin:** Sales
- **Gleisdorf:** R&D
- **Zlaté Moravce:** R&D, Logistics and Manufacturing
- **Tianjin:** Sales, R&D, Logistics and Manufacturing
- **Atlanta:** Sales, R&D and Logistics

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Produced by Secop | April 2022

DES.S.300.K1.02