WITH MORE THAN 60 YEARS OF EXPERIENCE IN COMPRESSOR TECHNOLOGY AND HIGHLY DEDICATED EMPLOYEES, OUR FOCUS IS ON DEVELOPING AND APPLYING ADVANCED COMPRESSOR TECHNOLOGIES TO ACHIEVE STANDARD SETTING PERFORMANCE FOR LEADING PRODUCTS AND BUSINESSES AROUND THE WORLD.

SECOP

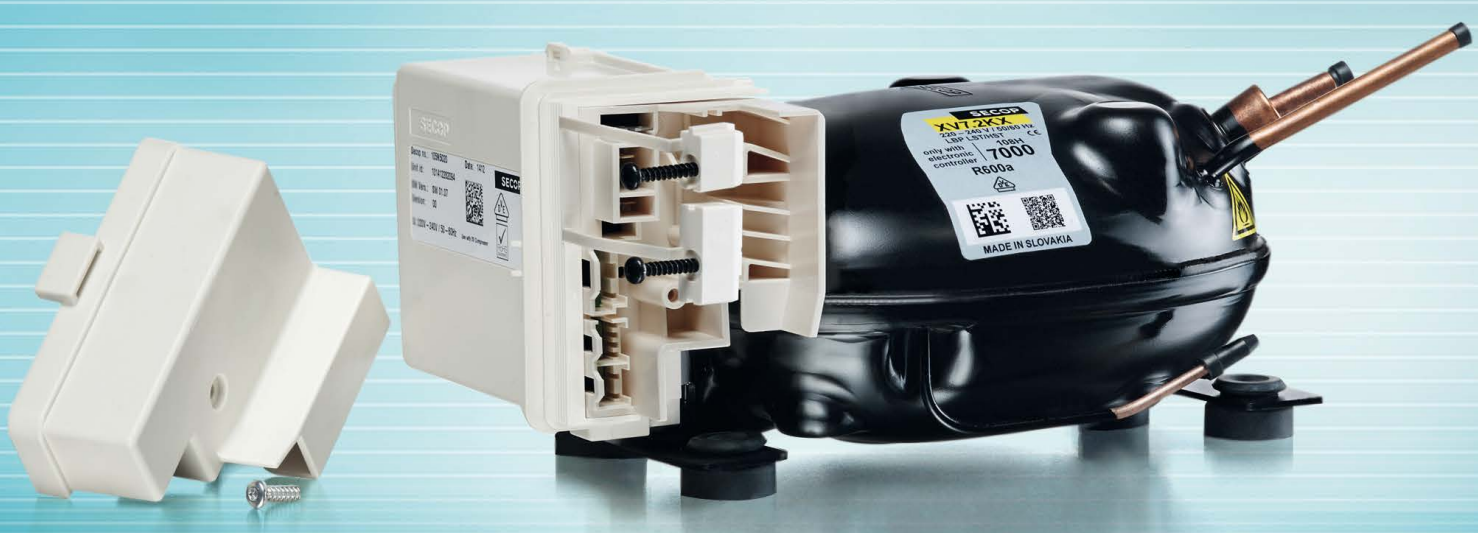
XV CONTROLLERS ATTACHED ELECTRONIC UNIT

OPERATING INSTRUCTIONS

105N5022 Electronic Unit - **XV-AEO/Freq.**

160-264 V / 50/60 Hz

COOL CAPACITY DRIVE



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SECOP
SECOP
XV1.2KX
220 – 240 V / 50/60 HZ
LBP LST/HST 108H
7210
only with
electronic
controller
R600a

1. INTRODUCTION

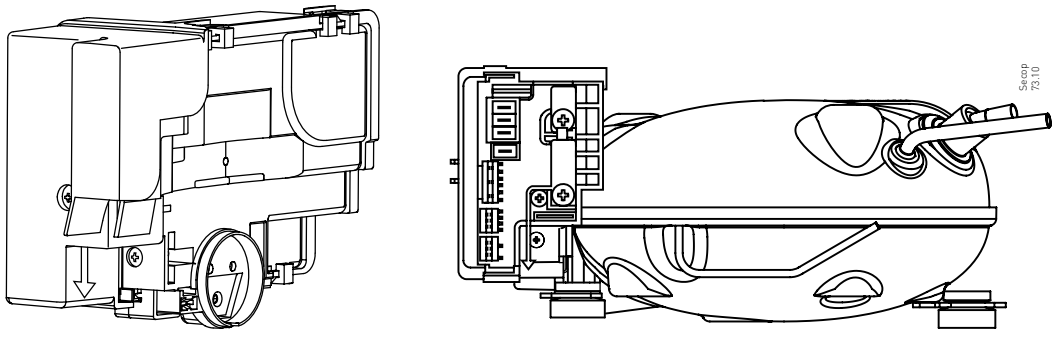
Secop´s revolutionary X-Series compressor range is entirely new and opens up for several new applications and improved refrigeration systems. The completely new platform not only offers the highest system efficiency; with its dimensions it also challenges the standards for compressor size in the future.

Typical applications for XV compressor could be:
- Household refrigerators (LBP)
- Light commercial refrigerators
- Bottle coolers
- Glass door merchandisers
- Wine cooler
- Integral freezers
- Display cabinets
- Beer coolers

The compact size enables 5-20 liters additional storage volume in cabinets or solves small and compact applications. The variable speed lowers the power consumption, limits the number of variants, and increases the capacity range.

XV features	**... your benefits**
• eXtreme small	• additional storage volume for refrigerators
• eXtreme light	• less weight, easier handling, lower transport costs
• eXtreme efficient	• increased system efficiency
• eXtreme flexible	• adaptable capacity for various applicaations

The XV attached electronic unit is mounted directly on the XV compressor.



XV attached electronic variant

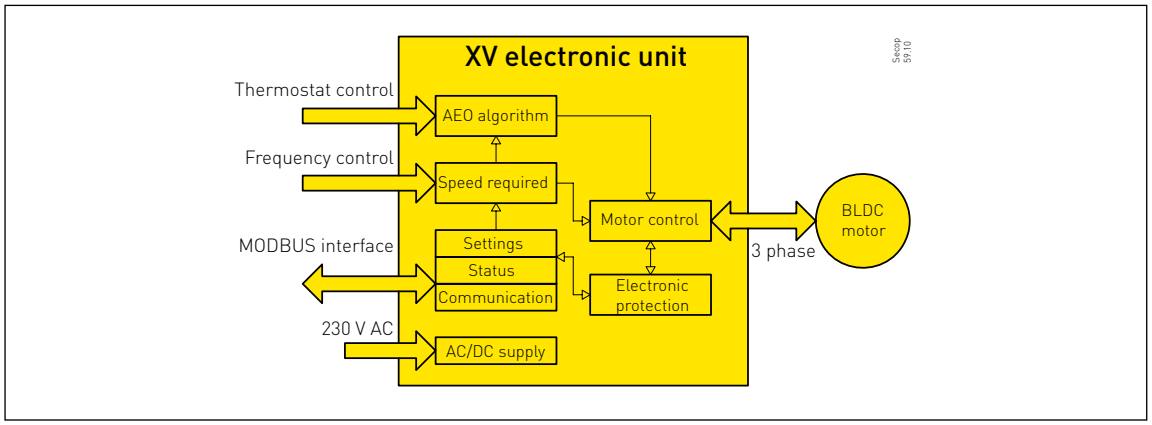
The most important functions of XV attached electronic unit are:

- Motor/compressor variable speed control
- Speed control by:
  - Thermostat input (ON/OFF) and AEO (Adaptive Energy Optimization)
  - Frequency input (variable signal)
  - Modbus communication interface
- Safety and monitoring
- Parameter/settings optimisation via PC software (via Modbus protocol)

The electronic unit takes input from a standard thermostat or a customer-controlled frequency signal from an appliance electronic controller. The Modbus interface port enhances possibilities for cabinet-specific settings, such as ramp up or ramp down control or forbidden frequencies as well as direct bus control.

2. COMPRESSOR SPEED

The speed, and thereby the capacity of the compressor, is set using a thermostat input or a frequency input. As a rule of thumb, the speed range of 1:4 corresponds to 1:3.5 in capacity. The compressor speed can be controlled by one of 3 inputs:



A. Thermostat input (ON/OFF) and AEO speed control
B. Frequency input (variable signal)
C. Modbus communication interface

Most applications can use the default settings in the electronic unit and nothing further needs to be changed. The AEO function (Adaptive Energy Optimization) adjusts the speed according to the thermostat input, which makes it ideal as direct replacement of fixed speed compressors. The frequency input signal from the appliance electronic controller can set the speed directly, which is easy, reliable and currently the most used input type. The third input is a serial communication port, which enables full flexibility but also requires increased interface functionality.

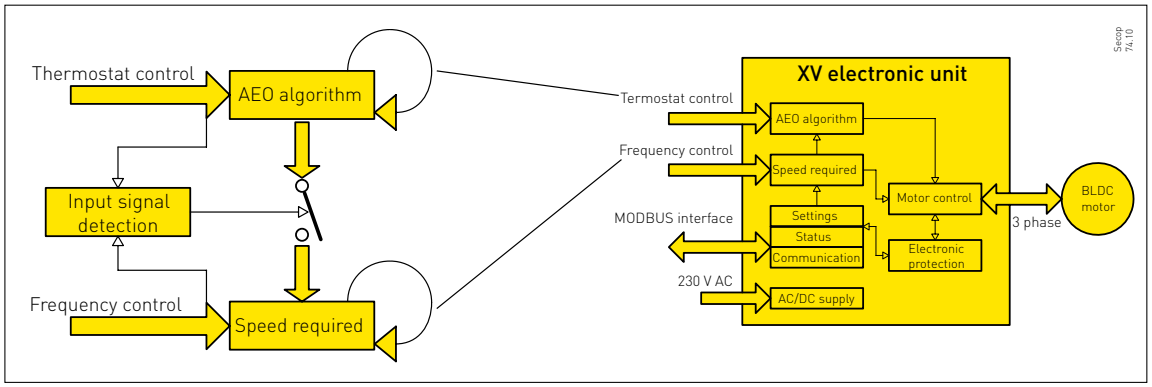
If default settings have to be changed, the Modbus port can be used. Changes can be done via Tool4Cool® software on a PC, or another appliance electronic controller can make the changes directly.
In the following sections, the related parameters for readout or control are shown as information, even if it is not necessary to change parameters.

3. SIGNAL INPUT THERMOSTAT OR FREQUENCY

The electronic unit has an input signal detection function, which will detect the input signal at all times and it will switch to either frequency control or thermostat control.

The default is frequency control and if a frequency is detected on the input, the frequency mode is selected and the thermostat control mode is disabled.

If a frequency is not detected on the input, the thermostat function with AEO is enabled, as indicated by a switch on the drawing below.



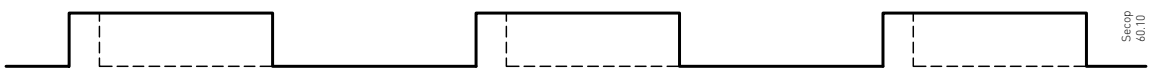
The thermostat is the input interface for the AEO. The thermostat switch can be a mechanical thermostat or a relay (or triac/FET) in an appliance electronic thermostat.

The thermostat input is supposed to take input from a normal cut-in and cut-out switch. This is a 230 V input.

The thermostat function will become disabled when a frequency signal is present on the input. (The parameter THC05 is enabled/disabled to show which input is detected and this status can be read on Modbus).

The frequency input signal is a square wave signal, defined from 0-200 Hz and it is a 5 V signal.

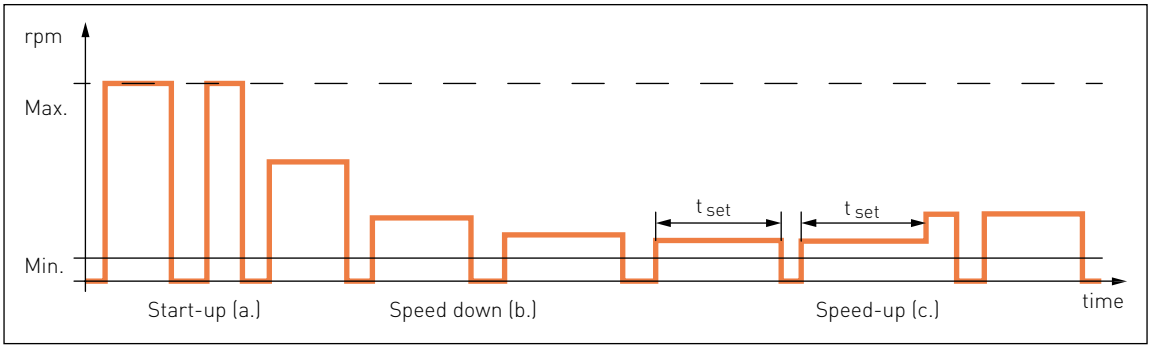
The frequency signal shape must be minimum 1.5 milliseconds on-time and up to 50% duty cycle.




0.4112
0.321
0.4251
4.001
3.984
2.003
1.965
1.955
1.987
1.288
1.239
1.245
0.2
0.3

3.1 Compressor speed thermostat – AEO

If the compressor speed is to be controlled by a thermostat input (ON/OFF signal like a relay or mechanical thermostat), the AEO (Adaptive Energy Optimization) function will convert to the optimum speed. The AEO function will optimise to the lowest possible speed. The AEO function will not make the variable speed compressor run continuously, as the compressor will cycle between the cut-in and cut-out temperature of the thermostat, but it will run with significantly longer run cycles compared to a standard compressor. The AEO will gradually adapt the capacity of the compressor until a predefined (tset=1 h) run-time cycle is met. The capacity needed for the next cycle is calculated on basis of the time between cut-in and cut-out and the speed during the last cycle. See (b.) and (c.) in this figure, as well as further below on this page.



The result will be lower condensing temperature and higher evaporator temperature and thereby saving energy due to higher compressor and system efficiency.

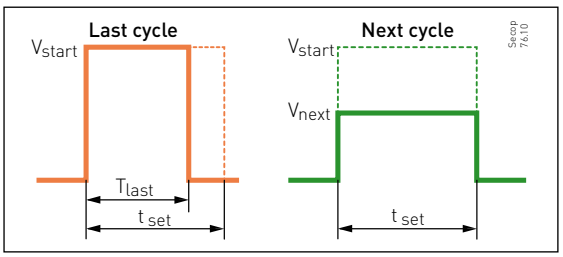
The AEO algorithm can be divided into four phases:

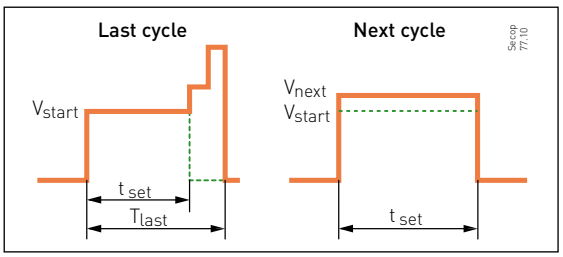
a. Start-up after power-on
b. Change of speed for the next cycle (speed down)
c. Change of speed within the actual cycle (speed up)
d. Boosting speed in case of heavy load change

a. For the two first cycles after power-on, the motor starts with the maximum allowed motor speed, independent of the resulting cycle run-time. After these cycles, the AEO control starts automatically to step down to reach the predefined cycle run-time t_{set}.
At a short power failure, the start-up sequence will not occur, but it will continue with the speed from the last cycle. A power failure lasting more than 1 minute will enable the start-up sequence.

b. When the cut-out from the thermostat occurs, before the predefined cycle run-time has been reached, the next cycle must have a lower speed. The speed for the next cycle is calculated on the basis of the run-time and average speed for the previous cycle. To avoid unstable cycling (oscillations), a damping factor is used, e.g. if a speed change of 50% is requested, the speed will only be adjusted with 25%, if the damping factor is set to 0.5 (default value).

c. If the compressor run-time cycle exceeds the preset run-time without reaching cut-out from the thermostat, it will gradually increase its speed until the cut-out is reached. The increments are reached in steps of 5%, 10%, 20%, 40%, 80% etc. for each 10% the preset run-time is exceeded.
The speed down and speed up cycles can also be seen in these figures:





d. The speed boost mode helps to decrease speed rapidly if the last cycle was much too short (an empty cabinet), or it will enable a faster reaction on for example heavy load changes.
At large run-time deviations of tlast/tset, it will make a large step in speed. If the time derivation is 50% lower or more, the speed step is -500 or -1000 rpm. If the time derivation is 200% higher or more, the speed step is +500 or +1000 rpm. The speed boost value is added to or subtracted from the calculated value of the next run-time cycle as shown in (c.). The damping factor is not used for the speed boost function.

The control parameters are normally not to be changed, but they are available for customised control over Modbus.

Cooling cycle time will be the optimum compressor run time at low speed, where the compressor capacity is sufficient for the cabinet. If it becomes too small, there is a risk of excessive energy consumption. If it becomes too large, there is a risk of a slow reaction system. (The parameter AE003 can be read on Modbus). Damping factor is used in the calculation of speed for the next cycle. If it is too small, there is a risk of an unstable system. If it is too large, there is a risk of a slow reaction system. (The parameter AE002 can be read on Modbus).

The start speed is the speed at every power up. The start speed is the first two cycles after power up and is default 4000 rpm. (The parameter AE012 can be read on Modbus).

If the cooling cycle time, the damping factor or the start speed must have a different value, the parameters AE010 – AE032 can be written over Modbus.

If the original settings are needed, the "Restore Factory Settings" can be activated. (The parameter AE008 on Modbus).

See appendix so see a complete list of parameters.

3.2 Compressor speed frequency

If an appliance electronic unit in the cabinet can measure the temperature and make a frequency output, it is possible to make a closed loop control for the speed of the compressor. A regular P or PI control loop can be used. In this mode, the thermostat function is not used.
The normal range for speed control is 33 Hz to 133 Hz and there is a linear ratio of 30 related to the compressor speed.

Compressor speed [rpm] = Frequency signal [Hz] x 30.

The compressor variable speed in this range is from 1000 rpm to 4000 rpm. The conversion is linear and every frequency respectively rpm is allowed.

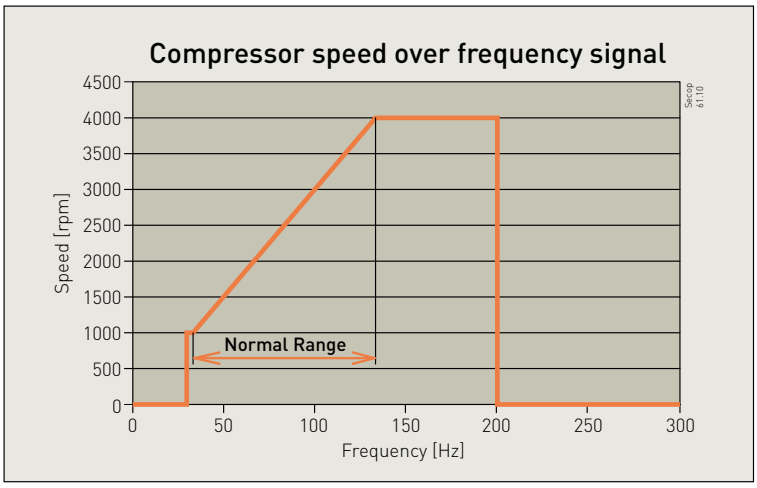
Stop of compressor is at a frequency below 30 Hz.

Frequencies higher than 200 Hz will stop the compressor.

The below table and figure show the compressor speed range and the corresponding frequency range.

If some frequency signals are seen as forbidden – see separate section later.

Frequency [Hz]	Compressor speed [rpm]
< 30	0
33.3	1000
40	1200
50	1500
66.6	2000
80	2400
100	3000
116.6	3500
133.3	4000
133.3-200	4000
200-300	0



Some speed and cooling capacity settings can be changed via the communication interface (Modbus).

The requested speed can be set to 1000-4000 rpm and this compressor speed will deliver a cooling capacity accordingly.
The start speed is the speed at every compressor start. The start time defines how long time the compressor runs at "start speed level" before changing to the requested speed. This is used to ensure that the lubrication is correct.

Settings

Name	Default	Max value	Min value	Step	Unit	PID
Requested speed	1000	4000	60	10	rpm	MS03
Start speed	1500				rpm	
Start time	1				seconds	

Some readings can be monitored as actual speed and actual power as well as compressor run-time since last start.

Measurements

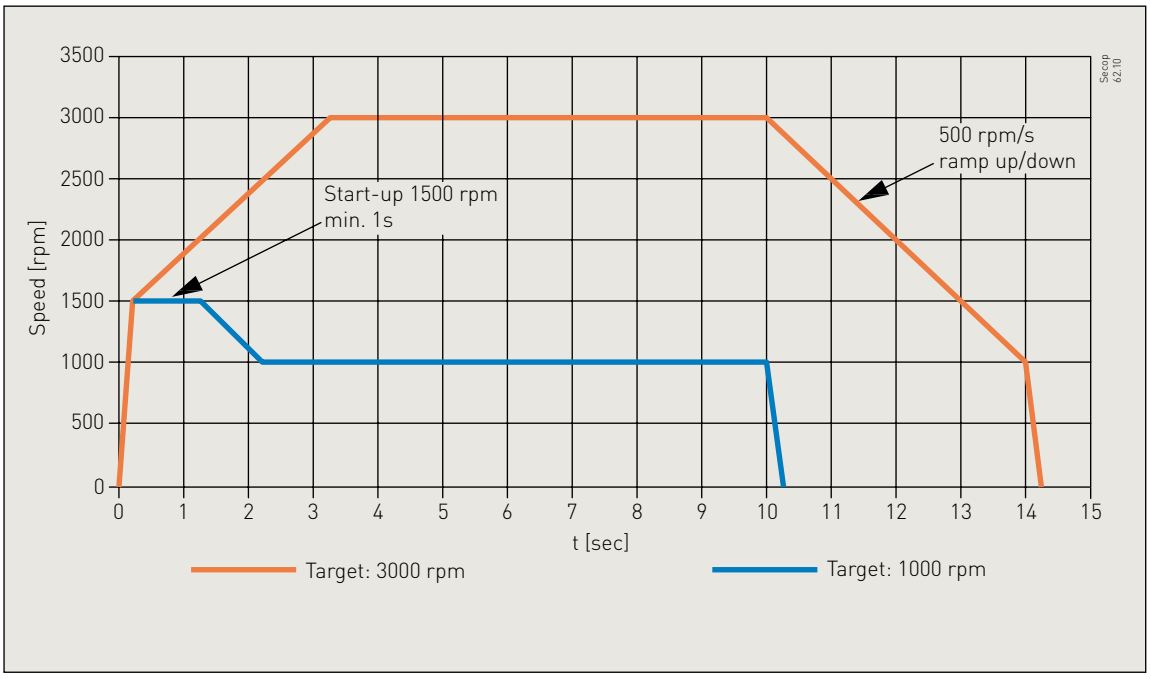
Name	Description	Step	Unit	PID
Compressor speed	Actual speed (+/-10%)	1	rpm	MS01
Power consumption	Actual power (+/-10%)=	1	W	PWR01
Compressor run-time	Time since last start	1	min	CDC01

3.3 Ramp up and ramp down

If the compressor electronic receives a signal below 30 Hz or above 200 Hz the compressor is first ramped down to 1000 rpm. The speed of the ramp down can be selected. After that the stop process, which is not applying any braking torque is initiated.

The possibility to change the ramp up and down speed is an important feature to optimize the noise behavior.

- Normal ramp up and ramp down is 500 rpm/s
- In order to secure lubrication and avoid knocking noise, a controlled start and stop is made.
- When starting, the speed is ramped to 1500 rpm for 1 sec; then a regulation towards the set point can be done.
- The ramp-up settings can be changed from 1500 rpm and up.
- The ramp-down settings can be changed down to 1000 rpm.



3.4 Forbidden speeds

The XV has a completely continuous speed range from 25% to 100% of maximum speed, 1000-4000 rpm, or a factor of 1:4.

The compressor alone has no forbidden speeds. But forbidden speed ranges can be used to avoid vibrations due to cabinet and plate resonances or pipe resonances.

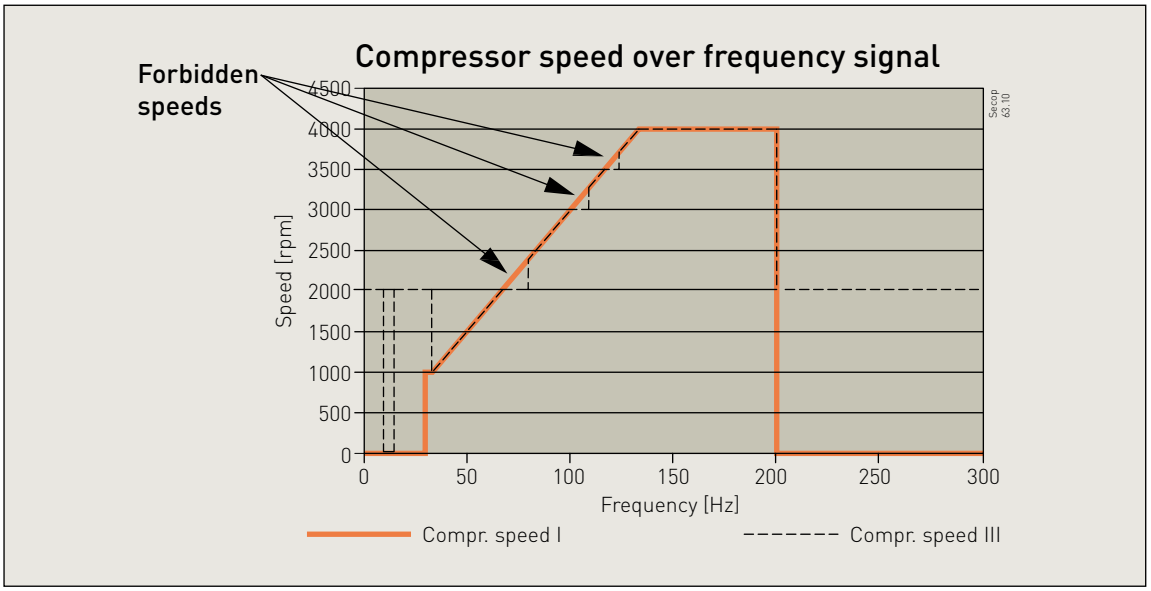
If it proves necessary to define one or more forbidden speed ranges , the appliance controller must deliver a frequency signal corresponding to only valid speeds.

The motor speed ranges can be defined by a forbidden "center speed" and a "delta speed" surrounding it. A forbidden speed range is hence defined as:

Forbidden speed = Center speed ± Delta speed

If a requested motor speed is within a forbidden speed range. The frequency signal is the rpm divided by 30.

Example:
Given a forbidden speed range at 3100 rpm with a bandwidth of +/- 100 rpm, the compressor must not be allowed to run at speeds between 3000 and 3200 rpm. Converted to a frequency signal, this becomes 103.3 Hz ± 3.3 Hz.



Tip: If a multimeter is connected to the frequency input wires, the display will show what frequency is critical, related to motor speed at which the cabinet causes resonances.

Notice: A frequency generator box can be arranged on special request at Secop.

Notice: In AEO mode, this option can only be selected on special request at Secop.

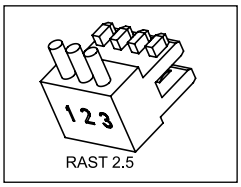
3.5 Emergency control

In case of frequency signal loss, at a broken wire or if the appliance control electronic becomes a break down, an emergency mode can be activated, and means the compressor will run at fixed speed. The dotted line shown at 0 Hz to 30 Hz shows this function.

To activate the emergency control, a short cut on the thermostat input has to be made. Make a steady connection from pin Lsw and L. This will make the compressor run with 1500 rpm as emergency speed at frequency loss. Or what the start speed is set to. (The parameter AEO12 can be read/write on Modbus).

4. WIRING AND CONNECTIONS

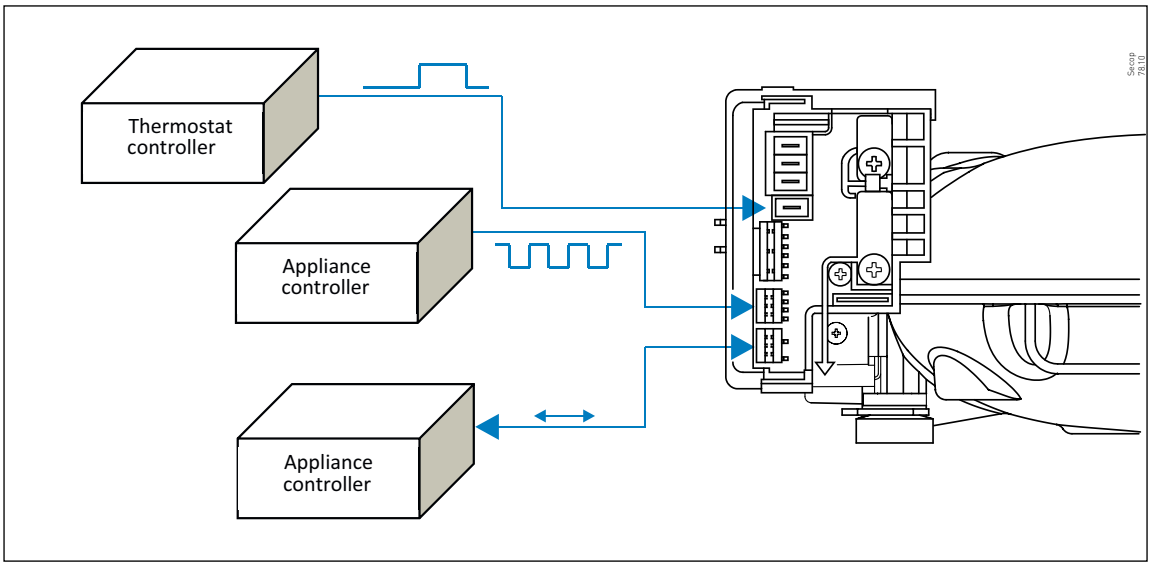
It is possible to connect the XV electronic unit by use of RAST 2.5 PCB connectors or flat pin connectors. These are standard types of connectors in the industry, which meet the requirements for safe connection combined with requirements for mass production.

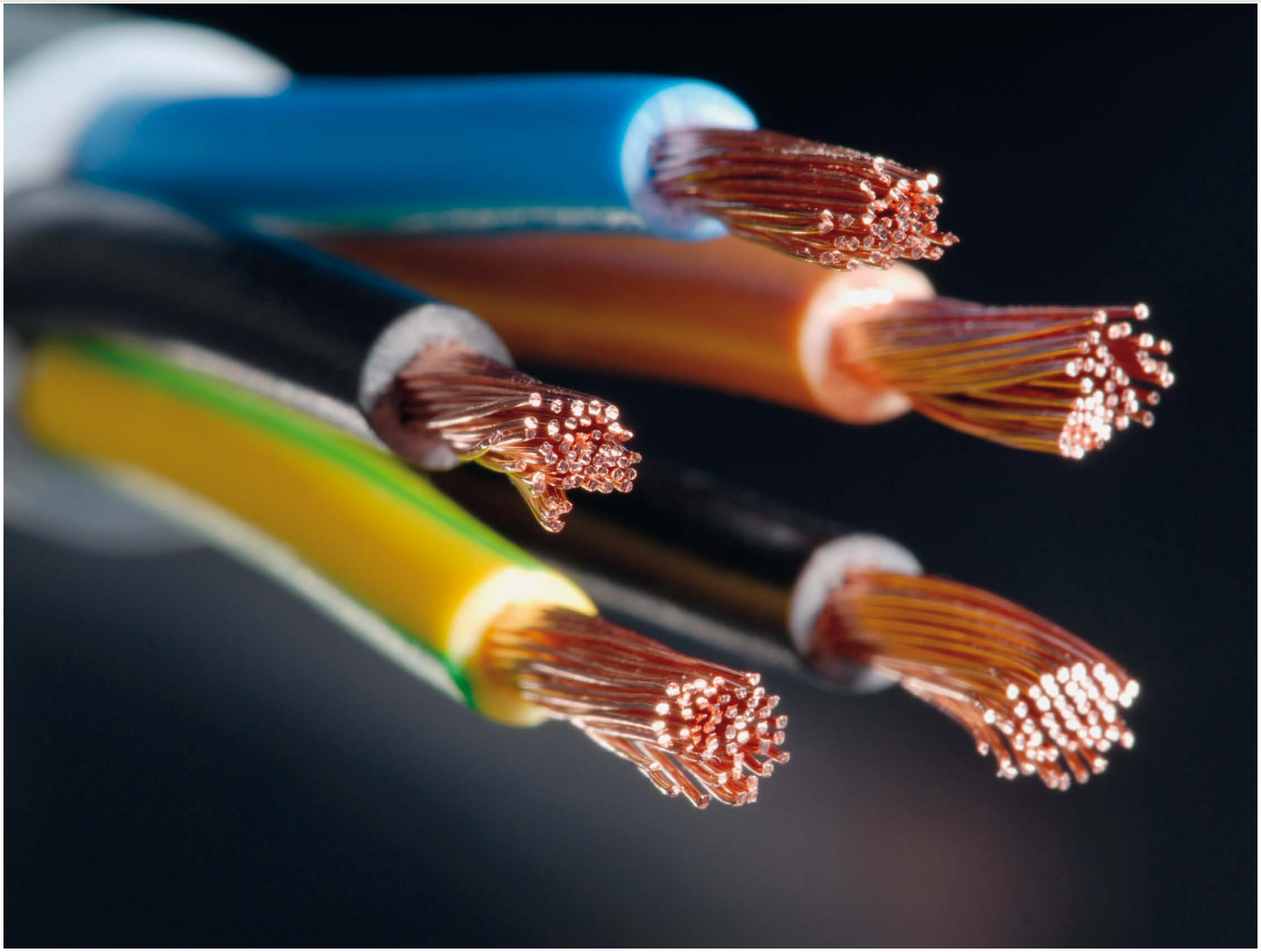


Connections are different for attached and detached electronic units. Please make sure to follow the appropriate mounting instructions.
The two input options are the thermostat control with AEO (open loop speed control) and the electronic frequency input control (closed loop speed control). The third option is a serial interface connection to an electronic appliance controller.

The XV attached electronic unit has 3 different functional wirings:

- Thermostat input
- Frequency input
- COM input: serial interface (Modbus)





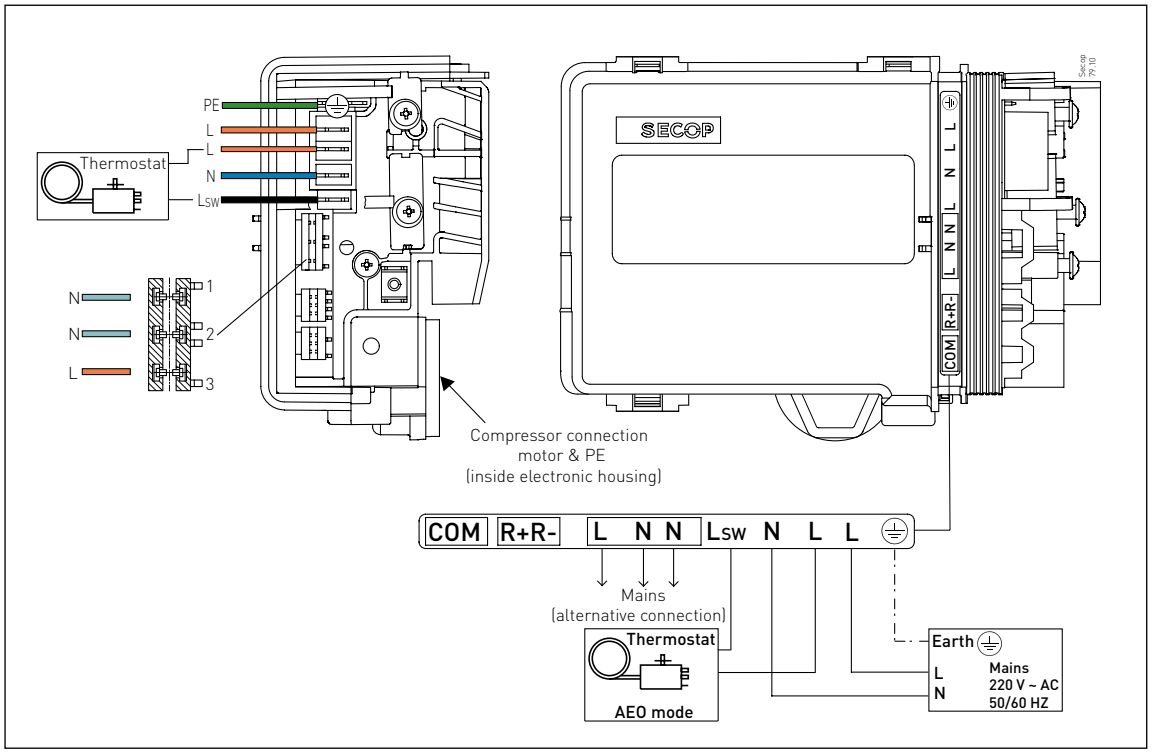
4.1 Wiring – thermostat

The electronic unit is mounted directly to the compressor, and the connections to the compressor are thus an internal connection.

When using a thermostat as input, the external wires can be connected as follows:
- Earth connects to PE.
- Mains connect to L and N.
- Thermostat input is Lsw (Live switched)
- Mains connect to L and N with RAST 2.5 power connector.

All terminals marked with L or N are internally connected.

The label on the box guides to the terminals. The connections are shown below as well.
The connectors to be used are flat pin 4.8 mm and RAST 2.5 power.



The XV electronic unit is designed to have permanent mains supply. It must not be switched as often as, for example, cut-in and cut-out of a thermostat, due to risk of excessive inrush current and damaged relay contacts. If the appliance electronic is able to connect/disconnect mains to the XV electronic, the duration between switching off and on must be considered.

Switching once a day is considered as safe, but this depends on the quality and switching performance of the relay (e.g. zero cross switching).

Defrost timer function can be used to switch off the XV electronic unit, and when turned on again the high speed in the first two cycles will act like a pull down after defrost. The relay size must then comply with the number of defrosts.

The compressor application must factor in power supply from an electrical circuit with the appropriate fuse or circuit breaker. In addition, the use of a GFCI (Ground Fault Circuit Interrupter) or RCD (Residual Current Device) is recommended.

4.2 Wiring – frequency

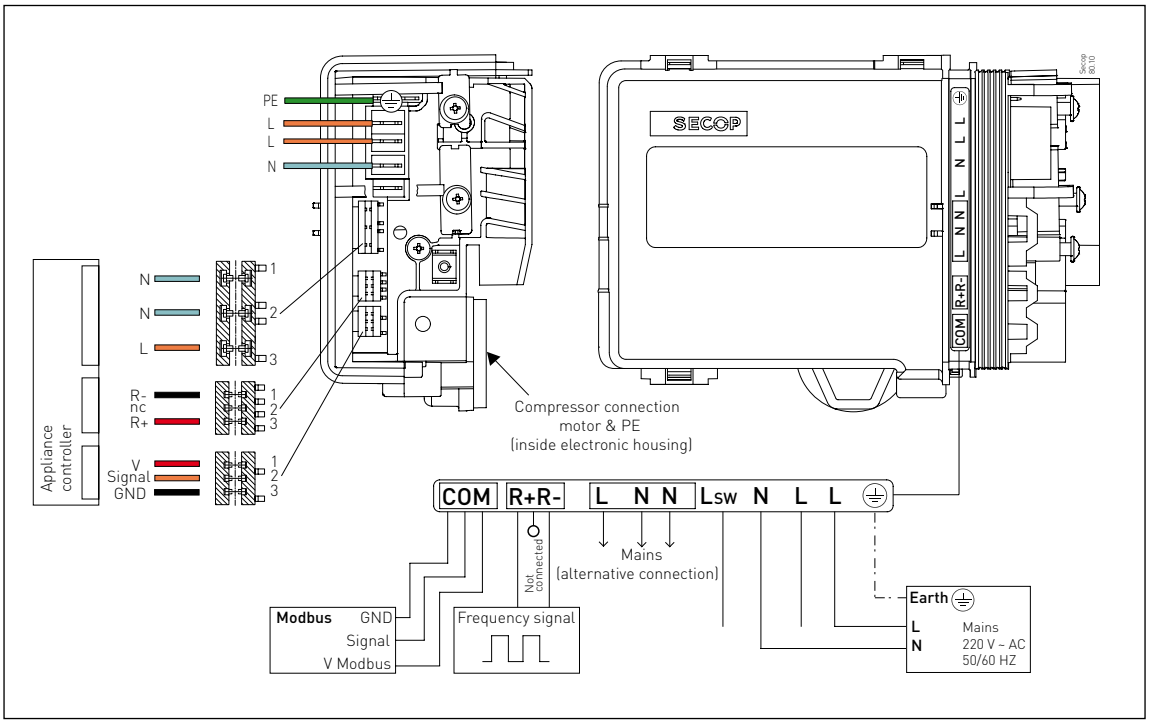
The electronic unit is here used with frequency input control. Another electronic appliance controller must deliver a frequency signal, which is converted to a variable speed for the compressor.
The connections to the appliance controller are done with a RAST 2.5 power connector and a RAST 2.5 connector for the frequency input.
Modbus communication connection to the appliance controller is optional.

When using a frequency signal as input, the external wires can be connected as follows:

- Earth connects to PE.
- Mains connect to L and N.
- Appliance electronic supply connects to L, N, with RAST 2.5 Power connector.
- Frequency input connects to R- and R+.
- Optional Modbus connects to V, Signal and GND.

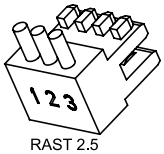
All terminals marked with L or N are internally connected.

The label on the box guides to the terminals. The connections are shown below as well.
The connectors are Flat Pin 4.8 mm and RAST 2.5 Power. R+ R- and COM is RAST 2.5 connector.



Connection of electronics					
Connector Description	**Signal**	**PIN**	**Pole**	**Type**	**Coding**
Appliance wall earth	Earth	1	1	4.8 flat pin	_
Connection of power cord	L	1			
	L	1			
	N	1			
Thermostat L switched	Lsw	1			
Connection of power to appliance unit	N	1	3	RAST 2.5 power	a, b, c, d, e, f
	N	2			
	L	3			
Frequency signal from appliance electronic	Ground	1	3	RAST 2.5	a, b, c, d,
	NC	2			
	Signal	3			
Serial signal (Tool4Cool®) (appliance controller)	Supply	1	3	RAST 2.5	a, b, c, d,
	Data	2			
	Ground	3			

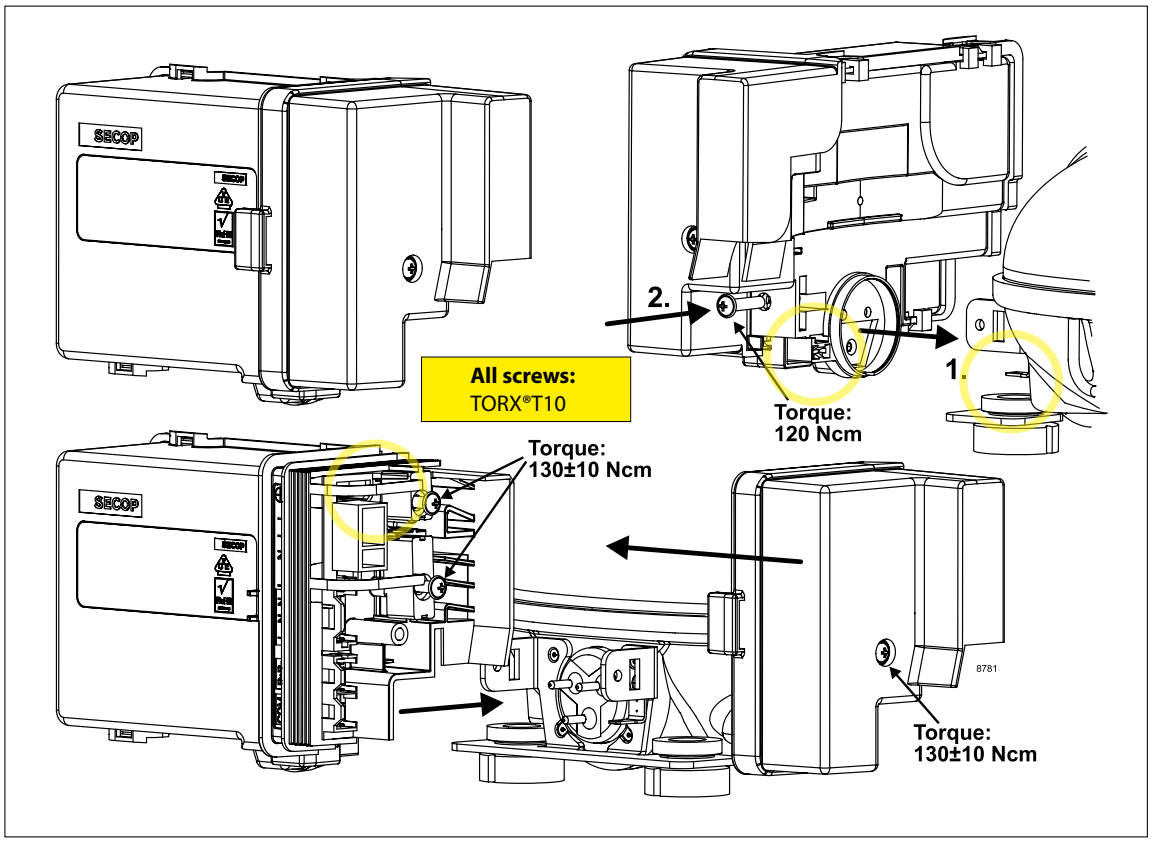
- Table shows the connector type.
- Pin number and poles are shown as well.
- Cut the "noses" on each connector as shown in the table as "coding" (by use of a knife).



RAST 2.5

4.3 Earth connections

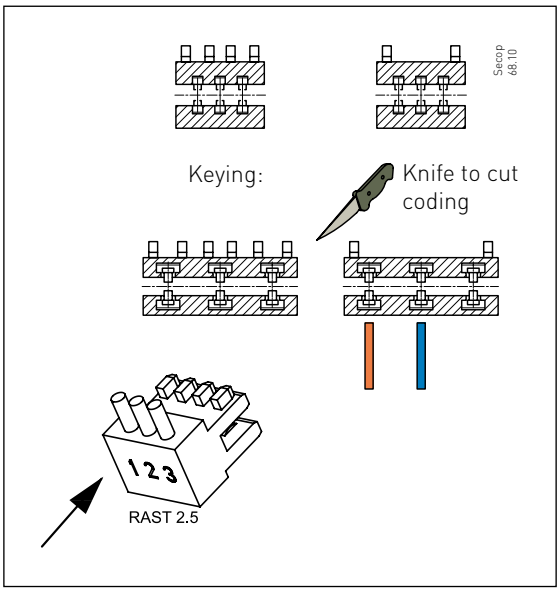
Make sure earth protections are properly connected to the compressor as well as to the electronic unit and mains supply.



4.4 RAST 2.5 connectors

This is an overview of different connectors from different suppliers. The list is not complete.

3 Pole Connector	RAST 2.5 (signal)	RAST 2.5 power
Lumberg	3521 03 K00 / K35	3570 03 K55
Molex	93050....	93051....
Stocko	ECO-TRONIC	ECO-TRONIC pro
	MFVV 7234-003-....	
Tyco/AMP	DUOPLUG 2.5	DUOPLUG power
	1-966194-3	0-1394918-3 / 0-1534415-3
Wire mm²*	0.22-0.35	0.35-0.75
Wire AWG*	24, 23, 22	22, 20, 18



It is possible to order 4 different connector kits. This is intended for laboratory use and 0-series production start-up.

Connector kit		105N9020 10 set	105N9021 100 set	105N9022 10 set	105N9023 100 set	Type
Attached XV	RAST 2.5 (signal)	20 pcs	200 pcs			Lumberg 3521 03..
	RAST 2.5 power	10 pcs	100 pcs			Lumberg 3570 03..
Detached XV	RAST 2.5 (signal)			10 pcs	100 pcs	Lumberg 3521 03..
	RAST 2.5 power			20 pcs	200 pcs	Lumberg 3570 03..

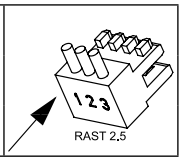
4.5 Connect to COM port

The COM port is used for communication to an appliance controller. The communication protocol is according to Modbus standard. The COM port has a galvanic isolation.

But the Modbus port is a single-wire interface. It is not like RS485 with two wires and not like RS232 with Rx and Tx wires. It is called a One Wire LIN data communication interface, where data are transmitted in both directions on one wire. Nevertheless, 3 wires must be connected, and a cable with 3 wires is therefore needed for the interface, because power supply and ground are needed as well.

1. Power supply is 6-9 V.
2. The data on pin 2 is standard 5 V logics.
3. Ground.

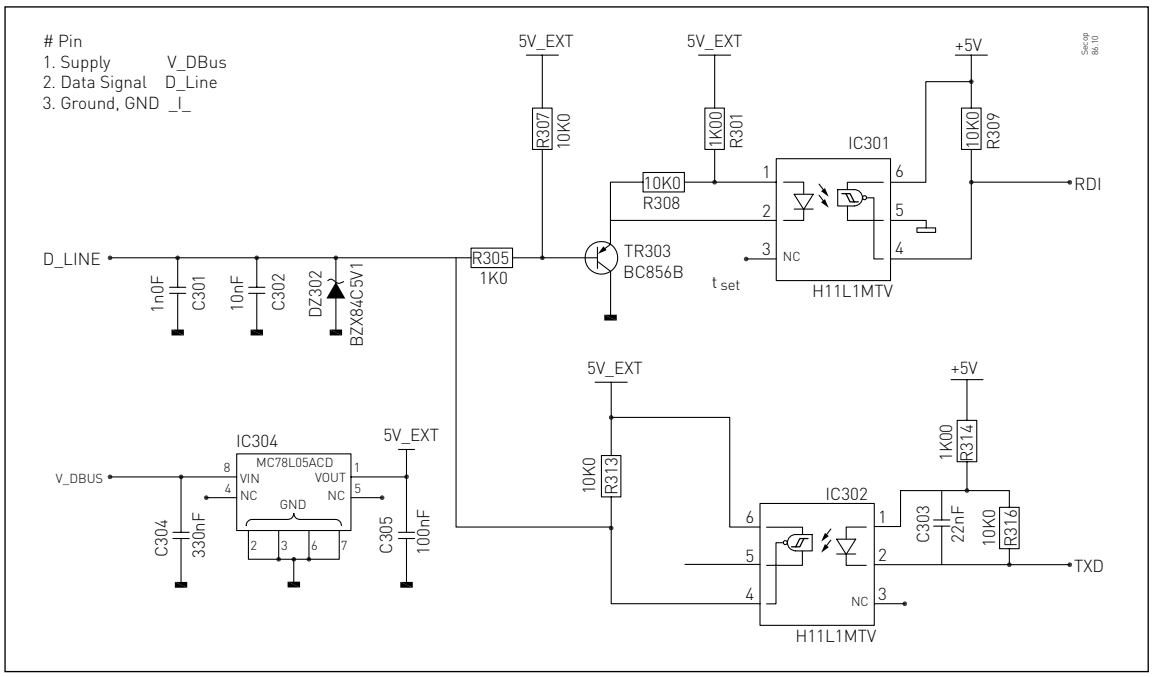
The wire connections are shown in the table below.

Serial signal (Tool4Cool®) (Appliance)	Supply	3x0.38 mm²	1	RAST 2.5	a, b, c, d,	
	Data		2			
	Ground		3			

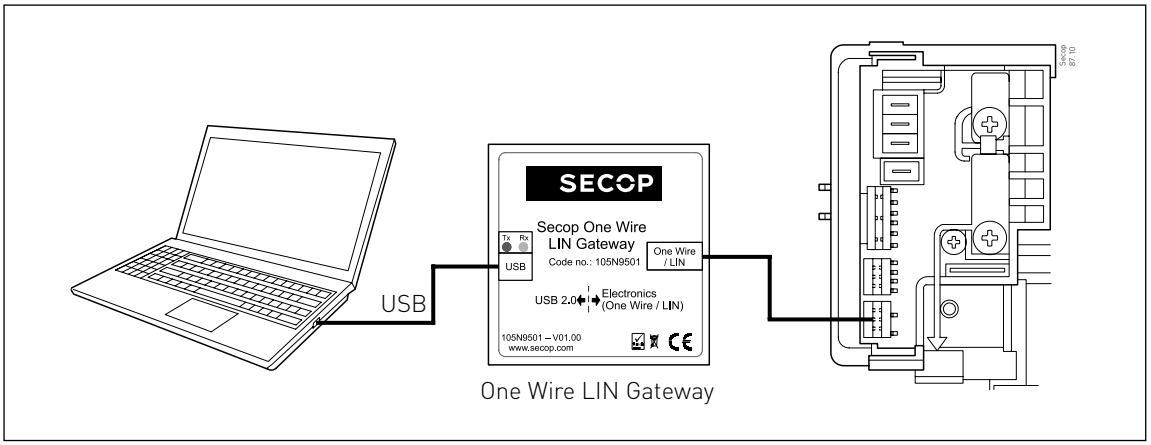
The "noses" on the connector must be cut with a knife, as shown in the table.

The serial interface to be implemented in the appliance electronic unit must be able to deliver the One Wire LIN data communication interface, including the power supply and ground. Galvanic isolation is only needed if the mains power supply doesn't deliver sufficient isolation.

The COM port in the XV electronic unit has its own voltage regulator and a galvanic isolation by means of opto-couplers.
A more detailed diagram of the XV COM port is shown here:



The gateway 105N9501 can be used to connect a PC with Tool4Cool® directly to the XV attached electronic unit. It is a galvanic isolated connection. See separate operation manual to make the Tool4Cool® connection.



One Wire LIN Gateway

5. SERIAL INTERFACE – MODBUS

The COM port can be driven by a Modbus serial interface from an appliance electronic unit. From the interface several parameters can be read out of the XV electronic unit. The appliance electronic unit can read and write several registers.

Operation in Modbus mode enhances possibilities for controlling the compressor speed and adapts special needs to a cabinet by setting parameters.

D-Bus mode can do the same but is only available on special code numbers.

The serial interface is designed according to the **Modbus Protocol Specification** and **Modbus Serial Line Protocol and Implementation Guide**, which are available at **www.Modbus.org**

List of implemented function codes that are supported:

PNU	3 (0x03)	Read holding registers
	4 (0x04)	Read input registers
	6 (0x06)	Write single registers
	20 (0x14)	Read request
	43 (0x2b)	Read device identification (0E)

The list of PNU numbers to be used to get access to parameters in XV electronic unit can be found in Appendix 7.2.

5.1 Communication

These serial interface settings are normally not changed but this overview provides information about the serial interface setup.

Node number

– Address of the electronic unit on the Modbus. It must be ensured that each address on the bus is used only once.

Bits per second

– Communication speed on the Modbus. All devices on one bus-line must share the same speed.

Communication time-out

– Defines the duration of communication time-out.

Protection code

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

Settings

Name	Default	Max value	Min Value	Step	Unit
Node number	1	247	1	1	
Bits per second	19200	19200	9600	9600	bps
Commnication time-out	900	7200	15	1	seconds
Setting protection code	0	9999	0	1	

Interface format

Baud rate	19200 bps. (default)
Duplex	Half
Coding system	8-bit binary
Parity	Even
Stop bits	One
Hand shaking	None

PNU numbers

Modbus Register	Parameter	Unit	PID	Min	Max	Default
	Product code		PI00			
	SW version		PI03			
	Unit ID		PI04			
35901	Node number			1	247	1
35902	Bits per second	bps		1	2	19200
35904	Communication time-out	sec				900

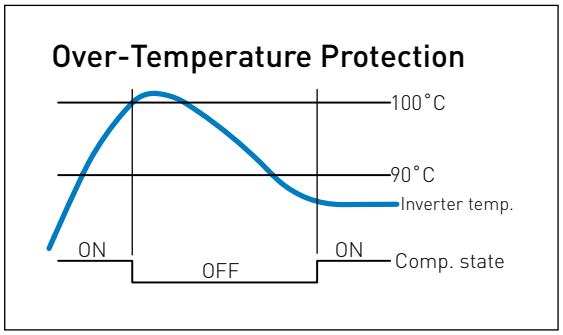
See all Modbus register numbers, called the parameter numbers (PNU), in the Appendix section 7.2.

6. PRODUCT SAFETY AND INFORMATION

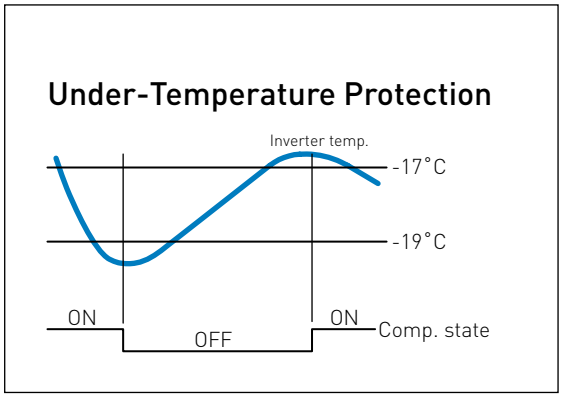
6.1 Temperature protection

The protection system ensures that the controller and compressor do 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 (measured by PCB NTC), the system will shut down and an actual error (thermal shutdown) will be raised.
After the temperature has dropped below 90 °C, the compressor is restarted automatically.



The undertemperature protection ensures that the compressor, including the magnets in the motor, is not damaged by excessively low temperatures. When the unit reaches -19 °C on PCB, the system will shut down and an error (thermal shutdown) will be raised.
After the temperature has risen above -17 °C, the compressor is restarted automatically.



The temperature limits cannot be changed but the actual PCB NTC temperature can be seen and the actual error can be read. See more in the section "PNU number overview – parameters".


SECURITY

Actual temperature Actual PCB NTC temperature

Actual error Thermal shutdown - temperature high
Thermal shutdown - temperature low

LED indication A thermal error will be indicated by flashing LEDs; 3 or 4 flash every five seconds – see more in the section "Error list – Alarm indication".

6.2 Compressor safety

In order to protect the compressor, an advanced compressor motor control is implemented. Several actions are controlled in a safe way and several measurements are used to make a safe control of the motor.

Safety control functions are: Starting and stopping the compressor, speed control, failure protection, under and over speed, maximum current, motor winding temperature, motor control voltage and BEMF detection and more.

The motor settings cannot be changed but the actual error and the actual suberror can be read if something is wrong. See more in the section "Error list – Alarm indication".

Actual error

- None
- Voltage failure
- Motor failure
- Speed failure
- Thermal failure

Actual suberror

- None
- Low voltage
- Min voltage
- Max voltage
- No BEMF or no valid BEMF
- Overcurrent
- Demagnetisation and zero-cross to close
- Waiting for safety stop delay elapsing
- Boost voltage high
- No demagnetisation
- Brake condition not reached
- Under speed
- Over speed
- Thermal shutdown - temperature high
- Thermal shutdown - temperature low

LED indication A compressor error will be indicated by flashing LEDs; 4 flash every five seconds.

6.3 Product label and numbers

Labels on electronic units consist of 6 lines with product information and a 2D Data Matrix code.

Text information on the label

Line 1: Secop code number, e.g. 105N5022 and product type, e.g. XV 7.2KX
Line 2: Unit ID (unique number): PL YY WW ssssss and date: YY WW
PL: Production location, 01 ... 99
YY: Year, 12 = 2012
WW: Week number, 01 ... 52
ssssss: Serial number, 000001 ... 999999
Line 3: Software version: V V.VV
Line 4: Product version: VV
VV: Version, 00 ... 99
Line 5: Text line: customised text
Line 6: Electrical information: voltage range

The 2D data matrix code always consists of 62 characters containing information about type, code number, product version, product revision, unit ID, supplier part number and software.

Readout example (62 characters):
SLV 230V 105N4327 0103040744012345A1-1234567SW 1.21

2D Matrix code on label

	Format	Field length (char)	Example
Product type	Text	18	SLV 230 V
Product number		10	105N4327
Product version	VV	2	01
Product revision	RR	2	03
Unit ID	PLYYWWssssss	12	040744012345
Supplier part number	Text	10	A1-1234567
SW. Vers.	V.VV	8	SW 1.21
	Total	62	

Product information can be read via Modbus registers

Modbus Register	Parameter	Unit	PID	Min	Max	Default
	Product code		PI00			
	SW version		PI03			
	Unit ID		PI04			
35901	Node number			1	247	1
35902	Bits per second	bps		1	2	19200
35904	Communication time-out	sec				900

6.4 QR code – instruction link

On the compressor a QR code can be found. This is a link to the mounting instructions and installation instructions for the XV compressor.

6.5 Error list – alarm indication

The purpose of the alarm indication is to notify the user when there is an error in the system, in order to locate functions with an error in the refrigeration system. An alarm system is not implemented, but two levels of alarm indication can be found.

LED inside the housing

The LED is visible after removing the cable cover, looking through the Ø 4 mm hole.

1 Flash – No error (hart beat)	(1x flash every 15th second)
2 Flash – No input signal	(2x flash every 5th second)
3 Flash – Inverter error	(3x flash every 5th second)
4 Flash – Compressor error	(4x flash every 5th second)

Modbus communication

In the XV electronic unit two error codes can be found as the **actual error** and the **actual suberror**. And when an alarm occurs, the last error message can be read in **last detected error and suberror**.
The error codes are measurements and can be read via Modbus.

Error list

Actual error

Name

0 = None
1 = Voltage failure
2 = Fan failure
3 = Motor failure
4 = Speed failure
5 = Thermal failure
6 = NTC sensor failure
7 = Communication failure

Actual suberror

Name	Action description
0 = None	
1 = Low voltage	Replace electronic
2 = Exception	-
3 = Oscillator	-
4 = Watchdog	-
5 = External reset	-
6 = I2C	-
7 = EEPROM RD error	-
8 = EEPROM WR error	-
10 = ADC timeout error	-
17 = Min voltage	Grid voltage is too low
18 = Max voltage	Grid voltage is too high
49 = No BEMF or no valid BEMF	Compressor not connected. Check cable
50 = Over current	Motor over load
51 = Demagnetization and zerocross to close	Motor error
52 = Waiting for safety stop delay elapsing	Wait
53 = Boost voltage high	Wait
54 = No demagnetization (simudemag)	Motor error
55 = Brake condition not reached	Wait
65 = Under speed	Wait
66 = Over speed	Wait
81 = Thermal shutdown – temperature high	Ambient temperature too high
82 = Thermal shutdown – temperature low	Ambient temperature too low
97 = NTC open	Replace electronic
98 = NTC shorted	-
113 = CCU bus	Communication error
114 = Modbus	-
115 = RS485 bus	-
116 = LIN bus	-

7. APPENDIX


SECOP
XV7.2KX
220 – 240 V / 50/60 Hz
LBP LST/HST
only with electronic controller
108H
7000
R600a
MADE IN SLOVAKIA


SECOP
XV12XX
220 – 240 V / 50/60 Hz
LBP LST/HST
only with electronic controller
10BH
7000
R600a
MADE IN SLOVAKIA

7.1 Electrical key parameters

Below is a list of parameters and corresponding standards used for test of the 105N5022 XV electronic unit.

Name	Value / Standards
Type code	105N5022 XV attached electronic unit
Connection	Direct connection on compressor
IP class	IP 52
Ambient humidity	30 % rH – 90 % rH
Cool	IEC 60068-2-1 A
Heat	IEC 60068-2-2 B
Temperature shock	IEC 60068-2-14 Na
Temperature humidity	IEC 60068-2-30 Db
Mechanical shock	IEC 60068-2-27
Vibration random	IEC 60068-2-64 Fh
Vibration sinus/resonance	IEC 60068-2-6 Fc
Free fall	IEC 60068-2-32
Tropical humidity test 90-95 % rH	no
Maximum operating temperature	45°C
Minimum operating temperature	0 °C
Storage temperature	- 30 °C to 70 °C

EMC conformity	According to 2004/104/EC
LVD conformity	According EN 60335-2-34
RoHS conformity	According to 2011/65/EU
EMC conformity	EN 55014-2 household appliances
Line surge	IEC 61000-4-5 (com. mode 2 KV, Diff. mode 1 KV)
Burst	IEC 61000-4-4 (standard 1 KV, tested 4 KV)
Power interruption	IEC61000-4-11
ESD	(Contact discharge 4 KV, air discharge 8KV)
Voltage fluctuations, flicker	EN61000-3-3
AC supply (L, N)	160-264 V / 50/60 Hz
Voltage drop	Speed drop to e.g. 200 rpm/10 V below 120 V
Internal fuse	5 A slow blow
External fuse required	Max. 16 A
Standby power consumption	Off mode 100 mW
Inrush current, power-up	34A @ 25°C; 40 A @ 30°C
Starting current, HST	2 A @ 230 V
Electronic efficiency	95-97 %
Approval	VDE, EN 60335-2-34 with annex AA
Compressor protection	Yes, protective electronic circuits (PEC)

Frequency input signal (R+, R-)	5 V, max. 12 V or max. 8 mA, 0-200 Hz
Frequency input	Galvanic isolation, short and reverse circuit protected
Thermostat input (Lsw)	230 Vac Live (same as AC supply)
Thermostat input	Galvanic isolation
Communication port (COM)	One wire LIN (not Rs 485), galvanic isolation, Modbus
Com. port input, output	High 4.4-5.15 V, low 0-0.8 V
Com. port (Vsupply)	6-12 V
Modbus communication	Modbus serial line protocol and implementation guide V1.02

Wire recommendation	Mains		0.5-0.75 mm²
	Harness		0.5-0.75 mm², AWG 22, 24 (multi wired)
	COM		0.2-0.35 mm² twisted

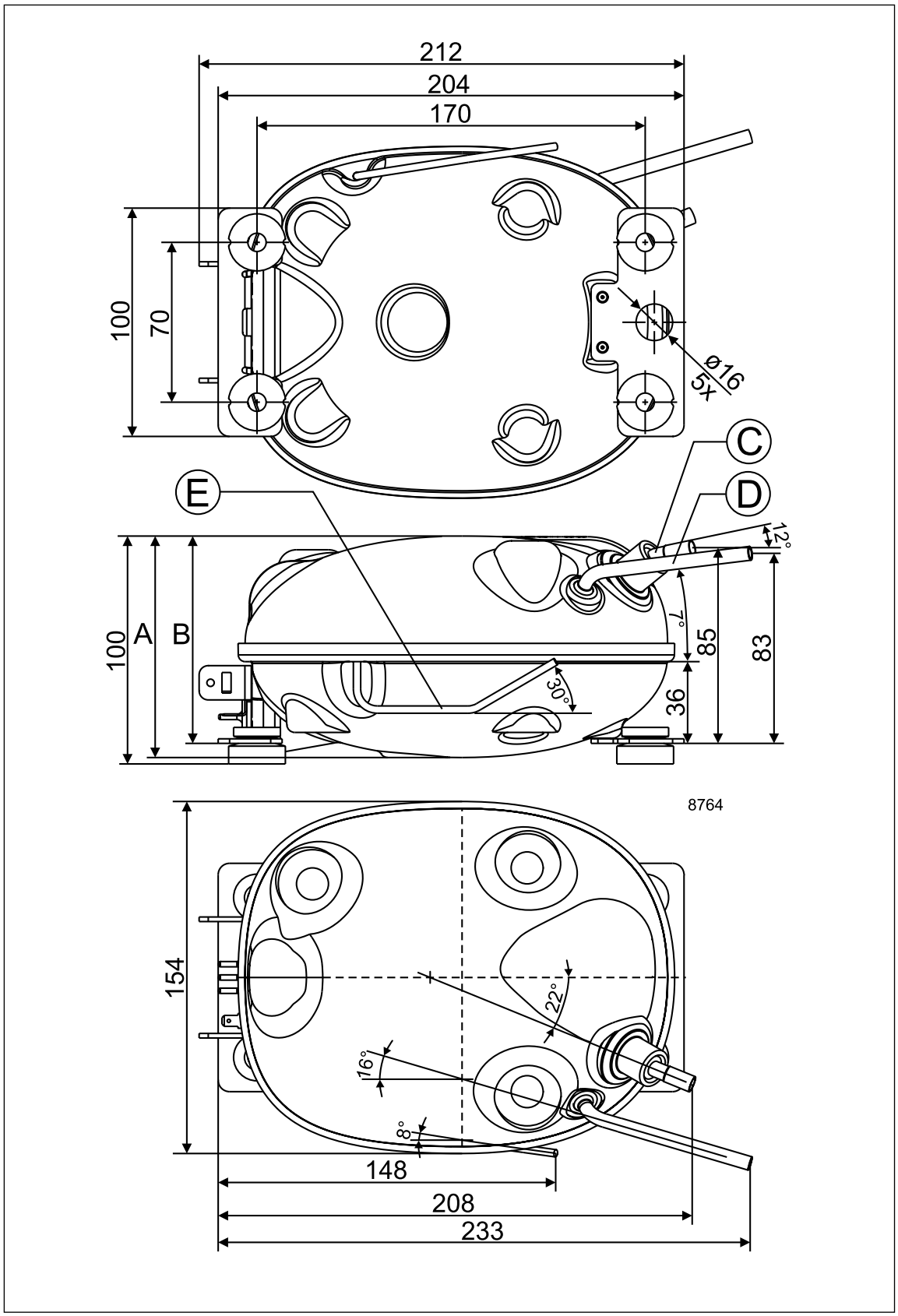
Connectors	RAST 2.5 and RAST 2.5 power 4.8 mm flat pin

7.2 PNU number overview – parameters

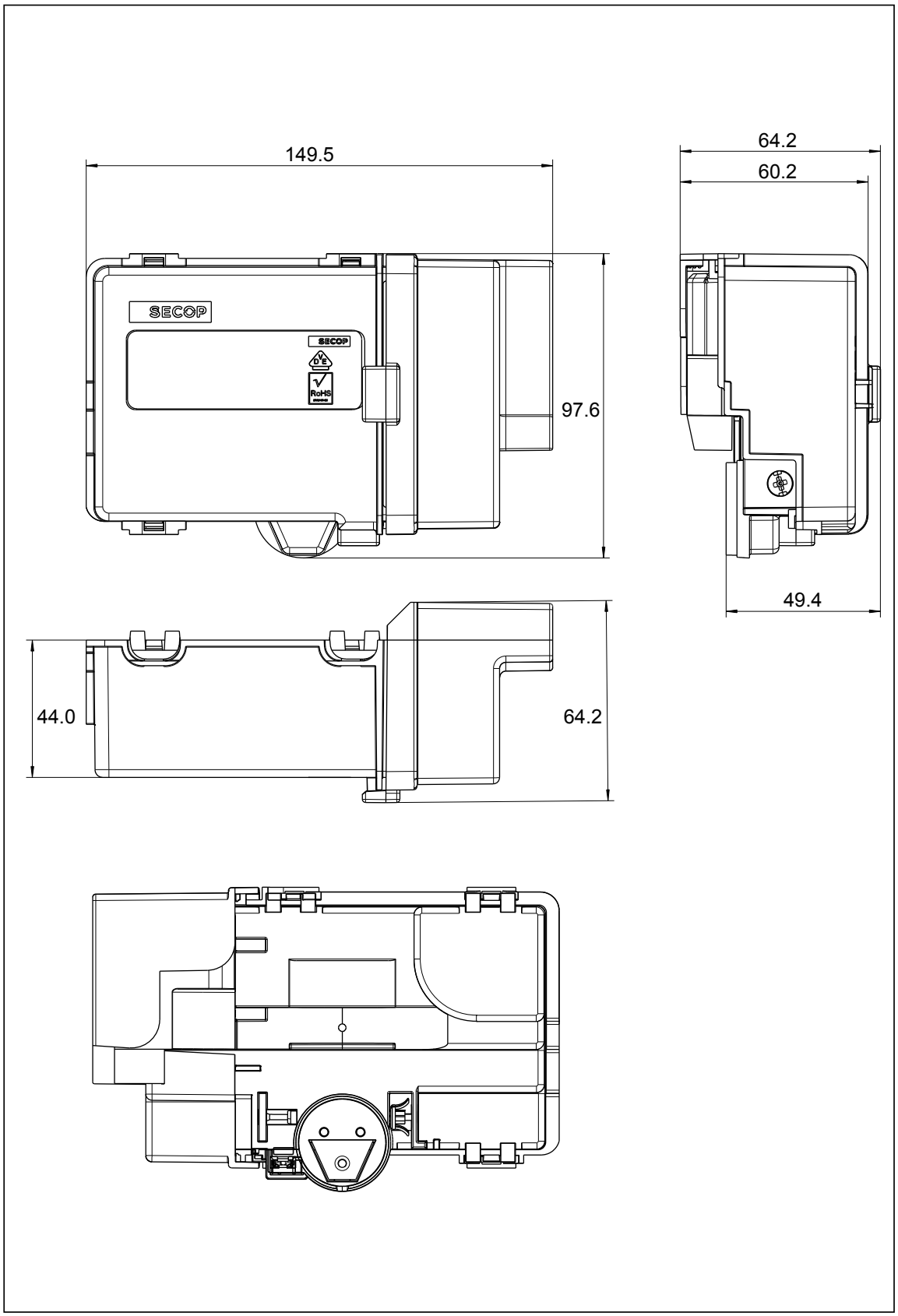
The following PNU numbers can be used to get access to parameters in XV electronic unit.

Modbus Register	Parameter	Unit	PID	Min	Max	Default
34830	Thermostat status		THC01			
35006	Requested speed	rpm	MS03	0	4000	
35098	Compressor speed	rpm	MS01	0	4000	
35099	Actual PCB NTC temperature	°C	TP01			
35100	Actual error		ERR01			none
35090	Actual suberror		ERR02			none
34830	Thermostat status		THC01	0	2	
34831	Thermostat logic		THC02	0	1	
34832 34833	Thermostat closing switch counter	counts	THC03	0	65535	
34834	Reset thermostat counter	command	THC04	0	1	
34835	Thermostat functionality		THC05	0	1	
34893	AEO smart setting		AEO01	0	3	
34805	AEO damping factor	%	AEO02	0	100	
34804	AEO cooling cycle time "t set"	min.	AEO03	0	600	
34820	AEO setup parameter transfer	command	AEO00	0	1	
34818	AEO control time base		AEO07	6	60	
34801 34802	AEO last runtime "t last"		AEO04	0 0	60 65535	
34819	AEO last start speed	rpm	AEO05a	0	4000	
34806	AEO next start speed	rpm	AEO05b	1000	4000	
34800	AEO requested speed	rpm	AEO06	0	4000	4000
34807	Smart setting 1: Cooling cycle time	min.	AEO10	10	600	120
34808	Smart setting 1: Damp factor	%	AEO11	0	100	70
34809	Smart setting 1: Start speed	rpm	AEO12	1000	4000	4000
34810	Smart setting 2: Cooling cycle time	min.	AEO20	10	600	60
34811	Smart setting 2: Damping factor	%	AEO21	0	100	50
34812	Smart setting 2: Start speed	rpm	AEO22	1000	4000	4000
34813	Smart setting 3: Cooling cycle time	min.	AEO30	10	600	90
34814	Smart setting 3: Damping facor	%	AEO31	0	100	70
34815	Smart setting 3: Start speed	rpm	AEO32	1000	4000	4000
34817	Restore to factory settings		AEO08	0	1	
35006	Requested speed	rpm	MS03	0	4000	
35004	Start speed	rpm		1000	4000	
35005	Start time	sec		0	600	
35098	Compressor speed	rpm	MS02	0	4000	
35601	Power consumption	W				
35199	Compressor run time	min.				
35100	Actual error	text	ERR01			none
35090	Actual suberror	text	ERR02			none
35091	Last detected error and suberror	text				none
	Product code		PI01			65NS02x
	Vendor name		PI02			SECOP
	SW version		PI03			
	Unit ID		PI04			
35901	Node number			1	247	1
35902	Bits per second	bps		4600	19200	19200
35904	Communication timeout	sec		60	400	900

7.3 Dimensions, compressor

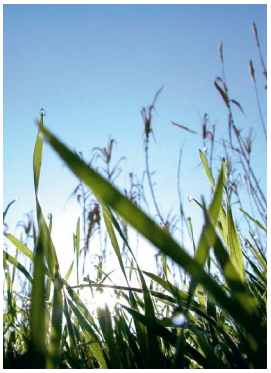


7.4 Dimensions, attached electronic unit



Secop´s XV compressor makes use of an external rotor motor and new innovative materials. Its simpler construction set-up add to both flexibility and efficiency and a considerable reduction in height, weight and noise.

Furthermore, the XV compressor is HST capable. This means it has a high starting torque and can start against a differential pressure. Also its wide voltage range (160-264 V at 50/60 Hz) means that it can operate in refrigerators and freezers in regions with an unstable voltage supply.



OUR JOURNEY SO FAR

1956
Production facility and headquarters in Flensburg, Germany founded.

1958
Start of production for PW compressors.

1970
Introduction of SC compressors.
The birth of a standard-setting platform in the light commercial market.

1972
Introduction of FR compressors.

1977
Introduction TL and BD compressors.

1990
Introduction of NL compressors.

1992
Introduction of PL compressors.

1993
Start of production with natural refrigerant R600a (isobutane).
Production facility in Crnomelj, Slovenia founded.

1999
Start of production with natural refrigerant R290 (propane).

2002
Production facility in Zlate Moravce, Slovakia founded.

2005
Introduction of GS compressors.

2008
Production facility in Wuqing, China 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.

2013
Introduction of the XV compressor - opening a new chapter in refrigeration history.
Secop acquires ACC Fürstenfeld, Austria.

2015
New generation of energy-efficient propane compressors.
New variable-speed platforms for household and light commercial applications.

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