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 DETACHED ELECTRONIC UNIT

OPERATING INSTRUCTIONS

105N5052 XV Electronic Unit - **XV-Frequency**

160-264 V / 50/60 Hz

CCD® COOL CAPACITY DRIVE

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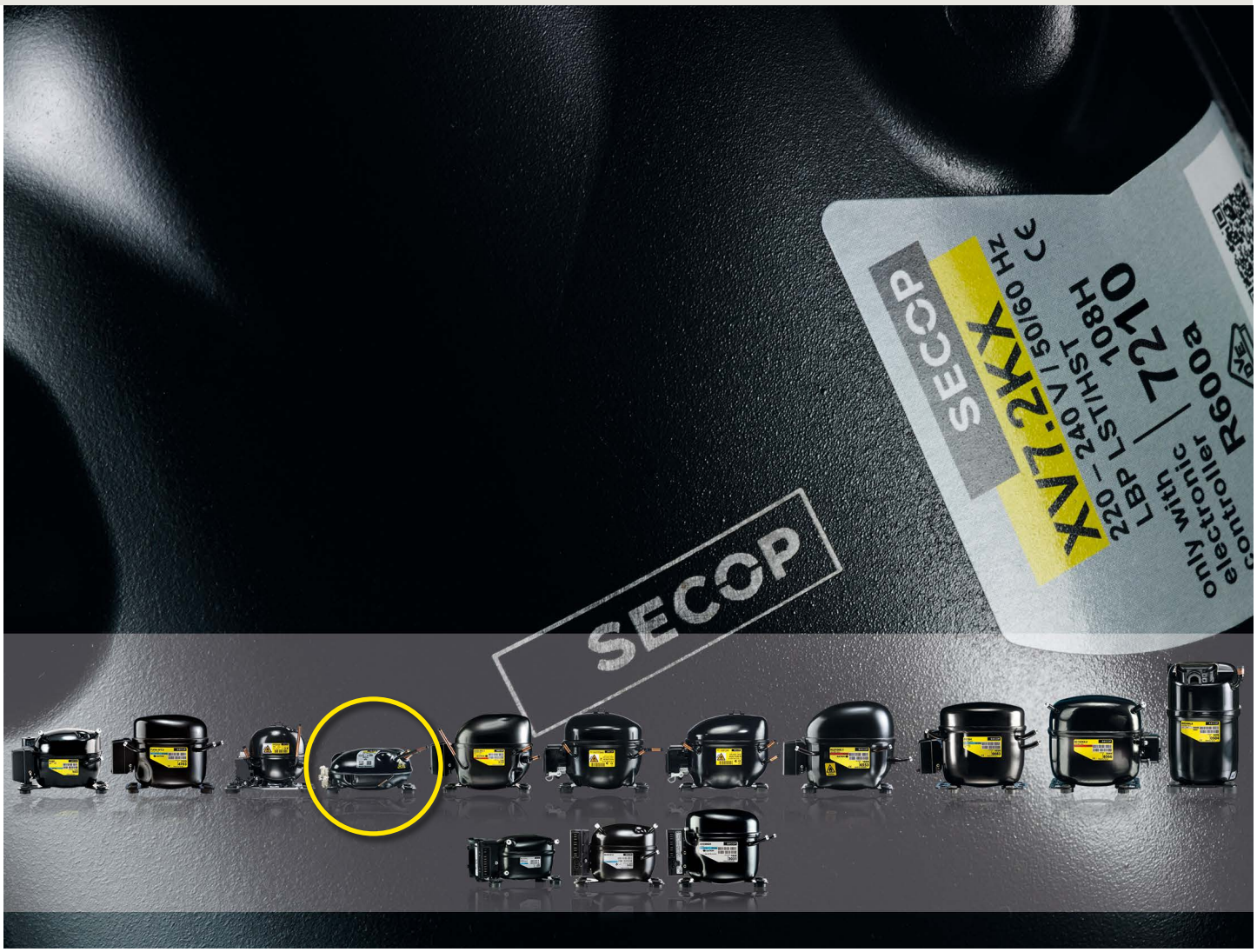

SECOP
SECOP
XV1.2XX
220 – 240 V / 50/60 HZ
LBP LST/HST 108H
7210
only with
electronic
controller
R600a

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 coolers
- Integral freezers
- Display cabinets
- Beer coolers

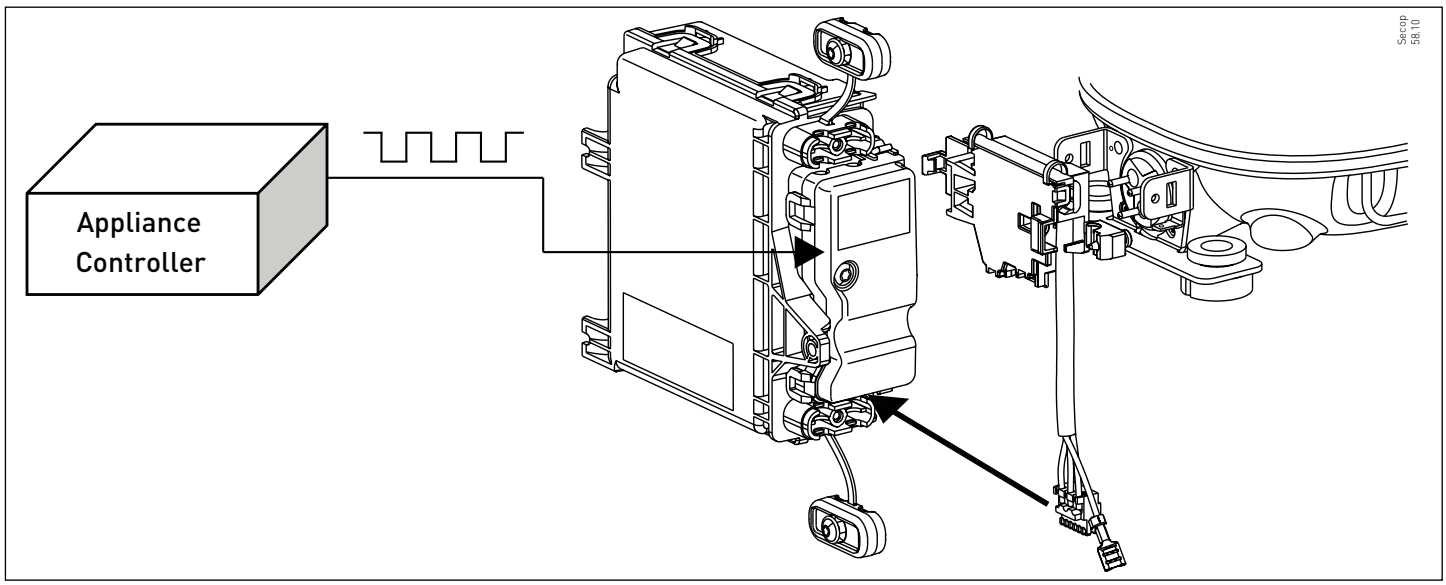
The compact size enables 5-20 liters additional storage volume in cabinets or solves small and compact applications. The variable speed lowers the power consumption, limits the number of variants, and increases the capacity range.

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 detached electronic unit is placed next to the XV compressor and connected by a cable.

XV detached electronic variant

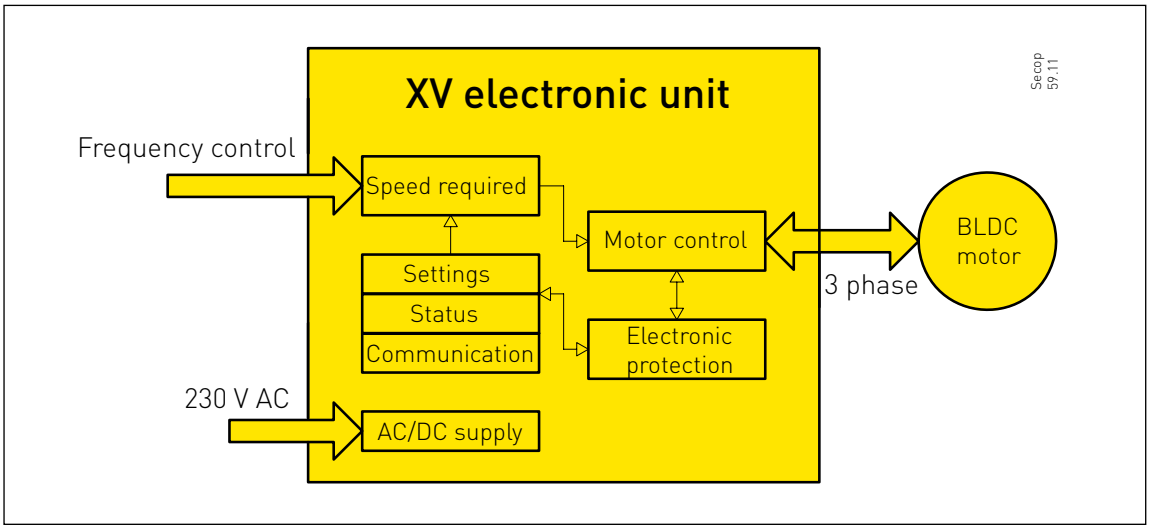
The electronic unit takes input from a customer-controlled frequency signal.



The most important functions of XV compressor systems are
- Motor / compressor variable speed control
- Speed control to be done by:
  – Frequency input (variable signal)

2. COMPRESSOR SPEED

The speed and thereby the capacity of the compressor is set using a frequency input. As a rule of thumb, the speed range of 1 : 4 corresponds to 1 : 3.5 in capacity.



A. Frequency input (variable signal)

Most applications can use the default settings in the electronic unit and nothing further needs to be changed. The frequency signal from the appliance electronic controller can set the speed directly.
If default settings have to be changed, please contact Secop for special software version.

3. SIGNAL INPUT FREQUENCY

The electronic unit has an input signal detection, which will detect the input signal at all times.
If a valid speed frequency is detected on the input, the compressor will start within a few seconds.

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.

3.1 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 of the speed of the compressor.
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.

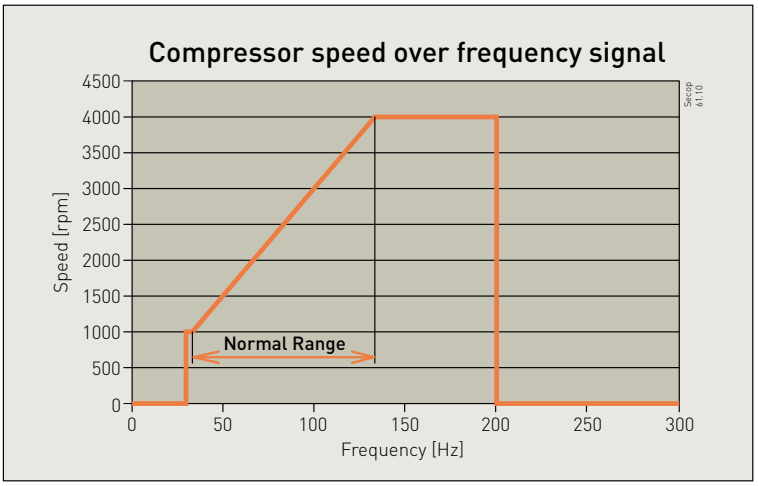
The compressor variable speed in this range is from 1000 rpm to 4000 rpm. The conversion is linear and every frequency rpm is allowed.

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 corresponding frequency range.

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

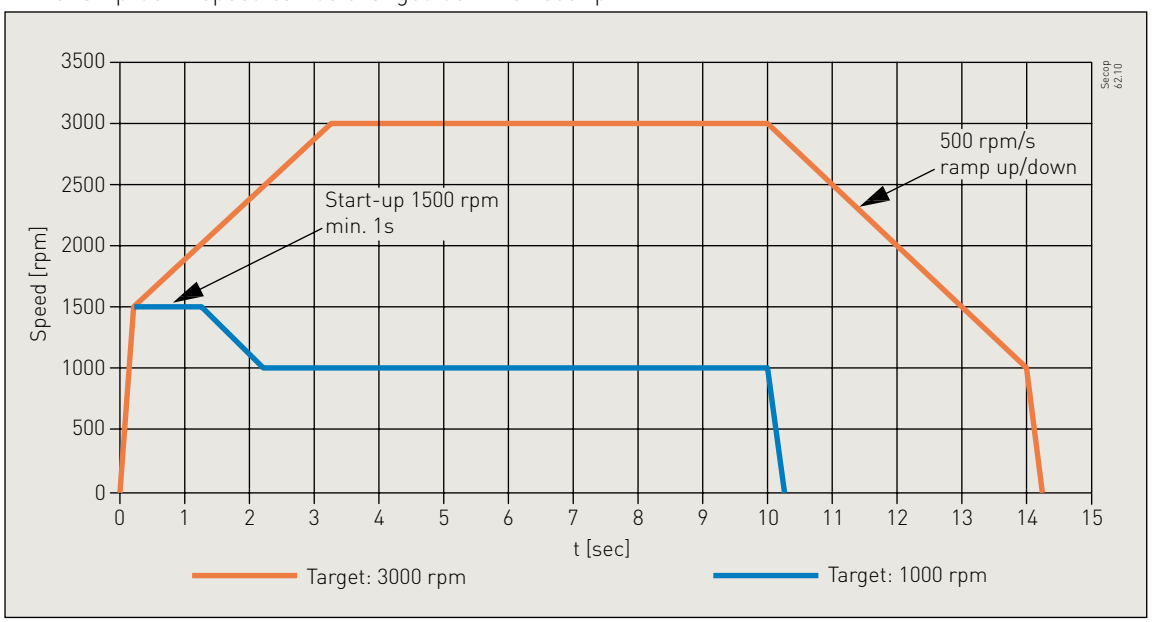


If some frequency signals are seen as forbidden – see separate section later.

3.2 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, before regulating towards the set point set by the frequency input.
- The ramp-up speed can be changed from 1500 rpm and up.
- The ramp-down speed can be changed down to 1000 rpm.



3.3 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.

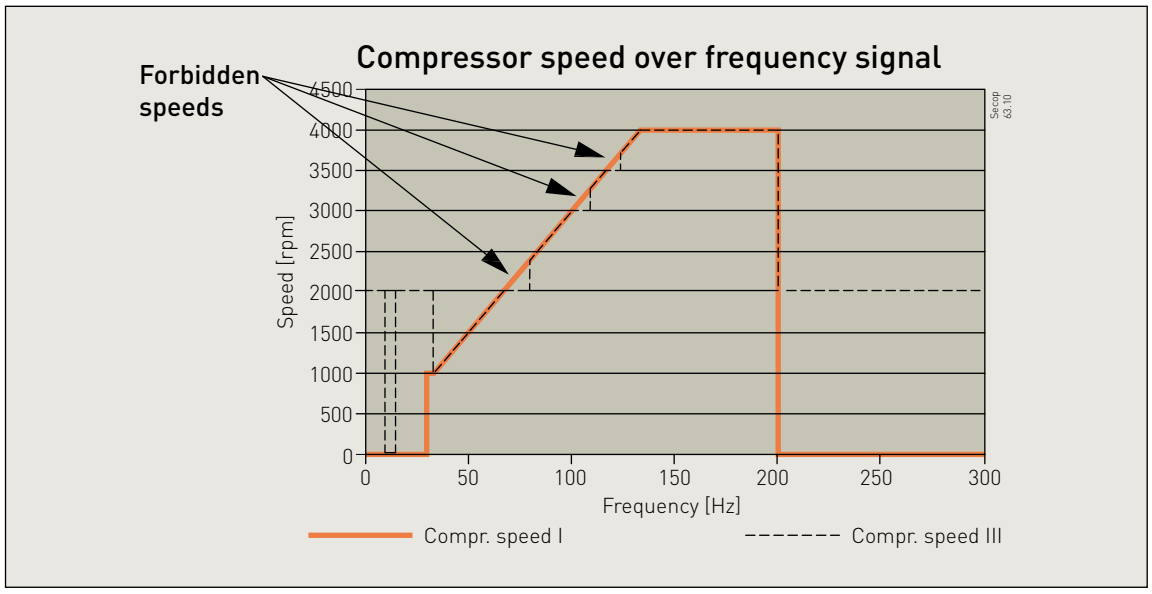
The motor speed ranges can be defined by a forbidden "center speed" and a "delta speed" surrounding it. A forbidden speed range is hence defined as:

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 is not 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.

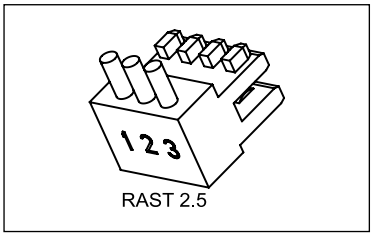
Notice: A frequency generator box can be arranged on special request at Secop.

3.4 Emergency control

In case of signal loss, at a broken wire or if the appliance control electronic becomes a break down, an emergency mode can be activated, means the compressor will run at fixed speed. The dotted line shown at 0 Hz to 10 Hz is optional control by special software. This option can only be selected on request at Secop.

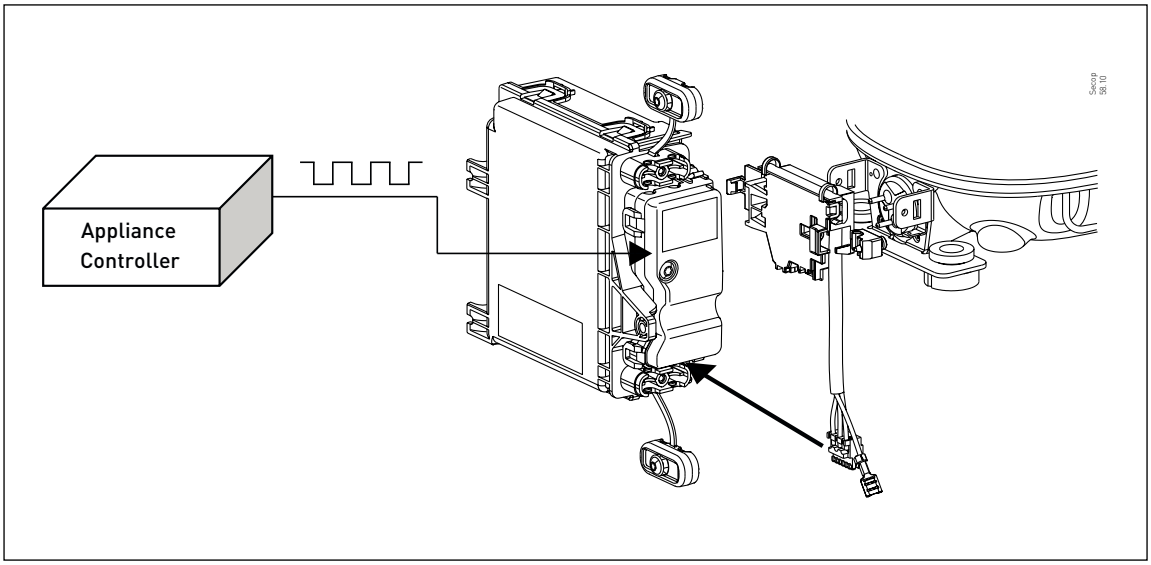
4. WIRING AND CONNECTIONS

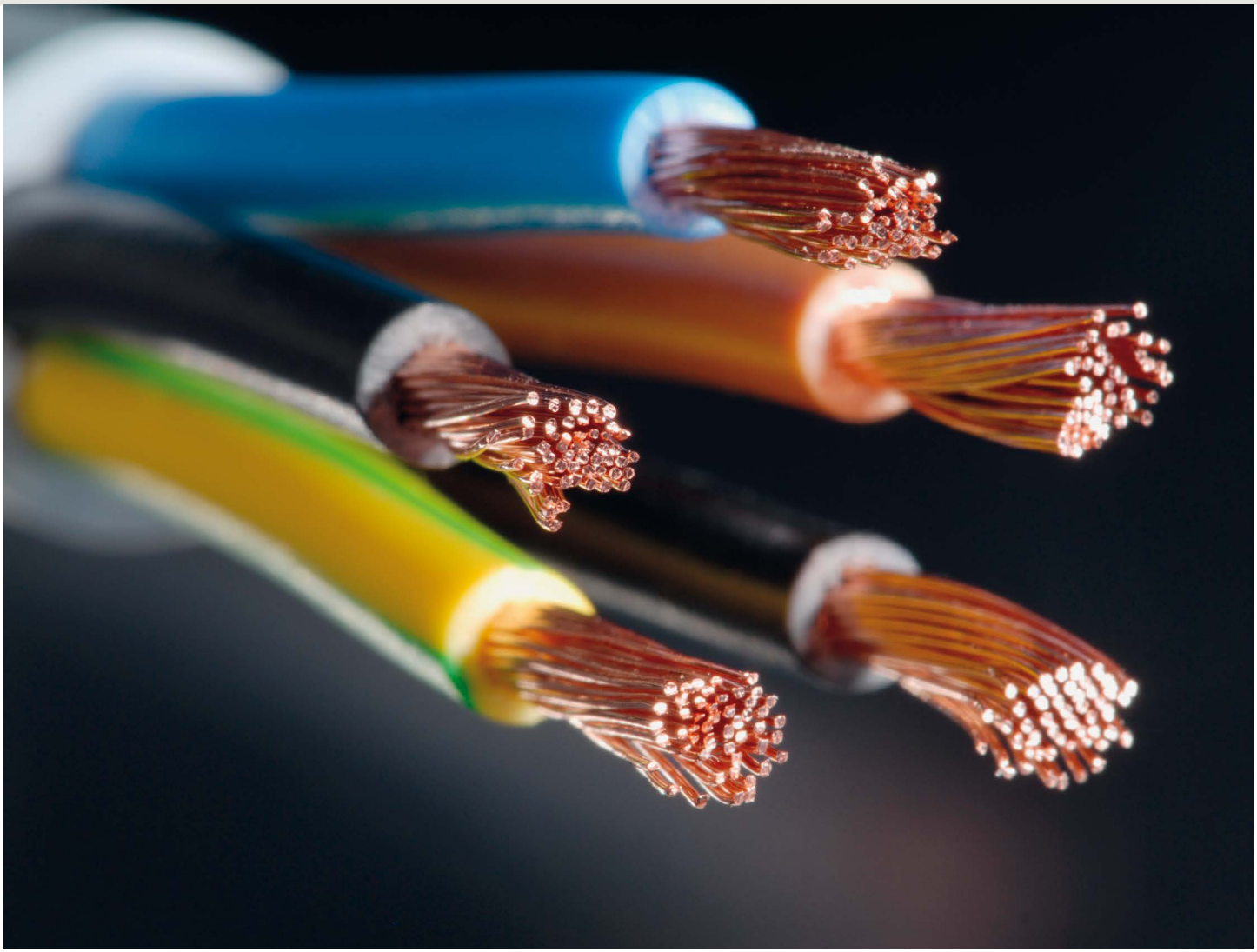
It is possible to connect the XV electronic unit by use of RAST 2.5 PCB connectors or flat pin connectors. These are standard types of connectors in the industry, which meet the requirements for safe connection combined with requirements for mass production.



Connections are different for attached and detached electronic units. Please make sure to follow the appropriate mounting instructions.

The XV detached electronic unit has 1 functional wiring:
Frequency input

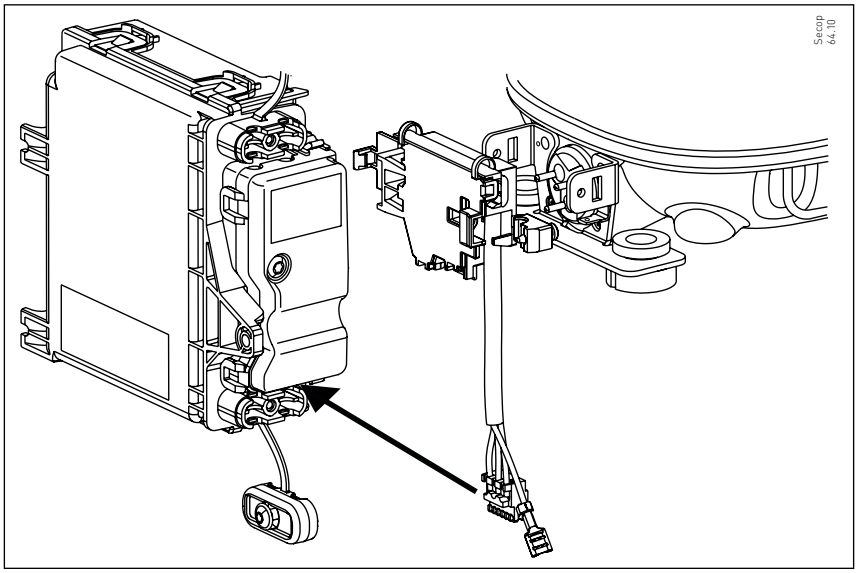




4.1 Wiring

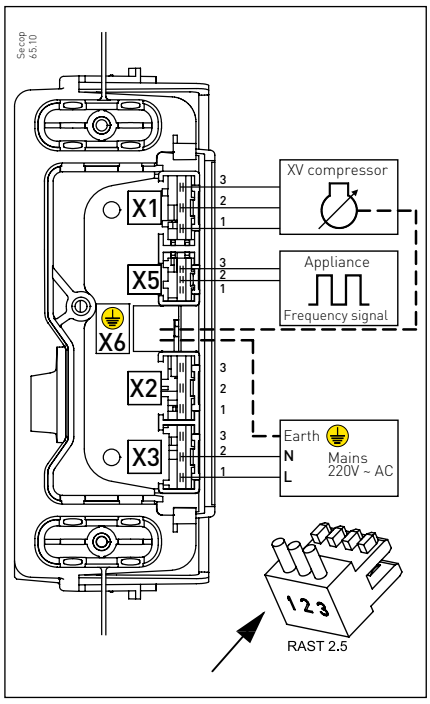
The detached variant of the electronic unit is mounted next to the compressor, and the connection to the compressor is thus done by a cable. A 3-pole connector and the flat pin earth connection from the compressor must be mounted on the electronic unit, X1.

Compressor connect to X1.



Only two external connections must be connected to X3 and X5:

- Mains connect to X3 with L and N. Use RAST 2.5 power connector.
- Earth connects to X6. Use flat pin 4.8 mm.
- Frequency input connects to X5 with R- on ground and R+ on signal. Use RAST 2.5 connector.
- Cut the "noses" on each connector as shown in the table as "coding".



Connection of electronics						
Connector description	**Signal**	**Terminal**	**PIN**	**Poles**	**Type**	**Coding**
Connection to motor	W	X1	3	3	RAST 2.5 power	a, b, c, d, e, f
	V		2			
	U		1			
	earth	X6	2		4.8 flat pin	–
Frequency signal from appliance electronic	Ground	X5	3	3	RAST 2.5	a, b, c, d,
	Signal		2			
	–		1			
Mains if X3 connects to appliance unit	Earth	X2	3	3	RAST 2.5 power	a, b, c, d, e, f
	N		2			
	L1		1			
Connection to mains	L1	X3	3	3	RAST 2.5 power	a, b, c, d, e, f
	N		2			
	L		1			
Appliance wall earthing	Earth	X6	1	1	4.8 flat pin	–

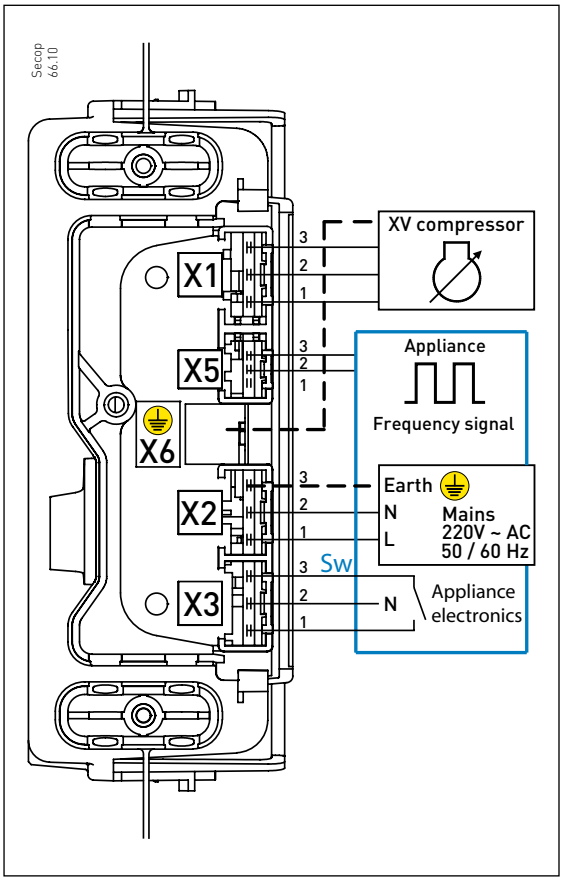
When the XV electronic unit is used as a junction box, the wirings are to be made differently.

It is possible to insert a main switch at position Sw, and it is possible to supply the appliance electronic unit from the XV Electronic unit. This is useful if power-up is to be controlled by the appliance unit, or if a long-lasting power-off must be made.

The connectors then have to be used differently.

See signal name and terminals in previous table.

- Mains connect to X2. All terminals marked with L1 or N is internally connected to X3. Use RAST 2.5 power connector.
- Earth connects internally from X2 to X6.
- Appliance electronic connects to X3. Use RAST 2.5 power connector.
- In appliance unit, L must be connected to L1 on X3.
- Frequency input connects to X5 with R- on ground and R+ on signal. Use RAST 2.5 connector.
- Cut the "noses" on each connector as shown in the table as "Coding".



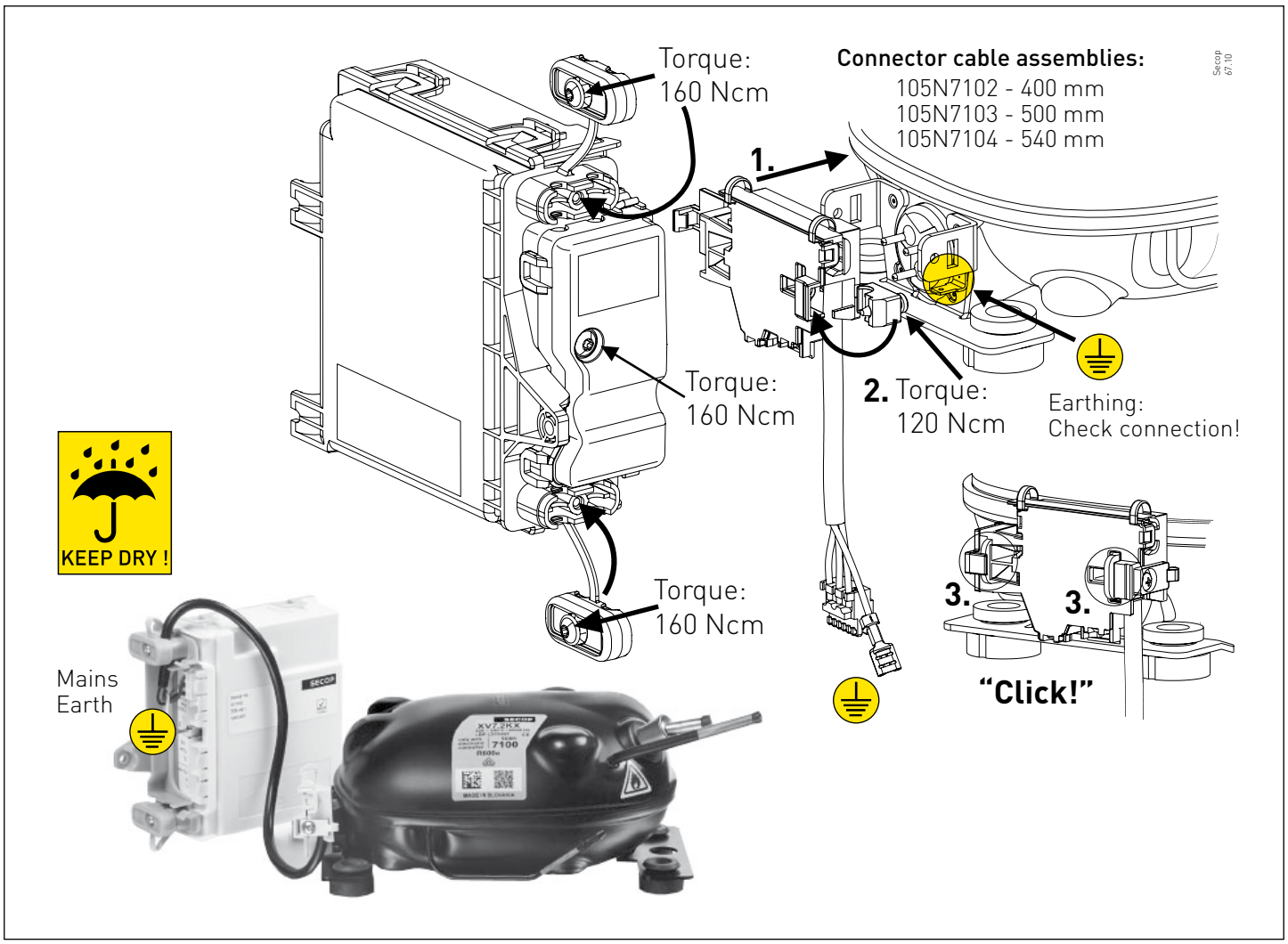
If the appliance electronic is able to connect/disconnect mains to/from the XV electronic, which is indicated on the drawing as the appliance relay, the duration between switching off and on must be considered.

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. 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).

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 Earth connections

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



4.3 Motor cables

The motor cables used for the detached variant:

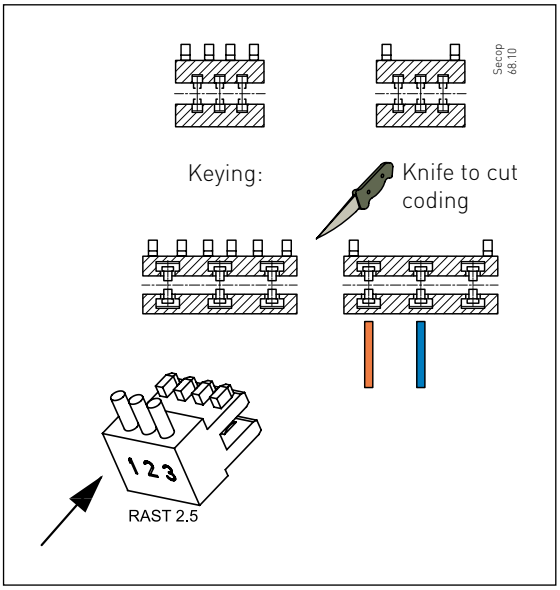
Code number	
105B7102	400 mm length
105B7103	500 mm length
105B7104	540 mm length

Due to electronic emissions, it is not allowed to extend the cable to more than 55 cm.

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..	3570 03 K00..
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



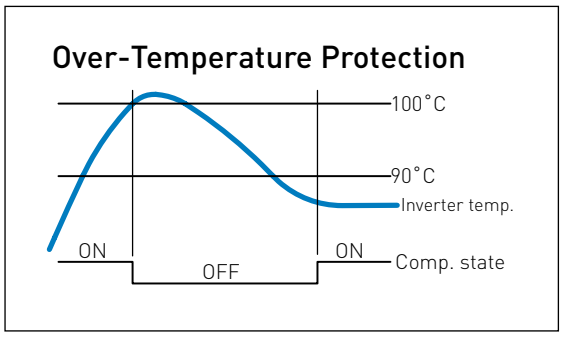
It is possible to order 4 different connector kits. This is intended for laboratory use and 0-series production start-up.

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..

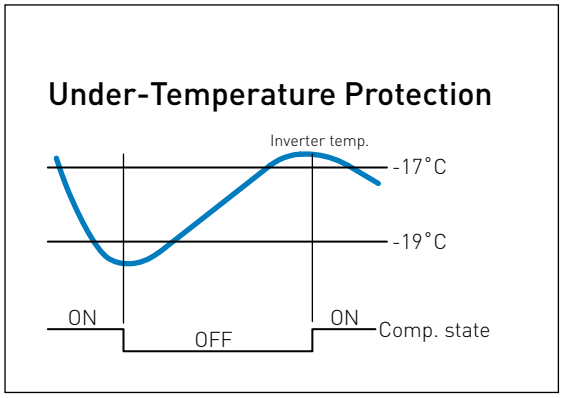
5. PRODUCT SAFETY AND INFORMATION

5.1 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 under-temperature 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.




SECURITY

5.2 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 taken to achieve safe control of the motor, the windings and the permanent magnets.

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. Only a special variant of the electronic unit can enable readout of error codes, the actual error and the actual suberror. Contact Secop if any needs of alarm handling occur.

5.3 Product information

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. 105N5052 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, Hz

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	

5.4 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. APPENDIX


SECOP
Secop no.:
Unit id.
SW ver.:
Version:
SECOP
XV7.2KX
220 – 240 V / 50/60 Hz
LBP LST/HST
only with electronic controller
108H
7100
R600a
MADE IN SLOVAKIA

6.1 Electrical key parameters

Below is a list of parameters and corresponding standards used for test of the 105N5052 XV electronic unit.

Name	Value / Standards
Type code	105N5052 XV detached electronic unit
Connection	Cable 400/500/540 mm
IP class	IP 52
Ambient humidity	30 % rH – 90 % rH
Temperature shock	IEC 60068-2-14 Na
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 %	No
Maximum operating temperature	45 °C
Minimum operating temperature	0 °C
Storage temperature	- 30 °C to 70 °C

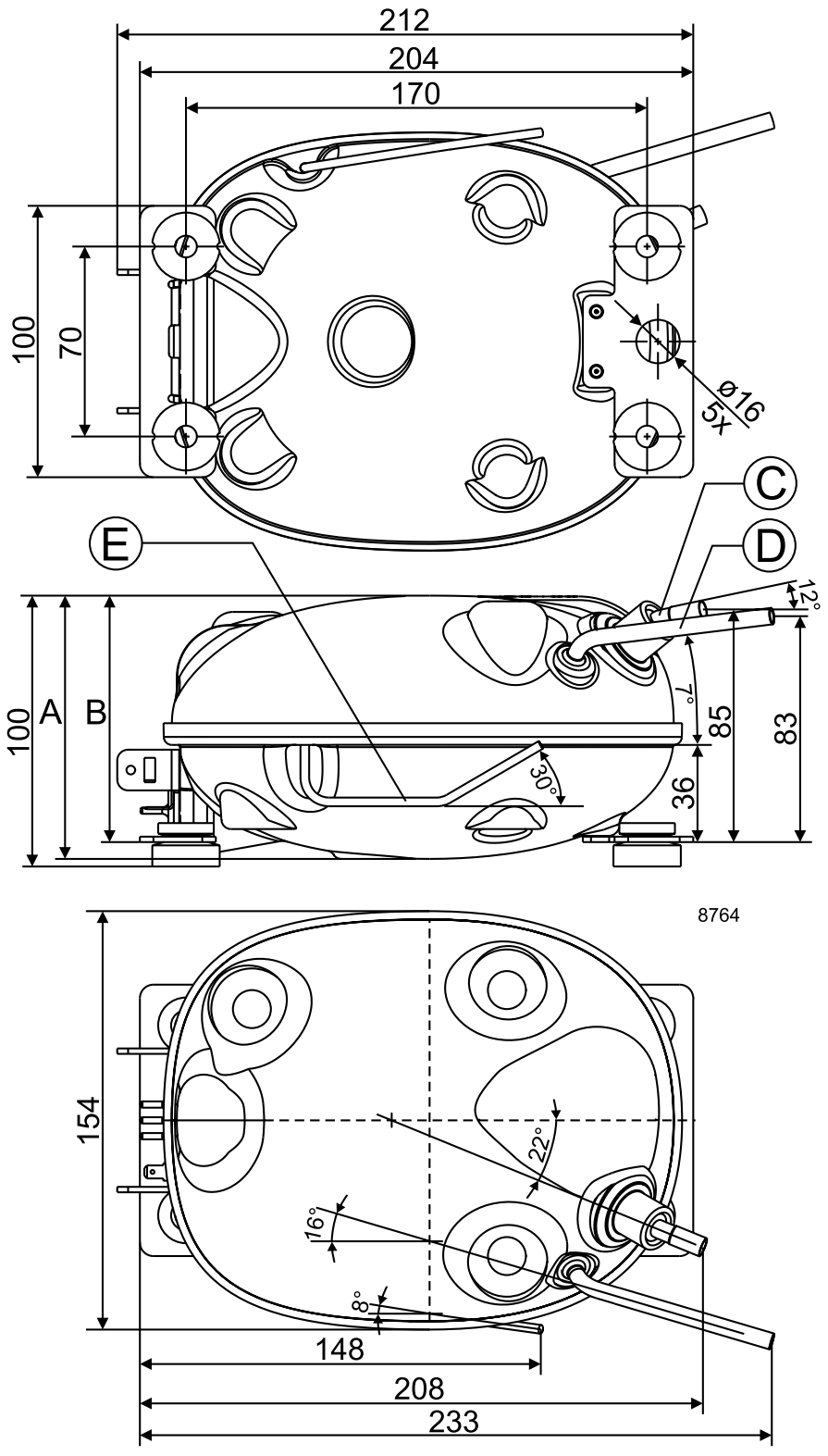
EMC conformity	According to 2004/104/EC
LVD conformity	According to EN 60335-2-34
RoHS conformity	According to 2011/65/EU
EMC conformity	EN 55014-2 household appliances
Line surge	IEC 61000-4-5 (com. mode 2 KV, diff. mode 1 KV)
Burst	IEC 61000-4-4 (standard 1 kV, tested 4 KV)
Power interruption	IEC61000-4-11
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 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

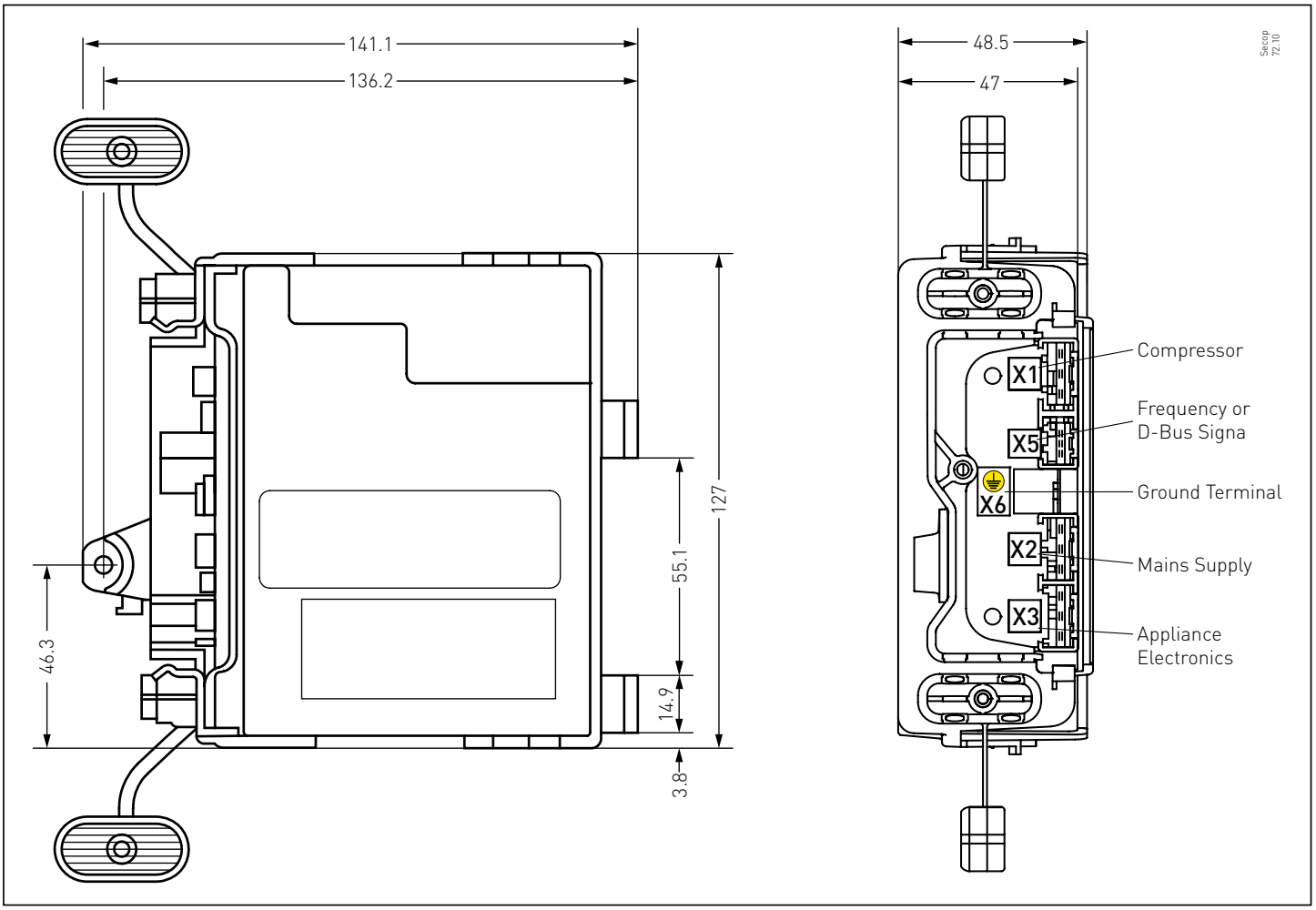
Wire recommendation	Mains		0.5-0.75 mm^2
	Harness		0.5-0.75 mm^2, AWG 22, 24 (multi wired)
	COM		0.2-0.35 mm^2 twisted

Connectors	RAST 2.5 and RAST 2.5 power 4.8 mm flat pin

6.2 Dimensions, compressor

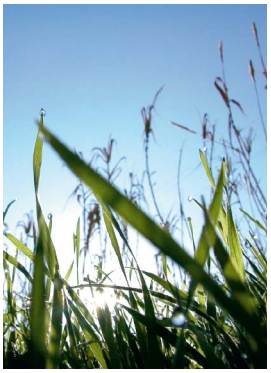


6.3 Dimensions, detached electronic unit



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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