WITH MORE THAN 50 YEARS OF EXPERIENCE IN COMPRESSOR TECHNOLOGY AND HIGHLY COMMITTED EMPLOYEES, OUR FOCUS IS TO DEVELOP AND APPLY THE ADVANCED COMPRESSOR TECHNOLOGIES TO ACHIEVE STANDARD SETTING PERFORMANCE FOR LEADING PRODUCTS AND BUSINESSES AROUND THE WORLD.

SLV CONTROLLER
105N46XX SERIES

SECOP

OPERATING INSTRUCTIONS

TOOL4COOL®
Flexible control settings

TOOL4COOL®

Flexible control settings

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1. INTRODUCTION

1.1 Applications

The SLV General Purpose controller 105N46xx regulates temperatures in refrigeration appliances, including supermarket refrigeration, freezer cabinet systems and industrial kitchens.

1.2 Capabilities

The controller is fully functional in every operation required for modern refrigeration control. The controller connects to a range of interfaces such as potentiometers, LED displays, PC software and bus monitoring systems. The controller features an internal temperature and event logging system and general purpose interface for broad and flexible application.

1.3 Operating Conditions

The compressor should be operated under the following conditions:

- Line voltage: 230 V AC 50 Hz
- Ambient temperature: 0 to 43°C

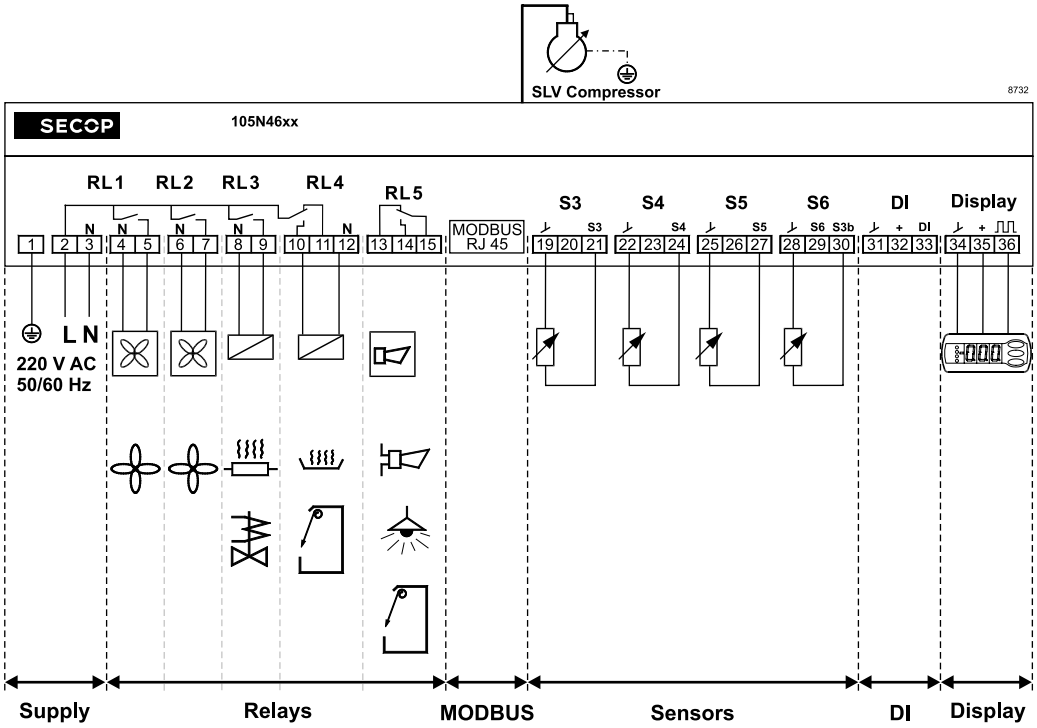
The controller should not be used in ambient air containing acid or alkaline. To ensure an optimal service life, the ambient temperature should be kept as low as possible (ambient temperature range for operation: 0 to 38°C compartment temperature, humidity 30 – 90%). The ventilation holes on the control units should not be covered and no objects should be lent up against the enclosure. The control system should not come into contact with dust or water. Ambient temperature range for storage: - 20°C to 70°C

1.4 Programming Interface

The controller can be accessed via:

- The local display CRA 172
- The Secop PC Service tool TOOL4COOL® together with a Bluetooth® gateway
- The Danfoss software tool, ADAP KOOL® via Modbus
- A custom interface - please contact Secop for further information regarding custom interfaces.

1.5 Hardware Interface Description



Supply
These are the supply lines.
The L and N supply terminals must be from the main supply.
The E must be connected to protective earth.
Please refer to the hardware specifications for the approved operating conditions.

Relay section
There are 5 relays which can be used for several purposes; they can be configured by the software parameters. The R1, R2, R3 and R4 are active outputs that direct the supply voltages to the output terminals. The R5 is galvanic separated and can be used for either switching external supply voltage or switching external auxiliary signals.
Please refer to the hardware specifications for approved operating conditions.

Modbus
This galvanic insulated terminal is used to connect a bus system according to the Modbus standard.
Please refer to the hardware specifications for approved operating conditions.

Sensors
There are up to 5 temperature sensor inputs available. The use of the sensor can be configured by the software parameters. Generally the S3 and S4 sensors are used to measure the product's temperature, S5 for controlling defrost, S3b for auxiliary functions and S6 for the temperature logger system.
Please refer to the hardware specifications and accessory listings for specification, approved operating conditions and sensors.

Digital Input DI
The digital input can be used to connect the auxiliary contact device, external for the door sensor and light switch. The controlling function can be selected by the software parameters.
Please refer to the hardware specifications for approved operating conditions.

Display
The display connection is used to connect the Secop display CRA 172.
Please refer to the hardware specifications for approved operating conditions.

Safety hints:
Sensors, DI and Display connectors are not insulated. Each appliance needs an insulation which is acceptable for 230 V environment.
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.

1.6 Functions

The main functions of the SLV compressor are:

- Motor control for the energy-optimised variable speed brushless DC motor used in the Secop SLV compressor
- Management of minimum and maximum run times
- Condenser and compressor fan control
- Temperature measurement and algorithms for determining the temperatures in the cooling application
- PI control to determine the required cooling capacity
- Display control (optional)
- Control menus to change the operating status or set parameters
- Alarm system reporting faults on the display, with a buzzer, via the Modbus interface, or via the alarm relay
- Data logging system to store events in the memory of the control unit. Data logs can be read via the system bus
- Hot gas defrost system
- Cold storage fan control module
- Modbus communication for supermarket monitoring systems

The controller also features integrated monitoring of the operating conditions and takes corrective action to prevent any damage to the electronics, which may occur in the event of an overload.

The following monitoring functions ensure that operating conditions remain within the acceptable range:

- Temperature sensor on the printed circuit boards to monitor the temperature of the electronics in the enclosure.
- Temperature sensor to monitor temperature in the motor inverter.
- Monitoring for correct motor speed; motor speeds outside the permissible range can damage the valves and bearings.
- Inadequate line voltage due to fluctuations in the line supply.
- Locked rotor caused by excessive pressure.

Other advantages:

- Minimal start current required due to non-simultaneous compressor and fan start up schedules.
- Controlled restart.
- Control of the pressure equalization time.

2. INSTALLATION

Installation involves the following steps:
- Checklist
- Connect cables
- Install gateway driver
- Set Modbus address in controller
- Software installation and configuration

2.1 Checklist

Check that you have the following before starting installation:

Secop SLV 105N46xx series controller	
Tool4Cool® LabEdition software installation CD	
Service Product key for SLV controller	**- on request -**
NTC temperature sensors (colour-coded)	
Display CRA 172 (cable must be ordered separately)	
Secop Bluetooth® gateway with USB power supply · Gateway · USB power supply · DSUB-9 / RJ45 adaptor · RJ45 Ethernet patch cable (not available from Secop)	

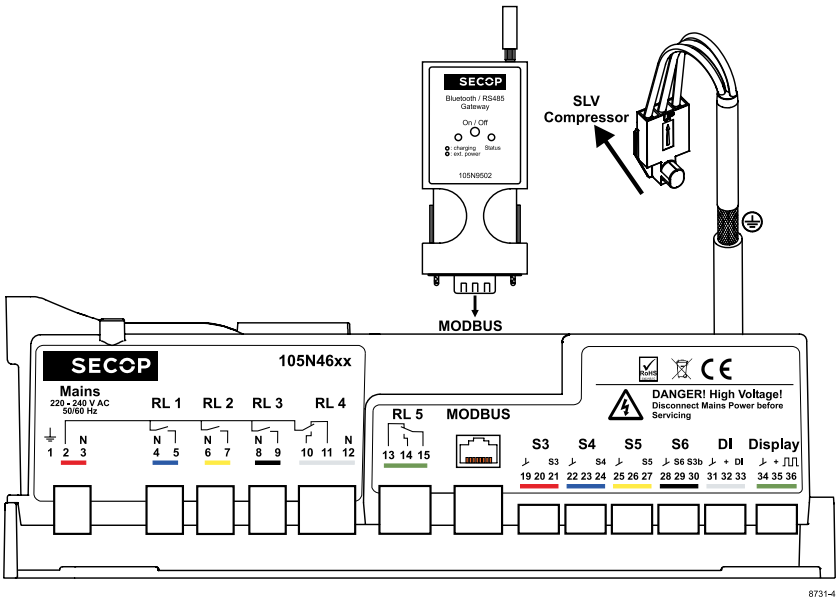
2.2
Connect Cables

The maximum cable length should not exceed 3 metres for all internal and external applications. A cable length of more than 3m could alter the EMI performance. In this case, the customer must make application specific inquiries to determine requirements for the certification of cooling applications. Under normal circumstances the supply line and the communication lines are longer; it is recommended to follow the installation guideline for the Modbus.
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.

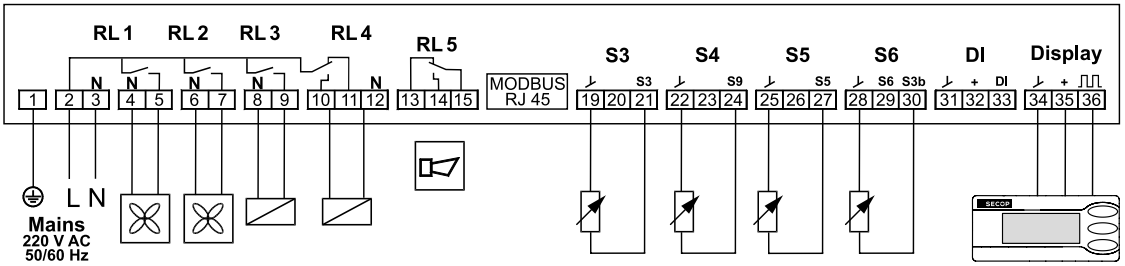
The compressor must be connected directly to PE; due to the low voltage decree. The PE connection by the motor cable shield has a more functional cause and is not sufficient as a safety relevant connection, so in case of an error it is not able to carry the whole current.
The cable shield of the motor cable must have a low impedance connection to the compressor. The connection should be made to the compressor where the shield has a large surface area. The newer compressors will come with a clamp instead of a plug for the shield.
Signal and data lines can be put together but divided from the 230 Vac power lines, including those lines which are switched by the internal relays.

The relay switched lines may be put together with the supply line as long as the other lines are not carrying current disturbances. The preferred way of installation heavily relies on the switched loads. In case of doubt the lines should be installed separately; to avoid coupling of disturbance between the lines. Connecting the Modbus communication line between two devices when the cable is installed outside the building or between two buildings is not allowed. This prevents potential induction problems, in case of lightning.

2.3
General Wiring



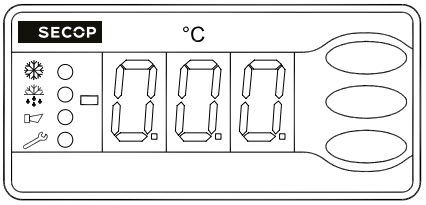
Schematic drawing showing 105N46xx controller for one SLV compressor in default configuartion



2.4 Display

The controller has a connection port for a CRA 172 display for local operation and temperature readouts. Furthermore it's possible to use the display for alarm indication, depending on whether the function is enabled.

As well as the 3½ digit LED display, the CRA 172 also has 3 buttons.



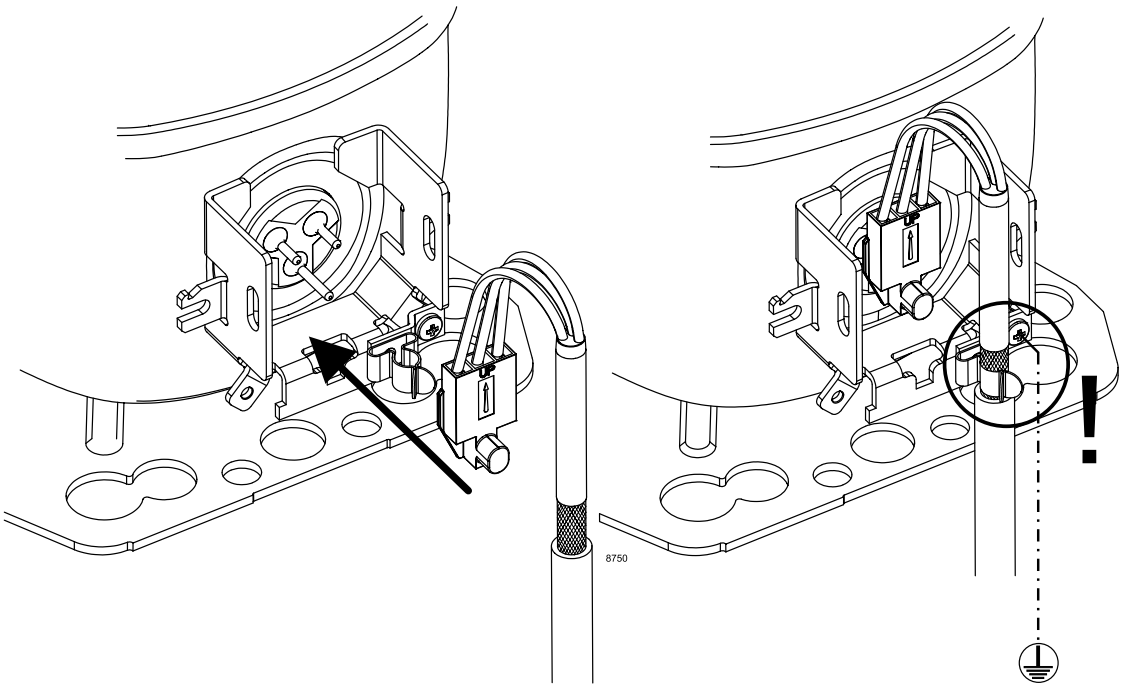
Display CR-172

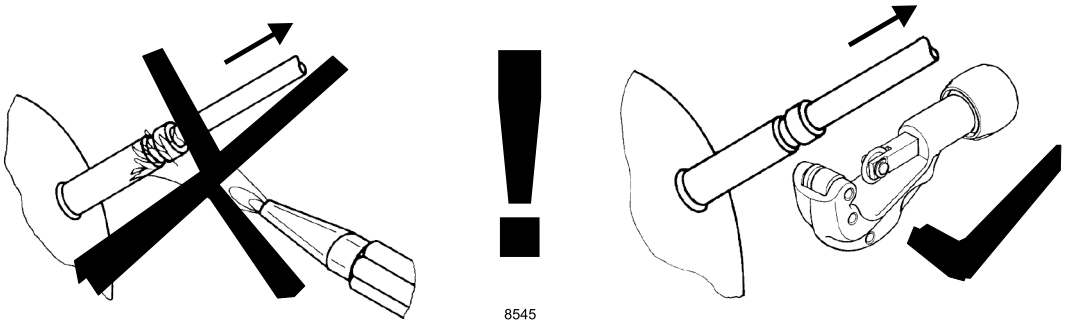
2.5 Modbus RTU

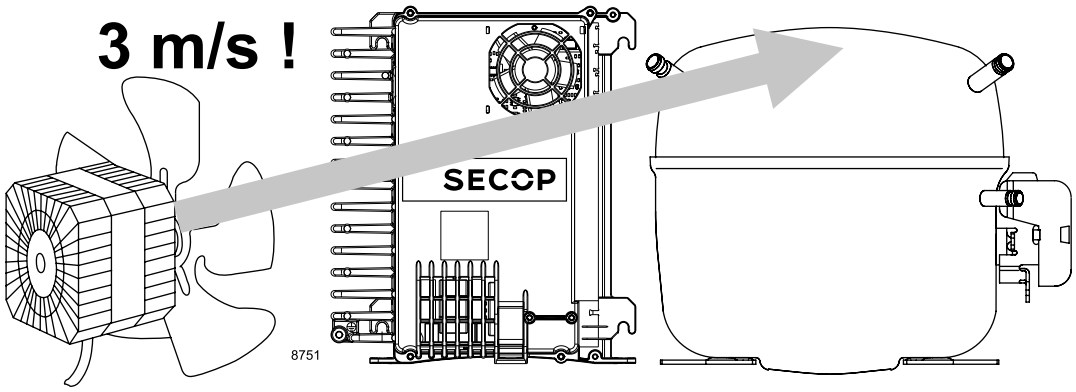
The bus can be connected to a bus monitoring system based on the Modbus specification for RS-485 based interfaces. The bus connection can be used for remote monitoring of the cabinet or for local service by means of the Tool4Cool® service tool.

For further information, please refer to section 6, Modbus

2.6 Mains / Earthing / Compressor







Airflow	3 m/s
Operating conditions	-10 °C to 43 °C - humidity < 90 % rH non condensing
Storage conditions	-20 °C to 70 °C - humidity < 90 % rH non condensing
Supply voltage	230 V (+15 % / - 20 %)
Frequency	50/60 Hz
Input power rating	max 1000 W at 230 V (+15 % / - 20 %)

3.
USER INTERFACES

3.1 Display CRA 172 Operations

The different parameters of the SLV controller can be accessed via the local display or via the Modbus. In this section, only the local display interface will be described.

The display CRA 172 performs the following functions:
Daily operation of the cooling appliance, readout of measurements and status of the refrigeration system, actual temperature, alarms, defrost activation, stop mode, setting of parameters, reset of alarms and more.
By entering the correct access code, it's also possible to get into the service level of the controller.
Besides the numeric display, there are 4 additional LED's which show the status of Alarm, Defrosting, Service and Cooling.

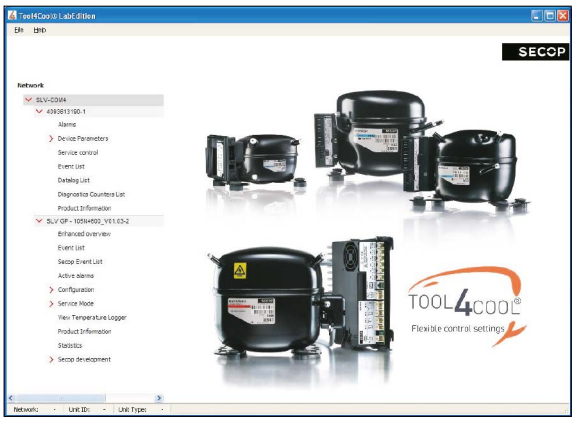
To access the different parameters of the SLV controller for the local display interface, there are three different access levels. Each level can be protected with an individual access code, defined by the manufacturer of the cooling appliance. If a level is protected with an access code, this code must be entered first.

If the SLV controller is accessed via both the CRA 172 and the Modbus at the same time, the latest modified value for a setting will be stored as the final.

3.2 Operating using TOOL4COOL®

The controller can be programmed and optimized via the Bluetooth® gateway from a PC using the Tool4Cool® software. An example of the Tool4Cool® user interface showing the main parameter groups of the SLV compressor is shown below. For details please look into the separate documentation

Example:



3.3 Operation using ADAP-KOOL®

The Danfoss ADAP-KOOL® software is used to control supermarket refrigeration systems. Please refer to existing documentation for operating instructions and further information. The literature number (in brackets) might change according to version and language:

- Data communication between ADAP-KOOL® refrigeration controls – Installation guide (RC8AC602)
- Service Tool AK-ST 500 Software for operation of AK controllers – Manual (RS8ES402)
- ADAP-KOOL® Refrigeration control systems – Catalogue (RK0YG402)

3.4 Operating using Third Party Software

The SLV controller can also be accessed from a third party front end. For details please contact lightcommercial@secop.com and refer to separate documentation available from Secop.

4.
DESCRIPTION OF FUNCTIONS

4.1 Application selector

4.1.1 Purpose
Many light commercial cooling applications are supposed to cool a variety of goods.
The cooling of different types of goods requires specific temperature settings and functions of defrosting, fan control etc. These settings are considered to be application dependent.
The selection of the application can be done by the end user, timer based or pre defined from the factory.

4.1.2 Functional description
Using the application selector, it is possible to select up to five different sets of settings which provide the SLV controller with different functions or simply different temperature settings.
The selection of the actual application can be done by the daily user via the local operation display, the internal control timer, digital input or as a factory selection at the OEM.

In the parameter overview the default settings for all parameters are shown for each of the five possible applications. Furthermore, the overview indicates whether a setting can be set differently for each of the five applications or if this setting is one common setting for all applications. If different settings are possible in the particular applications, this is indicated with an "x" in the column "Multi apps"

Before an application can be selected, this application must be enabled.

Application selection by the daily user:
If more than one application is enabled, the daily user can select one of the enabled applications by pressing the middle button on the display. If more than two applications are enabled, repeatedly pressing the middle button switches between the applications.

If the digital input DI1 is configured for application change over, the predefined application will be selected, as soon as the DI1 is closed. As soon as the DI1 is disconnected, the selection of application depends on the remaining settings.

If automatic application change over is desired, this can be achieved by using the control timer to select another application during the active timer. As an alternative, it is possible to force each application into another application, as long as the controller is in night mode.

4.1.3 Restrictions
For all the settings which can be programmed differently in the five applications, this is only made possible if the application has first been selected. This means that each application has to be programmed separately, by enabling and selecting the application prior to the programming.

4.1.4 Dependencies
None

4.2 Modbus Addressing

4.2.1 Purpose

The SLV controller can be mounted in a Modbus network of up to 247 controllers. To recognize the different controllers on the network, each controller must have its own, unique address.

4.2.2 Functional description

The Modbus address can be set either via the T4C service tool or the local display CRA 172. If the controller has a password, this must be entered first.
The address range can be set in the range from 1 to 247. Parameter 'Modbus address' (o03).

4.2.3 Restrictions

If the Modbus address is modified via the T4C, the user must ensure that the new address is within the setting range of the T4C, otherwise the communication to the controller will be lost, until the correct address range has been selected on T4C and the network has been scanned again.

4.2.4 Dependencies

None

4.3 Temperature acquisition

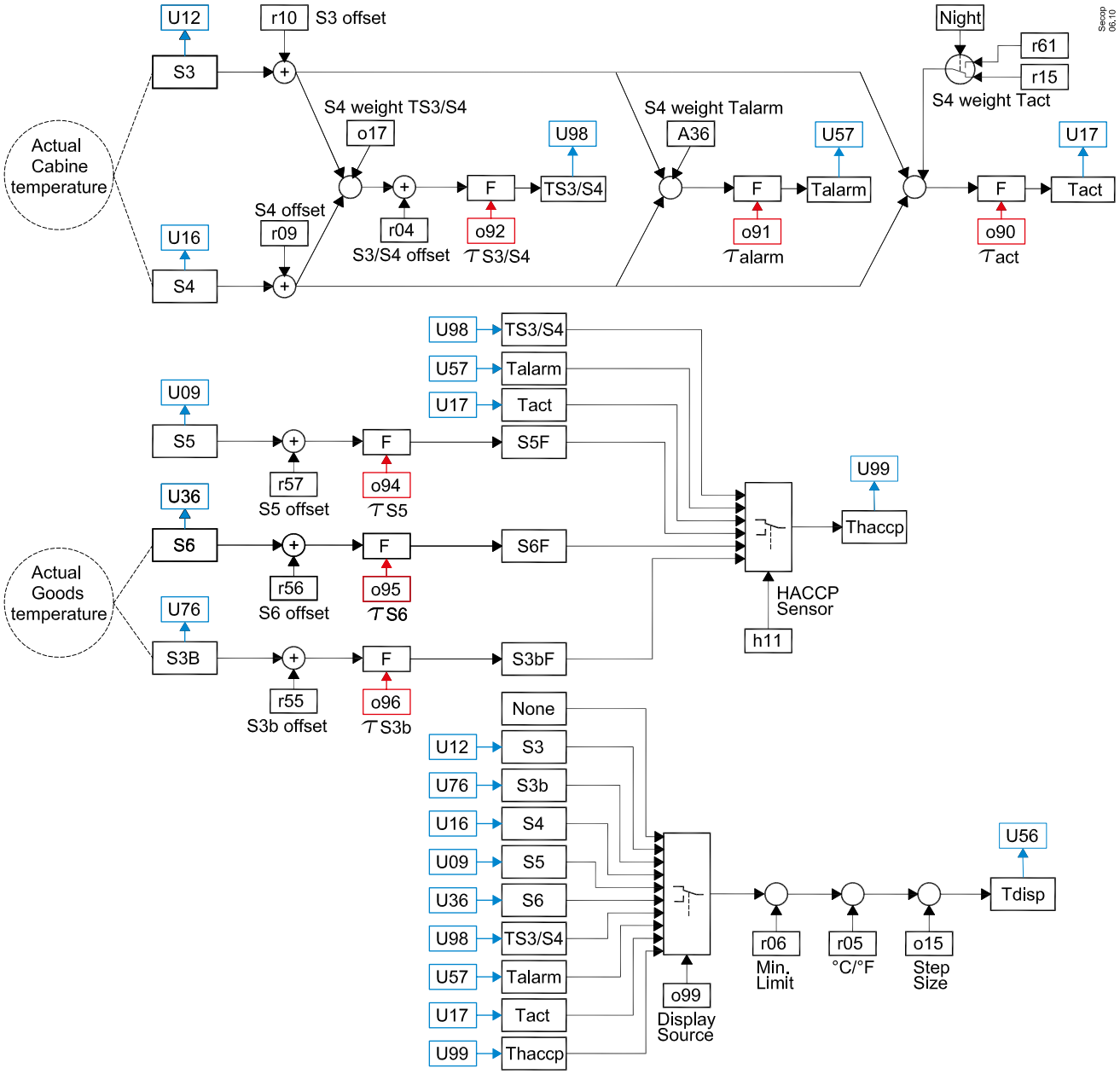
4.3.1 Purpose

The temperature acquisition system handles all the temperature measuring related issues, such as sensor selection, weighting of sensors and sensor error detection.

4.3.2 Functional description

The SLV controller has 5 sensor inputs. The S3, S3b, S4 and S5 sensors are compatible with the 5K NTC sensors. The S6 sensor uses a Pt1000 sensor.

Important remark: The sensor inputs are not galvanic separated and the sensor inputs are connected directly to the mains supply! For that reason only double isolated sensors must be used.



Weighting of sensors

In some cases it might be necessary to use 2 sensors, to achieve the correct temperature measurement. For measuring the cabinet temperature, the sensors S3 & S4 can be used, or a mix of these. Furthermore, it's possible to use different weighting of the 2 sensors during the day and night time. The parameters "S3/S4. Weighting for Tact at day" (r15) and "S3/S4 Weighting for Tact at night" (r61) give the weighting for day and night respectively. If set to 100% only the sensor S4 is used. If set to zero, only the S3 sensor is used.

In the same way, it's possible to weight the S3/S4 sensor for the alarm thermostat, "Weighting for alarm thermostat S4" (A36) and for the internal parameter "S3/S4" (U98), which amongst others can be used as input for the read out on the display.

4.3 Temperature acquisition (continued)

Offset adjustment of temperature measurements
To compensate for measuring errors or wrong placement of the sensor, all sensors include an offset adjustment. With the parameter "Sx offset" (r09), (r10), (r55), (r56) and (r57) it is possible to adjust the respective temperature measurements from -10 to 10 K.

Filtering of temperature measurements
Furthermore all temperature measurements can be filtered with the parameter "Filter constant for Txx"(o90 to o96)), which can be used for very unstable or fluctuating temperatures.

0: No damping, (fastest updating of the read out)
1: 0,10 K/sec
2: 0,09 K/sec
3: 0,08 K/sec
4: 0,07 K/sec
5: 0,06 K/sec
6: 0,05 K/sec
7: 0,04 K/sec
8: 0,03 K/sec
9: 0,02 K/sec
10: 0,01 K/sec (slowest updating of the read out)

Read out on the display
It's possible to select between a variety of different parameters to be shown on the CRA 172 display, "Display temperature" (099).
With "Minimum limitation of Display read out" (r06) the minimum read out can be limited downwards.
Furthermore, it's possible to select, whether the temperature read out on the display must be in °C or °F.
The parameter "Temperature unit" (r05) is default set to °C.

Restrictions
All sensor inputs include a detection of open or shorted sensors. A sensor alarm will only be reported and sent out if the sensor is being used by a function. If a sensor fails the sensor readout will be set to -300 °C for an open circuit and +300 °C for a shorted sensor.
If the sensors S3/S4 are used in a weighted combination and one of the sensors fails, the sensor without failure will be used and the weighting is disabled.
An alarm will be sent out for the defective sensor.

4.3.3 Dependencies
The step resolution for the display will be defined by the parameter "Display temperature step resolution" (o15). See chapter for "Local display indication and menu structure"

4.4 Temperature logger

4.4.1 Purpose

The SLV controller has an internal temperature logger, which can log a predefined temperature directly into the memory of the SLV controller. It is possible to attach an alarm to the logger, which will warn when the upper or lower alarm limits are exceeded and when the alarm delay timer has elapsed.

4.4.2 Functional description

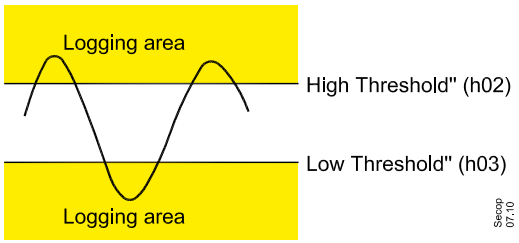
Using the parameter "Selection of sensor for the logger function" (h11), it is possible to select a temperature sensor or an internal temperature calculation for the temperature logger. If no sensor is selected, the logger will not begin. The speed of logging is determined by "Log interval" (h01). The number of logs is limited to 1000. This means that the duration of the logging period depends on the number of logs. For logging duration, please see the following table.

Logging interval	Maximum log duration in hours	Maximum log duration in days
15 minutes	250	10 days
30 minutes	500	20 days
60 minutes	1000	40 days

As soon as the logger is full, the oldest logs will be deleted and overwritten with a new log.

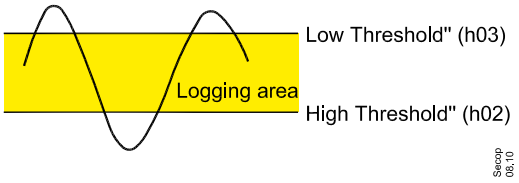
To limit at a certain number of logs, it is possible to set up thresholds for the logging range.

Logging of temperatures outside a predefined range:



If the "High Threshold" (h02) is set higher than the "Low Threshold" (h03), only temperatures outside these limits will be logged.

Logging of temperatures inside a predefined range:



If the "Low Threshold" (h03) is set higher than the "High Threshold" (h02), only temperatures inside these limits will be logged.

If the "Low Threshold for logging" and "High Threshold for logging" are set equal, no logging will be performed.

Furthermore the temperature logger contains a separate high alarm function (h12) with adjustable alarm delay (h13)

4.3.3 Restrictions

The maximum number of logs is limited to 1000.
In the event of a sensor error on the selected temperature probe, there will be no logging, but a sensor error alarm will be generated.

4.4.4 Dependencies

None

4.5 Temperature alarms

4.5.1 Purpose

The SLV controller contains a temperature monitoring function, which will generate temperature alarms, depending on if the temperature has exceeded some predefined limits. For some of the alarms a delay timer can be set up.

4.5.2 Functional description

For the temperature alarm function, it is possible to use a different weighting of the temperature sensors S3 and S4, compared to the one for the control thermostat (A36). This measurement will be compared with the High and Low alarm limits. If the limits are exceeded, a delay timer will begin. The controller has two different alarm delays, depending on whether the controller is in normal running mode (A03) or is starting up after the initial start, end of defrosting or case cleaning etc (A12).
An alarm will be generated after the delay timer has elapsed. Depending on the settings for the Alarm Handler, chapter 4.22, an alarm will be shown on the local display, or the local alarm relay will be activated.

4.5.3 Restrictions

None

4.5.4 Dependencies

In case of a sensor error the temperature monitoring will stop and a sensor error will be sent out. If the alarm thermostat is only using S3 or S4, the sensor error monitoring is only enabled for the active sensor.

4.6 Reference for the capacity controller

4.6.1 Purpose

The purpose of the reference function is to generate a reference for the compressor capacity controller and to create the limits for the temperature setting range during the day and night time. Based on the deviation between the actual temperature Tact , compared to the temperature reference Tref, the capacity controller will increase or decrease the requested compressor capacity. The bigger the deviation, the faster the requested compressor capacity will be adapted.

As an option, the reference can also be obtained by using the digital input DI1 as an analogue input.

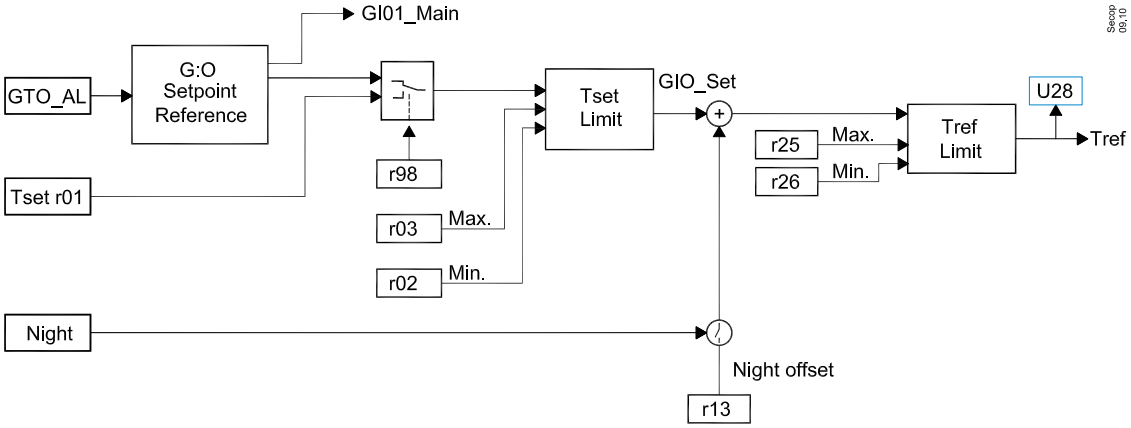
4.6.2 Functional description

Measurement and calculation of actual cabinet temperature T_{act}

The cabinet temperature can be measured with either S3, S4 or in special applications as a weighted combination of both. In the event of wrong temperature measurements, due to wrong placement of the sensors, both temperature inputs include an offset adjustment possibility. "Offset calibration of the S4 sensor" (r09) and "Offset calibration of the S3 sensor" (r10).

For the cabinet temperature measurement, with S3 and S4, a weighting of these 2 sensors is implemented. The weighting can be different for the day and night time. "S3/S4 weighting for Tact at day (100%=S4, 0%=S3)" (r15) and "S3/S4 weighting for Tact at night (100%=S4, 0%=S3)" (r61).
If the weighting is set to 100%, the temperature acquisition module only uses the S4 sensor. If set to 0%, only the S3 sensor is used. If set to 50%, a 50/50 mix is used etc.

Calculation of Tref



The temperature reference Tref for calculating the reference for the PID controller is calculated as follows:
Tref = Tset + "Night setback" (r13)

The setting range of Tset can be limited with the 2 parameters "T set max" (r02) and "T set min" (r03)
To avoid a temperature reference too high or too low, the allowed temperature reference band is limited with the following 2 set points:
"Tref min "(r25) and "Tref max."(r26)

Besides this limitation of the temperature reference, the actual temperature Tact is calculated on temperature measurements of S3 (U12) and S4 (U16). Both measurements can be offset adjusted (r10 and r09), before a weighting is performed. This weighting can be different during the day and the night time (r61 and r15). Finally a filtering of the calculated value can be performed, to avoid fluctuations of the Tact. (O90)

Reference via external signal???
Description of parameter (r98), GIO Setpoint reference, is missing

4.6.3 Restrictions

None

4.6.4 Dependencies

If a weighted sensor signal for the Tact is chosen and one of the sensors S3 or S4 is detected to be defective, a sensor error for that sensor will be generated. For the calculation of Tact the contribution from this sensor will be ignored and the Tact will only be based upon the remaining functioning sensor.

4.7 Compressor capacity control

4.7.1 Purpose

The purpose of this function is to calculate the requested compressor capacity, which is needed to cool down or maintain the correct cabinet temperature during normal temperature control.
During the pull up/down of the cabinet, after the initial start or after a defrosting sequence, the capacity controller will be over ruled by predefined capacity requests.

4.7.2 Functional description

The reference "T ref" for the controller is given by the reference function, based upon either the temperature sensor S3, S4 or a mix of both. The ratio between them is set by the setting "S4 weight %". 100 % means sole usage of S4 while 0% means solely S3 etc.

The determination of the actual requested compressor capacity is based on a PI controller, which compares the actual temperature with the reference temperature. The bigger the deviation of the temperature, the faster the adaptation of the compressor capacity is performed.
The SLV compressor can be speed controlled in the range from 50% to 100%, corresponding to 2000 to 4000 revolutions per min. If the requested compressor capacity is less than 50%, the compressor will start and stop at 2000 rev^{-1} on a PWM basis. As default, the "Compressor Period time" (g05) is set to 15 minutes. This means that the compressor will be running for a shorter or longer time within this period.

Requested Compressor capacity	Compressor speed, Period time = 15 minutes
0%	Compressor constantly stopped
25%	Pulse width modulation, PWM 7,5 minutes ON (2000 rev^{-1}) 7,5 minutes OFF
50%	Compressor constantly running 2000 rev^{-1}
75%	Compressor constantly running 3000 rev^{-1}
100%	Compressor constantly running 4000 rev^{-1}

The capacity controller contains compressor protection settings to prevent the start/stop of the compressors from occuring too often (g02, g03 and g04).

After initial start the compressor capacity will be set to 100%, until the reference temperature Tref has been reached. In some applications it might be an advantage to run the compressor at the pull down capacity for some extra time. Although the air temperature in the cabinet has reached the set point, the goods will still be too warm. For that reason, the pull down period can be extended, until the "Tact below Tref to end Pull Down" (n48) has been reached. After this the PI controller will be preset to a default value, depending on whether the controller is in day or night mode (n53 and n54).

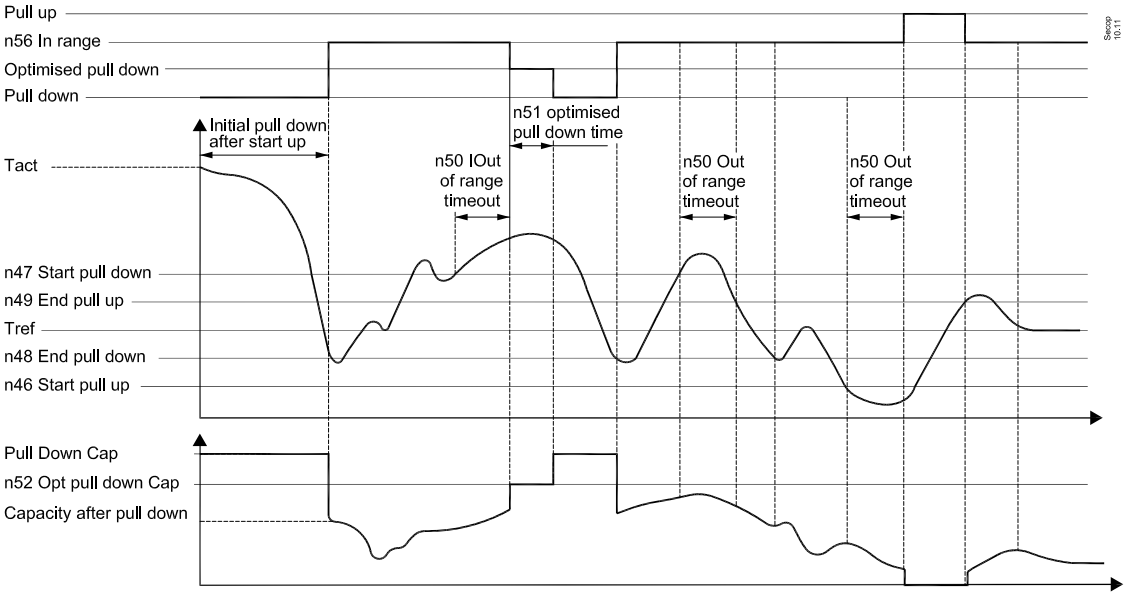
Depending on the size of the deviation between the reference temperature Tref and the actual temperature, the requested capacity will now be increased or decreased faster or slower. The speed of adapting the requested capacity depends on the settings for the PI controller.

Due to different load profiles for the different applications, the controller has a "smart setting for PI control" (n30) application. The default setting is medium control, but if a faster adaptation of the requested compressor capacity is needed, this can be changed to fast or even very fast control. On the other hand, this can also be set to slow or very slow, if the cooling application requests this. In situations, where one of these settings is not suitable for the application, the PI settings can be adjusted by the customer (n35 to n43). It is recommended to contact the supplier of the controller for optimal adjustment. Although, the right smart setting or individual adaptation of the PI controller has been chosen, it might happen from time to time, that the cabinet temperature exceeds a pre defined minimum or maximum limit, compared to the temperature reference Tref.
As soon as the temperature reaches the limit of "Tact above Tref to start Pull Down limit" (n47) or the limit of "Tact below Tref to start Pull up limit" (n46), a timer "Temperature out of range timeout" (n50) begins. After this timer has elapsed, a forced Pull up or Pull down starts. The timer will be reset, as soon as the temperature is back within the min and max limits.

If a pull down is requested, the compressor capacity will be preset to "Optimised pull down capacity" (n52). This capacity will be applied, until the time "Optimised pull down time" (n51) has elapsed. Hereafter the compressor will run at 100%, until the setpoint has been reached.
If a forced pull up has been initiated, the compressor will stop, until the temperature exceeds "Tact above Tref to end Pull up" (n49).

If the digital input DI1 is defined to be used as a door switch, it is possible to stop the evaporator fan during open doors. It is also possible to override the capacity controller at the same time. The compressor can be stopped "Compressor Capacity switching on door open" (n22) or the compressor capacity can be preset by "Compressor Capacity at door open" (n23). As soon as the door is shut again, the capacity controller will resume with the same capacity as prior to the door opening.

4.7 Compressor capacity control (continued)



4.7.3 Restrictions

Defrosting:

The PI controller is suspended during a defrosting sequence. Prior to a defrosting, the actual requested compressor capacity is stored in the memory. After the end of defrosting and following pull down of the temperature to a set point, the normal capacity control is resumed, based upon the previous stored capacity.

Emergency cooling:

In the event of sensor errors, the capacity controller stops and the compressor capacity is preset to a customer specified value, "Emergency cooling Capacity during S3 / S4 error" (n21). For more information see the chapter "Emergency cooling"

4.7.4 Dependencies

The compressor capacity control can be overridden by an analogue signal on the DI depending on that the parameter "I/O function" (o02) is set to 16.
A 500 kΩ logarithmic potentiometer connected to pin 31 and pin 33 is now representing a requested compressor capacity between 0% and 100%.
All remaining control functions are not affeted by this!

4.8 Safety function

4.8.1 Purpose

The purpose of the "safety function" is to stop the compressor, if the pull down after a defrosting fails, due to an open hot gas valve.

4.8.2 Functional description

The safety function monitors a predefined temperature after a defrosting sequence. The temperature is selected with the parameter "Check temperature" (P50). If the compressor is running and the hot gas valve is closed properly, this temperature is expected to be below the "Maximum Check value" (P50), within a predefined time, "Time after compressor start to check" (P51). If this isn't the case, the compressor will stop and an alarm generated.

4.8.3 Restrictions

None

4.8.4 Dependencies

None

4.9 Emergency cooling function

4.9.1 Purpose

The purpose of this function is to ensure a reasonable level of refrigeration in case of a reference temperature sensor error.
For low temperature applications, it is better to run at a high compressor capacity while high temperature applications prefer a reduced capacity, to prevent freezing of the chilled gds.

4.9.2 Functional description

If the sensor required by the application input setup is in a sensor error state, an emergency cling function takes over and presets the requested compressor capacity to "Emergency cling capacity during S3 / S4 error" (n21). The emergency cling function takes over the normal capacity control, while all remaining functions will run unaffected.
When normal compressor capacity control resumes, the PI controller will be "released" from the emergency cling level and the requested compressor capacity will adapt to the actual needed capacity,

4.9.3 Restrictions

The function is overruled by the main switch off, service mode, case clean mode, loading of cabinet, dr function cut out or the defrost mode, which do not contribute to the calculation of the requested compressor capacity.

4.9.4 Dependencies

If a weighting of S3 and S4 is to be used for the input to the temperature reference, the emergency cooling function will only be enabled when both sensors are detected to be defective. If only 1 sensor is defective, the calculation of the cabinet temperature will be based upon the remaining sensor.

4.10 Defrost control function

4.10.1 Purpose

The purpose of the defrost control function is to manage all aspects related to the defrosting of the appliance. The start of the defrosting can be based on an internal real time clock, remotely controlled or manually initiated by the end user.

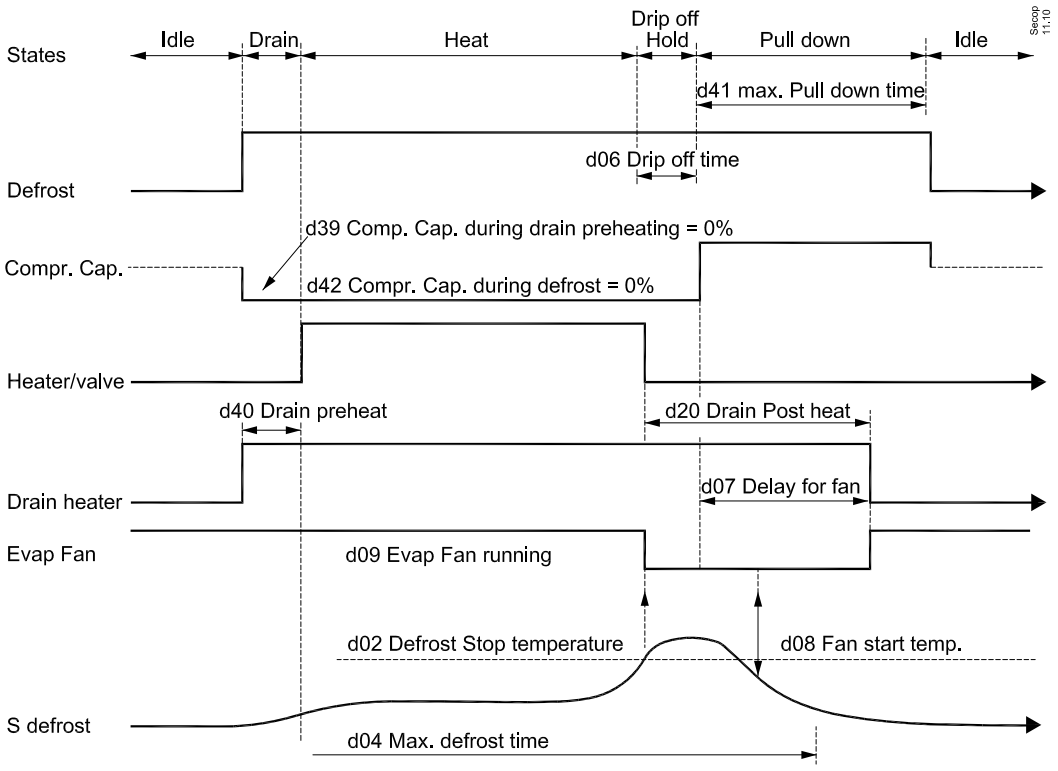
4.10.2 Functional requirement description

Depending on the chosen cooling application, different defrosting sequences apply. In the following a "worst case scenario" for a defrosting sequence is described. Depending on the different defrosting modes, some of the functions can or will be omitted. Through settings, the user can choose between Passive, Electrical or Hot gas defrost. The setting, "Defrost stop Sensor" (d10), allows the customer to define, which temperature sensor must be used for termination of the defrosting on temperature. When no sensor is chosen, the defrosting will only be terminated on time and the mentioned safety function below will be disabled.

4.10 Defrost control function (continued)

4.10.2.1 Passive defrost:

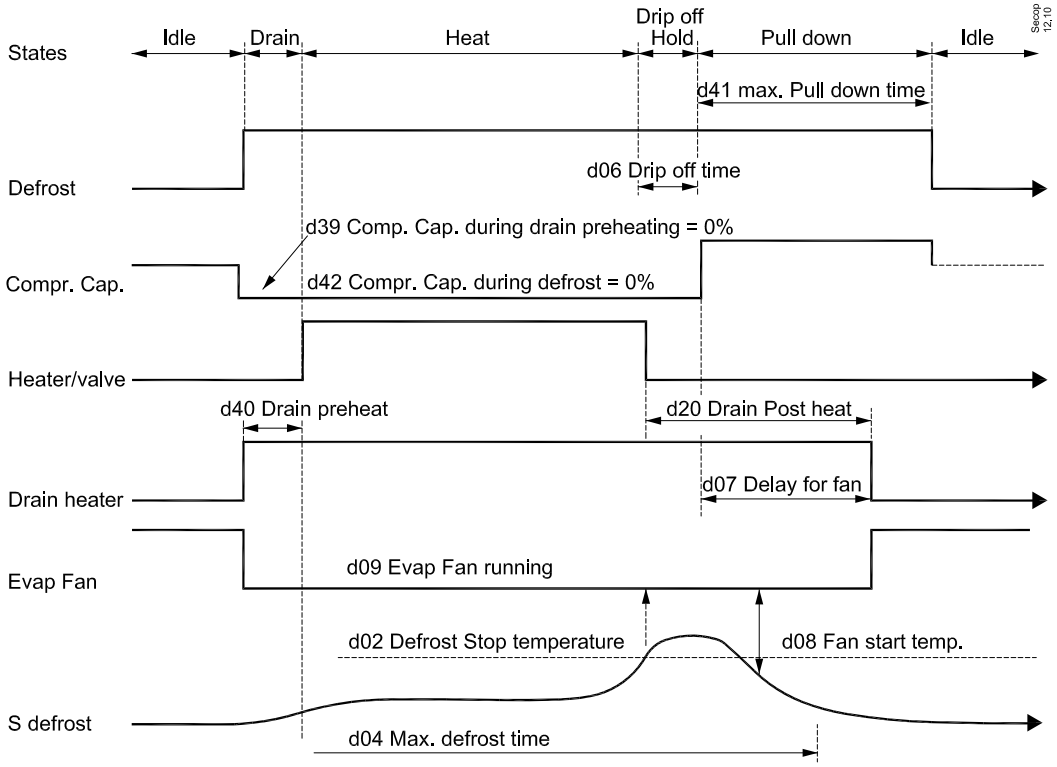
1. Defrost starts according to internal schedule, manually via display or DI, remotely or via Front end
2. The actual requested compressor capacity is stored in the memory and the compressor is set to OFF, depending that the setting "Compressor capacity during drain preheat" (d39) is set to 0%. If an evaporator fan is mounted, this is set to ON. The parameter "Evaporator fan running during defrost" (d09) must be set to 1!
3. The drain heater (if mounted) is energized for a preset time "Drain pre heating time" (d40). The heater is kept ON during the whole defrost period and until the timer "Drain post heating time" (d20) has elapsed, after the defrost stops.
4. The compressor remains off, dependent that the "Compressor capacity during defrost" (d42) is set to 0% and the relay for heater/valve is activated.
5. Defrosting continues, until the "Defrost stop temperature" (d02) has been reached, measured with S5. If the temperature has not been reached before the "Max defrost time" (d04) has elapsed, the defrosting is terminated anyway and an alarm is sent out. If no stop defrost sensor is selected, the defrosting terminates with the timer only.
6. Before starting the compressor for new "Pull down", the evaporator fan, if mounted, remains stopped for a preset time, to drain the evaporator. "Drip off time" (d06). During drip off, the "Compressor capacity during drip off time" (d43) forces the compressor capacity to a preset value. After this timer has elapsed, the compressor is released for a new pull down. The fan remains stopped for another preset time, "Additional delay for evaporator fan start after drip off" (d07), to "tie" water drips to the evaporator. In some cases it might be desired to control the starting point according to the evaporator temperature only. In such cases the "Additional delay for evaporator fan start after drip off" (d07) must be set to a very high temperature, so that the start is controlled according to the evaporator temperature "Evaporator fan start temperature" (d08).
7. Evaporator fan starts
8. The compressor continues the "Pull down" until the set point has been reached, thereafter normal capacity control resumes with the same capacity as before the defrost started.



4.10 Defrost control function (continued)

4.10.2.2 Electrical defrost:

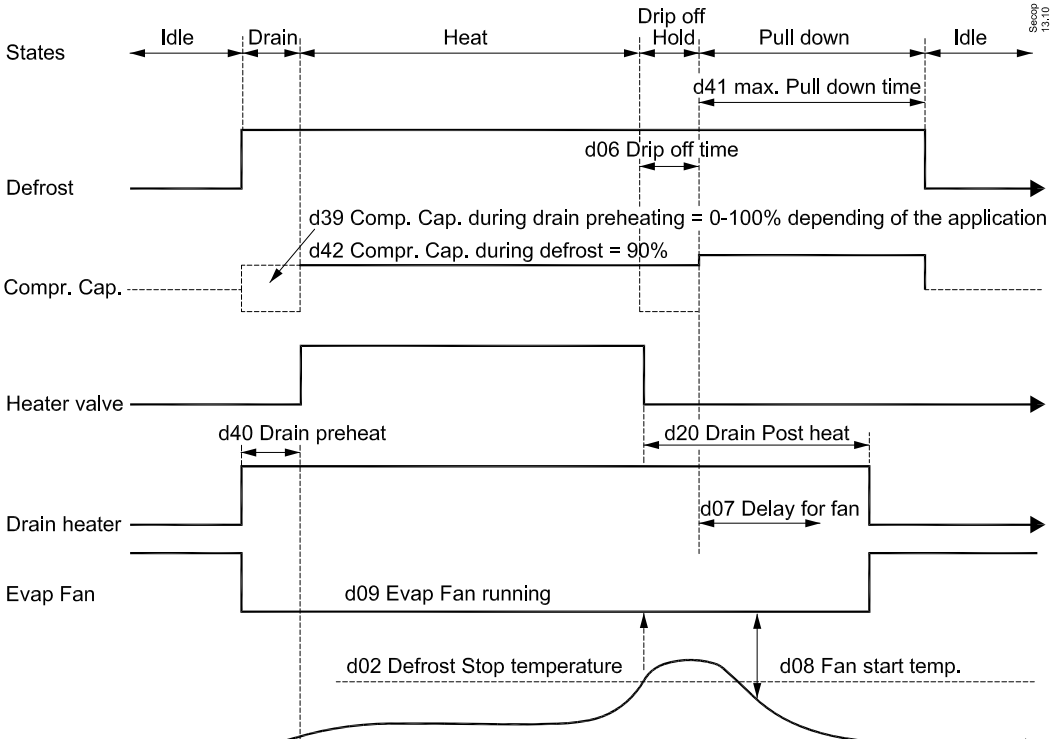
1. Defrost starts according to internal schedule, manually via display or DI, remotely or via Front end
2. The actual requested compressor capacity is stored in the memory and the compressor is set to OFF, depending that the setting "Compressor capacity during drain preheat" (d39) is set to 0%. If an evaporator fan is mounted, this is set to OFF. The parameter "Evaporator fan running during defrost" (d09) must be set to 0!
3. The drain heater (if mounted) is energized for a preset time "Drain pre heating time" (d40). The heater is kept ON during the whole defrost period and until the timer "Drain post heating time" (d20) has elapsed, after the defrost stops.
4. The compressor remains off, dependent that the "Compressor capacity during defrost" (d42) is set to 0% and the relay for heater/valve is activated.
5. Defrosting continues until the "Defrost stop temperature" (d02) has been reached, measured with S5. If the temperature has not been reached before "Max defrost time" (d04) has elapsed, the defrosting is terminated and an alarm is sent out. If no defrost stop sensor is selected, the defrosting terminates with the timer only.
6. Before starting the compressor for new "Pull down", the evaporator fan, if mounted, remains stopped for a preset time, to drain the evaporator, "Drip off time" (d06). During drip off, the "Compressor capacity during drip off time" (d43) forces the compressor capacity to a preset value. After this timer has elapsed, the compressor is released for a new pull down. The fan remains stopped for another preset time, "Additional delay for evaporator fan start after drip off" (d07), to "tie" water drips to the evaporator. In some cases it might be desired, to control the starting point according to the evaporator temperature only. In such cases the "Additional delay for evaporator fan start after drip off" (d07) must be set to a very high temperature, so that the start is controlled according to the evaporator temperature "Evaporator fan start temperature" (d08).
7. Evaporator fan starts
8. The compressor continues the "Pull down" until the set point has been reached, thereafter normal capacity control resumes with the same capacity as before the defrost started.



4.10 Defrost control function (continued)

4.10.2.3 Hot-gas defrosting:

1. Defrost starts according to internal schedule, manually via display or DI, remotely or via front end
2. The actual requested compressor capacity is stored in the memory and the compressor capacity is preset to the setting "Compressor capacity during drain preheat" (d39). If an evaporator fan is mounted, this is set to OFF. The parameter "Evaporator fan running during defrost" (d09) must be set to 0! This can prepare some hot gas in the system.
3. The drain heater (if mounted) is energized for a preset time "Drain pre heating time" (d40). The heater is kept ON during the whole defrost period and until the timer "Drain post heating time" (d20) has elapsed, after the defrost stops.
4. The compressor capacity is set to a preselected setting "Compressor capacity during defrost" (d42) to generate hot gas for the defrosting. The relay for heater/valve is activated.
5. Defrosting continues, until the "Defrost stop temperature" (d02) has been reached, measured with S5. If the temperature has not been reached before the "Max defrost time" (d04) elapses, the defrosting is terminated and an alarm is sent out. If no defrost stop sensor is selected, the defrosting terminates with the timer only. Hereafter the hot gas valve is closed.
6. Before starting a new "Pull down", the evaporator fan, if mounted, remains stopped for a preset time, to drain the evaporator. "Drip off time" (d06). During drip off, the "Compressor capacity during drip off time" (d43) forces the compressor capacity to a preset value. After this timer has elapsed, the compressor is released for a new pull down. The fan can remain stopped for another preset time, "Additional delay for evaporator fan start after drip off" (d07), to "tie" water drips to the evaporator. In some cases it may be desired, to control the starting point according to the evaporator temperature only. In such cases the "Additional delay for evaporator fan start after drip off" (d07) must be set to a very high temperature, so that the start is controlled according to the evaporator temperature "Evaporator fan start temperature" (d08).
7. Evaporator fan starts
8. The compressor continues the "Pull down" until the set point has been reached, thereafter normal capacity control resumes with the same capacity as before the defrost started.



4.10
Defrost control function (continued)

4.10.2.4 Defrosting start

The SLV controller includes a real time clock and a defrosting schedule which can start the defrosting. It is possible to set up a defrosting schedule on a daily or weekly basis. "Number of defrosts" (d90).

0 = Never, No automatic defrost,
Only manual or remote defrost start is possible.

1 = One pr. Day, based on the real time clock
The start time for each day in hours, (d71) to (d77) and minutes, (d81) to (d87)

2 = Multiple defrost per day at fixed hour, based on the real time clock
The SLV controller can initiate up to 8 defrosts per day. The first to last daily defrost start time in hours, (d71) to (d77) and minutes, (d81) to (d87)

3 = Multiple per day, timer based with fixed interval, set via d03.
Every time a defrosting has been performed, a new defrosting will be initiated with a fixed interval after the termination of the previous one.

4 = Defrost on demand
Interval between defrost, when multiple defrost per day has been chosen. (d90 = 3)

To prevent defrosts from occurring too often, the parameter "Min interval between defrost" (d62) can be set in the range of 0 to 168 hours. This protection timer can only be reset by switching OFF and ON the mains supply to the controller. The controller must be de energized, until the light in the display is switched off!

Apart from the defrosting schedule, it is also possible to start and stop a defrosting either locally on the control display "Allow local display to start defrost" (d61) or remotely via the Modbus, "Allow remote start of defrost" (d60)

4.10.2.5 Drain heater

The drain heat output is intended for the connection of an optional, electrical drain heater. The function of this heater is to prevent the draining pipes for the melted ice from sticking up, before and during defrost. This function will most likely not be used on cooling applications (plus temperatures) but occasionally on freezing applications. The relay will only be activated in connection with a defrosting sequence, the rest of the time, it will be OFF. Please see the defrosting sequence.

4.10.2.6 Coordinated Defrosting

If the SLV controller and compressor are used in a cabinet together with another SLV set, on 1 common cooling cabinet, it will be necessary to coordinate the defrosting. This secures that both cooling circuits have terminated the defrosting, before a new pull down is performed on 1 cooling circuit, while the other one still is defrosting. Otherwise there will be a high risk of ice build up on the cold evaporator, while the second one is still defrosting. The maximum delay of a new started pull down after defrost is set with "Max hold time after coordinated defrost" (o16). After this timer has elapsed, the cooling will restart and an alarm "A05 Max hold after defrost exceeded" will be sent out.

The coordination of this defrosting must be controlled via the Master on the Modbus.

4.10.3 Restrictions

- A new defrost is not initiated if the compressor isn't running, due to a compressor error prior to a new defrost sequence, in order to prevent heating of the cabinet.
- If a sensor error is detected on the defrost stop sensor, prior to start of defrost, the next defrost will be started and terminated on time. A sensor error alarm is generated.
- If the defrost stop sensor is detected as faulty during the defrosting, the ongoing defrost is terminated on time and a sensor error alarm is generated.
- If the temperature is not below the "check temperature" (P50) before the timer "Time after compressor start to check" (P51) has elapsed, an alarm is sent out and the compressor and evaporator fan stop.
- The sensor error detection functionality on the "Defrost stop sensor" (d10) is only enabled when a sensor is selected.

4.10.4 Dependencies

The coordinated defrost function will only work, if a master is present on the Modbus!.

4.11 Melt function

4.11.1 Purpose

On high temperature cabinets, there is a risk of ice flakes forming on the evaporator which could block the air flow, when the thermostat has not made cut out for a certain time period. In order to avoid this, the melt function will initiate a forced stop of the compressor with regular time intervals.
During the stop period the ice flakes will be transformed into solid ice and therefore prevent the air passage through the evaporator from blocking up.
During the melting, the display will show the "DeF" code.

4.11.2 Functional description

The melt function is divided into two parts.

- The melting part, where the compressor stops and the evaporator fan, if present, continues to run. The stop period is determined with "Duration of melt period" (r17).
- The cool down period, where the compressor is running at 100%, until the temperature set point has been reached. After this the capacity controller resumes with the same compressor capacity as before the start of a melting cycle.

The condition to start a melt period is as follows:

- The melting interval "Time between melt periods "(r16) is set different to zero.
- The compressor has been running continuously during the melting interval.
- The sensor for Tact has been without fault
- The Tact (U17) is between the lower limit "Lower temperature limit to start melt"(r19) and the upper limit "Higher temperature limit to start melt "(r20).
- The temperature controller must be in range at this time

During the melting and cooling action, the following conditions must terminate the sequence:

- the sensor for Tact has a fault
- the melt function is overruled by an operation mode with a higher priority
- the Tact (U17) is not between the lower limit (r19) and the upper limit (r20)
- The melting interval (r16) is set to zero.

4.11.3 Restrictions

The melt function is inactive if "Time between melt periods" (r16) = 0 or "Duration of melt period" (17) = 0.
At thermostat air sensor error, the melt function is inactive.
Furthermore the function will be inactive, when "The air" (u17) is above the "High Lim air" (a13) or when the SLV is in Pull down mode.

4.11.4 Dependencies

This function only makes sense on applications running with evaporator fans.

4.12 Case cleaning function

4.12.1 Purpose

The purpose of the case cleaning function is to assist the daily user in the cleaning of the cabinet. If the function is enabled, the daily user can initiate and terminate a case cleaning by pushing a button on the cabinet.

4.12.2 Functional description

If the DI1 is defined to be used for case cleaning, the following sequence will start, as soon as the button is activated:

First activation:

- The actual compressor capacity is stored in the SLV memory, to be resumed at the end of the cleaning sequence.
- De icing of the evaporator starts. Depending on the setting of the "De icing method" (o47), this can either:
  1: Stop the compressor and the evaporator fan (if present) continues to run, until the defrost stop temperature has been reached.
  2: Start a defrosting sequence, until the defrost stop temperature has been reached. This can be electrical, hot gas or natural.

At the end of manual cleaning, the daily user activates the button a second time.

Second activation:

- A new pull down of the cabinet temperature is initiated, until the set point has been reached.
- Normal temperature control resumes with the same compressor capacity as before the start of a cleaning sequence.

The parameter "Case cleaning status" displays the status of the sequence:

0: No cleaning initiated
1: De icing of the evaporator is in progress. This can be either electrical, natural or hot gas defrosting.
2: Waiting for the daily user, to finish the cleaning and to activate the button a second time.

Display readout:
Readout on the display during the cleaning cycle and after following pull down: "deF"

Alarm handling:
During case cleaning all alarm messages are disabled (except for the case cleaning message and sensor errors). The alarm delay for High Temperature alarms is set by the parameter "Delay timer for High temperature alarms, after initial start up or defrosting" (A12).

Defrost:
A normal defrost sequence cannot be started, and an ongoing defrost will stop during case cleaning.

Stop of case cleaning:
The user can stop a case cleaning procedure using the same signals as for initiation. A case cleaning procedure can also be terminated by setting the main switch to OFF.

4.12.3 Restrictions

None

4.12.4 Dependencies

None

4.13 Condenser or compressor compartment fan control

4.13.1 Purpose

The purpose of this function is to control the condenser fan during the different running conditions and different SLV states. Depending on the application, this fan can be a combined condenser and compressor compartment fan or a dedicated condenser fan.

4.13.2 Functional requirement description

Before using the condenser fan control block, one of the relay outputs must be defined to be used as a condenser fan relay. "Relay x configuration" (L01 to L059) must be set to 5. The condenser fan can be controlled in four different ways, determined by the parameter "Condenser fan mode" (F11).

0: No control at all, always OFF
1: The fan runs continuously, as long as the compressor is running
2: Hysteretic control of the fan, based upon temperature measurement with S3b. Cut in temperature is set with "Condenser fan start temperature" (F12). Cut out temperature is set with "Condenser fan stop temperature" (F13).
3: Always ON, unless in stopped mode.

In some applications, it might be an advantage to pulse the fan during the night condition, to save further energy or to reduce the noise emission to the surroundings. The function is enabled with "Condenser fan pulsing" (F15). If set to ON, the fans will be pulsed during the night. The pulsing period time is set with "Condenser Fan period time for pulse mode" (F16), while the "Condenser Fan On-time in % of period time" (F17) is giving the duty cycle during pulsing.

Besides the above mentioned functions, it is possible to set up an alarm thermostat "Condenser Fan Alarm temperature (S3b)" (F14) for monitoring the maximum temperature, in case of a blocked condenser fan or dirt on the condenser surface.

If the temperature limit has been exceeded, an alarm A37 will be sent out.

4.13.3 Restrictions

None

4.13.4 Dependencies

None

4.14 Evaporator fan Control

4.14.1 Purpose

The purpose of the evaporator fan control is to establish the necessary airflow through the evaporator and to distribute the air into the cooling application. In applications with skin evaporators, running on fresh meat applications etc, this fan may be used internally in the cabinet, to improve the cooling inside of the cabinet. On passive or natural defrosting, the fan is also used to circulate the necessary airflow during the defrosting.

4.14.2 Functional description

The mounting of an evaporator fan is optional for many of the SLV applications. For applications with skin evaporators it is most likely that the fan will not be mounted. On the other hand, in most cases the finned evaporators will need the fan.

Before using the evaporator fan control block, one of the relay outputs must be defined to be used as an evaporator fan relay. "Relay x configuration" (L01 to L059) must be set to 6.

The parameter "Evaporator Fan mode" (F01) makes it possible to select the most appropriate evaporator fan control mode.

0 = No evaporator fan control.
The relay output can be used for other purposes,
1= Fan control is enabled.
The fan will run during the different control states, over ruled by the defrosting, the door control and compressor state. For details see parameter F03 to F07
2 = The fan control is enabled, with temperature check.
Same function as for 1, but with a safety function, which will stop the fan if the evaporator temperature exceeds the safety level "Evaporator Fan stop temperature" (f04). The fan will start again, when the evaporator temperature 2 K is below the safety limit again. The evaporator temperature is measured with the same sensor as for the defrost stop function. Parameter "Defrost stop sensor" (d10).

During cooling (when the compressor is running) the fan must run, but during thermostat cut out (or PWM control of the compressor) the fans can be pulse controlled, to save energy. The parameter "Evaporator Fan mode" (F01) must be set different to 0 (enabled).

If the Digital input is defined as a door switch, it is possible to stop the evaporator fan during door opening. The compressor capacity during open doors is set in the compressor capacity section. The parameter "Evaporator fan stop on door open" (F03) must be set to 1 (enabled). If set to 0, the fan will continue running at open doors.

During defrosting, the evaporator fan control is over ridden by the defrost sequence controller. On cabinets with night set back, the fans can be pulsed at thermostat cut out in order to save energy.
When the cabinet is set to "cleaning mode", the status of the fans depends on the cleaning routine.

"Evaporator Fan mode" (F01) must be set to 1.

Fan pulsing control

Function
Via the set point "Evaporator fan pulsing" (F05) it is possible to select how to control the fan:

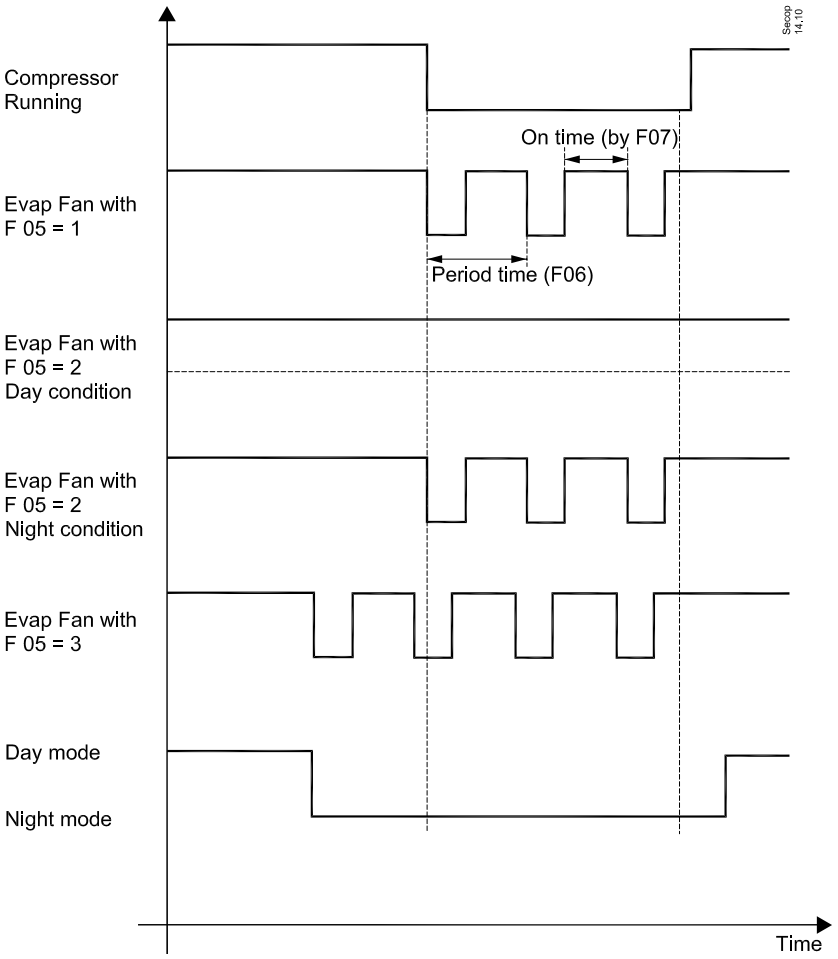
- "Evaporator fan pulsing" (F05) = 0:
  No fan pulsing – fan is always running, unless in stopped mode, cleaning mode or defrosting etc.

- "Evaporator fan pulsing" (F05) = 1:
  Fan always runs together with the compressor, but will be pulsed at thermostat cut out

- "Evaporator fan pulsing" (F05) = 2:
  Fan always runs together with the compressor, but will be pulsed at thermostat cut out, during night condition or night blinds activated.

- "Evaporator fan pulsing" (F05) = 3:
  The fan is always pulsed during night condition.

4.14 Evaporator fan control (continued)



If pulsing is active, the fan is pulsed according to a duty cycle pattern. Within a duty cycle the fan is set to ON for a set period of time (set in percent of the duty cycle time) "Evaporator fan period time for pulse mode" (F06).
The minimum duration of the time period must be adapted according to the type of output used to control the fan (on relay outputs the lifetime has to be taken into account).

Each period starts with an ON period followed by an OFF period.
The output 'Relay' is ON during the 'ON period' and OFF during the 'OFF period'.

4.14.3 Restrictions

When the compressor is not running, due to a compressor error, the evaporator fan will stop, to prevent heating of the cabinet and unnecessary cold dissipation.

4.14.4 Dependencies

None.

4.15 Blind control function

4.15.1 Purpose

The purpose of the blind control function is to manage the blinds in front of the cabinet in sync with the day / night mode of the controller. The function can be over ridden by the digital input, which will put the curtain into day position at closed DI.

4.15.2 Functional description

The relay for the blind control will be engaged during night mode. For some control systems, a 1 pole change over relay will be needed, to run the curtain motor in 2 different ways. This option is possible on relay 4 and 5. To activate the blind function, the parameter "Blind function" (o62) must be set ON.

The SLV can be set into night mode via one of the following methods:

- Manually via settings in the controller
- Via a signal on the digital input, if the DI is defined for Day / Night control
- Via the "Day / Night function" in the Master Control system.

4.15.3 Restrictions

If the DI is defined for curtain control, a closed DI will over ride the above mentioned inputs and force the curtain into day position.

4.15.4 Dependencies

None

4.16 Light control function

4.16.1 Purpose

The purpose of the light control function is to manage the lights in the cabinet.

4.16.2 Functional description

The relay output for Light / Curtains is a 1 pole change over relay. The relay is engaged during night mode.

The SLV can be set to night mode via one of the following methods:

- Manually via settings in the controller
- Via a signal on the digital input, depending on settings in the controller
- Via the "Day / Night function" in the Master Control system.

4.16.3 Restrictions

Safety functions during day / night control:
When the night setting signal is lost, the controller will revert back to the default day condition. For that reason, the night signal from the front end must be retransmitted (Master control block) to keep the night mode in the SLV. Otherwise the SLV goes into day mode (light on and curtain up)

4.16.4 Dependencies

None

4.17 Real Time Clock and control timer

4.17.1 Purpose

The SLV controller contains a real time clock with battery backup. This RTC is used for the control timer, which can operate different functions. Furthermore the RTC is used for the defrosting schedule. For defrosting, please see section 1.11 Defrost control function.

4.17.2 Functional description

The real time clock is powered from the internal SLV supply. In case of a power drop out, the RTC will be powered from the internal battery back up.
The RTC can be set up in one of the following ways via the local display, the T4C or remotely via the Front end system. If the set up is done via the local display, please follow the instructions in section 1.25, Local Display indications and menu.
When T4C is used for setting up the RTC, you don't have to enter a value for each RTC parameter. Instead it's possible to push the "Set PC time to SLV" in the T4C menu structure.
Based on the RTC, the SLV controller also has a control timer, with a daily schedule.
With this control timer, it is possible to intervene into the normal control of the SLV. The parameter "Control timer Function" (t84) has the following options:

0 = None. No override of the SLV
1 = Do not use
2 = Stop mode. The SLV is put into the Stop mode as long as the Control Timer is active..
3 = Night operation. Selection of day / night mode via the internal control timer
4 = Light. Light ON / OFF as function of the control timer.
5 = Application changeover. Selection of an application as a function of a pre defined schedule in the control timer.
6 = Relay out. ON / OFF control of a pre selected relay, as function of the control timer.

4.17.3 Restrictions

None

4.17.4 Dependencies

None

4.18 Alarm Handler

4.18.1 Purpose

The alarm handler manages the alarms, in case of different types of errors. The alarms can be indicated on the local display, and activated by relay or via the Modbus.

4.18.2 Functional requirement description

All possible alarms in the SLV controller are split into 5 different groups, depending on type of error:

Group	Name	Description
0	User Application Faults	Application faults are faults that are caused by trouble in the application shouts as the cooling circuit or missing air to the machinery room
1	System related Errors	System faults are related to trouble emerging from external condition to the cabinet. E.g. over voltage on the mains
2	Sensor Errors	Sensor faults are faults that are detected on the sensors if they are used
3	Electronic Faults	Electronic faults are trouble caused by the electronics
4	Motor Faults	Motor faults are all troubles influencing the motor causing it to fail to operate. It can be caused by overloading the cooling system or very big deviations on the mains power supply.

4.18.2.1 Application related alarms

The application alarms are alarms that relate to the cabinet and are caused by using the cabinet in a wrong way.
The 2 columns "T4C event listing Value 1" and "T4C event listing Value 2" show useful information, concerning the alarm. Depending on the alarm number, this can be:

- Setting value for the alarm threshold
- Actual value at time for alarm occurrence
- Maximum value of the parameter during the alarm

4.18
Alarm Handler
(continued)

T4C event listing Text	T4C event listing Value 1	T4C event listing Value 2	Manual text	Alarm Group
A04 Door alarm			The door has been detected open for too long (A04)	0
A05 Max hold after defrost exceeded	Max hold minutes		During the remote control of a coordinated defrost, the maximum defrost hold time has been exceeded (o16)	0
A06 Max defrosting time exceeded	Tact temperature	Maximum temperature	The temperature to stop the defrost heating has taken too long (d04)	0
A15 Alarm on DI			When the DI is selected to be an alarm or separate alarm open input, the switch has been open for more than the (A27) time. If the DI is configured to separate alarm open, the system will be put in emergency stop mode.	0
Fatal alarm on DI				
A20 High Temperature alarm	Tact temperature		The actual temperature Tact has been over the maximum limit (A13) for longer time than (A03) or (A12)	0
A37 Condenser temperature too high	Condenser Max temperature	Tact temperature	The condenser temperature has exceeded the maximum limit (F14)	1
A43 Low Temperature alarm	Tact temperature		The actual temperature Tact has been below the minimum limit (A14) for longer time than (A03) or (A12)	0
A60 Temperature logger high alarm	Tact temperature	Max temperature	The temperature logger temperature has been above the maximum limit (h12) for longer time than (h13)	0
A75 Evaporator temperature too high	Separate alarm temperature	Max temperature	The separate alarm temperature, selected by (P50), has been over the allowed maximum temperature (P53)	0
A76 No application selected			No application is enabled by the user. The user must enable at least one application and select it. (P01 to P05)	0
A81 Motor speed temporarily too high			The motor has been running too fast and has stopped. This can be caused by fast pressure fall on the condenser side or if the main voltage has high fluctuations	1
A82 Motor speed temporarily too low			The motor has been running too slowly and has stopped. This can be caused by fast pressure increase on the condenser side or if the mains voltage has high fluctuations	1
A90 Check clock settings			The clock needs to be adjusted	0
A91 Configuration mismatch on DI's			The DI input is configured for the same function twice.	0
A92 Compressor stop due to too high Controller temperature		Condenser Temperature	The temperature of the inverter has been exceeding the maximum limit and the motor has stopped. If the temperature falls under the limit the motor will be automatically restarted.	1
A93 Mains supply voltage out of range			The mains supply voltages have been below the minimum limit or above the maximum limit.	1
A95 Mains supply frequency out of range	0 50 Hz fault 1 60 Hertz fault 2 High frequency 3 Low frequency 4 Floating frequency 5 No frequency		A fault has been detected on the mains supply.	1
A96 Overload of Display outlet			The digital input or display supply voltage has been short circuited	1
A97 Controller internal temp. too high			The temperature of the inverter is exceeding the maximum limit. The electronics are too hot	1
A98 Inverter temp. too high			The temperature of the inverter is exceeding the maximum limit. The electronics are too hot	1

4.18.2.2 Other alarms

T4C event listing Text	T4C event listing Value 1	T4C event listing Value 2 format	Manual text	Alarm Group
E25 S3 Sensor error			The S3 sensor has a fault	2
E26 S4 Sensor error			The S4 sensor has a fault	2
E27 S5 Sensor error			The S5 sensor has a fault	2
E28 S6 Sensor error			The S6 sensor has a fault	2
E29 S3b Sensor error			The S3b sensor has a fault	2
E80 Motor error			The motor system has detected a fault	4
E90 Electronic failure			The electronic has an internal fault.	3

For diagnosis of the sensor errors please refer to the section "Service mode"

4.18.3 Alarm acknowledgement

There are 3 different ways to acknowledge alarms:

- By pushing the reset button on the local display CRA 172, remotely from a front end system or auto acknowledge by the SLV.
- As default, the SLV is not set to auto acknowledge.
- By setting the parameter "Auto acknowledge" (o84) different to zero the function is enabled.

4.18.4 Restrictions

None

4.18.5 Dependencies

None

4.19 Event logging system

4.19.1 Purpose

In order to analyse information during the electronic and systems lifetime, the SLV has a logging system, which tracks events such as alarms, change of settings or local events initiated by the user.

4.19.2 Functional description

The event logger will show all events in a chronological order, starting with the most recent event on top. The event logger can hold up to 200 events, before the logger is full. In such a case, the oldest event at the bottom will be deleted and substituted with the latest on top. In the "Time" column the time of occurrence is listed. The 2nd column "User" is showing the initiator for the event. The following initiators can create an event:

- System: For example Temperature Alarms, controller in service mode, Logger alarms, Max defrost time exceeded
- Tool4Cool: For example change of settings.
- MMI: For example change of settings, acknowledge of alarms, controller in Stop mode, application change over, defrost start
- Danfoss front end system: For example application change over, defrost start, alarm acknowledge etc.
- 3rd party front end: For example application change over, defrost start, alarm acknowledge etc.

4.19.2.1 List of possible Events

The following events are useful to track changes and operations during the life of the control unit

T4C event listing Text	T4C event listing Value 1	T4C event listing Value 2 format	Description
Event database cleared			The event database was cleared
Parameter changed – [Parameter name]		New value	A parameter has been changed. (The parameter name is in the brackets)
User connected	System, Tool4Cool, Secop Front end, 3rd Party front end Supply chain FFT Supply chain ICI Supply chain RA OEM production MMI		When a new user uses the system a logging of the event will be done in order to track who has made changes.
Mains voltage detected	115V 230V		This event is normal after power up of the system
Temperature log cleared			The temperature log has been cleared
Automatic baudrate change detected	9600 baud 19200 baud		The baud rate has automatically changed the baud rate
System boot			The system started
Acknowledge of alarms			The alarm has been acknowledged by the user
Factory settings stored			The factory settings have been stored in the database
Factory settings restored			The factory settings in the database have been restored
A220 Case cleaning completed			This alarm shows that the case cleaning has been completed
A226 Controller in Service mode			This alarm shows that the controller was set in service mode

4.19.3 Restrictions

None

4.19.4 Dependencies

None

4.20 Service Mode

4.20.1 Purpose

Accessing the service mode makes it possible to manually set the outputs and read the status of the inputs. This improves the service ability of the whole cabinet.

4.20.2 Functional description

To protect the SLV against unauthorised setting modifications, the SLV is protected with access codes for the different user levels. To access the Service level, the appropriate access code for the service level "Access code service" (o07) must be entered first.

In the service level it is possible to read different measurements, as well as force the relay outputs ON or OFF and force the compressor to run at different speeds.

Readings:
In the service level, the following readings are available:

L50	PCB temperature	Readout of the controller temperature on the circuit board
L51	Inverter temperature	Readout of the controller temperature on the inverter module
L52	Mains voltage supply	Readout of mains supply voltage
L53	Mains frequency	Readout of mains supply frequency
L60	Compressor manual control	Shows that the compressor is in manual mode
L61	Compressor actual state	Indication of whether the compressor is running or not
L62	Compressor manual speed percentage when running	Set point of the actual compressor speed, in % of the variable speed band during manual control. 0% means compressor runs at minimum speed and 100% means that the compressor runs at max speed during service mode.
L63	Compressor actual speed percentage when running	Readout of the actual compressor speed, in % of the variable speed band during manual control. 0% means compressor runs at minimum speed and 100% means that the compressor runs at max speed during service mode.

Furthermore, all temperature measurements can be read out. To check the correct reading, compared to the actual sensor temperature the below 2 tables can be used.

4.20 Service Mode (continued)

NTC temperature table for S3, S3b, S4 and S5

T (°C)	$B_{25/100}$ = 3980 K, R_{25} = 5000 Ω, T_R = 0°C		
	R_{nom}(Ω)	R_{nom}(Ω)	R_{nom}(Ω)
-40	169160	159350	178970
-35	121800	115390	128200
-30	88766	84552	92979
-25	65333	62555	68111
-20	48614	46778	50450
-15	36503	35291	37715
-10	27680	26883	28478
-5	21166	20646	21686
0	16330	16003	16657
5	12696	12386	13006
10	9951	9670	10232
15	7855	7604	8105
20	6246	6025	6467
25	5000	4806	5194
30	4029	3859	4198
35	3266	3118	3414
40	2665	2535	2794
45	2186	2073	2298
50	1803	1705	1901
55	1495	1419	1581
60	1247	1172	1321
65	1044	979.0	1110
70	878.9	821.7	936.1
75	743.1	692.9	793.4
80	631.0	586.9	675.2

Pt 1000 temperature table for S6

Temperature	Ohm
-40	842,7
-35	862,5
-30	882,2
-25	901,9
-20	921,6
-15	941,2
-10	960,8
-5	980,4
0	1000,0
5	1019,5
10	1039,0
15	1058,5
20	1077,9
25	1097,3
30	1116,7
35	1136,1
40	1155,4
45	1174,7
50	1194,0
55	1213,2
60	1232,4
65	1251,6
70	1270,7
75	1289,9

Access levels:
Once the service level code has been entered, it's possible to modify the access codes for the different access levels:

o05	Access code end user	Access code for the end user level on the display
o06	Access code installer	Access code for the installer level on the display
o07	Access code service	Access code for the service level on the display
o08	Access code OEM lab	Access code for the OEM level on the display

Activation of outputs:
Before it is possible to activate the relays ON/OFF, the service mode must be activated via the parameter "Service mode" (p83). There are 4 different service modes available:

0: Normal, control mode
1: Service mode
2: Customer lab mode, only to be used in the OEM lab for running special approval test, only accessible with OEM key.

When the SLV controller is set in service mode, all relays are switched off and the compressor speed is set to zero. When the controller is set back into normal control all relays are set back into same state as before entering the service mode and the compressor resumes with the same capacity.

The 5 relays R1 to R5 can be set ON and OFF with the parameters "Relay X Manual control" (P84 to P88)

When the controller is taken out of the service mode and put into the normal control mode, the normal cabinet control will be resumed, regardless of the actual states of the relay in the service mode.

4.20.3 Restrictions
None

4.20.4 Dependencies
None

4.21 Local Display indications and menu structure

4.21.1 Purpose

The function of the display is to act as the user interface between the user and the cooling application. This includes readouts of temperature, application change over, setting of parameters, starting of a defrosting and reset of alarms.
Besides the 3 numeric digits the display also has 4 LED's for Alarm, Defrosting, Service and Cooling.

4.21.2 Functional description

The different parameters of the SLV controller can be accessed via the local display or via the Modbus. In this section, only the local display interface will be described.
The different parameters of the SLV controller are split into 3 different levels on the display interface. Each level can be protected with an individual access code, which can be defined by the customer. If a level is protected with an access code, the user will be asked to enter in the access code for the actual level.

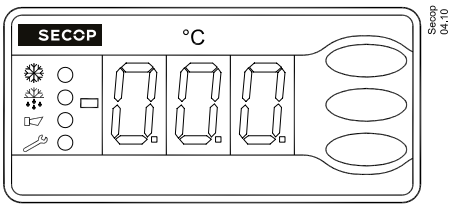
For details concerning the access codes, please refer to section 1.23, Service Mode.

o05	Access code end user	Access code for the end user level on the display
o06	Access code installer	Access code for the installer level on the display
o07	Access code service	Access code for the service level on the display
o08	Access code OEM lab	Access code for the OEM level on the display

In the parameter overview the accessibility indicated in the different levels is shown with an "R" or a "W", which represents read or write.

Menu structure for the display
The manoeuvring through the local display menu structure is based on different activations of the buttons on the right side of the front. There are 3 different ways of activating the buttons:

- Single short activation
- Single long activation
- Triple short activation



Display CR-172

Level	Event	Action
Daily	Upper button short	Acknowledge active alarm/receipt alarm/see alarm code Change to inspection of alarms
	Upper button long	Change to parameter selection.
	Middle button short	Application change over (if more than 1 application is enabled, this will toggle between the enabled applications)
	Middle button triple	Change to edit set point for actual selected application
	Lower button short	Selection of special function according to below scheme.
	Lower button long	Start/Stop defrost depending on d61 and d62, please refer to section 4.10.2.4 Defrost control function
	Lower button tripple	Stopped / operating, depending on "Selection of stopped mode" (P32)

It is possible for the customer, to define a function on the lower right button, during daily operation:

4.21 Local Display indications and menu structure (continued)

Definition of functionality on lower button (o93)	
1 = Activation of Light ON /OFF	Activation of the lower right button switches the light ON or OFF. The light can also be controlled via the internal control timer or remotely via the Modbus. It is always the last command which determines the status of the light.
2 = Activation of Night Mode	Activation of the lower right button switches the night mode ON or OFF.
3 = Read out of Defrost stop temperature	Activation of the lower right button reads out the temperature of the Defrost stop sensor.
4 = Read out of S6 temperature	Activation of the lower right button reads out the temperature of the S6 sensor
5 = Read out of S5 temperature	Activation of the lower right button reads out the temperature of the S5 sensor
6 = Read out of S3b temperature	Activation of the lower right button reads out the temperature of the S3b sensor
7 = Read out of Actual Tref	Activation of the lower right button reads out the temperature reference for the controller.

Level	Event	Action
Inspection of alarms	Upper button short	Previous alarm in alarm listing
	Lower button short	Next alarm in alarm listing

Inspection of alarms will timeout after 4 seconds and the menu system reverts back to the daily level.

Level	Event	Action
Parameter selection	Upper button short	Select next parameter
	Upper button long	Select next parameter continuously
	Lower button short	Select previous parameter
	Lower button long	Select previous parameter continuously
	Middle button short	Change to edit parameter

During parameter selection, the upper and lower buttons scroll through the parameters, which are sorted in alphanumeric order.
Parameter selection will timeout after 4 seconds and the menu system reverts back to the daily level.
If the parameters are protected with access codes, the parameters o05 to o08 are set to a value different from 0. In such cases, the access code must be entered first.

Level	Event	Action
Edit set point	Upper button short	Increment set point value
	Upper button long	Fast increment set point value
	Lower button short	Decrease set point value
	Lower button long	Fast decrease set point value
	Middle button short	End editing set point

The edit set point level will timeout after 4 seconds, without any activity on any button, and the menu system reverts back to the daily level. If a value was altered it will not be stored unless the middle button is activated.

Alarms on the display

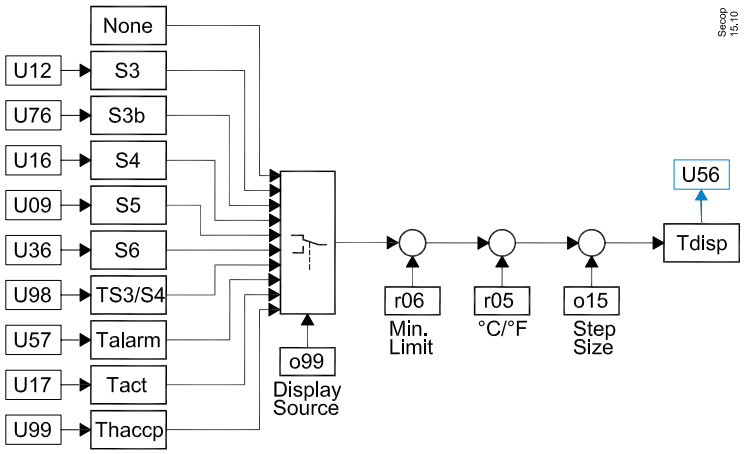
The alarms, which can be generated in the SLV controller, are divided into different groups, depending on the reason for the alarm. These alarms can be sent out on the Modbus, via the local alarm relay or the local display. With the parameter "alarm on the display" (o98), the following 3 options are possible:

0 = No alarm indication on the display at all.
1 = Only User Application Faults (System related). These alarms are caused by the end user and can also be corrected, without assistance of a service engineer. Typical reasons could be overloading of the cabinet, loading of the cabinet with hot goods, dirt, open doors etc.
2 = All alarms will be shown on the local display.

4.21 Local Display indications and menu structure (continued)

Readout on the Display CRA 172

It is possible to select between a number of different readouts on the display CRA 172.



In most cases, the customer will use the actual cabinet temperature Tact but it is possible to select between the following number of parameters, "Display temperature" (o99):

0 = TS3/TS4, weighting based upon the parameter "S3/S4 weighting" (017)
1 = T Temperature logger, temperature used for the internal temperature logger.
2 = Tact
3 = Talarm, temperature used for the alarm thermostat
4 = S3
5 = S3b
6 = S4
7 = S5
8 = S6

With the parameter "display temperature step resolution" (o15), it is possible to change the resolution of the display readout as follows:

1 = XX,1° - → resolution of 0.1
2 = XX,5° - → resolution of 0.5
3 = XX,0° - → resolution of 1.0

With the parameter "S3/S4 temperature offset" (r04) it is possible to adjust the readout on the display, while the parameter "Minimum limitation of the lowest temperature readout of the display" (r06) can be used to limit the lowest possible shown readout.

With the parameter "Temperature unit (°C/°F)" (r05), it is possible to select between °C or °F for the display read out. Please keep in mind that all settings are in °C only!

4.21.3 Restrictions

None

4.21.4 Dependencies

None

4.22 Configuration of relays

4.22.1 Purpose

The configuration of the relay outputs is pre defined from the factory. They can be redefined via settings in the controller. Relay R1 to R4 are pre wired internally in the controller, so that no additional, external junction box is needed.
The max total load of R1 to R4 is 2 Amps, which must be shared for these 4 relays. Please see the technical data for the controller.

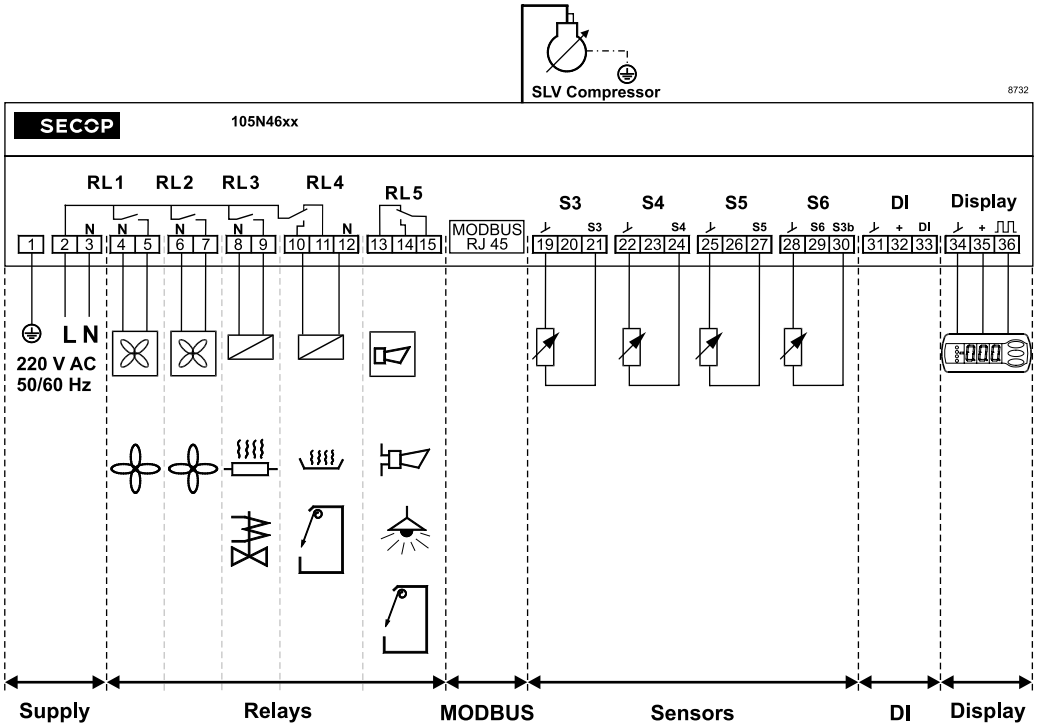
The relay R5 is galvanic isolated from the rest of the electronics and can be used in a separate alarm circuit or as a changeover relay in certain applications.

4.22.2 Functional description

All 5 relay outputs are mechanical coded, to prevent wiring errors in the production and especially in the field in cases of service.

With the parameters "Relay x configuration" (L01 to L05), each of the 5 relays can be defined as follows:

"Relay x configuration" (L01 to L05)	Description
0: Always OFF	No control functions attached to the relay.
1: Always ON	The relay will be activated, as soon as the SLV is connected to the mains supply.
2: ON during operation	The relay will be activated, as soon as the controller is energized and has left the stopped mode.
3: ON during stopped	The relay will be activated, as long as the controller is energized and in the stopped mode.
4: Follows Compressor	The relay will be ON, as long as the compressor is running
5: Condenser fan	The relay is controlled by the condenser control function
6: Evaporator fan	The relay is controlled by the evaporator control function
7: Defrost	The relay is attached to the defrost control algorithm. The relay will be ON, when defrosting heat is requested. This can be an electrical heater or a hot gas valve.
8: Drain heater	The relay is controlling the drain heater, which can be energized prior to, during and after a defrosting.
9: Do not use	The controller isn't supporting this function yet, which is prepared for a future function.
10: Do not use	The controller isn't supporting this function yet, which is prepared for a future function.
11: Blind relay	It's possible to connect a night blind or curtain to the relay output, which will be controlled by the night blind function.
12: Light relay	It's possible to connect a cabinet light to the relay output, which will be controlled by the light function.
13: Do not use	The controller isn't supporting this function yet, it is prepared for a future function.
14: Do not use	The controller isn't supporting this function yet, it is prepared for a future function.
15: Alarm relay	The relay is used for local alarm indication. The relay will be activated as soon as the controller is energized and no alarms are active. If a galvanic separated alarm is demanded, the relay R5 must be used.
16: Temperature logger alarm relay	The relay will be activated, when the temperature limits for the internal temperature logger have been exceeded and the delay timer has elapsed.
17: Do not use	The controller isn't supporting this function yet, it is prepared for a future function.
18: Control timer	The relay will follow the status of the control timer. The relay will be active, when the control timer is active.



4.22.3 Restrictions

None

4.22.4 Dependencies

The control of the relay outputs will be overruled, when the controller is put into service mode.
All relays will be de energised during the start up of the controller.

4.23 Configuration of Low voltage I/O

4.23.1 Purpose

The SLV controller contains one digital input DI1 that can be configured for different functions, which includes overriding the normal control of the SLV, activated by the end user.

4.23.2 Functional description

The DI1 input holds many functions. The parameter "I/O function" (o02) specifies the usage of the DI inputs. Depending on the DI type/function configured, the DI may operate either as a contact or as a push button.

The status of the digital input is defined as follows:

- The contact is closed; the DI input is defined to be 1/ON
- The contact is open; the DI input is defined to be 0/OFF

Important remark: The Digital input is not galvanic separated and the input is connected directly to the mains supply! For that reason, only double isolated switches must be used, as well as the cables must fulfil the the double insulation requirements

If the DI1 is configured for alarm monitoring, an alarm will be sent out after the delay timer "Alarm delay for DI1" (A27) has elapsed.

DI1 config.	Function	Description
0	Do not use No DI1 function enabled	Not in use
1	DI-status / Bus (status only)	Contact, ON=closed
2	Door function	The door will be considered as being closed, as long as the DI1 is OFF
3	Alarm	If the DI1 is ON, an alarm will be sent out after elapse of delay timer
4	Defrost start	The defrosting will be started when the DI1 changes from OFF to ON
5	Main switch on	The controller will go into Stopped mode when the DI1 is OFF
6	Night operation	The controller will go into Night setback mode when the DI1 is ON (closed)
7	Application change over	The pre defined application will be selected, when the DI is ON
8	Light switch	The Light will be turned ON when the DI is closed
9	Separate alarm	An alarm will be generated if the DI1 is open
10	Case cleaning	The Case cleaning sequence will be started or stepped further when the DI1 goes from OFF to ON.
11	Do not use No DI1 function enabled	Not in use
12	Blind cover button	The curtain or night blind will be toggled up or down, every time the DI1 goes from OFF to ON
13	Do not use No DI1 function enabled	Not in use
14	Do not use No DI1 function enabled	Not in use
15	Set point Tref	Not in use
16	Set point CapRef	External compressor capacity given by a 500 kΩ logarithmic potentiometer connected to DI1.
17	Alarm LED	The DI will energise an operating LED simultaneously with the Alarm LED on the display CRA 172.
18	Operating LED	The DI will energise an operating LED as long as the controller is not in Stopped mode.
19	Capacity in	Not in use. The lead-lag compressor capacitiy control is not released by Secop yet. For details please contact Secop.
20	Capacity out	Not in use. The lead/lag compressor capacitiy control is not released by Secop yet. For details please contact Secop.
21	Do not use No DI1 function enabled	Not in use
22	Do not use No DI1 function enabled	Not in use
23	Do not use No DI1 function enabled	Not in use

4.23.3 Restrictions

The DI1 input has a one second minimum response time before make/break is detected, i.e. a condition must be present for at least one second before detection.

4.23.4 Dependencies

None

4.24 Storing and restoring to factory settings

2.24.1 Purpose

The SLV controller contains a "Store to factory" and "Restore to factory" function. With this function it is very convenient for the OEM to program the SLV with his own factory settings. Furthermore, it helps the service engineer to restore a controller of cooling application in case of "lost overview" during modification or optimization of setting on site.

2.24.2 Functional description

Storing settings as factory settings "Store to factory setting"(P31) is only possible with an OEM log in, the restoring function "Restore to factory settings" (P30) is also enabled for the service engineer.

2.24.3 Restrictions

When activating the "Restore to factory" function, all actual settings in the SLV controller will be over written immediately.

2.24.4 Dependencies

None

5. PARAMETERS

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
A03	Temperature alarms	High Temperature alarm delay, during normal control		Delay timer for high temperature alarms, during normal control
A04	Configuration - Door alarm	Delay for door alarm		Delay for door alarm, if set to zero the alarm is turned off. If DI is defined as door contact, the delay is measured from the moment the switch is open.
A12		High Temperature alarm delay, after power up, defrosting, case cleaning etc.		Delay timer for high temperature alarms, after initial start up or defrosting
A13	Temperature alarms	High alarm limit		Setting for high temperature alarm
A14	Temperature alarms	Low alarm limit		Setting for low temperature alarm
A27	Configuration - Low voltage I/O	Alarm Delay for DI		Alarm Delay for DI Min value = 0 Max value = 240 minutes
A36	Temperature alarms	Weighting for alarm thermostat S4		For the temperature alarm, a mix of the S3 & S4 measurement can be used. With a setting of 100%, only the S4 sensor will be used. With a setting of 0% only the S3 sensor will be used. For settings inbetween, a mix will be used.
d02	Defrost setup	Defrost stop temperature	Min value = 0 and Max value = 25	An ongoing defrosting will stop as soon as a defrost stop temperature has been reached. If this limit has not been reached within the max defrosting time, the ongoing defrosting will stop anyway and a "max defrosting Time exceeded" alarm will be sent out. In case of a sensor error for the defrost stop temperature, the defrosting will instead be terminated on time.
d03	Defrost Schedule	Interval between defrost start	Min value = 0 and Max value = 168 hours	Interval between defrost, when multible defrost per day has been chosen. (d90 = 3)
d04	Defrost setup	Max. defrost time	Min value = 0 and Max value = 240 minutes	An ongoing defrosting will stop as soon as a defrost stop temperature has been reached. If this limit has not been reached within the max defrosting time, the ongoing defrosting will stop anyway and a "Max defrosting Time exceeded" alarm will be sent out.
d06	Defrost setup	Drip off time	Min value = 0 and Max value = 60 minutes	Delay of compressor and evaporator fan start after defrosting, to drain remaining drips out of the evaporator. If set to zero, this function is obsolete.

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	1	240	min	90	90	30				W	W	W	W	W
	x	0	240	min	60	60	60				W		W	W	W
	x	1	240	min	240	240	90				W	W	W	W	W
	x	-50	50	°C	-14	15	8				W	W	W	W	W
	x	-50	50	°C	-30	-10	-30				W	W	W	W	W
	x	0	240	min	30	30	30					W	W	W	W
	x	0	100	%	100	100	100				W	W	W	W	W
	x	0	25	°C	3	5	6				W	W	W	W	W
	x	1	168	hrs	4	4	4				W		W	W	W
	x	o/skip	240	min	120	45	45				W	W	W	W	W
	x	0/skip	60	min	0	0	0				W		W	W	W

5. Parameters (continued)

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
d07	Defrost setup	Additional delay for evaporator fan start after drip off	Min value = 0 and Max value = 60 minutes	Additional delay for evaporator fan start after drip off, starting after"Drip off time (d06)" has elapsed. The delay timer will be cancelled, if the evaporator temperature is below the "Evaporator fan start temperature (d08)".
d08	Defrost control	Evaporator fan start temperature	Min value = -50 and Max value = 0	The evaporator fan will not be started, before the 2 delay timers d06 and d07 have elapsed.
d09	Defrost control	Evaporator fan running during defrost	Enabled Disabled	Selection of whether the evaporator fan should be running during defrosting. For electrical and hot gas defrosting, the evaporator is normally stopped, while the fan normally runs during natural defrosting.
d10	Defrost control	Defrost stop sensor	Stop on time S5 S4 S3	Selection of defrost stop sensor. When no sensor is detected, the defrosting is terminated on time. If a sensor is selected and detected as defective, an sensor error alarm is sent out and the defrosting is terminated on time.
d20	Defrost control	Drain post heating time	Min value = 0 and Max value = 240 minutes	Additional ON time for the drain heater, after the defrosting is terminated.
d39	Defrost control	Compressor capacity during Drain Preheat	Min value = 0 and Max value = 100 %	For electrical and natural defrosting, this parameter should be set to 0. Once it has been decided to start a defrost, it makes no sense to spend compressor energy on keeping the evaporator cold. For hot gas defrosting it must be considered to set the capacity between 50 and 100%, not to loose the high condensing pressure.
d40	Defrost control	Drain pre heating time	Min value = 0 and Max value = 240 minutes	Drain preheating time for drain, prior to a defrosting, to make sure that the drain is free. If set to zero, this function is obsolete.
d41	Defrost control	Maximum pull down time. after defrosting	Min value = 0 and Max value = 240 minutes	During the defrosting cycle and during the aftercoming pull down of the cabinet temperature, the local display will read out the "dEF" code.
d42	Defrost control	Compressor capacity during hot gas defrosting	Min value = 0 and Max value = 100 %	Compressor capacity during hot gas defrosting. For electrical or natural defrosting, this setting must be zero
d43	Defrost control	Compressor capacity during drip off time	Min value = 0 and Max value = 100 %	Capacity during drip off time
d60	Defrost setup	Allow remote start of defrost	Disabled Enabled	Allow remote start of defrost via Modbus.
d61	Defrost setup	Allow local disply to start defrost	Disabled Enabled	Manual start of defrost via local display
d62	Defrost Schedule	Min interval between manual defrost.	Min value = 0 and Max value = 168 hours	Min interval between manual defrost, to avoid too many defrosting cycles, initiated by an inexperienced daily user. Can be reset by switching OFF and ON the controller. If set to zero, there is no limitation.
d71	Defrost Schedule	1st daily start or Sunday hour (-1 = not active)	Min value = -1 and Max value = 23 hours	If 1 defrost per day is selected (d90 = 1), this parameter gives the starting hour for Sunday. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start hour for the 1st defrost.
d72	Defrost Schedule	2nd daily start or Monday hour (-1 = not active)	Min value = -1 and Max value = 23 hours	If 1 defrost per day is selected (d90 = 1), this parameter gives the starting hour for Monday. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start hour for the 2nd defrost.

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	0	60	min	0	0	0				W		W	W	W
	x	-50	0	°C	-5	-5	-5				W		W	W	W
	x	0/no	1/yes	-	0	0	1				W		W	W	W
	x	0	3	-	1	1	0				W		W	W	W
	x	0	240	min	0	0	30				W		W	W	W
	x	0	100	%	0	0	0						W	W	W
	x	0/skip	240	min	3	3	0				W		W	W	W
	x	0	240	min	90	90	0				W		W	W	W
	x	0	100	%	90	90	0				W		W	W	W
	x	0	100	%	0	0	0						W	W	W
	x	0	1	-	1	1	0			W	W	W	W	W	
	x	0	1	-	1	1	0					W	W	W	W
	x	0	168	hrs	21	21	0				W		W	W	W
	x	-1	23	hrs	-1	1	.1			W	W	W	W	W	W
	x	-1	23	hrs	1	-1	-1			W	W	W	W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
d73	Defrost Schedule	3rd daily start or Tuesday hour (-1 = not active)	Min value =-1 and Max value = 23 hours	If 1 defrost per day is selected (d90 = 1), this parameter gives the starting hour for Tuesday. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start hour for the 3rd defrost.
d74	Defrost Schedule	4th daily start or Wednesday hour (-1 = not active)	Min value = -1 and Max value = 23 hours	If 1 defrost per day is selected (d90 = 1), this parameter gives the starting hour for Wednesday. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start hour for the 4th defrost.
d75	Defrost Schedule	5th daily start or Thursday hour (-1 = not active)	Min value = -1 and Max value = 23 hours	If 1 defrost per day is selected (d90 = 1), this parameter gives the starting hour for Thursday. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start hour for the 5th defrost.
d76	Defrost Schedule	6th daily start or Friday hour (-1 = not active)	Min value = -1 and Max value = 23 hours	If 1 defrost per day is selected (d90 = 1), this parameter gives the starting hour for Friday. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start hour for the 6th defrost.
d77	Defrost Schedule	7th daily start or Saturday hour (-1 = not active)	Min value = -1 and Max value = 23 hours	If 1 defrost per day is selected (d90 = 1), this parameter gives the starting hour for Saturday. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start hour for the 7th defrost.
d78	Defrost Schedule	8th daily start hour (-1 = not active)	Min value = -1 and Max value = 23 hours	If 1 defrost per day is selected (d90 = 1), this parameter has no effect. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start hour for the 8th defrost.
d81	Defrost Schedule	1st daily start minute (-1 = not active)	Min value = -1 and Max value = 59 minutes	If 1 defrost per day is selected (d90 = 1), this parameter has no effect. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start minute for the 1st defrost.
d82	Defrost Schedule	2nd daily start minute (-1 = not active)	Min value = -1 and Max value = 59 minutes	If 1 defrost per day is selected (d90 = 1), this parameter has no effect. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start minute for the 2nd defrost.
d83	Defrost Schedule	3rd daily start minute (-1 = not active)	Min value = -1 and Max value = 59 minutes	If 1 defrost per day is selected (d90 = 1), this parameter has no effect. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start minute for the 3rd defrost.
d84	Defrost Schedule	4th daily start minute (-1 = not active)	Min value = -1 and Max value = 59 Minutes	If 1 defrost per day is selected (d90 = 1), this parameter has no effect. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start minute for the 4th defrost.
d85	Defrost Schedule	5th daily start minute (-1 = not active)	Min value = -1 and Max value = 59 minutes	If 1 defrost per day is selected (d90 = 1), this parameter has no effect. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start minute for the 5th defrost.
d86	Defrost Schedule	6th daily start minute (-1 = not active)	Min value = -1 and Max value = 59 minutes	If 1 defrost per day is selected (d90 = 1), this parameter has no effect. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start minute for the 6th defrost.

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	-1	23	hrs	-1	-1	-1			W	W	W	W	W	W
	x	-1	23	hrs	-1	-1	-1			W	W	W	W	W	W
	x	-1	23	hrs	1	-1	-1			W	W	W	W	W	W
	x	-1	23	hrs	-1	-1	-1			W	W	W	W	W	W
	x	-1	23	hrs	-1	-1	-1			W	W	W	W	W	W
	x	-1	23	hrs	-1	-1	-1					W	W	W	W
	x	0	59	min	0	0	0					W	W	W	W
	x	0	59	min	0	0	0					W	W	W	W
	x	0	59	min	0	0	0					W	W	W	W
	x	0	59	min	0	0	0					W	W	W	W
	x	0	59	min	0	0	0					W	W	W	W
	x	0	59	min	0	0	0					W	W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
d87	Defrost Schedule	7th daily start minute (-1 = not active)	Min value = -1 and Max value = 59 minutes	If 1 defrost per day is selected (d90 = 1), this parameter has no effect. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start minute for the 7th defrost.
d88	Defrost Schedule	8th daily start minute (-1 = not active)	Min value = -1 and Max value = 59 minutes	If 1 defrost per day is selected (d90 = 1), this parameter has no effect. If multiple defrosts per day have been selected (d90 = 2), this parameter gives the start minute for the 8th defrost.
d90	Defrost Schedule	Number of defrostings	Never One pr. Day Multi pr. day fixed hour Multiple pr. day timer based Defrost on Demand	Selection of number of automatic defrosts per day or week. 0 = Never 1 = One per day, based on the real time clock 2 = Multi defrost pr. day at fixed hour, based on the real time clock 3 = Multiple per day, timer based with fixed interval, set via d03.
F01	Evaporator fan control	Evaporator Fan mode	Off Enabled Enabled on Tdefr	Selection of evaporator fan control mode: 0 = No evaporator fan control 1 = Enabled, for details see parameter F03 to F07 2 = Enabled and fan stop check on Tdefr (F04)
F03	Evaporator fan control	Evaporator Fan stop on door open	No Yes, expect defrosting	If the DI1 is set up as a door switch, this parameter specifies whether to stop the evaporator fan during door opening or not. 0 = No, evaporator fan continues running. 1 = Yes, evaporator stop at door open
F04	Evaporator fan control	Evaporator Fan stop temperature (Tdefr)	Min value = -50 and Max value = 50	To avoid heating of the cabinet, in case the cooling stops, the evaporator temperature is monitored. If the evaporator fan mode (F01) is set to 2, this gives the maximum temperature for the evaporator, measured with Tdef. . If exceeding this value the fan must stop. The Fan must start again when the temperature at Tdefr falls below F04 – 2 K.
F05	Evaporator fan control	Evaporator Fan Pulsing	No pulse operation At compressor cut out Compressor cut out at night During night	In certain cooling applications, it might be beneficial, to pulse the evaporator fan during predifined conditions: 0 = No pulse operation 1 = At compressor cut out only 2 = Only at compressor stop during night operation 3 = During night
F06	Evaporator fan control	Evaporator Fan period time for pulse mode	Min value = 1 and Max value = 30 Minutes	If pulsing mode is active, this setting gives the pulsing period time.
F07	Evaporator fan control	Evaporator Fan On-time in % of period time	Min value = 0 and Max value = 100 %	If pulsing mode is active, this parameter gives the ON - time in % compared to the period time.
F11	Condenser fan control	Condenser Fan mode	Off Run with compressor Hysteretic controlled by S3b Always Run unless stopped	Running mode for condenser fan, if present.
F12	Condenser fan control	Condenser Fan start temperature (S3b)	Min value = -50 and Max value = 50	Cut in value for condenser fan during hysteretic control. Based on temperature measured with S3b
F13	Condenser fan control	Condenser Fan stop temperature (S3b)	Min value = -50 and Max value = 50	Cut out value for condenser fan during hysteretic control. Based on temperature measured with S3b
F14	Condenser fan control	Condenser Fan Alarm temperature (S3b)	Min value = -50 and Max value = 50	High temperature alarm limit for condenser fan control. Based on temperature measured with S3b

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	0	59	min	0	0	0					W	W	W	W
	x	0	59	min	0	0	0					W	W	W	W
	x	0	4	-	1	1	0			W	W	W	W	W	W
	x	0	2	-	0	0	1				W		W	W	W
	x	0/no	1/yes	-	1	1	1				W		W	W	W
	x	-50	50	°C	10	10	10				W		W	W	W
	x	0	3	-	0	0	0				W		W	W	W
	x	1	30	min	5	5	5				W		W	W	W
	x	0	100	%	100	100	100				W		W	W	W
	x	0	3	-	1	1	3						W	W	W
	x	-50	50	°C	50	50	50						W	W	W
	x	-50	50	°C	50	50	50						W	W	W
	x	0	50	°C	0	0	0						W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
F15	Condenser fan control	Condenser Fan Pulsing	No pulse operation During night	If active, the condenser fan will be pulsed during the night mode. 0 = No pulse operation 1 = During night
F16	Condenser fan control	Condenser Fan period time for pulse mode	Min value = 1 and Max value = 30 minutes	If condenser fan pulsing is chosen to be active during the night mode, this parameter gives the length of the pulsing interval
F17	Condenser fan control	Condenser Fan On-time in % of period time	Min value = 0 and Max value = 100 %	If condenser fan pulsing is chosen to be active during the night mode, this parameter gives the ON time during this period.
g02	Compressor control	Compressor Restart time		Minimum time between two starts.
g03	Compressor control	Compressor Minimum Stop time		Minimum compressor stop time, betwen stop and new start
g04	Compressor control	Compressor Minimum Run time		Minimum run time, once the compressor has started, Regardless of actual requested compressor capacity
g05	Compressor control	Compressor Period time		If the requested compressor capacity goes below 50%, the compressor starts and stops in a PWM pattern, where the duty cycle changes from 0 too 100. With this parameter, the period time is set.
g16	Compressor control	Compressor status	Running	Read out if compressor is running or not.
g17	Compressor control	Compressor speed percentage when running		Read out of the actual compressor speed in % of the variable speed band. 0% means minimum speed and 100% means maximum speed.
h01	Configuration -Temperature logger	Log interval	Min value = 15 and Max value = 240	Log interval for the temperature logger, The smaller the logging interval is selected, the sooner the logger will be full and over write previous logs.
h02	Configuration - Temperature logger	High threshold for logging	Min value = -50 and Max value = 50	"High Threshold" ≥ "Low Threshold": Temperatures outside or on these limits will be logged. "Low Threshold" > "High Threshold": Temperatures inside or on these limits will be logged.
h03	Configuration - Temperature logger	Low threshold for logging	Min value = -50 and Max value = 50	"High Threshold" ≥ "Low Threshold": Temperatures outside or on these limits will be logged. "Low Threshold" > "High Threshold": Temperatures inside or on these limits will be logged.
h04		Clear Datalog	1=Clear (Auto reset)	Clearing of the temperature logger
h11	Configuration - Temperature logger	Selection of sensor for the logger function	None S6 TS3/S4 Talarm Tact S5 S3B	The SLV has an internal temperature logger, which can log one of the following parameters: 0 = No logging function defined 1 = S6 temperature, with a Pt1000 sensor 2 = TS3/S4 temperature, 3 = Talarm temperature, 4 = Tact temperature, 5 = S5 temperature, 6 = S3B temperature,
h12	Configuration - Temperature logger	Alarm limit for the logger function	Min value = -50 and Max value = 50	High alarm limit for the temperature logger
h13	Configuration - Temperature logger	Time delay for the alarm	Min value = 1 and Max value = 60 minutes	Time delay for high temperature alarm on the Temperature logger

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	0	1	-	0	0	0						W	W	W
	x	1	30	min	5	5	5						W	W	W
	x	0	100	%	100	100	100						W	W	W
	x	0	10	min	2	2	2						W	W	W
	x	0	240	sec	90	90	90						W	W	W
	x	0	240	sec	30	30	30						W	W	W
	x	5	30	min	15	15	15						W	W	W
		0	1	-						R	R	R	R	R	R
		0 (2000 RPM)	100 (4000 RPM)	%						R	R	R	R	R	R
	x	15	240	Min	30	30	30		W	W	W	W	W	W	W
	x	-50	50	°C	-50	-50	0						W	W	W
	x	-50	50	°C	50	50	0						W	W	W
		0	1	-									W	W	W
	x	0	6	-	4	4	0			W	W		W	W	W
	x	-50	50	°C	-14	15	8			W	W	W	W	W	W
	x	1	60	min	60	60	30			W	W	W	W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
L01	Configuration - Relay configuration	Relay 1 configuration	Configuration of Relay 1: 0: Always OFF 1: Aways ON 2: ON during operation 3: ON when stopped 4: Follows Compressor 5: Condenser fan 6: Evaporator fan 7: Defrost 8: Drain heater 11: Blind relay 12: Light relay 13: Do not use 14: Do not use 15: Alarm relay 16: Temperature logger alarm relay 17: Do not use 18: Control timer	Configuration of Relay 1: 0: Always OFF 1: Aways ON 2: ON during operation 3 ON when stopped 4: Follows Compressor 5: Condenser fan 6: Evaporator fan 7: Defrost 8: Drain heater 11: Blind relay 12: Light relay 13: Do not use 14: Do not use 15: Alarm relay 16: Temperature logger alarm relay 17: Do not use 18: Control timer
L02	Configuration - Relay configuration	Relay 2 configuration	Configuration of Relay 1: 0: Always OFF 1: Aways ON 2: ON during operation 3: ON when stopped 4: Follows Compressor 5: Condenser fan 6: Evaporator fan 7: Defrost 8: Drain heater 11: Blind relay 12: Light relay 13: Do not use 14: Do not use 15: Alarm relay 16: Temperature logger alarm relay 17: Do not use 18: Control timer	Configuration of Relay 2: 0: Always OFF 1: Aways ON 2: ON during operation 3: ON when stopped 4: Follows Compressor 5: Condenser fan 6: Evaporator fan 7: Defrost 8: Drain heater 11: Blind relay 12: Light relay 13: Do not use 14: Do not use 15: Alarm relay 16: Temperature logger alarm relay 17: Do not use 18: Control timer
L03	Configuration - Relay configuration	Relay 3 configuration	Configuration of Relay 1: 0: Always OFF 1: Aways ON 2: ON during operation 3: ON when stopped 4: Follows Compressor 5: Condenser fan 6: Evaporator fan 7: Defrost 8: Drain heater 11: Blind relay 12: Light relay 13: Do not use 14: Do not use 15: Alarm relay 16: Temperature logger alarm relay 17: Do not use 18: Control timer	Configuration of Relay 3: 0: Always OFF 1: Aways ON 2: ON during operation 3: ON when stopped 4: Follows Compressor 5: Condenser fan 6: Evaporator fan 7: Defrost 8: Drain heater 11: Blind relay 12: Light relay 13: Do not use 14: Do not use 15: Alarm relay 16: Temperature logger alarm relay 17: Do not use 18: Control timer
L04	Configuration - Relay configuration	Relay 4 configuration	Configuration of Relay 1: 0: Always OFF 1: Aways ON 2: ON during operation 3: ON when stopped 4: Follows Compressor 5: Condenser fan 6: Evaporator fan 7: Defrost 8: Drain heater 11: Blind relay 12: Light relay 13: Do not use 14: Do not use 15: Alarm relay 16: Temperature logger alarm relay 17: Do not use 18: Control timer	Configuration of Relay 4: 0: Always OFF 1: Aways ON 2: ON during operation 3: ON when stopped 4: Follows Compressor 5: Condenser fan 6: Evaporator fan 7: Defrost 8: Drain heater 11: Blind relay 12: Light relay 13: Do not use 14: Do not use 15: Alarm relay 16: Temperature logger alarm relay 17: Do not use 18: Control timer

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	0	18 (19: not used. 20: relay 1 test)	-	Follow com-pressor 4	Follow com-pressor 4	5						W	W	W
	x	0	18 (19: not used. 21: relay 2 test)	-	Always off0	Always off0	6						W	W	W
	x	0	18 (19: not used. 22: relay 3 test)	-	Defrost relay 7	Defrost relay 7	8						W	W	W
	x	0	18 (19: not used. 23: relay 4 test)	-	Light Relay 12	Light Relay 12	7						W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
L05	Configuration - Relay configuration	Relay 5 configuration	Configuration of Relay 1: 0: Always OFF 1: Aways ON 2: ON during operation 3: ON during stopped 4: Follows Compressor 5: Condenser fan 6: Evaporator fan 7: Defrost 8: Drain heater 11: Blind relay 12: Light relay 13: Do not use 14: Do not use 15: Alarm relay 16: Temperature logger alarm relay 17: Do not use 18: Control timer	Configuration of Relay 5: 0: Always OFF 1: Aways ON 2: ON during operation 3: ON during stopped 4: Follows Compressor 5: Condenser fan 6: Evaporator fan 7: Defrost 8: Drain heater 11: Blind relay 12: Light relay 13: Do not use 14: Do not use 15: Alarm relay 16: Temperature logger alarm relay 17: Do not use 18: Control timer
L50	Service Mode	PCB temperature		Controller temperature on the circuit board
L51	Service Mode	Inverter temperature		Controller temperature on the inverter module
L52	Service Mode	Mains voltage supply		Readout of mains supply voltage
L53	Service Mode	Mains frequency		Readout of mains supply frequency
L60	Service Mode	Compressor manual control	on off	Compressor in manual mode
L61	Service Mode	Compressor actual state		Indication of wether the compressor is running or not
L62	Service Mode	Compressor manual speed percentage when running		Setpoint of the actual compressor speed, in % of the variable speed band during manual control. 0% means compressor runs at minimum speed and 100% means that the compressor runs at max speed during service mode.
L63	Service Mode	Compressor actual speed percentage when running		Readout of the actual compressor speed, in % of the variable speed band during manual control. 0% means compressor runs at minimum speed and 100% means that the compressor runs at max speed during service mode.
L99	Enhanced Overview - Enhanced Overview	Actual motor speed		Readout of actual compressor speed in RPM
n21	Configuration - Safety function	Emergency cooling Capacity during S3 / S4 error	Min value = 0 and Max value = 100 %	In case of a sensor error, the compressor capacity will be reset to this value
n22	Compressor control	Compressor Capacity Switching on door open (n23)	on off	If the DI1 input is defined as a door switch, the compressor will be completely stopped.
n23	Compressor control	Compressor Capacity at door open	Min value = 0 and Max value =100	If the DI1 input is defined as a door switch, the compressor capacity will be reset to this value.
n28	Compressor control - Advanced settings	Capacity Override mode	0: No override 1: Override, followed by resuming previous capacity. 2: Override, followed by Pull dow or Pull up	Readout of the input for capacity controller: 0: No override 1: Override, followed by resuming previous capacity. 2: Override, followed by Pull down or Pull up

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	0	18 (19: not used. 24: relay 5 test)	-	Always off0	Always off0	Alarm Relay 15						W	W	W
		0 (61691)	100 (15329)	°C (Bit)								R	R	R	R
		0 (1989)	150 (52469)	°C (Bit)								R	R	R	R
		0	307	V								R	R	R	R
		40 (valid limit)	70 (valid limit)	Hz								R	R	R	R
		0	1	-						R	R	R	R	R	R
		0	1	-								R	R	R	R
		0 (2000 RPM)	100,00 (4000 RPM)	%						R	R	W	W	W	W
		0 (2000 RPM)	100,00 (4000 RPM)	%								R	R	R	R
		0	6000	RPM								R	R	R	R
	x	0	100	%	60	30	50				W		W	W	W
	x	0/no	1/yes	-	1	1	1						W	W	W
	x	0	100	%	50	50	50				W		W	W	W
		0	2	-							R	R	R	R	R

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
n29	Compressor control - Advanced settings	Capacity Override value		Read out of requested compressor capacity during override
n30	Compressor control	Smart setting for PI control	0: User defined 1: Very slow control 2: Slow control 3: Medium control (Default) 4: Fast control 5: Very fast control	The settings for the PI controller can be defined by the user, in close cooperation with Secop. As a starting point it is suggested to start with "Medium Control" If faster or slower capacity adaptation is needed, for instance in small cabinets or control according to air temperature, the speed can be increased or vice versa. 0: User defined 1: Very slow control 2: Slow control 3: Medium control (Default) 4: Fast control 5: Very fast control
n35	Compressor control - Advanced settings	PID polynomial R1	Min value = -50 and Max value = 50	The SLV controller is using a PID controller for the calculation of the appropriate compressor capacity, based upon the deviation of the actual cabinet temperature compared to the reference temperature Tref. The bigger the deviation, then the faster the compressor speed increases or decreases. The adaptation of the 8 polynomial values and the sampling time should only be done in close cooperation with Secop.
n36	Compressor control - Advanced settings	PID polynomial R2	Min value = -50 and Max value = 50	The SLV controller is using a PID controller for the calculation of the appropriate compressor capacity, based upon the deviation of the actual cabinet temperature compared to the reference temperature Tref. The bigger the deviation, then the faster the compressor speed increases or decreases. The adaptation of the 8 polynomial values and the sampling time should only be done in close cooperation with Secop.
n37	Compressor control - Advanced settings	PID polynomial S0	Min value = -50 and Max value = 50	The SLV controller is using a PID controller for the calculation of the appropriate compressor capacity, based upon the deviation of the actual cabinet temperature compared to the reference temperature Tref. The bigger the deviation, then the faster the compressor speed increases or decreases. The adaptation of the 8 polynomial values and the sampling time should only be done in close cooperation with Secop.
n38	Compressor control - Advanced settings	PID polynomial S1	Min value = -50 and Max value = 50	The SLV controller is using a PID controller for the calculation of the appropriate compressor capacity, based upon the deviation of the actual cabinet temperature compared to the reference temperature Tref. The bigger the deviation, then the faster the compressor speed increases or decreases. The adaptation of the 8 polynomial values and the sampling time should only be done in close cooperation with Secop.

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
		0	100	%						R	R	R	R	R	R
	x	0	10	no test	3	3	3			W	W	W (no copy)	W (no copy)	W (no copy)	W (no copy)
	x	-50.00	50,0	-									W	W	W
	x	-50.00	50,0	-									W	W	W
	x	-50.00	50,0	-									W	W	W
	x	-50.00	50,0	-									W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
n39		PID polynomial S2	Min value = -50 and Max value = 50	The SLV controller is using a PID controller for the calculation of the appropriate compressor capacity, based upon the deviation of the actual cabinet temperature compared to the reference temperature Tref. The bigger the deviation, then the faster the compressor speed increases or decreases. The adaptation of the 8 polynomial values and the sampling time should only be done in close cooperation with Secop.
n40	Compressor control - Advanced settings	PID polynomial T0	Min value = -50 and Max value = 50	The SLV controller is using a PID controller for the calculation of the appropriate compressor capacity, based upon the deviation of the actual cabinet temperature compared to the reference temperature Tref. The bigger the deviation, then the faster the compressor speed increases or decreases. The adaptation of the 8 polynomial values and the sampling time should only be done in close cooperation with Secop.
n41	Compressor control - Advanced settings	PID polynomial T1	Min value = -50 and Max value = 50	The SLV controller is using a PID controller for the calculation of the appropriate compressor capacity, based upon the deviation of the actual cabinet temperature compared to the reference temperature Tref. The bigger the deviation, then the faster the compressor speed increases or decreases. The adaptation of the 8 polynomial values and the sampling time should only be done in close cooperation with Secop.
n42	Compressor control - Advanced settings	PID polynomial T2	Min value = -50 and Max value = 50	The SLV controller is using a PID controller for the calculation of the appropriate compressor capacity, based upon the deviation of the actual cabinet temperature compared to the reference temperature Tref. The bigger the deviation, then the faster the compressor speed increases or decreases. The adaptation of the 8 polynomial values and the sampling time should only be done in close cooperation with Secop.
n43	Compressor control - Advanced settings	h sampling time	Min value = 10 and Max value = 600 Seconds	The SLV controller is using a PID controller for the calculation of the appropriate compressor capacity, based upon the deviation of the actual cabinet temperature compared to the reference temperature Tref. The bigger the deviation, then the faster the compressor speed increases or decreases. The adaptation of the 8 polynomial values and the sampling time should only be done in close cooperation with Secop.
n46	Compressor control - Advanced settings	Tact below Tref to start Pull Up limit	Min value = -10; Max value = 0 K	At sudden load fluctuations, the cabinet temperature falls below this limit. In such cases a forced pull up is iniated once the timer n50 has elapsed, in order to get the cabinet temperature inside the range as fast as possible.
n47	Compressor control - Advanced settings	Tact above Tref to start Pull Down Limit	Min value = 0 and Max value = 10 K	At sudden load fluctuations, the cabinet temperature reaches above this limit. In such cases a forced pull down is iniated once the timer n50 has elapsed, in order to get the cabinet temperature inside the range as fast as possible.

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	-50.00	50,0	-									W	W	W
	x	-50.00	50,0	-									W	W	W
	x	-50.00	50,0	-									W	W	W
	x	-50.00	50,0	-									W	W	W
	x	10	600	sec	30	30	30				W		W	W	W
	x	-10	0	K	-3	-3	-3				W		W	W	W
	x	0	10	K	3	3	3				W		W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
n48	Compressor control - Advanced settings	Tact below Tref to end Pull Down	Min vallue= -10 and Max value = 10 K	An ongoing pull down will stop when the cabinet temperature reaches this value. This "under shoot" in temperature helps the PI controller to hit the right compressor capacity after a pull down. The result is a more stable temperature control.
n49	Compressor control - Advanced settings	Tact above Tref to end Pull Up	Min vallue= -10 and Max value = 10 K	An ongoing pull up will stop when the cabinet temperature reaches this value. This "over shoot" in temperature helps the PI controller to hit the right compressor capacity after a pull up. The result is a more stable temperature control.
n50	Compressor control - Advanced settings	Temperature out of range timeout	Min value = 0 and Max value = 1800 minutes	Time to elapse, before a forced pull up or pull down is initated.
n51	Compressor control - Advanced settings	Optimized pull down time	Min value = 0 and Max value = 1800 minutes	When the SLV controller decides to initiate a new pull down, the compressor capacity will be set to "The optimised pull down capacity (n52)" as long as this timer is active.
n52	Compressor control - Advanced settings	Optimized pull down capacity	Min value = 20 and Max value = 100 %	Compressor capacity during the "Optimised pull down time (51)"
n53	Compressor control - Advanced settings	Compressor capacity after pulldown day	Min value = 0 and Max value = 100 %	At initial start up or start up after power down during the day time, the SLV controller will use this "Best guess" as a starting point for the PI controller after the pull down. In all other cases the SLV controller will remember the actual running compressor capacity and revert back to this after the pull down.
n54	Compressor control - Advanced settings	Compressor capacity after pulldown night	Min value = 0 and Max value =100 %	At initial start up or start up after power down during the night time, the SLV controller will use this "Best guess" as a starting point for the PI controller after the pull down. In all other cases the SLV controller will remember the actual running compressor capacity and revert back to this after the pull down.
n55	Compressor control - Advanced settings	Requested capacity	Min value = 0 and Max value = 100 %	Readout of the actual requested compressor capacity
n56	Compressor control - Advanced settings	Controller state		Readout of the current controller state: 0 = Off 1 = Pull down 2 = Pull up 3 = In range 4 = Out of range Up 5 = Out of range Down 6 = Override
n80		Under voltage Cut out		
n81		Under voltage Cut in		
n82		Over voltage alarm		

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	-10	10	K	0	0	0				W		W	W	W
	x	-10	10	K	0	0	0				W		W	W	W
	x	0.0	30.0	min	4	4	4.0				W		W	W	W
	x	0.0	30.0	min	10	10	10.0				W		W	W	W
	x	20	100	%	60	60	60				W		W	W	W
	x	0	100	%	60	60	60				W		W	W	W
	x	0	100	%	55	55	55				W		W	W	W
		0	100	%							R	R	R	R	R
		0	6	-						R	R	R	R	R	R
		fix 36301	fix 36301	AD value (V AC)								R	R	R	W
		fix 38436	fix 38436	AD value (V AC)								R	R	R	W
		fix 56373	fix 56373	AD value (V AC)								R	R	R	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
o02	Configuration - Low voltage I/O	I/O function	None Do not use Door function Alarm Defrost start Main switch Night operation Application changeover Light switch Separate alarm open Case cleaning Do not use Blind cover button Do not use Do not use Setpoint Tref. Setpoint CapRef Alarm LED Operating LED Capacity in Capacity out Do not use Do not use Do not use	
o03	Configuration - Application setup	Modbus address		Setting for the Modbus address. If this setting is modified remotely, the controller will be lost on the modbus, until the new address is recognised from the front end. If the address is set outside the accessible address range, the controller will remain invisible.
o04	Configuration - Application setup	Modbus baud rate	1 = 9600 2= 19200	Setting for the Modbus baud rate if this setting is modified remotely, the controller will be lost on the modbus, until the new baud rate has been changed in the front end.
o05	Service Mode	Access code enduser	Min value = -999 and Max value = 999	Acces code for the end user level on the display
o06	Service Mode	Access code installer	Min value = -999 and Max value = 999	Acces code for the installer level on the display
o07	Service Mode	Access code service	Min value = -999 and Max value = 999	Acces code for the service level on the display
o08	Service Mode	Access code OEM lab	Min value = -999 and Max value = 999	Acces code for the OEM level on the display
o15	Configuration - User interface	Display temperature step resolution	0,1 0,5 1,0	The temperature read out of the display is shown with one digit after the comma. Here you select the step resolution. 1 = XX,1° - → resolution of 0.1 2 = XX,5° - → resolution of 0.5 3 = XX,0° - → resolution of 1.0
o16	Defrost control	Max hold time after coordinated defrost	Min value = 0 and Max value = 360 minutes	If Max hold time after coordinated defrost is set active and the ADAP COOL system has set a hold request through the Modbus register 2022 the pull down must be delayed until the signal is received from the master to resume cooling the o16 time expires. If the o16 time expires an alarm A5 must be signalled.
o17	Configuration - User interface	S3/S4 weighting (100%=S4, 0%=S3)	Min value = 0 and Max value = 100 %	For the temperature read out on the display a mix of the S3 & S4 measurements can be used. With a setting of 100%, only the S4 sensor will be used. With a setting of 0% only the S3 sensor will be used. For settings in between, a mix will be used.

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	0	23	-	0	0	0					W	W	W	W
		1	247	-	1	1	1		W	W	W	W	W	W	W
		1	2	-	2	2	2		W	W	W	W	W	W	W
		-999	999	-	0 - off	0 - off	0				W	W	W	W	W
		-999	999	-	11	11	0				W	W	W	W	W
		-999	999	-	22	22	0				W		W	W	W
		-999	999	-	33	33	0				W		W	W	W
	x	1	3	°K	2 = XX,5° - → resolut-ion of 0.5	2 = XX,5° - → resolut-ion of 0.5	2				W		W	W	W
	x	0/skip	240	min	20	20	20				W		W	W	W
S4% (100% = S4, 0% = S3)	x	0	100	%	100	100	100				W		W	W	W

5. Parameters (continued)

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
o38	Configuration - light control	o38a: Configuration light by night condition o38b: Configuration light by door switch o38c: Control light by o39	Enabled Disabled Enable Disabled Disabled o39 control o39 network timeout Illegal	Enabling of controls that can turn off the light. As default the light will always be on.
o39	Configuration - light control	Remote Activation of light relay	on off	Activation of light via modbus
o40	Configuration - light control	Light turn off delay after door close.	Min value = 0 and Max value = 240 minutes	Delay of Light Off, after closing the door
o41	Configuration - light control	Inverted Light function	Enabled Disabled	Inverted light function, so that the relay is on during the day time.
o46	Configuration - Case cleaning	Case cleaning status		Readout of the case cleaning status 0: Not started 1: De icing 2: Waiting for cleaning
o47	Configuration - Case cleaning	Deicing method	Compressor off Execute defrost	Selection of de icing method during a melting cycle. 0: Compressor stop 1: Execute defrost
o62	Configuration - Blind function	Blind function	None Night	Selection of how to start the blind function
o84	Alarm handling	Auto acknowledge timer (0 disabled)	0 = off, 1-240min	Auto acknowledgement timer for alarms 0: No auto acknowledgement 1 - 240: delay
o90	Configuration- Calibration	Filter constant for Tact	no filter 0,10 K/sec 0,09 K/sec 0,08 K/sec 0,07 K/sec 0,06 K/sec 0,05 K/sec 0,04 K/sec 0,03 K/sec 0,02 K/sec 0,01 K/sec	In some cases it might be useful to slower the updating speed of the actual temperature value: 0: No damping, (fastest updating) 1: 0,10 K/sec 2: 0,09 K/sec 3: 0,08 K/sec 4: 0,07 K/sec 5: 0,06 K/sec 6: 0,05 K/sec 7: 0,04 K/sec 8: 0,03 K/sec 9: 0,02 K/sec 10: 0,01 K/sec (slowest updating)
o91	Temperature alarms	Filter constant for Talarm	no filter 0,10 K/sec 0,09 K/sec 0,08 K/sec 0,07 K/sec 0,06 K/sec 0,05 K/sec 0,04 K/sec 0,03 K/sec 0,02 K/sec 0,01 K/sec	In some cases it might be useful to slower the updating speed of the alarm temperature value: 0: No damping, (fastest updating) 1: 0,10 K/sec 2: 0,09 K/sec 3: 0,08 K/sec 4: 0,07 K/sec 5: 0,06 K/sec 6: 0,05 K/sec 7: 0,04 K/sec 8: 0,03 K/sec 9: 0,02 K/sec 10: 0,01 K/sec (slowest updating)

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	0	15	-	a38a=En a38b=En a38c=o39 control	a38a=En a38b=En a38c=o39 control	a38a=En a38b=En a38c=o39 control						W	W	W
only if o38 = 2 or 4) On = light		0/Off	1/On	-	1	1	0						W	W	W
(only if o38 = 3)	x	0	0	min	0	0	2						W	W	W
	x	0	0	-	0	0	0						W	W	W
		0	2	-	0	0	0					R	R	R	R
	x	0	1	-	0	0	0					W	W	W	W
	x	0	1	-	0	0	0			W	W	W	W	W	W
		0	240	min	0	0	0						W	W	W
(0 = Fastest, 10 = Slow-est)	x	0	10	D°K/ sec	1= 0.1K/ sec	1= 0.1K/ sec	1						W	W	W
	x	0	10	D°K/ sec	1	1	1						W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
o92	Configuration-Calibration	Filter constant for TS3/S4	no filter 0,10 K/sec 0,09 K/sec 0,08 K/sec 0,07 K/sec 0,06 K/sec 0,05 K/sec 0,04 K/sec 0,03 K/sec 0,02 K/sec 0,01 K/sec	In some cases it might be useful to slower the updating speed of the weighted S3/S4 temperature value: 0: No damping, (fastest updating) 1: 0,10 K/sec 2: 0,09 K/sec 3: 0,08 K/sec 4: 0,07 K/sec 5: 0,06 K/sec 6: 0,05 K/sec 7: 0,04 K/sec 8: 0,03 K/sec 9: 0,02 K/sec 10: 0,01 K/sec (slowest updating)
o93	Configuration - User interface	Definition of functionality on lower button	None Light switch Night Mode Defrost stop temperature S6 temperature S5 temperature Readout of S3b temperature Actual Tref	The lower right button of the display contains a number of predefined functions: 0 = No function 1 = Activation of Light ON /OFF 2 = Activation of Night Mode, 3 = Read out of Defrost stop temperature, 4 = Read out of S6 temperature, 5 = Read out of S5 temperature, 6 = Read out of S3b temperature, 7 = Read out of Actual Tref
o94	Configuration-Calibration	Filter constant for S5	no filter 0,10 K/sec 0,09 K/sec 0,08 K/sec 0,07 K/sec 0,06 K/sec 0,05 K/sec 0,04 K/sec 0,03 K/sec 0,02 K/sec 0,01 K/sec	In some cases it might be useful to slower the updating speed of the S5 temperature value: 0: No damping, (fastest updating) 1: 0,10 K/sec 2: 0,09 K/sec 3: 0,08 K/sec 4: 0,07 K/sec 5: 0,06 K/sec 6: 0,05 K/sec 7: 0,04 K/sec 8: 0,03 K/sec 9: 0,02 K/sec 10: 0,01 K/sec (slowest updating)
o95	Configuration-Calibration	Filter constant for S6	no filter 0,10 K/sec 0,09 K/sec 0,08 K/sec 0,07 K/sec 0,06 K/sec 0,05 K/sec 0,04 K/sec 0,03 K/sec 0,02 K/sec 0,01 K/sec	In some cases it might be useful to slower the updating speed of the S6 temperature value: 0: No damping, (fastest updating) 1: 0,10 K/sec 2: 0,09 K/sec 3: 0,08 K/sec 4: 0,07 K/sec 5: 0,06 K/sec 6: 0,05 K/sec 7: 0,04 K/sec 8: 0,03 K/sec 9: 0,02 K/sec 10: 0,01 K/sec (slowest updating)
o96	Configuration-Calibration	Filter constant for S3b	no filter 0,10 K/sec 0,09 K/sec 0,08 K/sec 0,07 K/sec 0,06 K/sec 0,05 K/sec 0,04 K/sec 0,03 K/sec 0,02 K/sec 0,01 K/sec	In some cases it might be useful to slower the updating speed of the S3b temperature value: 0: No damping, (fastest updating) 1: 0,10 K/sec 2: 0,09 K/sec 3: 0,08 K/sec 4: 0,07 K/sec 5: 0,06 K/sec 6: 0,05 K/sec 7: 0,04 K/sec 8: 0,03 K/sec 9: 0,02 K/sec 10: 0,01 K/sec (slowest updating)
o97	Alarm handling	Alarm on relay	None Application Faults All	Selection of alarm level on the relay: 0 = No alarm indication at all 1 = Only User Application Faults (System related) 2 = All

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	0	10	D°K/ sec	1= 0.1K/ sec	1= 0.1K/ sec	1						W	W	W
		0	7	-	1	1	0				W		W	W	W
	x	0	10	D°K/ sec	1= 0.1K/ sec	1= 0.1K/ sec	1						W	W	W
	x	0	10	D°K/ sec	1= 0.1K/ sec	1= 0.1K/ sec	1						W	W	W
	x	0	10	D°K/ sec	1= 0.1K/ sec	1= 0.1K/ sec	1						W	W	W
		0	2	-	1	1	2		W	W	W		W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
o98	Configuration - User interface	Alarm on display	None Application Faults All	Selection of alarm level on the display: 0 = No alarm indication at all 1 = Only User Application Faults (System related) 2 = All
o99	Configuration - User interface	Display temperature	TS3/TS4 T Temperature logger Tact Talarm S3 S3b S4 S5 S6	Selection of temperature, to show on the display: 0 = TS3/TS4 1 = T Temperature logger 2 = Tact 3 = Talarm 4 = S3 5 = S3b 6 = S4 7 = S5 8 = S6
P01	Configuration - Application setup	Application 1 enable	Enabled Disabled	Enabling the Application 1
P02	Configuration - Application setup	Application 2 enable	Enabled Disabled	Enabling the Application 2
P03	Configuration - Application setup	Application 3 enable	Enabled Disabled	Enabling the Application 3
P04	Configuration - Application setup	Application 4 enable	Enabled Disabled	Enabling the Application 4
P05	Configuration - Application setup	Application 5 enable	Enabled Disabled	Enabling the Application 5
P10	Configuration - Application setup	Application selection	Application 1 Application 2 Application 3 Application 4 Application 5	Application selection
P20	Enhanced Overview - Status & Configuration - Application setup	Actual selected application		Actual selected application
P21	Configuration - Application setup	Night application mode for Application 1	None Application1 Application 2 Application 3 Application 4 Application 5	Night application mode for Application 1
P22	Configuration - Application setup	Night application mode for Application 2	None Application1 Application 2 Application 3 Application 4 Application 5	Night application mode for Application 2
P23	Configuration - Application setup	Night application mode for Application 3	None Application1 Application 2 Application 3 Application 4 Application 5	Night application mode for Application 3
P24	Configuration - Application setup	Night application mode for Application 4	None Application1 Application 2 Application 3 Application 4 Application 5	Night application mode for Application 4

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
		0	2	-	1	1	2		W	W	W	W	W	W	W
	x	0	8	-	0 = TS3/ S4	0 = TS3/ S4	2			W	W		W	W	W
		0	1	-	1	1	1		W	W	W	W	W	W	W
		0	1	-	1	1	1		W	W	W	W	W	W	W
		0	1	-	0	1	1		W	W	W	W	W	W	W
		0	1	-	0	1	1		W	W	W	W	W	W	W
		0	1	-	0	1	1		W	W	W	W	W	W	W
		0	4	-	x	x	x					W (no copy)	W (no copy)	W (no copy)	W (no copy)
		0	4	-	R	R	R	R	R	R	R	R	R	R	R
		0/ None	5	-	0	0	0		W	W	W	W	W	W	W
		0/ None	5	-	0	0	0		W	W	W	W	W	W	W
		0/ None	5	-	0	0	0		W	W	W	W	W	W	W
		0/ None	5	-	0	0	0		W	W	W	W	W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
P25	Configuration - Application setup	Night application mode for Application 5	None Application1 Application 2 Application 3 Application 4 Application 5	Night application mode for Application 5
P27	Configuration - Application setup	Application for closed DI	None Application1 Application 2 Application 3 Application 4 Application 5	Application for closed DI
P28	Configuration - Application setup	Application for Active control timer	None Application1 Application 2 Application 3 Application 4 Application 5	Application selection for Active control timer
P30	Service Mode	Restore to factory settings		Restore controller settings to factory settings
P31	Configuration - Application setup	Store to factory settings		Store actual controller settings as factory settings
P32	Configuration - User interface	Selection of stopped mode	None Display Remote Digital Input Action Timer	The SLV controller can be put into stop mode by mode by one of the following ways: 0: No stopped functionality 1: Via a button on the display 2: Remotely via the Modbus 3: Digital input DI1 4: During active Control timer
P34	Enhanced Overview - Status	Alarm		Read out of active alarms
P39 (U84, U85, U86, U87, U88)	Service Mode	U84 Relay 1 actual state U85 Relay 2 actual state U86 Relay 3 actual state U87 Relay 4 actual state U88 Relay 5 actual state		Read out of actual relay state
P50	Configuration - Safety function	Check temperature	None Tdefr Tact S3b	When the "Check Temperature" function is chosen to be active after a defrosting, one of the following temperatures must be below the "Maximum check value (P53)" before the timer P51 has elapsed. Otherwise the compressor will stop. This function should only be chosen if the cabinet is performing hot gas defrosting! 0 = No safety function enabled 1 = Monitoring of the Tdefr temperature 2 = Monitoring of the Tact temperature 3 = Monitoring of the S3b temperature
P51	Configuration - Safety function	Time after compressor start to check	Min value = 0 and Max value = 240 minutes	Delay, before the temperature check is made.
P52	Configuration - Safety function	Interval between checking's	Min value = 0 and Max value = 240 minutes	Interval between checkings

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
		0/ None	5	-	0	0	0		W	W	W	W	W	W	W
		0/ None	5	-	0	0	0		W	W	W	W	W	W	W
		0/ None	5	-	0	0	0					W	W	W	W
		0	1/Do	-						W	W	W	W	W	W
		0	1/Do	-							W		W (no copy)	W (no copy)	W (no copy)
	x	0	5	-	1	1	0			W	W	W	W	W	W
	x	0	255	-								R	R	R	R
		0	65535	-								R	R	R	R
	x	0	3	-	1	1	0				W		W	W	W
	x	0/ Always	240	min	15	15	5				W		W	W	W
	x	0	240	min	1	1	1				W		W	W	W

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
P53	Configuration - Safety function	Maximum check value (P50)	Min value = -50 and Max value = 50	Maximum allowed temperature for the check function
P82				
P83	Service Mode	Service mode	Normal mode, Service mode Customer lab mode Secop test mode Supply Chain test mode	Selection of controller mode: 0: Normal mode, 1: Service mode 2: Customer lab mode 3: Secop test mode 4: Supply Chain test mode
P84	Service Mode	Relay 1 Manual Control	on off	Relay 1 manual ON during service mode
P85	Service Mode	Relay 2 Manual control	on off	Relay 2 manual ON during service mode
P86	Service Mode	Relay 3 Manual control	on off	Relay 3 manual ON during service mode
P87	Service Mode	Relay 4 Manual control	on off	Relay 4 manual ON during service mode
P88	Service Mode	Relay 5 Manual control	on off	Relay 5 manual ON during service mode
r01	Enhanced Overview - Status & Configuration - Temperatures setpoint	Tset		Temperature setpoint
r02	Configuration - Temperatures setpoint	Tset max	min value = -50 and Max value = 50	Upper limitation of the temperature setpoint range. The reference is calculated as Tset + delta night. To prevent the end user from creating settings beyond the intended working range of the cabinet.
r03	Configuration - Temperatures setpoint	Tset min	min value = -50 and Max value = 50	Lower limitation of temperature setpoint range. The reference is calculated as Tset + delta night. To prevent the end user from creating settings beyond the intended working range of the cabinet.
r04	Configuration - User interface	S3/S4 temperature offset	min value = -10 and Max value = 10 K	Offset adjustment for the display read out
r05	Configuration - User interface	Temperature unit (°C/°F)	°C °F	Selection of the temperature units for the display 0: °C 1: °F
r06	Configuration - User interface	Minimum limitation of Display read out	Min value = -50 and Max value = 20	Limitation of the lowest temperature readout of the display.
r09	Calibration - Temperature sensors	S4 offset		Offset calibration of the S4 sensor
r10	Calibration - Temperature sensors	S3 offset		Offset calibration of the S3 sensor
r13	Configuration - Temperatures setpoint	Night setback	Min value = -10 and Max value = 10 K	Displacement of the Tset during night condition.

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	-50	50	°C	12	12	12				W		W	W	W
		0	65535				0						W	W	W
		0	4	-	0	0	0			W	W	W	W	W	W
		0	1	Off / On			0			W	W	W	W	W	W
		0	1	Off / On			0			W	W	W	W	W	W
		0	1	Off / On			0			W	W	W	W	W	W
		0	1	Off / On			0			W	W	W	W	W	W
		0	1	Off / On			0			W	W	W	W	W	W
	x	-49	50	°C	-20	5	0					W	W	W	W
	x	-49	50	°C	-15	10	50					W	W	W	W
	x	-50	49	°C	-27	0	-50					W	W	W	W
	x	-10.0	+10.0	°K	-3	-3	0				W		W	W	W
	x	°C	°F	°C/°F	0 = C	0 = C	0 = C				W		W	W	W
	x	-50	20	°C	-50	0	-50				W		W	W	W
	x	-10.0	10.0	°K	0	0	0						W	W	W
	x	-10.0	10.0	°K	0	0	0						W	W	W
	x	-10	10	°K	0	0	0					W	W	W	W

5. Parameters (continued)

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
r15	Configuration - Temperatures setpoint	S3/S4 weighting for Tact at day (100%=S4, 0%=S3)	Min value = 0 and Max value = 100 %	For the thermostat temperature measurement during the day, a mix of the S3 & S4 measurement can be used. With a setting of 100%, only the S4 sensor will be used. With a setting of 0% only the S3 sensor will be used. For settings in between, a mix will be used.
r16	Configuration - Melting function	Time between melt periods	Min value = 0 and Max value = 60 hours	If the compressor has been running continously longer than the time limit, a compressor cut out will be initiated.
r17	Configuration - Melting function	Duration of melt period	Min value = 0 and Max value = 65535 minutes	During this cycle the display will show "deF" until the cool down period has elapsed. If the timers for "Drain post heating" and "Delay for fan" have not elapsed at this time, they will be forced off.
r18	Configuration - Melting function	Duration of cool down period	Min value = 0 and Max value = 65535 minutes	During this cycle the display will show "deF" until the cool down period has elapsed. If the timers for "Drain post heating" and "Delay for fan" have not elapsed at this time, they will be forced off.
r19	Configuration - Melting function	Lower temperature limit to start melt	Min value = -15 and Max value = 15	There will be no melting initiated, if the temperature setting for the thermostat is below this limit.
r20	Configuration - Melting function	Higher temperature limit to start melt	Min value = -15 and Max value = 15	There will be no melting initated, if the temperature setting for the thermostat is above this limit.
r25	Configuration - Temperatures setpoint	Tref max	min value = -50 and Max value = 50	Upper limitation of temperature reference range. The reference is calculated as Tset + night setback.
r26	Configuration - Temperatures setpoint	Tref min	min value = -50 and Max value = 50	Lower limitation of temperature reference range.The reference is calculated as Tset + night setback.
r55	Calibration - Temperature sensors	S3b offset		Offset calibration of the S3b sensor
r56	Calibration - Temperature sensors	S6 offset		Offset calibration of the S6 sensor
r57	Calibration - Temperature sensors	S5 offset		Offset calibration of the S5 sensor
r61	Configuration - Temperatures setpoint	S3/S4 weighting for Tact at night (100% = S4, 0% = S3)	Min value = 0 and Max value = 100 %	For the thermostat temperature measurement during the night, a mix of the S3 & S4 measurement can be used. With a setting of 100%, only the S4 sensor will be used. With a setting of 0% only the S3 sensor will be used. For settings in between, a mix will be used.
t07	Configuration - Real time clock	hour	Min value = 0 and Max value = 59	Hour setting for the internal clock
t08	Configuration - Real time clock	Minutes	Min value = 0 and Max value = 59	Minute setting for the internal clock
t09		Seconds		

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
S4% (100% = S4, 0% = S3)	x	0	100	%	100	100	100				W		W	W	W
	x	0/Off	10	hrs	0	0	1				W		W	W	W
	x	1	10	min	0	0	5				W		W	W	W
	x	0	10	min	0	0	0				W		W	W	W
	x	-15	15	°C	-5	-5	-5						W	W	W
	x	-15	15	°C	10	10	10						W	W	W
	x	-49	50	°C	-15	10	50					W	W	W	W
	x	-50	49	°C	-27	0	-50					W	W	W	W
	x	-10.0	10.0	°K	0	0	0						W	W	W
	x	-10.0	10.0	°K	0	0	0						W	W	W
	x	-10.0	10.0	°K	0	0	0						W	W	W
S4% (100% = S4, 0% = S3)	x	0	100	%	100	100	100				W		W	W	W
		0	23	hrs					W	W	W	W(no copy)	W(no copy)	W(no copy)	W(no copy)
		0	59	min					W	W	W	W(no copy)	W(no copy)	W(no copy)	W(no copy)
		0	59	min								W(no copy)	W(no copy)	W(no copy)	W(no copy)

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
t45	Configuration - Real time clock	Day	Min value = 1 and Max value = 31	Day setting for the internal clock
t46	Configuration - Real time clock	Month	Min value = 1 and Max value = 12	Month setting for the internal clock
t47	Configuration - Real time clock	Year	Min value = 2000 and Max value = 2099	Year setting for the internal clock
t80	Configuration - Control timer	Control timer Start hour	Min value = 0 an Max value = 23 hours	Starting time for the control timer. Ieg. Day/ night change over, application selection etc.
t81	Configuration - Control timer	Control timer Start minute	Min value = 0 and Max value = 59 minutes	Starting time for the control timer. Ieg. Day/ night change over, application selection etc.
t82	Configuration - Control timer	Control timer Stop hour	Min value = 0 and Max value = 23 hours	Stop time for the control timer
t83	Configuration - Control timer	Control timer Stop minute	Min value = 0 and Max value = 59 minutes	Stop time for the control timer
t84	Configuration - Control timer	Control timer Function.	Function: None Status display Main switch Night operation Light Application changeover Relay out	Selection of action for the control timer The function" Status display" is currently not supported.
U09	Service Mode	S5 Temperature		Readout of the raw S5 measurement
U12	Service Mode	S3 Temperature		Readout of the raw S3 measurement
U16	Service Mode	S4 Temperature		Readout of the raw S4 measurement
U17	Enhanced Overview - Status	Temperature Actual		Readout of the actual temperature, used as input to the temperature controller
U28	Enhanced Overview - Status	Tref		Readout of actual temperature reference, calculated as Tset + Night setback.
U36	Service Mode	S6 Temperature		Readout of the raw S6 measurement
U37	Enhanced Overview - Enhanced Overview	Defrost Temperature		Read out of defrost temperature
U56	Enhanced Overview - Enhanced Overview	Temperature Display		Read out of the temperature shown in the display

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
		1	31	day					W	W	W	W(no copy)	W(no copy)	W(no copy)	W(no copy)
		1	12	month					W	W	W	W(no copy)	W(no copy)	W(no copy)	W(no copy)
		9	99	Years					W	W	W	W(no copy)	W(no copy)	W(no copy)	W(no copy)
		0	23	hrs	0					W	W	W	W	W	W
		0	59	min	0					W	W	W	W	W	W
		0	23	hrs	0	0	0			W	W	W	W	W	W
		0	59	min	0	0	0			W	W	W	W	W	W
		0	6	-	0	0	0			W	W	W	W	W	W
		-55,00 (open circuit: -300,00)	+85.00 (short circuit: 300.00)	°C						R	R	R	R	R	R
		-55,00 (open circuit: -300,00)	+85.00 (short circuit: 300.00)	°C						R	R	R	R	R	R
		-55,00 (open circuit: -300,00)	+85.00 (short circuit: 300.00)	°C						R	R	R	R	R	R
	x	-55,00 (open circuit: -300,00)	+85.00 (short circuit: 300.00)	°C								R	R	R	R
	x	-59	60	°C	Ø	Ø	Ø					R	R	R	R
		-55,00 (open circuit: -300,00)	+85.00 (short circuit: 300.00)	°C						R	R	R	R	R	R
		-55,00 (open circuit: -300,00)	+85.00 (short circuit: 300.00)	°C								R	R	R	R
	x	-50,0 (depends on r06) (open circuit: -300.00)	+85.00 (short circuit: 300.00)	°C / °F								R	R	R	R

Code	T4C Parameter group	T4C Parameter text	T4C Drop down text	T4C Description of the parameter
U57	Enhanced Overview - Enhanced Overview & Temperature alarms	Alarm Temperature		Read out of the temperature used for the alarm monitoring
U70	Enhanced Overview - Status	Cooling appliance status		Readout of the cooling appliance status 0: Power up delay 1: Service mode 2: Stopped 3: Case deicing 4: Case cleaning 5: Loading 6: Defrosting 7: Melting 8: Cooling after melt 9: Normal control 10: Door open 11: Emergency cooling 12: Safety alarm stop 13: Busadr. in display 14: Restoring factory settings 15: Storing factory settings 16: Normal operating mode
U76	Service Mode	S3b Temperature		Readout of the raw S3b measurement
U98	Enhanced Overview - Enhanced Overview	Temperature TS3/S4		Read out of the weighted temperature S3/S4
U99	Enhanced Overview - Enhanced Overview & Configuration - Temperature logger	T Log		Read out of the temperature used in the temperature logger

T4C Help Text	Multi Apps	Min	Max	Unit	Default App. 1	Default App. 2	Default App. 3...5	Display End user Level	Display Inst. Level	Display Serv. Level	Display Prod. Level	T4C Service	T4C LL	T4C DSL	T4C DDL
	x	-55,00 (open circuit: -300,00)	+85.00 (short circuit: 300.00)	°C								R	R	R	R
	x	0	16	-								R	R	R	R
		-55,00 (open circuit: -300.00)	-85,00 (short circuit: -300.00)	°C						R	R	R	R	R	R
		-55,00 (open circuit: -300.00)	-85,00 (short circuit: -300.00)	°C								R	R	R	R
	x	-55,00 (open circuit: -300.00)	-85,00 (short circuit: -300.00)	°C								R	R	R	R

6.
MODBUS

The Modbus used in the SLV is based on a RS-485 physical layer. Timing is controlled by an UART. The transmission of data happens on a differential pair of wires. D1 is the non inverted representative of the UART signal; D0 is the inverted signal of the UART.
Be aware: the RS-485 is not comparable with a RS-232. Both lines on a RS-485 are carrying the same data, however on a RS-232 one line is for transmission and one is for receiving. The logic is based on the voltage level, D0 > D1 = ´1´and D0 < D1 =´0´. Both lines are referring against each other, whereas RS-232 signals are always referring to GND.
The communication is controlled by a bus-master. The required supported bus speeds are 9.6 kbit and the standard bit rate19.2 kbit; other standard bit rates are not supported.

Short description of all bus parts:

Knots
Knots are all devices on a bus which can receive and/or transmit data.

Bus-Master (Head-Unit, Gateway)
The bus-master is an active knot which starts the communication process requesting data from other passive knots. There is always only one bus master allowed.

Secondarys
Secondarys like the SLVs are passive knots which should only transmit data when a master requests them. A PNU list containing the data addresses is necessary to setup the bus-master.

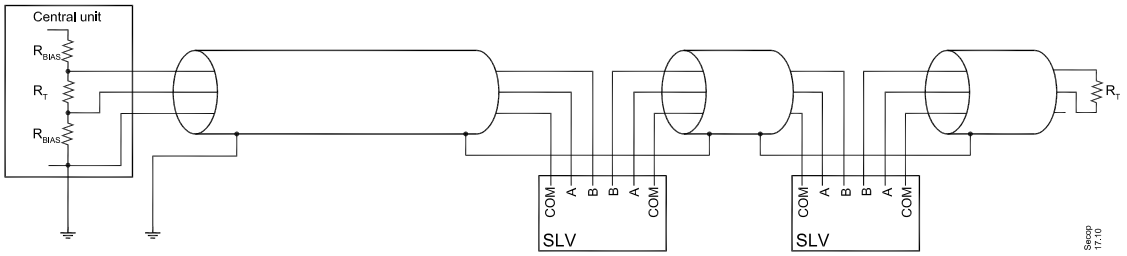
Data-Line
The data-line in a RS-485 based Modbus is a differential pair. A differential pair is built by 2 wires; D1 and D0. The logic is based on the voltage level, D0 > D1 = ´1´and D0 < D1 =´0´. The differential pair should always be together in a twisted pair.
For a minimum setup a bus-master, a secondary and the data-line between them is necessary. All the following items are recommended; they will increase the performance and reliability significantly.

Common-Line
The common-line is required to bring all transceivers to one potential level.

BIAS-Resistors (R_{BIAS}) (also called balancing or polarization)
The voltage level on the bus line is not defined when there is no transceiver active, so it is necessary to pull D1 and D0 to the bus-idle-state (D1=´1´, D0=´0´).

Termination-Resistor (R_T)
Must be installed at each end of the bus. They have to suppress reflections of the data signal at the end of the data-line.

Shield
The cable which is used should be shielded to protect the data-line against outside disturbances.



Equivalent Circuit diagram of the Modbus

6. Modbus (continued)

Recommended electrical equipment:

The SLV is designed to use standard network equipment with RJ-45 CAT5 cables and RJ-45 Y-distributors with 1:1 pin connection. Make sure that the adapter is a shielded type; otherwise the shield will end behind the first Y-connector. With these parts it is very simple to build up the connections between the SLV and the bus master. Screw terminals and D-shell 9 are also accepted by the standard and could be used, the SLV is designed to support RJ-45.

Be aware: Connection of a crossed cable in a 2-wire Modbus system may cause damage.

Installation:

Cable length
With the recommended usage of RJ-45 and CAT-5 cables, a maximum cable length of 600m may be reached without additional equipment. A cable length of 1000m is possible when choosing other cables, but this solution is normally much more expensive in material and installation. The possible cable length depends on the installation quality and the type of termination.

Knot count
The knot count depends on the properties of each connected knot and from the quality of the installation. At least 32 knots are always guaranteed (without repeater) by the specification, but this requires a proper installation.
The properties of the knots are defined by their driver capabilities. There are "full", "1/2", "1/4" and "1/8" available on the market. Full transceivers make 32 knots possible. With "1/2" transceivers up to 64 knots are possible and so on. The weakest transceiver holds the maximum possible knot count. When there is only one "full" transceiver in a bunch of "1/4" transceivers the bus is limited to max 32 units. With "1/8" transceivers it is possible to build a network with up to 256 knots, but this requires good network equipment and a very proper installation. With more than 32 knots a repeater could be necessary. When more than 31 SLVs are used, a repeater is recommended.

Data-Rate
The SLV is supporting a data rate of 9.6 kbit and 19.2 kbit, 19.2 kbit being the default. Further data-rates are not supported.

Wiring
The wiring is a one to one connection of the used lines, so all D1-lines are connected to one wire, similarly D0- lines and all commons (see also "Pin-Assignments"). D1 and D0 must be together in a twisted pair. This is guaranteed with the recommended equipment. The recommended topology is the "bus"- structure with passive taps and a derivation cable to the SLV. The standard allows a maximum length for passive taps of 20m and with multi-port taps of 40m, but the derivation cables should be as short as possible to reduce problems and increase performance.
This solution is the simplest way to install a cheap network with low risk of error. The recommended equipment is the standard parts for computer networks.

Polarization
The communication with the SLVs requires line polarization, the SLV as a passive device isn't prepared to do this. Both bus lines must be pulled to a stable state which represent its logical idle state D1 = '1'(type 5V) and D0= '0'(COM/PE). The specification requires a value of 450Ω to 650Ω for each. These balancing resistors must only be installed once on the bus. Often the master will have these resistors built in; otherwise it should be close to the master.

Termination
The specification requires a resistor of 150Ω (0.5W) at either end or a 120Ω (0.25W) resistor with a 1nF (25V) capacitor in series between D1 and D0. The bus termination is a very important point when the knot count is high and/or the cable is very long. The termination must be placed on both ends of the communication line.
It is possible that other Modbus equipment has built in termination, these terminators must be disabled (these additional terminators will increase the busload and limit the possible length of the bus and knot count). Only the terminators at the ends of the Modbus are allowed. The general rule is to reduce the resistance or to decrease the current. A reduction of the current by using a RC-terminator instead of a simple resistor is one of the safest ways. Be aware, it's possible that the terminations inside the bus master only have a resistor. In these cases it is recommended to disable the internal termination and add a RC-terminator external. This solution has the benefit of the lowest power consumption in bus idle state. A bus configuration with a normal resistor termination should only be used if there are only a few knots and a relative short bus.

6. Modbus (continued)

Common-Line

The common-line is required to bring together all transceivers which are connected to the bus. This line should have only one direct connection to PE, which should be close to the bus master. In some cases the master has a common port which has a direct PE connection. If this internal PE connection is optional a direct connection to a PE-rail would be the better choice. Further PE connections (like contact to the chase of the fridge) will establish loops which could have influence on the communication quality. Non isolated bus-knots are in general not allowed.

Shield

The used cables must be shielded. The requirements are the same as for the common. The shield must be connected to PE at only one point. Best-case would be the same point as the common (when common is direct connected to PE), but the common and the shield should have no further connection to each other. A connection to PE via a pigtail will decrease the performance; a metal cable clamp on a PE-rail is the preferable solution. All cables and connectors should be shielded. The shield of the female connector must be connected to the other female connectors in the Y-adaptors or in the D-shells.

Pin assignments

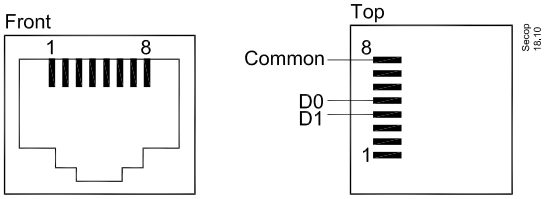
If an RJ-45 or a 9-pin D-shell connector is used for a standard Modbus device, the pin outs hereafter must be respected for every implemented circuit.

2W-Modbus RJ45 and 9-pin D-shell Pinouts						
Pin on RJ45	**Pin on D9-shell**	**Level of requirement**	**IDv Circuit**	**ITr Circuit**	**EIA/TIA-485 name**	**Description for IDv**
3	3	optional	PMC	–	–	Port Mode Control
4	5	required	Df	D1	B/B'	Transceiver terminal 1, V1 Voltage (V1 > V0 for binary 1 (OFF) state)
5	9	required	D0	D0	A/A'	Transceiver terminal 0, V0 Voltage (V0 > V1 for binary 0 (ON) state)
7	2	recommended	VP	–	–	Positive 5...24 V D.C. Power Supply
8	1	required	Common	Common	C/C'	Signal and Power Supply Common

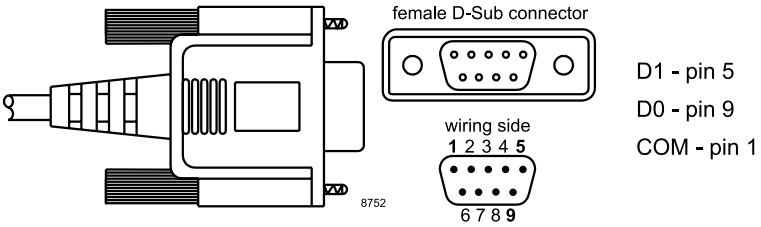
Pin assignment for RJ-45 and D-Sub

RJ-45 Jack for single pair communication

Device side – female connector



D-Sub connector



The following systems can be connected to the Modbus:

- ADAP-KOOL® – Danfoss supermarket monitoring system

- Master functions:
  - Night offset
  - Blind
  - Clock synchronization
  - Alarm limit offset
  - Dew point control

- TOOL4COOL® – Secop tool for adjusting and servicing of variable speed compressor products

The possibility of errors in the installation is very limited when using standard computer network equipment for the Modbus. A safely running bus is ensured with BIAS-resistors (inside the bus-masters) and the correct termination. Bigger networks require a proper installation of common lines and shielded cables.

For more information please refer to "Technical Resources" on www.modbus.org

7.
TECHNICAL DATA

7.1
SLV15CNK.2
Compressor R290

General		
Code number (without electronic unit)		104H8541
Electronic unit		105N46xx series controller
Approvals		EN 60335-2-34, CCC
Compressors on pallet		80

Application			
Application		LBP	
Frequency	Hz	50	60
Evaporating temperature	°C	-40 to -10	-40 to -10
Voltage range	V	180 - 254	180 - 254
Max. condensing temperature continuous (short)	°C	55 (65)	55 (65)
Max. winding temperature continuous (short)	°C	125 (135)	125 (135)

Cooling requirements							
Frequency	Hz	50			60		
Application		LBP	MBP	HBP	LBP	MBP	HBP
32°C		F2	–	–	F2	–	–
38°C		F2	–	–	F2	–	–
43°C		F2	–	–	F2	–	–

Remarks on application:
F2 = Fan cooling 3 m/s necessary
LST only, airflow on compressor and electronic unit: 3m/s

Features		
Speed range	rpm	2000 - 4000
Thermostat		- intregrated
		- electronic
Protections		- current
		- speed
		- temperature

Motor		
Motor type		permanent magnet
LRA (rated after 4 sec. UL984),	A	electronic cut off
Maximum current	A	4.6
Resistance, all 3 windings (25°C)	Ω	7.7

Design		
Displacement	cm^3	15.28
Oil quantity (type)	cm^3	600 (polyolester)
Maximum refrigerant charge	g	150
Free gas volume in compressor	cm^3	1510
Weight - Compressor/Electronic unit	kg	12.0/1.4

7.1 SLV15CNK.2 Compressor R290 (continued)

2,000 rpm	EN 12900 Household (CECOMAF)* 220 V, 50 Hz, fan cooling F_2																
Evap. temp. in °C	-45	-40	-35	-30	-25	-23.3	-20	-15	-10	-6.7	-5	0	5	7.2	10	15	20
Capacity in W		175	236	311	402	437	510	638	786								
Power cons. in W		192	229	266	303	315	338	372	402								
Current cons. in A		1.01	1.19	1.37	1.54	1.60	1.70	1.86	2.01								
COP in W/W		0.91	1.03	1.17	1.33	1.39	1.51	1.72	1.96								

2,500 rpm	EN 12900 Household (CECOMAF)* 220 V, 50 Hz, fan cooling F_2																
Evap. temp. in °C	-45	-40	-35	-30	-25	-23.3	-20	-15	-10	-6.7	-5	0	5	7.2	10	15	20
Capacity in W		218	297	393	509	553	645	805	990								
Power cons. in W		242	284	327	371	385	414	455	493								
Current cons. in A		1.18	1.39	1.60	1.80	1.87	2.01	2.22	2.42								
COP in W/W		0.90	1.05	1.20	1.37	1.43	1.56	1.77	2.01								

3,000 rpm	EN 12900 Household (CECOMAF)* 220 V, 50 Hz, fan cooling F_2																
Evap. temp. in °C	-45	-40	-35	-30	-25	-23.3	-20	-15	-10	-6.7	-5	0	5	7.2	10	15	20
Capacity in W		258	353	467	602	652	759	941	1151								
Power cons. in W		271	331	388	441	458	489	533	571								
Current cons. in A		1.34	1.57	1.80	2.03	2.11	2.26	2.50	2.73								
COP in W/W		0.95	1.07	1.21	1.37	1.43	1.55	1.77	2.02								

4,000 rpm	EN 12900 Household (CECOMAF)* 220 V, 50 Hz, fan cooling F_2																
Evap. temp. in °C	-45	-40	-35	-30	-25	-23.3	-20	-15	-10	-6.7	-5	0	5	7.2	10	15	20
Capacity in W		325	460	615	792	858	996	1228	1494								
Power cons. in W		355	436	512	583	607	650	713	771								
Current cons. in A		1.68	2.02	2.36	2.68	2.78	2.99	3.28	3.56								
COP in W/W		0.92	1.06	1.20	1.36	1.42	1.53	1.72	1.94								

Accessories for SLV15CNK.2	Code number
Cover	103N2008

Mounting accessories		Code number
Bolt joint for one compressor	Ø: 16 mm	118-1917
Bolt joint in quantities	Ø: 16 mm	118-1918
Snap-on in quantities	Ø: 16 mm	118-1919

Test conditions	EN 12900/CECOMAF*
Condensing temperature	45°C
Ambient temperature	32°C
Suction gas temperature	32°C
Liquid temperature	no subcooling

7.2 SLV12CLK.2 Compressor R404A/R507

General		
Code number (without electronic unit)		104L2603
Electronic unit		105N46xx series controller
Approvals		EN 60335-2-34, CCC
Compressors on pallet		80

Application			
Application		LBP	
Frequency	Hz	50	60
Evaporating temperature	°C	-40 to -10	-40 to -10
Voltage range	V	180 - 254	180 - 254
Max. condensing temperature continuous (short)	°C	50 (60)	50 (60)
Max. winding temperature continuous (short)	°C	125 (135)	125 (135)

Cooling requirements							
Frequency	Hz	50			60		
Application		LBP	MBP	HBP	LBP	MBP	HBP
32°C		F2	–	–	F2	–	–
38°C		F2	–	–	F2	–	–
43°C		F2	–	–	F2	–	–
Remarks on application: F2 = Fan cooling 3 m/s necessary LST only, airflow on compressor and electronic unit: 3m/s							

Features		
Speed range	rpm	2000 - 4000
Thermostat		- intregrated
		- electronic
Protections		- current
		- speed
		- temperature

Motor		
Motor type		permanent magnet
LRA (rated after 4 sec. UL984),	A	electronic cut off
Maximum current	A	4.6
Resistance, all 3 windings (25°C)	Ω	7.7

Design		
Displacement	cm^3	12.87
Oil quantity (type)	cm^3	600 (polyolester)
Maximum refrigerant charge	g	1300
Free gas volume in compressor	cm^3	1510
Weight - Compressor/Electronic unit	kg	12.0/1.4

7.2 SLV12CLK.2 Compressor R404A/R507 (continued)

2,000 rpm	EN 12900 Household (CECOMAF)* 220 V, 50 Hz, fan cooling F_2											
Evap. temp. in °C	-45	-40	-35	-30	-25	-23.3	-20	-15	-10	-6.7	-5	0
Capacity in W		134	196	269	355	387	455	572	705			
Power cons. in W		182	227	268	308	321	345	379	410			
Current cons. in A		0.97	1.16	1.36	1.55	1.62	1.74	1.94	2.13			
COP in W/W		0.74	0.86	1.00	1.15	1.21	1.32	1.51	1.72			

2,500 rpm	EN 12900 Household (CECOMAF)* 220 V, 50 Hz, fan cooling F_2											
Evap. temp. in °C	-45	-40	-35	-30	-25	-23.3	-20	-15	-10	-6.7	-5	0
Capacity in W		160	243	342	459	502	592	742	910			
Power cons. in W		212	270	325	377	394	426	472	515			
Current cons. in A		1.06	1.32	1.58	1.82	1.91	2.07	2.30	2.53			
COP in W/W		0.75	0.90	1.05	1.22	1.27	1.39	1.57	1.77			

3,000 rpm	EN 12900 Household (CECOMAF)* 220 V, 50 Hz, fan cooling F_2											
Evap. temp. in °C	-45	-40	-35	-30	-25	-23.3	-20	-15	-10	-6.7	-5	0
Capacity in W		181	283	406	550	604	714	895	1093			
Power cons. in W		237	308	375	439	460	499	557	612			
Current cons. in A		1.13	1.45	1.76	2.06	2.16	2.35	2.62	2.88			
COP in W/W		0.76	0.92	1.08	1.25	1.31	1.43	1.61	1.79			

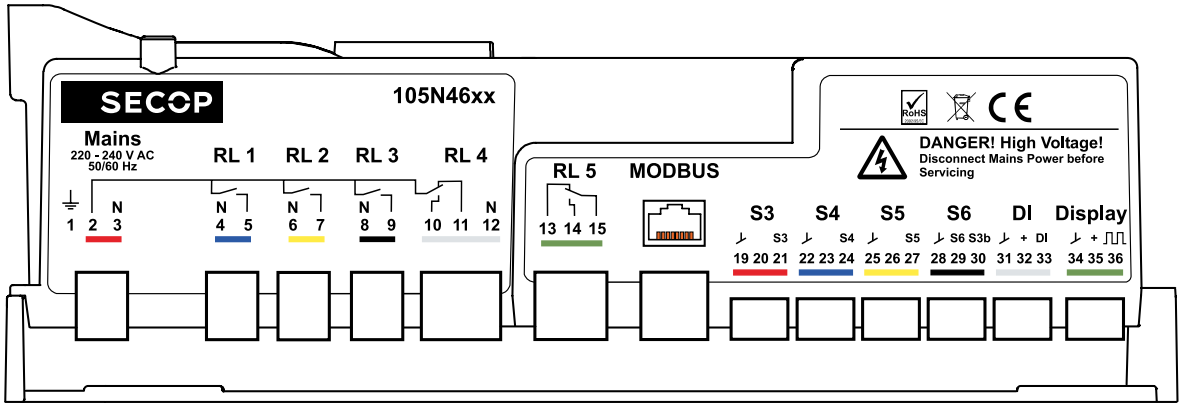
4,000 rpm	EN 12900 Household (CECOMAF)* 220 V, 50 Hz, fan cooling F_2											
Evap. temp. in °C	-45	-40	-35	-30	-25	-23.3	-20	-15	-10	-6.7	-5	0
Capacity in W		200	370	542	720	782	909	1114	1339			
Power cons. in W		270	404	508	588	611	649	695	731			
Current cons. in A		0.91	1.68	2.30	2.77	2.90	3.10	3.28	3.31			
COP in W/W		0.74	0.92	1.07	1.22	1.28	1.40	1.60	1.83			

Accessories for SLV12CLK.2	Code number
Cover	103N2008

Mounting accessories		Code number
Bolt joint for one compressor	Ø: 16 mm	118-1917
Bolt joint in quantities	Ø: 16 mm	118-1918
Snap-on in quantities	Ø: 16 mm	118-1919

Test conditions	EN 12900/CECOMAF*
Condensing temperature	45°C
Ambient temperature	32°C
Suction gas temperature	32°C
Liquid temperature	no subcooling

7.3
SLV 105N46xx Series Controller



Mains	red
RL 1	blue
RL 2	yellow
RL 3	black
RL 4	grey
RL 5	green
S3	red
S4	blue
S5	yellow
S6	black
DI	grey
Display	green

Input Power

Name	Pin	Name	Type	Specification
Earth	1			protective earth
Phase	2			voltage
Neutral	3			current 6.3 A (10 A Fuse)

Relays

Name	Pin	Name	Type	Specification
RL 1	4	Neutral	Neutral pass through, live switched, normally open	Voltage 230 V AC current 2 A rms cos phi 0.65 number of switchings (EN60730-1) 100000 special feature for R3: zero crossing switch special feature for R5: zero crossing switch gold plated for small signal switching min contact load 1 mA max contact load 20 mA Attention: if used for more than 20 mA once, it cannot be used for low voltage again max. total current for RL1 to RL 4 2 A rms max. current for RL5 2 A rms
	5	Normal open		
RL 2	6	Neutral	Neutral pass through, live switched, normally open	
	7	Normal open		
RL 3	8	Neutral	Neutral pass through, live switched, normally open	
	9	Normal open		
RL 4	10	Normal open	Neutral pass through, live switched, normally open and normally closed	
	12	Normal closed		
	12	Neutral		
RL 5	13	Normal closed	Galvanic isolated, base pin and normally/closed connection	
	14	Normal open		
	15	Common		

Modbus

Name	Pin	Name	Type	Specification
MODBUS	4	D1	MODBUS-RTU, RS-485	COM-Port Settings: 19.2 kbit 8 bit data length Even parity, single stop bit
	5	D0		
	8	GND (insulated)		

Sensor inputs

Name	Pin	Name	Type	Specification
S3	19	GND	Analogue input for connection to NTC 5K sensor	Measurement range -55 to 85° C Max. cable length 3 m Suitable for EPCOS M2020 Not insulated
	21	S3		
S4	22	GND	Analogue input for connection to NTC 5K sensor	
	24	S4		
S5	25	GND	Analogue input for connection to NTC 5K sensor	
	27	S5		
S3b	28	GND	Analogue input for connection to NTC 5K sensor	
	30	S3b		
S6	28	GND	Analogue input for connection to PT 1000 sensor	HACCP Suitable for PT 1000, double insulated
	29	S6		

Miscellaneous

Name	Pin	Name	Type	Specification
Not used	20			No connection
Not used	23			No connection
Not used	26			No connection

7.3 SLV 105N46xx Series Controller (continued)

Motor connection

Name	Pin	Name	Type	Specification
COMP (cable)	MC		3 phase trapezoidal and sensor less BLDC motor drive	Voltage switched 350 V DC Current limit 4.5 A Frequency norm 10 KHz / < 15 KHz

DI

Name	Pin	Name	Type	Specification
DI	31	GND	Low voltage digital I/O Analogue input	+ supply voltage (32/33)
	32	Supply for external device		Voltage 12 V DC Max. current 50 mA Short circuit protected
	33	DI		Max. current sourcing 20 mA

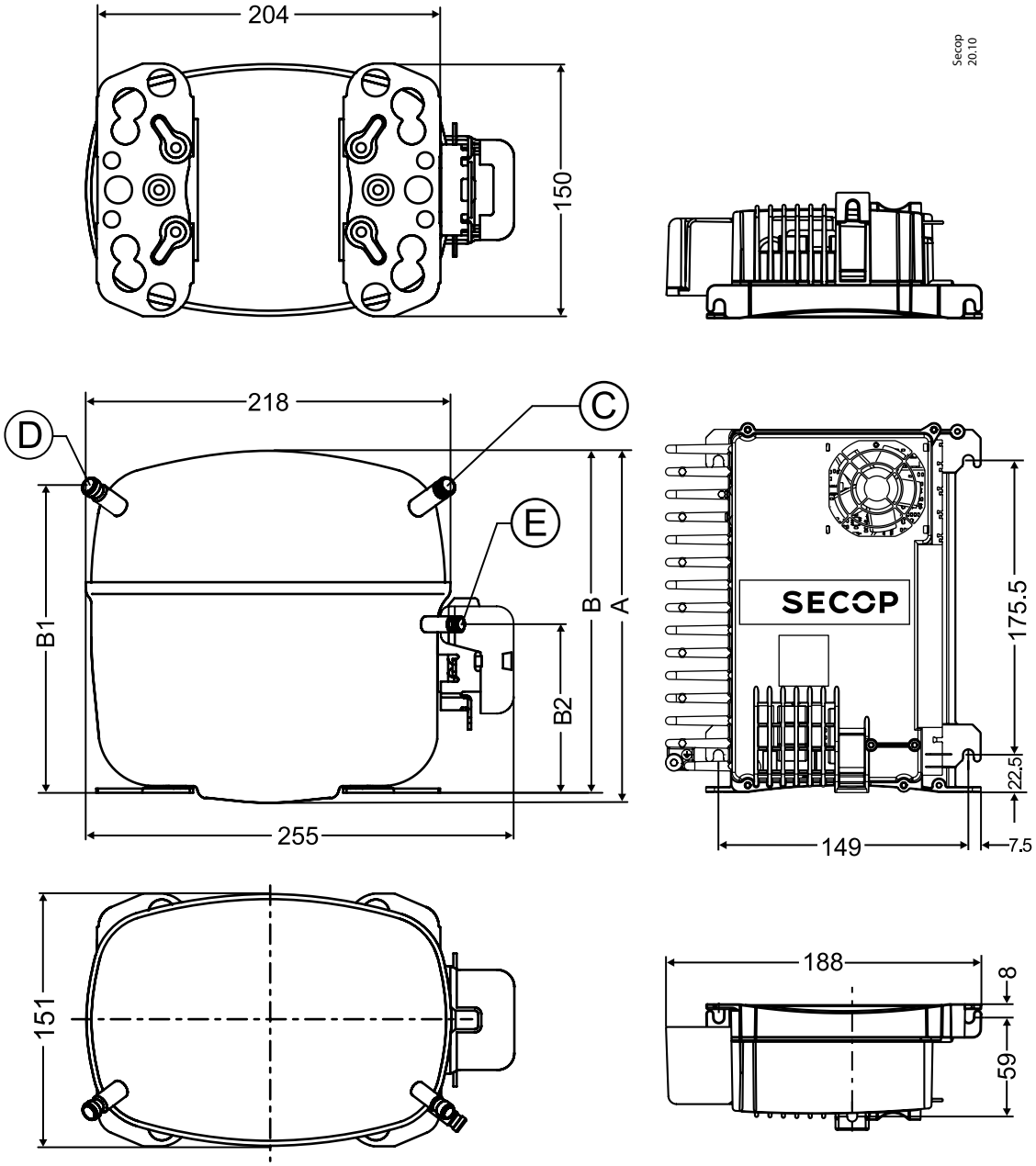
Display

Name	Pin	Name	Type	Specification
Display	34	GND	Display connection Low voltage digital I/O Analogue input	+ supply voltage (35/36)
	35	Supply		Voltage 12 V DC Max. current 50 mA Short circuit protected
	36	Data signal		Max. current sourcing 20 mA

General Specifications

Name	Specification
	WEEE RoHS IMDS CE LVD - Low Voltage Directive 2006/95/EC EMC - Electromagnetic Compatibility Directive 2004/108/EC
Operating conditions	-10 °C to 50 °C humidity < 90 % RH non condensing
Storage conditions	-20 °C to 70 °C humidity < 90 % rH non condensing
Supply voltage	230 V (+15 % / - 20 %)
Frequency	50/60 Hz
Input power rating	1000 W at 230 V (+15 % / - 20 %)
Idle power	1 W
Airflow	Min 3 ms

7.4
Dimensions



Dimensions			
Height	mm	A	199
		B	193
		B1	173
		B2	90
Suction connector	location/I.D. mm | angle	C	10.2 | 37°
	material | seal		Cu-plated steel | Al cap
Process connector	location/I.D. mm | angle	D	6.2 | 37°
	material | seal		Cu-plated steel | Al cap
Discharge connector	location/I.D. mm | angle	E	6.2 | 37°
	material | seal		Cu-plated steel | Al cap
Oil cooler connector	location/I.D. mm | angle	F	–
	material | seal		–
Connector tolerance	I.D. mm		±0.09

8.
ORDERING

	Item	Code no.	Description
Controller	SLV controller 105N46xx series	105N4600	For refrigeration device with Modbus only
Display / Cables / Sensors / Connetors / Potentiometer Control	Display CRA 172	105N9512	3 ½ LED based local display 3 push buttons width: 74 mm, height: 34 mm, depth: 22 mm
	Display cable, short	105N9509	length: 600 mm 3 wires isolated for display connection
	Display cable, long	105N9511	length: 2000 mm 3 wires isolated for display connection
	Temperature sensor S3	105N9626	length: 3000 mm EPCOS M2020
	Temperature sensor S4	105N9629	length: 2000 mm EPCOS M2020
	Temperature sensor S5	105N9633	length: 2000 mm EPCOS M2020
	Counter connector for Digital Input	105N9513	10 pcs. / bundle
	Counter connector for Mains	105N9563	10 pcs. / bundle
	Counter connector for RL1	105N9565	10 pcs. / bundle
	Counter connector for RL2	105N9567	10 pcs. / bundle
	Counter connector for RL3	105N9569	10 pcs. / bundle
	Counter connector for RL4	105N9571	10 pcs. / bundle
	Counter connector for RL5	105N9573	10 pcs. / bundle
	Counter connector for DI, Mains, RL1-RL5	105N9575	7 pcs. / bundle (1 piece of each type)
	Potentiometer control	on request	small assembly with potentiometer for setpoint control, 1 Operating/Fault LED
Gateway	Secop Bluetooth® gateway	105N9502	with USB power supply and DSUB-9 / RJ45 adaptor
	RJ45 Ethernet patch cable	not available from Secop	connection between SLV controller and Bluetooth® gateway with DSUB-9 / RJ45 adaptor
Software	Tool4Cool® LabEdition	free of charge	**www.secop.com/tool4cool.html**

TOOL4COOL®

Flexible control settings

SLV WITH INTELLIGENT 220 V 50/60 HZ CONTROLLER

SLV compressors are the natural choice when you need a versatile package for a wide range of applications. The built-in data logging function which monitors system performance and the intelligent controller for ultimate control and alarm management, are just a few of the enhancements that place SLV compressors above other optimised compressors.




OUR JOURNEY SO FAR

1956
Founded and start up production of Pancake compressor.

1960
Introduction TL compressors.

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

1972
Introduction FR compressors.

1990
Introduction NL 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 Zlate Moravce, Slovakia founded.

2008
Production facility in Wuqing, China founded.

2010
Introduction SLV-CNK.2 and SLV-CLK.2 variable speed compressors.

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