ECKELMANN

Operating instruction

VS 300 Compact Pack Controller

Controller for Compressor and Condenser Control - Version V2.10

Doku-Version 2.05 - Firmware 2.10 - 15. September 2017

Eckelmann Gruppe

Eckelmann AG
Business Unit Refrigeration and Building Automation
Berliner Straße 161
65205 Wiesbaden, Germany

Telephone +49 611 7103-700
Fax +49 611 7103-133

elds-support@eckelmann.de
www.eckelmann.de

Before commissioning and use, please check that this is the latest version of the document.
With the publication of a new version of the documentation, all previous versions lose their validity.
Errors and technical modifications are expressly reserved.

The current operating manual and information such as data sheets, more detailed documentation and FAQs are available for you on-line in E°EDP (Eckelmann ° Electronic Documentation Platform) at
www.eckelmann.de/elds

You reach all relevant documents for this component directly using the QR code:

Information on safety and connection instructions
are described in detail in chapter 1 ”Industrial safety notes”.

Notice:

Conventions

Explanation of 'General Instructions'

A general instruction is composed of two elements:
1. A pictogram of a hand at the side of the page as well as
2. The actual text:

For example:

Further information on the device's degree of protection is contained in the chapter ”Technical Data”.

Explanation of 'Safety Instructions and Hazard Warnings'

Safety instructions or hazard warnings are composed of four elements:
1. The pictogram (warning sign / symbol) at the edge of the page.
2. A short, concise description of the danger.
3. A description of the possible consequences.
4. A catalogue with prevention measures.

For example:

Warning - hazardous electrical voltage!
Danger of electric shock! BEFORE and AFTER connection it must checked that the 230 V AC relay outputs are **off load!**

On the following pages the warning signs and symbols employed for the safety instructions and hazard warnings in this documentation are described in more detail.

Warning Signs and Symbols Employed

Explanation of the warning signs and symbols employed for the safety instructions and hazard warnings in this documentation:

- **Attention symbol - general hazard warning**

1. Hazard warning
The attention symbol indicates all safety instructions in this operating and service manual, which, if not observed, could result in danger to life and limb. Carefully comply with the work safety instructions and proceed with special caution in these cases.

2. Attention
The attention symbol highlights guidelines and regulations, instructions and correct working procedures that must be carefully observed in order to prevent damage to or destruction of E*LDS components or a malfunctioning (for example to avoid damage to goods).

Failure to observe the attention symbol can result in personal injury (in extreme cases serious injuries or death) and/or material damage!

- **Voltage symbol - warns of hazardous electrical voltage**

This work safety symbol warns of danger from a hazardous electrical voltage, with potential consequences such as serious injury or death.

- **ESD symbol - warns of electrostatic sensitive components and assemblies**

This symbol indicates electrostatic sensitive components and assemblies, for details see chapter 1.5.

- **Note symbol**

The note symbol highlights practice tips and other useful information contained in this operating and service manual.

- **Battery disposal symbol**

Never dispose of this product with other household waste. Please inform yourself of the local regulations for the separate disposal of electrical and electronic products. The correct disposal of your old equipment will protect people and the environment from possible negative effects.
You will find further information in the chapter ”Decommissioning and Disposal”.

1 Safety instructions

The safety regulations, codes and notes contained in this section must definitely be observed and complied with at all times. During repairs on the entire E*LDS system, the accident prevention regulations and general safety instructions must be observed. Important information (safety instructions and hazard warnings) are indicated by corresponding symbols (see page 1 of the chapter ”Conventions”).
Follow these instructions in order to prevent accidents and danger to life and limb, as well as damage to the E*LDS system.

Warning - hazardous electrical voltage!
Danger of electric shock! Beware of external voltage at the digital inputs and outputs!
All device connections/plugs are **only** to be plugged in, unplugged and/or wired when **off load**.

- This instruction manual is an integral part of the equipment. It **must** be kept in the proximity of the equipment and must be stored for future use, so that it can be referred to when necessary. To avoid operating errors, the operation instructions must **always** be kept available for operating and maintenance staff, see Chapter 1.2.
- For safety reasons, the equipment must not be used for any application other than described in the manual i.e. only for the intended use, see Chapter 1.3.
- Before using the equipment, always check that its limits are suitable for the intended application.
- Check that the electric power supply is correct for the equipment before connecting it to power.
- When using uncoded plug connectors, it is possible to connect them so that there is a danger to life and limb! If this cannot be ruled out, coded plug connectors must be used.
- Specified ambient conditions (e.g. humidity and temperature limits) must be observed and complied with in order to avoid malfunctioning (see Section “Specifications”).
- Check correct wiring of the connections before switching on power to the equipment.
- Never operate the equipment without its casing. Before opening the casing the equipment must be switched to zero potential.
- Note and observe maximum load on relay contacts (see Section “Specifications”).
- Contact the supplier in any malfunction.
- Note that all leads running to and from the controller- especially those of the CAN bus - must be shielded and installed sufficiently clear of other leads carrying live power. Doing so will avoid faulty measurements and will protect the equipment from external interference via the analog inputs.
  Parallel connection of RC elements is recommended for applications in a critical environment.

1. According to experience, error message transmission is not yet fully functional during commissioning (no telephone line laid etc.) In such cases it is urgently recommended to monitor the controller via the CAN bus using a system centre, a store computer or an operator terminal, and enable error message transmission e.g. using a GSM modem via a mobile telephone network. In stand alone operation, or as an alternative to monitoring with the system centre / store computer / operator terminal, an alarm contact on the controller must be used in order to realise error message transmission via a telephone network.
2. In the interests of fire prevention, allowance should be made at the time of planning the system for a suitable shutdown device designed to operate in the event of excessive temperature on the defrost heater (high-temperature cutout).

For further information on the CAN bus, see the operation instructions
”Basic and General Safety and Connection Instructions”.

Work on electrical equipment may **only be undertaken by authorized and duly trained personnel** (as defined by DIN/VDE 0105 and IEC364) with full observance of the currently valid regulations contained in the following:

- VDE Regulations
- Local safety codes
- Intended use see chapter 1.3
- BGV A3 - Five Safety Rules see chapter 1.4
- ESD precautions and rules see chapter 1.5.
- Operating instructions

1.1 Disclaimer in the event of non-compliance

These operating instructions contain information on the commissioning, function, operation and maintenance of the controls and of the associated components.

Observance of these operating instructions is a prerequisite for safe and trouble-free operation.

1.2 Personnel requirements, requirements on staff

Special skills are required for project planning, programming, assembly, commissioning and maintenance work. This work may be performed by qualified and specially trained staff.

The staff involved in installation, commissioning and maintenance must have received the special training needed for them to work on the unit and on the automation system.

The project planning and programming staff must be familiar with the safety concepts involved in automation technology.

Expertise is a requirement for any work on electrical systems. Work on electrical installations may only be performed by trained electrical specialists (or may only be performed when directed or supervised by them). The applicable regulations (e.g. DIN EN 60204, EN 50178, BGV A3, and DIN VDE 0100/0113) must be followed.

The operating staff who deal with the unit/machine and the controls must be correspondingly trained and familiar with the operating instructions.

1.3 Intended use

This control system may only be used for the purpose for which it is intended:
The VS 300 has been designed for use as pack controller in commercial and industrial refrigeration systems with the intended functional scope as described in these operating instructions, and it is to be used under the environmental conditions in these instructions.

Follow the safety instructions, as well as the instructions on installation, commissioning, operation and maintenance. Only THEN should you start commissioning or operating the machine/system.

The safety and function of the machine/unit is only assured in the use for which it has been intended.

Never use the machine/unit, its components, assemblies or parts of it for a different purpose.

The installation may be only operated for the first time when the entire unit has been shown to conform to the EC Directives.

1.4 BGV A3 - Five safety rules

The following rules must be strictly observed:

1. **Disconnect electric power:** Disconnect power at all connections of the entire installation on which work is to be carried out.

Warning - hazardous electrical voltage!
Beware of possible external power supplies! **BEFORE and AFTER** connection it must be checked that the controller is **off load**! All device connections/plugs are only to be plugged in, unplugged and/or wired when off load.

2. **Secure against reconnection of power:** Tag the disconnected equipment with the following information:
   - What has been disconnected from power
   - Why it has been disconnected
   - Name of person who disconnected power
   - Use a suitable lock-out (e.g. padlock) to prevent reconnection of power.
3. **Make sure that power is off (authorized and duly trained personnel only):**
   - Check with voltmeter immediately before use.
   - Check that power is off on all connections at the disconnection point.
   - Check that power is off on all connections at the place of work.
4. **Ground and short circuit:** Ground and then short circuit all electrical parts at the place of work.
5. **Cover or bar off adjacent power-carrying parts:** Any equipment carrying power adjacent to the work area must be covered by suitable means (e.g. insulating cloths or panels).

1.5 Electrostatic sensitive devices (ESDs)

Electronic components and assemblies (e.g. printed circuit boards) are vulnerable to electrostatic discharge. Regulations for handling and working with electrostatic sensitive devices must definitely be observed and complied with, see also section 1.5.1!

All electrostatic sensitive devices (ESDs) are identified by the warning sign illustrated. Electrostatic discharge is caused by friction of insulating materials (e.g. floor coverings, synthetic fiber clothing, etc.).

Even slight charges can cause components to be damaged or destroyed. Damage cannot always be ascertained directly and it may take time for the component to actually fail in operation.

1.5.1 ESD - Rules for handling and working

Transport and store ESDs only in the protective packaging provided.

Avoid materials that may produce electrostatic discharge, for example

- Plastic containers and table tops
- Synthetic fiber clothing
- Plastic-soled shoes
- Plastic file covers
- Styrofoam packaging
- Computer monitors, etc.

Preferably wear the following:

- Cotton work clothes
- ESD shoes with conductive soles or leather soles

Use the following:

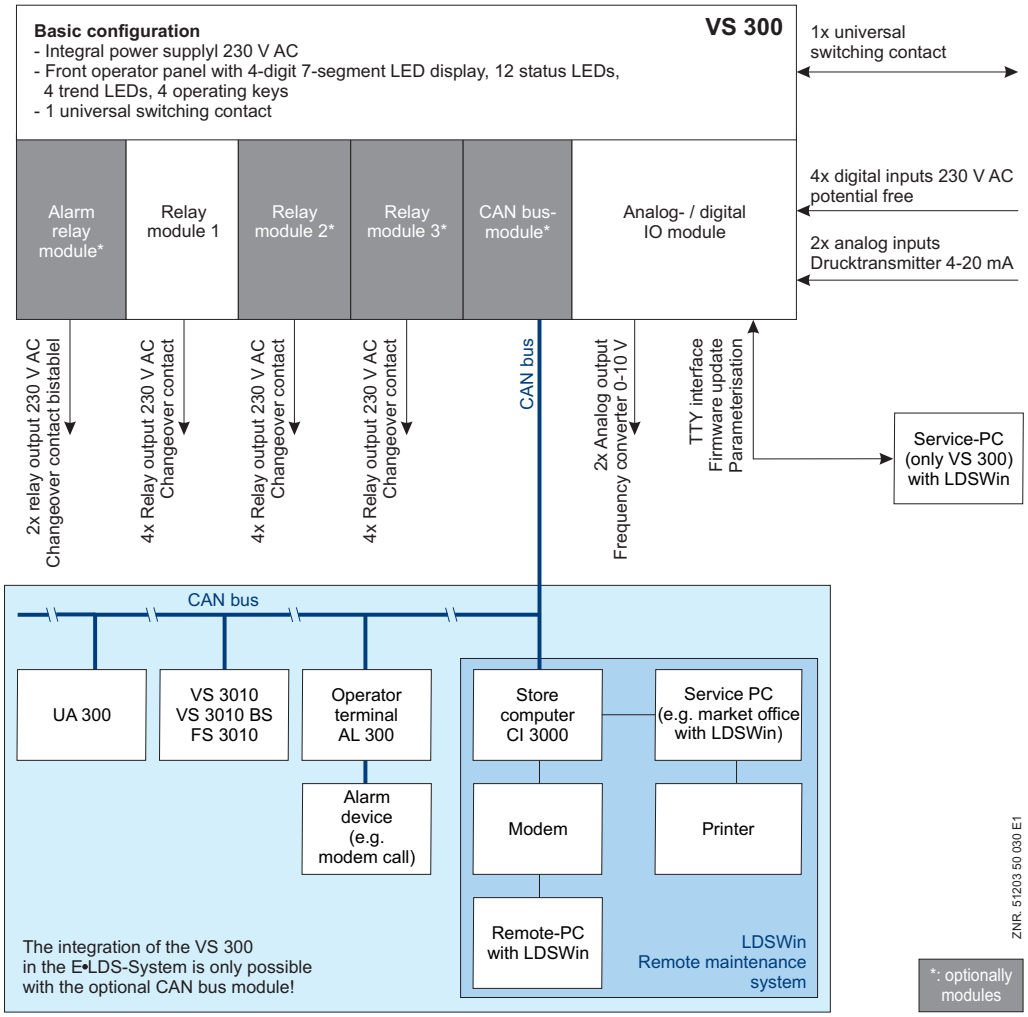
- Conductive flooring
- ESD workstations equipped with suitable tools (grounded soldering guns, antistatic wrist straps, etc.)
- Conductive ESD bags, conductive plastic containers, IC tubes or cartons lined with conductive foam
- Containers and worktops made of wood, metal or conductive plastics or paper bags

1.6 Abbreviations used

DIN	**D**eutsches **I**nstitut für **N**ormung e. V.
EGB	**E**lektrostatisch **G**efährdete **B**auelemente oder Baugruppen
ESD	**E**lectro-**s**tatic **d**ischarge (**E**lectro **S**ensitive **D**evices)
VDE	**V**erband **d**er **E**lektrotechnik **E**lektronik Informationstechnik e.V.
IEC	**I**nternational **E**lectric **C**ommittee
BGV A3	Employer’s Liability Association regulations for health and safety in the workplace

2 System Design of VS 300

The VS 300 Pack Controller is a modular-design unit.



See section 5 Pin and Terminal Assignments for detailed information on device and terminal assignment for the VS 300 Pack Controller.

Interfaces

CAN bus: For communication in LDS System

TTY: For firmware update and parameter setting of VS 300

Basic configuration - Front

1x Front operator panel with 4-digit 7-segment LED display

12 x Status LEDs indicating operating status of the relay/control stages

4 x Trend LEDs showing temperature/pressure status (high, low or within neutral zone)

4 x Operating keys and a universal switching contact.

Basic configuration - Rear

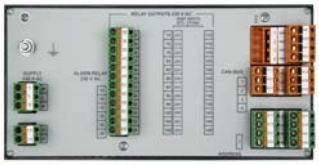
1 x Analog/digital IO module

- 4 digital inputs 230 V AC
- 2 analog inputs, pressure transducer 4-20 mA
- 2 analog outputs, speed adjuster/FC 0-10 V
- TTY port

1 x Universal contact to actuate external devices

1 x Power supply connection

Available expansion stages:

Number of relay modules	**1** (with 4 relay outputs)	**2** (with 8 relay outputs)	**3** (with 12 relay outputs)
CAN bus	**without** CAN bus module (stand alone operation)	**with** CAN bus module*	**with** CAN bus module*
Order number	**EVS300A001**	**EVS300A003**	**EVS300A004**
			

*** CAN bus module**

With the CAN bus module added, the VS 300 Pack Controller can be operated fully by a connected terminal (AL 300 Alarm Terminal or CI 3000 Store Computer), messages/alarms can be retrieved and processed, or the controller can be integrated in the LDSWin remote monitoring system.

2.1 New features compared to earlier versions

From Version 2.10:

- Increase of the system stability

From Version 2.09:

- Following refrigerants are supported:
  R22, R502, R134a, R404A, R402A, R717, R1270, R507, R407C, R410A, R290, R744 (transcritical operation not available), R407F, R422A, R422D, R408A, R407D, R407A, R427A, R438A, R512a, R170, R600, R600a, R449A, R450A, R448A, R455A, R447B, R1234ze, R1233zd, R41234yf

From Version 1.74:

- Extended range for pressure transmitter (up to 75 bar)

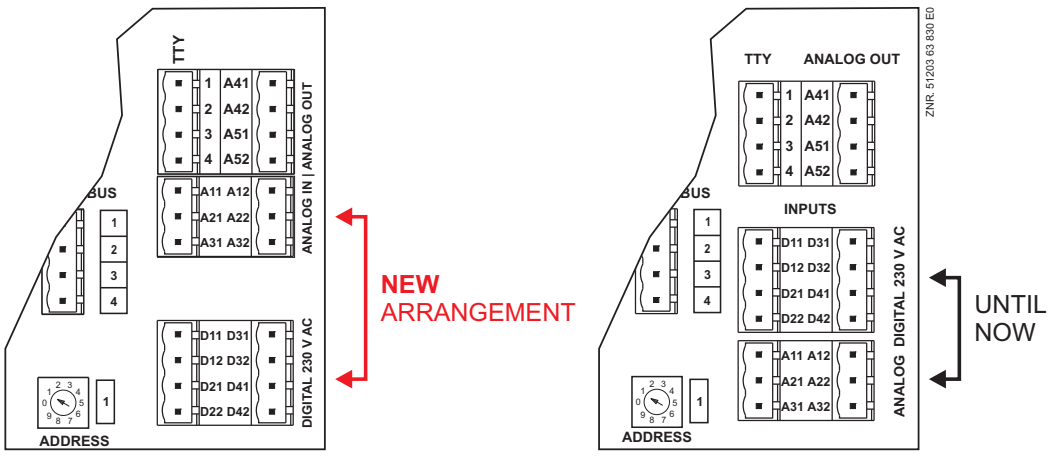
From Version 1.72:

- Centralized time synchronization (master clock):
  Date and time can be set with the pack controller for the complete system, if no System Centre, Store Computer or Operating Terminal ar available. Also performs cyclic synchronization of internal clocks in all E*LDS components via the CAN bus.

From Version 1.55:

- Demand dependent t_0-shift
- Monitoring of the minimum t_0-t_c difference

As of November 01, 2006, the pack controller is produced in a new unit version!
A point to note in wiring is that arrangement of the connections for digital and analog inputs has been modified as part of advanced technical design (see illustration):



From Version 1.46:

- NTLT controller configuration introduced
- Consumer control with compressor speed control
- Support for English and French languages

Notice:

3 Application of VS 300

The VS 300 Pack Controller is designed for controlling small to medium refrigeration compressor packs and condensers. It contains its own user interface with 4-digit 7-segment LED display and is suitable for stand-alone use. When expanded by an optional CAN bus module, it can be fully integrated into the LDSWin remote monitoring system. Additionally, it can be combined with an optional alarm module containing two alarm relays (Priority 1 and Priority 2).

For the compressor pack and condenser the VS 300 provides the following functions:

- Control and regulation
- Fault reporting
- Fault archiving
- Monitoring
- Archiving

These functions are as follows:

Pressure control with two freely configurable control loops for one or two independent refrigerant circuits (temperature/pressure ranges: **NT** - low-pressure normal-temperature refrigeration, **LT** - low-pressure low-temperature refrigeration and **HP** - high pressure) Depending on the expansion stage, the maximum number of relay/control stages is as follows:

- 4 relay/control stages (basic configuration)
- 8 relay/control stages (first expansion stage)
- 12 relay/control stages (second expansion stage)

The relay/control stages can be allocated to one control loop or split between the two control loops. Capacity-controlled compressors with up to three capacity stages are supported.

- The following control types are supported:
  - Step control
  - Speed control
  - Combined control
- Base load rotation (running sequence control)
- Load shedding
- Booster operation
- Data archiving
  - Messages/alarms
  - Starts
  - Run times
  - Activity/utilization
- Monitoring functions

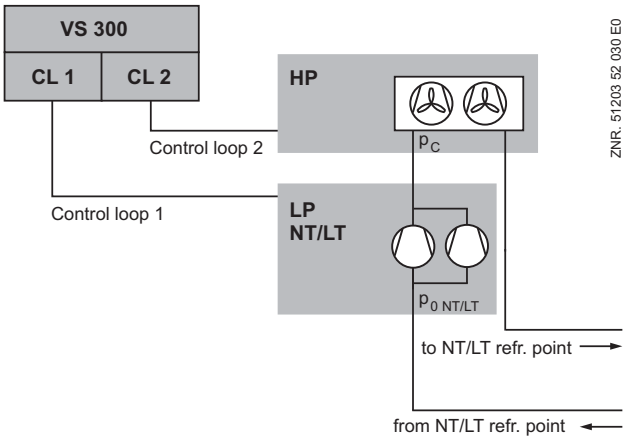
Four freely configurable inputs are available and can be assigned the following functions:

- Fast unload
- Load shedding
- Second setpoint toggle
- External alarm
- Heat recovery (HR) mode
- Safety loop

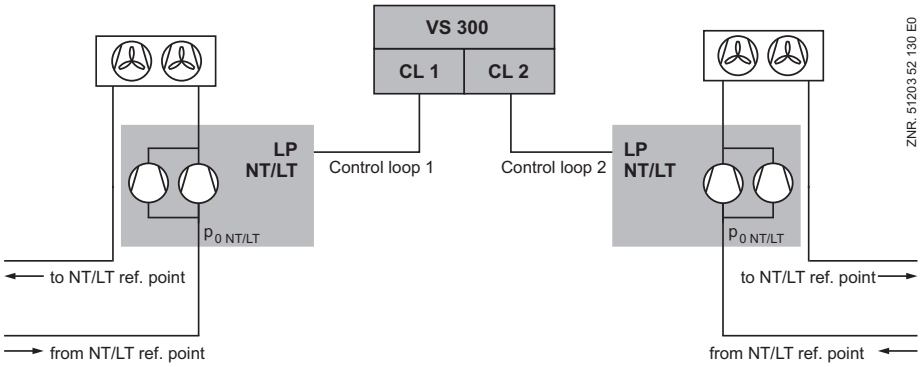
3.1 System expansion options

Potential applications of the VS 300 are illustrated in the following diagrams. Depending on the expansion stage, either 4, 8 or a maximum of 12 relay/control stages (see section 1 Design) can be divided among the compressor or condenser stages for control.

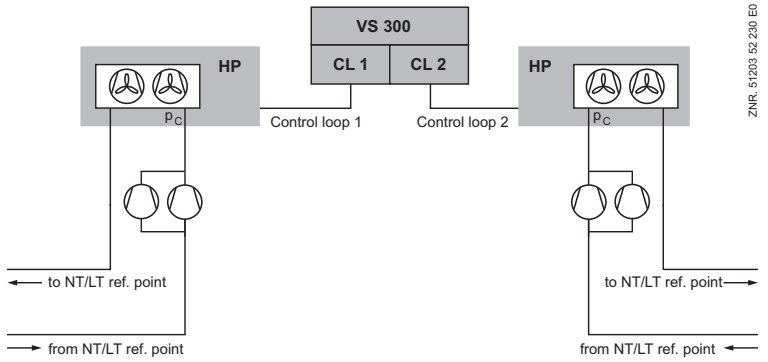
- Low-pressure and high-pressure control. Available operating modes are NT/HP or LT/HP



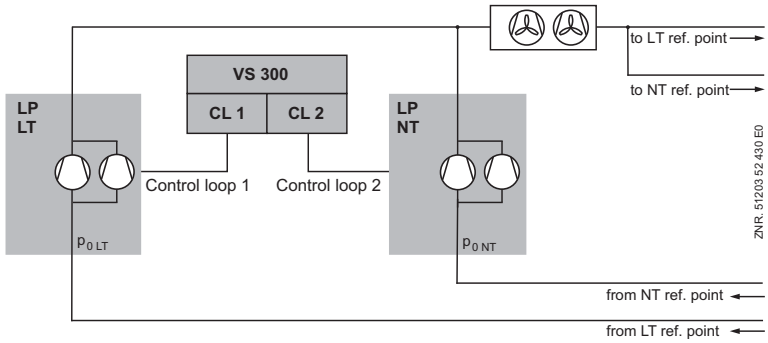
- Control of two independent low-pressure loops. Available operating modes are NT/NT, NT/LT or LT/LT



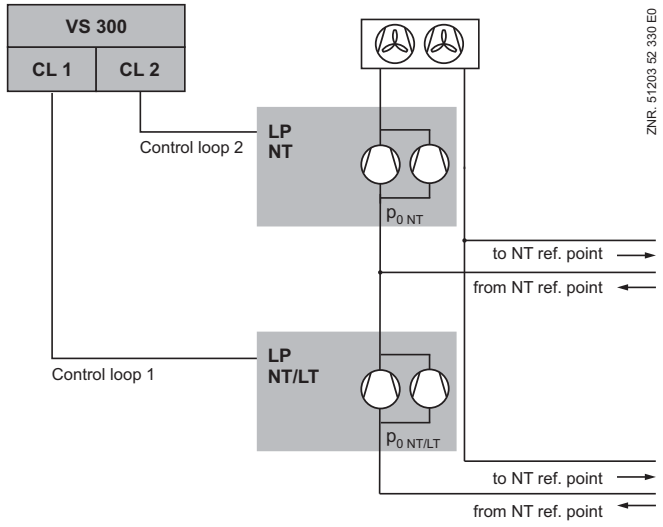
- Control of two independent high-pressure loops (HP/HP).



- Satellite operation - with common condenser



- Booster operation - with common condenser



The parameter list - see chapter 3 parameter list and menu structur - is to be considered for satellite and booster operation. There in detail one describes, under which conditions these modes of operation are to be adjusted. Configuration of the controller must be made prior to individual parameter setting, because default settings will be loaded when changing the configuration.

Notice:

4 Function of VS 300

4.1 System Configuration

The VS 300 Pack Controller contains two control loops that can be configured optionally as a low-pressure (LP, compressor control) or high-pressure loop (HP, fan control). Two different temperature ranges (NT = normal-temperature refrigeration or LT = low-temperature refrigeration) are provided for compressor control. The two control loops can optionally act on two separate or one common refrigerant circuit (see section 2 Application).

An analog input for connection of a pressure transducer (4-20 mA current output) is assigned to each control loop. Depending on the expansion stage, a total of 4, 8 or 12 relay/control stages is available for the two control loops. An 0-10 V analog output is additionally assigned to each control loop with continuous control (speed or combined control).

4.1.1 System design – Allocation of relay/control stages

Depending on the expansion stage, the VS 300 has 4, 8 or 12 relay/control stages that can be used to control

- compressors
- fans
- Alarm calling device (e.g. telephone dialling equipment)

These relay/control stages can be split at random between the two control loops and the telephone dialling equipment.

Alternatively, all relays can be assigned to one control loop and the system operated with only one pressure transducer. This requires the number of base load stages of one control loop to be set to 0 (G_x=0; x = either CL1 or CL2).

The following six parameters (see section 7 Parameter List and Menu Structure) are used to allocate the relay/control stages of the VS 300:

G_{CL1}: Total number of base load stages, Control Loop 1
(compressors with and without capacity control)

L_{CL1}: Number of capacity stages each capacity-controlled base load stage, Control Loop 1
(= 1 for compressors without capacity control)

B_{CL1}: Number of capacity-controlled base load stages, Control Loop 1
(= 0, when using only compressors without capacity control)

G_{CL2}: Total number of base load stages, Control Loop 2
(compressors with and without capacity control)

L_{CL2}: Number of capacity stages each capacity-controlled base load stage, Control Loop 2
(= 1 for compressors without capacity control)

B_{CL2}: Number of capacity-controlled base load stages, Control Loop 2
(= 0, when using only compressors without capacity control)

***AL*:** Number internal alarm relais

With a mixed configuration of single-stage and capacity-controlled compressors, the capacity-controlled compressors must be connected at the beginning of the relay field assigned to the respective control loop, followed by the single-stage compressors. Capacity-controlled stages (fans/compressors) are not supported with continuous control (speed or combined control). The settings for these operating modes are therefore: **L_x=1 and B_x=0**.

With speed control, base load stages can be assigned to Control Loop 1 or 2 depending on whether a bypass function to bridge the frequency changer is desired or not (see section 4.5.5 Control Algorithm with Speed Control). A minimum of two base load stages must be assigned to the control Loop with combined control.

The number of relay/control stages required for a control loop is calculated as follows:

$$\textbf{\textit{No. of relays CL}}_x = (G_x - B_x) + B_x \cdot L_x$$ where x = either CL1 or CL2

The relay outputs assigned to Control Loop 1 always start at relay/control stage S1.

The relay outputs assigned to Control Loop 2 start at relay/control stage Sn where
n = *(No. of relays CL1 + 1)*

See section 5 Pin and Terminal Assignments for details of pin assignments.

When setting parameters for system configuration, make sure not to exceed the number of relay/control stages available:
No. of relays CL1 + No. of relays CL2 + number internal alarm relais
<= Number of VS 300 relay/control stages (4/8/12 depending on expansion stage)

4.1.2 Dispatching of the internal alarm outputs

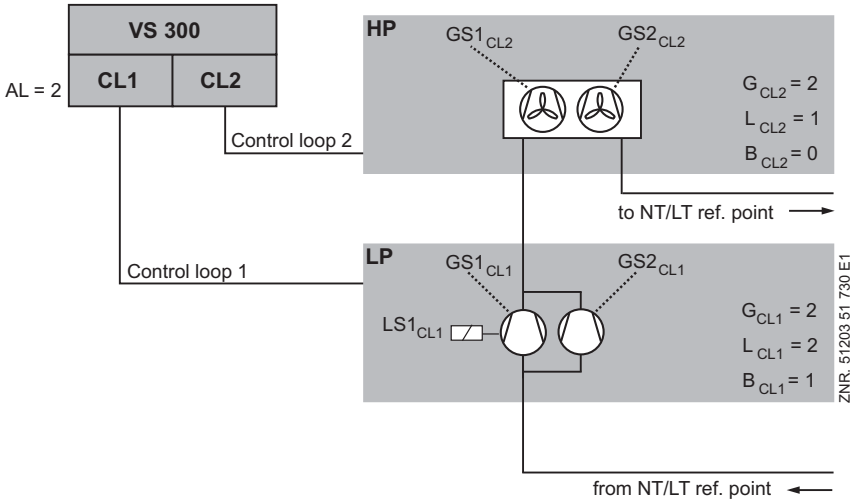
To the control of alarm signalling equipment (telephone selecting equipment etc..) can up to two relays for messages with priority 1 or 2 be assigned (chapter 7 Parameter list and menu structure). These relays always are at the end of each stage of development.

Extension Number of relay/control stages	**Extension** Number internal alarm relais	**Relais number,** Intended for the alarm signalling equipment (see chapter 5 Pin and Terminal Assignments of VS 300)
4	1	S4: Priority 1 and priority 2
	2	S3: Priority 1 S4: Priority 2
8	1	S8: Priority 1 and priority 2
	2	S7: Priority 1 S8: Priority 2
12	1	S12: Priority 1 and priority 2
	2	S11: Priority 1 S12: Priority 2

When setting parameters for system configuration, make sure not to exceed the number of relay/control stages available:
No. of relays CL1 + No. of relays CL2 + number internal alarm relais
<= Number of VS 300 relay/control stages (4/8/12 depending on expansion stage)

4.1.3 Example of VS 300 system configuration

System requirements: - VS 300 without CAN bus module
- 2 fans
- 2 compressors (1 capacity-controlled and 1 single-stage compressor)



Calculation of relay/control stages required for system configuration in example:

G_{CL1}= 2, L_{CL1}=2, B_{CL1}=1 G_{CL2}=2, L_{CL2}=1, B_{CL2}=0

$G_{CL1/2}$ = Total number of base load stages, Control Loop 1/2 (compressors with and without capacity control)

$L_{CL1/2}$ = Number of capacity stages each capacity-controlled base load stage, Control Loop 1/2 (= 1 for compressors without capacity control)

$B_{CL1/2}$ = Number of capacity-controlled base load stages, Control Loop 1/2

AL = Number internal alarm relais

Result:

=> Number of relay/control stages required for this VS 300 configuration:

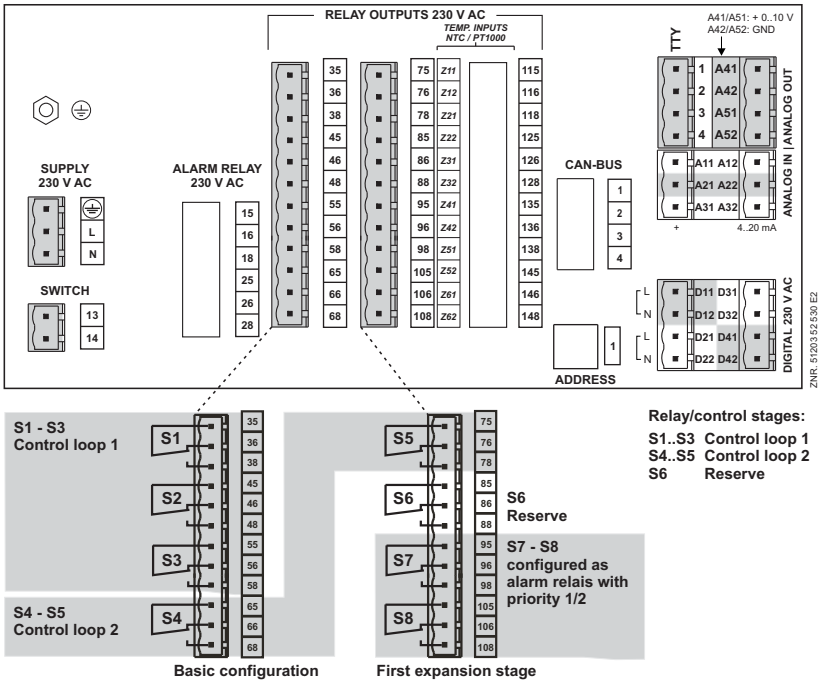
=> VS 300 with first expansion stage is necessary to implement this configuration

	VS 300 Basic configuration				First expansion stage			
Relay No.	S1	S2	S3	S4	S5	S6	S7	S8
Terminals	35	45	55	65	75	85	95	105
Numbers	36	46	56	66	76	86	96	106
Each relay	38	48	58	68	78	88	98	108

$G_{CL1/2}$ = Basic load stage of standard or capacity-controlled
- compressor with LP control (CL1)
- Motor of fan with HP control (CL2)

$LS_{CL1/2}$ = Capacity stage of capacity-controlled compressor (Bypass valve, etc.)

n.c. = Not connected/assigned



Rear of VS 300: Allocation of relay/control stages

4.2 Configuration / monitoring of digital inputs

External alarms and messages can be transmitted to the VS 300 through four freely configurable digital inputs. These inputs can also be used to activate the following operating modes on the VS 300:

- **Fast unload:**
  All control stages are unloaded in rapid sequence in the respective control loop. Die Verbraucherfreigabe der zugehörigen Kühlstellenregler wird entzogen, es sei denn, der Niderdruck ist zu tief.
- **Load shedding:**
  A definable number of control stages is disabled in the respective control loop.
- **Second setpoint:**
  Setpoint toggle is performed in the respective control loop by an external signal (e.g. central lighting).
- **External alarm:**
  An external signal (e.g. motor overload cutout, etc.) can be detected as an alarm by the VS 300 and reported. When the CAN bus module is installed, the alarm message can display a user-definable text.
- **Heat recovery mode (HR mode):**
  By activating HR mode, the respective HP control loop can be made to work at higher HP control loop condensing temperature.
- **Safety loop:**
  All control stages are unloaded immediately in the respective control loop! A message is transmitted. When the CAN bus expansion is installed, this message can display a freely definable text. Die Verbraucherfreigabe der zugehörigen Kühlstellenregler wird entzogen, es sei denn, der Niderdruck ist zu tief.

The following parameters can be set for these four digital inputs (see section 7 Parameter List and Menu Structure – Common Setpoints - System Configuration).

A - Function of digital input:

Integral operation VS 300 LED display	Display AL 300 or CI 3000	Function
0	OFF	Deactivated
1	FastRet.	Fast unload CL 1/2
2	Load Shed	Load shedding CL 1/2
3	SetpTog.	Second setpoint toggle CL 1/2
4	Ext.Alarm	External alarm (no CL assignment)
5	HR	Heat recovery mode CL 1/2
6	SaftyL.	Safety loop CL 1/2

Ext. Alarm is independent of the control loop and a user-definable text can be entered.

B - Assignment of digital input to control loop (defines which control loop the selected function acts on):

Integral operation VS 300 LED display	Display AL 300 or CI 3000	Assignment
0	CL1	Assigned to Control Loop 1
1	CL2	Assigned to Control Loop 2
2	All	Assigned to both control loops

C - Polarity of digital input:

Integral operation VS 300 LED display	Display AL 300 or CI 3000	Polarity
0	`Polarity 0`	Function activated when input is de-energized
1	`Polarity 1`	Function active when input is energized

D - Alarm delay:

Integral operation VS 300 LED display	Display AL 300 or CI 3000	Time delay
0..60	`Time delay  xs`	Alarm delay (seconds): If digital input is configured as alarm input, alarm will be transmitted at end of set delay.

E - Alarm text (with CAN bus module only):

Integral operation VS 300 LED display	Display AL 300 or CI 3000	delay
Alarm text cannot be entered in VS 300!	`Alarm text:` `xxxxxxxxxxxxxxxxxxxx`	When the controller is fitted with the CAN bus module, a message text can be entered for each alarm input to be displayed on the AL 300 or CI 3000.

4.3 Low-pressure control / compressor control

When the control loop is configured as a low-pressure loop (compressor control), its purpose is to maintain low-side pressure at a defined setpoint.

The VS 300 provides three different methods for these low-pressure control functions:

- **Step controller:**
  Control by loading and unloading compressor stages or compressor capacity stages (single- and multi-stage compressors).
- **Speed controller:**
  Continuous control by speed adjuster for one or more compressors. Low-pressure control is made by an analog signal input to the speed adjuster for the required speed.
- **Combined controller:**
  Control by combination of speed adjuster and additional loading/unloading of compressor capacity stages.

The VS 300 also provides the following functions for low-pressure control:

- **Base load rotation of stages**
- **Monitoring functions**

On the VS 300, actual values are detected by a pressure transducer delivering a continuous current output (4-20 mA). Control type can be programmed on the integral user interface or by means of a terminal (AL 300 Operator Terminal and CI 3000 Store Computer).

4.3.1 Setting parameters for LP transducer characteristic

The VS 300 Pack Controller works with continuous pressure transducers possessing a linear characteristic. At the present time, exclusively pressure transducers working with current output (4-20 mA) are usable.

Current hardware design of analog inputs on pressure transducers for Control Loops 1 and 2 is as current inputs (4-20 mA)!

Care must be exercised when installing the pressure transducers. Leads must be shielded and must not run parallel with power cables. Appropriate measures must be taken to prevent interference from entering the pressure transducer leads.

The following parameters are used to match the controller to the pressure transducer:

Integral operation **VS 300 LED display**	**Display** **AL 300 or CI 3000**	**Description**
See section 7 Parameter List an Menu Structure/Parameter List S3 - Pressure transducers parameter setting CL1/CL for 4 mA	`po 4 mA`	Parameter defines pressure p_0 at which transducer delivers 4 mA output signal.
See section 7 Parameter List an Menu Structure/Parameter List S3 - Pressure transducers parameter setting CL1/CL for 20 mA	`po 20 mA`	Parameter defines pressure p_0 at which transducer delivers 20 mA output signal.

An alarm is transmitted when either of these parameters is changed:

Integral operation **VS 300 LED display**	**Display** **AL 300 or CI 3000**	**Description**
E203	`Sens.type change`	Parameter for pressure transducer has been changed.

Incorrect setting of parameters can result in severe impairment of function.

4.3.2 Low-pressure control neutral zone

When using low-pressure control by step controller, no loading or unloading of compressors takes place as long as the control error remains with a programmable neutral zone. When using low-pressure control by combined controller, the effect of the neutral zone is as follows:

As long as the control error is within 1.5 times the neutral zone, low pressure is controlled by increasing or decreasing compressor speed. Above or below 1.5 times the neutral zone, the compressor runs at maximum or minimum speed to quickly achieve steady state.

4.3.3 Control algorithm with low-pressure control

The controller cycle time is 1 second. The control algorithm depends on the control type.

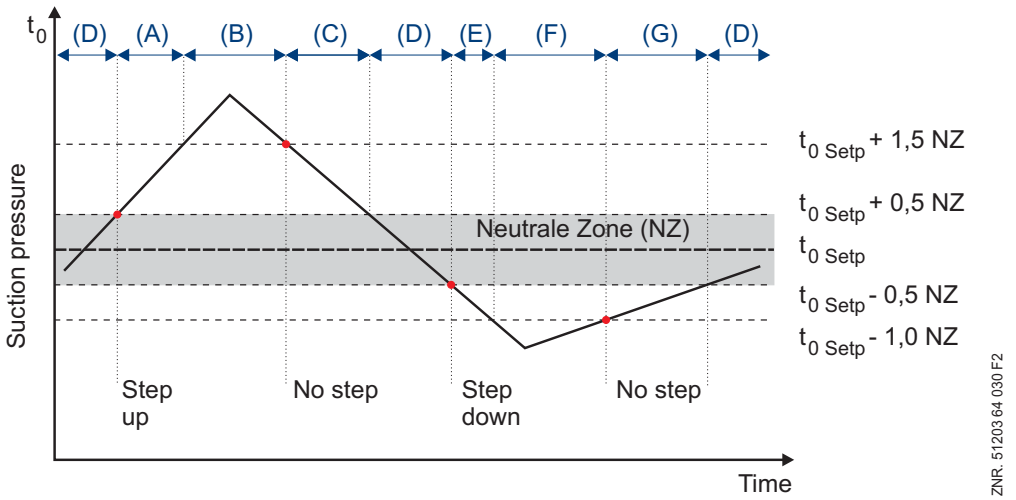
In the wet vapor range, temperature is a clear function of refrigerant and pressure: t = f (p, refrigerant). The VS 300 calculates temperatures from the measured pressures as a function of the refrigerant used. Exclusively temperature values are used for control. Temperatures (t_0, t_c) therefore stand for pressures (p_0, p_c) in the system documentation.

4.3.4 Control algorithm with step controller

Low pressure measured by an A/D converter is compared with the setpoint (see section 4.3.10 Determining the Low-Pressure Setpoint). The relationship is as follows:

Control error =

Control algorithm LP step controller



(A) At a pressure greater than the actual value plus 0.5 times the neutral zone (NZ) and less than the actual value plus 1.5 times the NZ, the step switching mechanism actuates stages in the event of a **positive** pressure change.

(B) At a pressure greater than the setpoint value plus 1.5 times the NZ, the step switching mechanism actuates stages, **independent** of the pressure change. This results in the compressors being activated in the order of their operating times (compressor with the shortest operating time first).

(C) In the event of a fall in pressure less than the setpoint value plus 1.5 times the NZ and greater than the setpoint value plus 0.5 times the NZ, no compressor actuation occurs as it is to be expected that the NZ will shortly be reached.

(D) In the NZ **no** compressor actuation occurs.

(E) At a pressure less than the setpoint value minus 0.5 times the neutral zone (NZ) and greater than the setpoint value minus 1.0 times the NZ, and in the event of a **negative** pressure change, the step switching mechanism switches down stages.

(F) At a pressure less than the setpoint value minus 1.0 times the NZ, the step switching mechanism switches down a stage, **independent** of the pressure change. This results in the compressor with the longest operating time being disabled.

(G) With an increase in pressure in the range between the setpoint value - 1.0 x NZ and the setpoint value -0.5 x NZ, no compressor actuation occurs.

(D) If the control error is within a programmable NZ, then no compressor actuation occurs.

4.3.5 Control algorithm with speed controller

Low pressure measured by an A/D converter is compared with the setpoint (see section 4.3.10 Determining the Low-Pressure Setpoint). The following relationship applies:

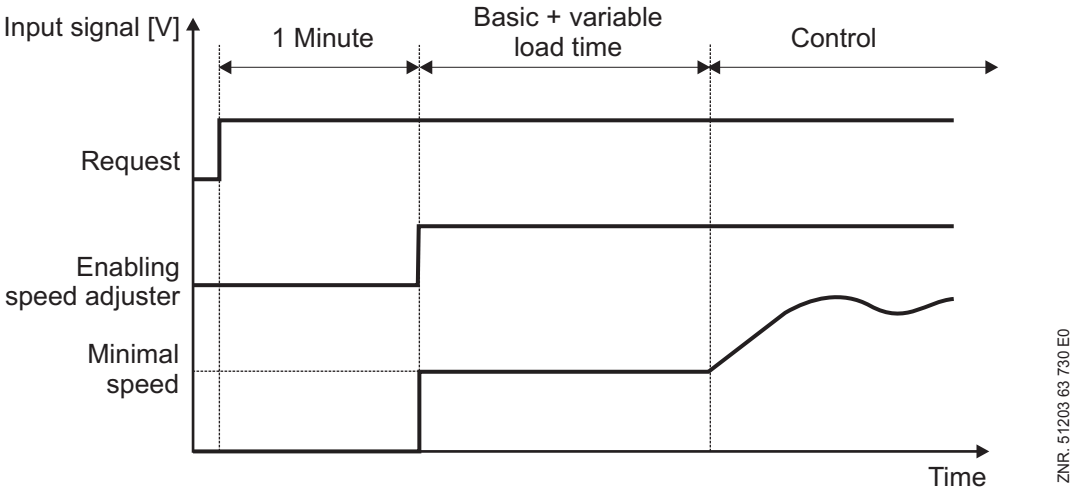
Control error =

When the control error is positive, a PI control algorithm calculates a speed setpoint that is transmitted to the frequency changer through an analog output (0-10 V). The frequency changer controls compressor speed to the defined setpoint.

The frequency changer/speed adjuster is enabled by means of the first capacity stage. When the frequency changer/speed adjuster has been enabled, the compressor runs at minimum speed until the basic and variable load times have expired, after which speed is determined by the PI control algorithm.

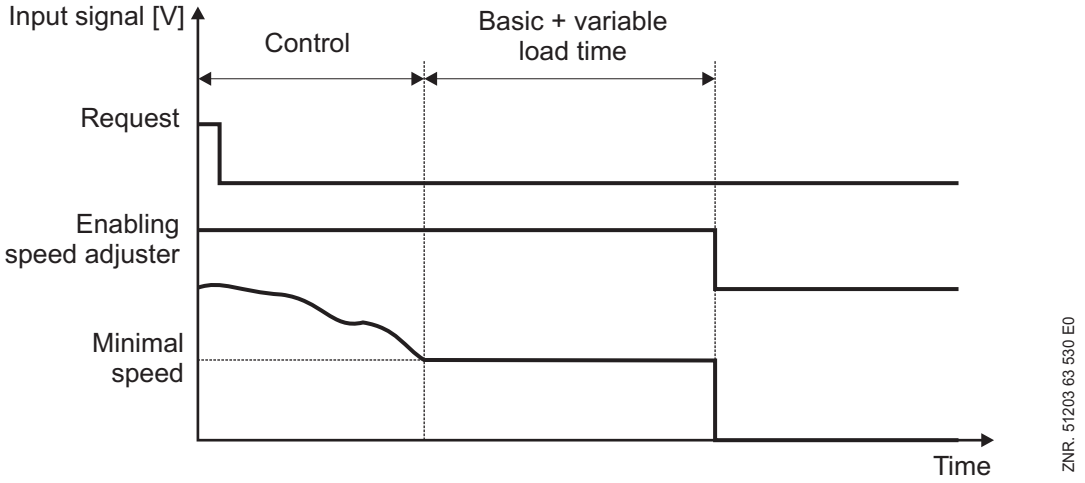
Following restart of the controller (after a power failure, etc.), the analog output is maintained at minimum speed for 1 minute after the frequency changer/speed adjuster has been enabled.

VS 300 Compressor setup characteristic



When the control error is negative, the speed adjuster is disabled by means of the first capacity stage of the assigned VS 300 control loop as soon as speed drops to low level and the basic unload time and variable unload time have elapsed.

VS 300 Speed adjuster cutoff



Control can be influenced by three parameters:

- Minimum speed of frequency changer with continuous control
- Adjusting differential/regulating speed of analog output
- Maximum temperature with speed control

These parameters are only displayed when speed or combined control is activated as the control type (see section 8.1.8 Parameter List S3: Common Setpoints for System Configuration).

The *Minimum Speed* parameter can be used to define minimum speed for the speed adjuster. Entry is made in percent for the 0-10 V analog output of the VS 300. Controller speed can be set by the *Analog Output Regulating Speed* parameter.

The value must be increased if the controller is too slow and should be decreased if hunting occurs. One or two relay/control stages can be allocated to one speed controller. If only one stage is allocated, it is used for enabling/disabling of the frequency changer. When two stages are allocated to the controller, the first is used for enabling/disabling and the second to actuate a frequency changer bypass.

The connected compressor then runs at constant speed (line frequency) bypassing the frequency changer. If the limit entered as maximum temperature with speed control is exceeded and a second relay/control stage is allocated to the speed controller, this second stage (bypass) will be activated and the first stage disabled (enabling of frequency changer).

On attaining the defined t_0 setpoint, the controller returns to control mode (bypass off, enabling of frequency changer on).

When parameters are set for a bypass stage, the stage must always be connected, since enabling of the speed adjuster is disabled at high temperature!

4.3.6 Determining the setpoint with speed controller

Low-pressure detected by an A/D converter is compared with the setpoint. The following relationship applies:

Control error =

Additionally a speed setpoint is determined. The following relationship applies for calculation:

$U_{setp} = P_{Action} +$

U_{Setp} = Frequency changer setpoint (0-10 V)
P_{Action} = Proportional action of controller
I_{Action} = Integral action of controller
Control error:

$$P_{Action} = \frac{(t_{0\_Act} -}{2}$$

t_{0_Act} = Current value of t_0
t_{0_Setp} = Setpoint for t_0
The P action of the controller responds directly to control errors. The I action avoids sustained control errors.

$$I_{Action} = I_{ActionI} + \frac{(t_{0\_Act} - t_{0\_SetpI})}{8} + \frac{adjusting\ diff.}{20}$$

Adjusting differential = Definable controller speed

4.3.7 Control algorithm with combined controller

Low-pressure detected by an A/D converter is compared with the setpoint (see section 4.3.10 Determining the Low-Pressure Setpoint. The following relationship applies:

$$Control\ error =$$

Depending on the control error, a controller output is calculated for control of compressor speed as a 0-10 V signal. Since the controller works as a PI controller, a P and I action is calculated.

$$P_{Action} = control$$

- **Calculation of P action:**
- **Calculation of I action:**

The P action acts immediately on the speed in response to a change of pressure. The remaining control error is minimized by continuously increasing or decreasing the control signal (ramp function). Ramp speed (I action of controller) is a function of the control error.

An excessively high ramp speed results in continuous overshoot of suction pressure. An excessively low ramp speed results in the suction pressure setpoint only being attained after a lengthy time delay.

In that case the controller is too slow. Ramp speed can be adjusted by means of the *Adjust Diff.* parameter to match the I action to the system.

$$I_{Action} = I_{Action} + \text{!}$$

A positive control differential results in steady state being obtained faster, a negative control differential results in slower control action. The I action is damped as a means of avoiding control swing at low part load. The compressor pack operates at lower part load if only the variable-speed compressor is running, the control signal (0-10 V) is less than 50% and the control error is less than the neutral zone.

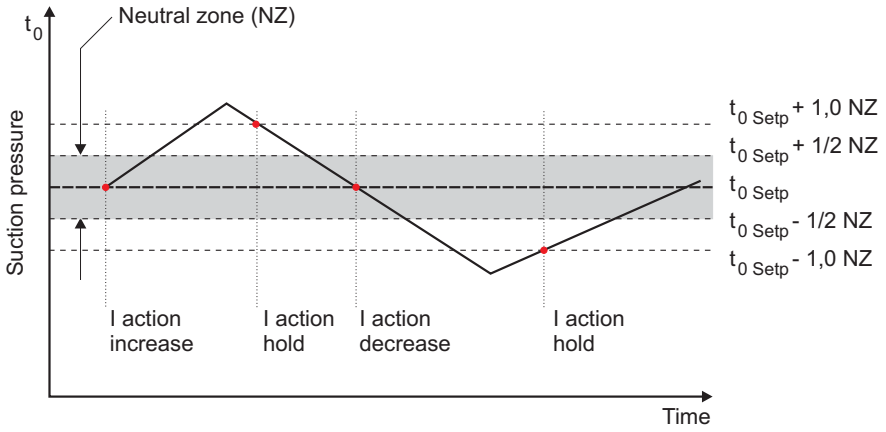
I action is then

$$I_{Action} = I_{Action} + \frac{1}{8}\left(\frac{control\ error}{2} + \frac{adjust\ diff.}{20}\right)$$

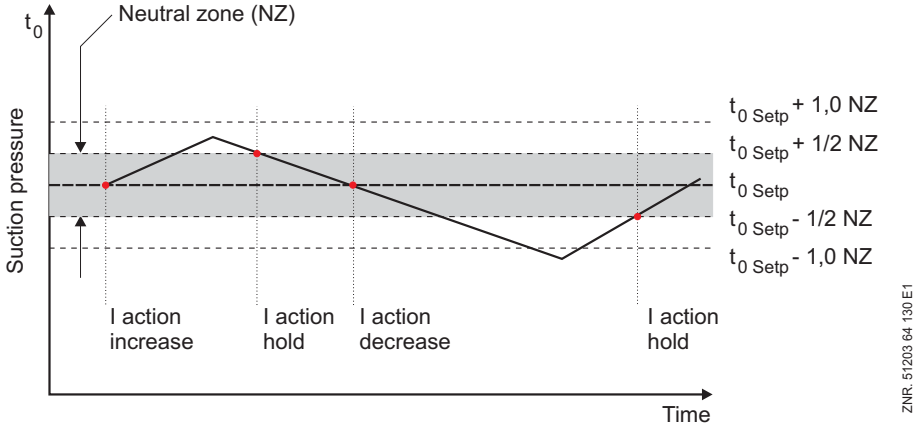
The pressure change is taken into account for small control errors. No change of I action takes place if the control error is positive, pressure is falling and is less than the setpoint plus neutral zone in part-load operation or half the neutral zone in full-load operation. I action is also not changed when the control error is negative, pressure is rising and is greater than the setpoint less the neutral zone in part-load operation or half the neutral zone in full-load operation.

In order to avoid speed being increased too fast, increase of the I action is limited to a maximum of 10% of the control signal (0-10 V). With control errors above or below 1.5 times the neutral zone, the compressor is run at maximum or minimum speed.

Control algorithm LP combined controller
- part-load operation -



- load operation -



The controller output for the speed adjuster is calculated from the P and I action:

Controller outpu

When all compressor stages are off and the actual value is greater than the setpoint (positive control error), the first compressor stage (C1: enable frequency changer) is loaded immediately. Speed control is however not activated until a set delay has passed (Time = Basic time plus variable time, see also Compressor Actuating Times). During the time delay, the compressor runs at a definable minimum speed.

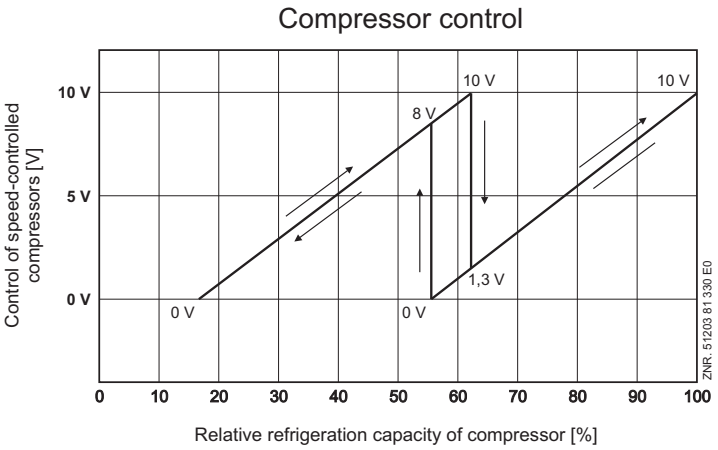
4.3.8 Loading and unloading fixed-speed compressors

If the required capacity cannot be delivered by varying the compressor speed, fixed-speed compressors can be loaded or unloaded allowing for the compressor actuating times (see section 4.3.9 Compressor Actuating Times).

After the variable-speed compressor has attained maximum speed, the fixed-speed compressor having the shortest run time is loaded. The variable-speed compressor is unloaded to the level at which the pack capacity corresponds to the capacity prior to loading the supplementary fixed-speed compressor.

After the variable-speed compressor has attained minimum speed, the fixed-speed compressor having the longest run time is unloaded. The variable-speed compressor is loaded up to the level at which the pack capacity corresponds to the capacity prior to unloading the supplementary fixed-speed compressor.

The following diagram shows the control sequence for a two-compressor pack:



The characteristic of the frequency changer must be parameterisable for this so that an output signal of 0 V at the analogue output for compressor control corresponds to the minimum frequency and an output signal of 10 V to the maximum frequency. The control signal of the frequency changer must be parameterised as 0 V - 10 V interface.

4.3.9 Compressor actuating times

Compressor actuation with step control:

Compressor actuation takes place only outside the neutral zone, when a defined time load/unload time has elapsed and the control error has exceeded a defined value (neutral zone).

Compressor actuation with combined control:

If suction pressure is greater than the setpoint, the variable-speed compressor is loaded immediately. Loading or unloading of supplementary fixed-speed compressors takes place when maximum or minimum compressor speed is attained and a certain time for loading or unloading has passed.

The delay is a function of the actual control error. With a large control error, actuation takes place quicker than with a small control error. The actuating time is calculated from basic time t_b plus variable time t_v. Differentiation is made between loading and unloading by the step controller.

The variable time is inversely proportional to the control error. At maximum control error the variable time t_v is 0. As the control error becomes smaller, time t_v is automatically increased up to a defined maximum.

Basic time and maximum variable time for loading and unloading are programmable parameters. The following relationships apply to determining actuating times:

$t = t_b + t_v$ = Actuating time

t_b = Basic time: Can be programmed for every loading of a compressor capacity stage.

t_v = Variable actuating time

The following applies for t_v:

$$t_v = t_{v\_max} - (t_{v\_max} \cdot d_t) / d_{t\_max}$$

$d_t > d_{t\_max}$ is equivalent to $d_t = d_{t\_max}$

t_v = Variable actuating time

t_{v_max} = Maximum variable actuating time (definable)

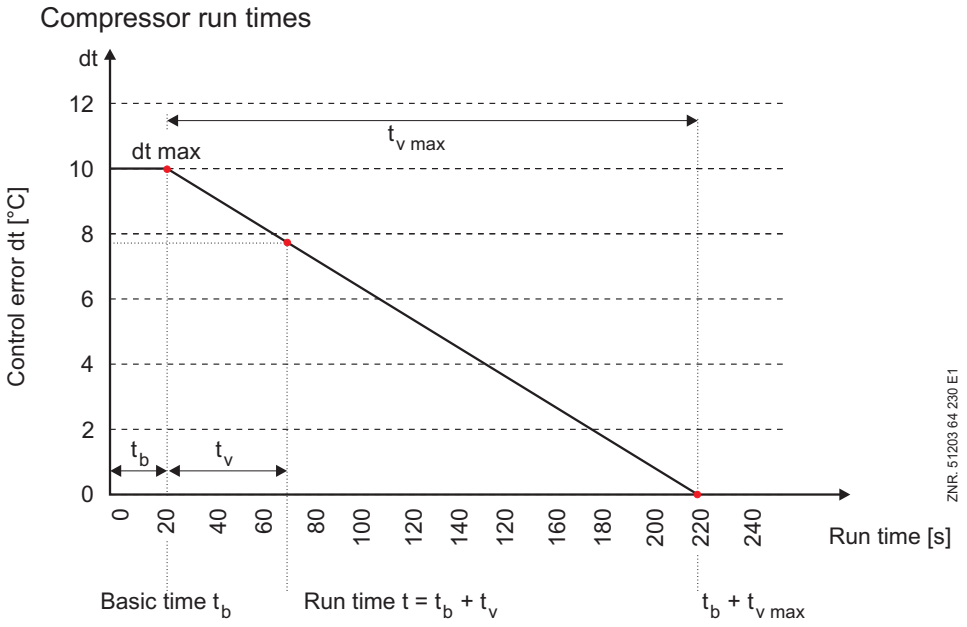
d_t = Control error

d_{t_max} = Maximum control error/constant (definable)

Load delay is actuated on loading a compressor capacity stage or when rising suction pressure reaches a value greater than the lower limit of the neutral zone.

Unload delay is actuated on unloading a compressor capacity stage or when falling suction pressure reaches a value less than the upper limit of the neutral zone.

Actuating time is calculated at every controller cycle. The variable time is recalculated and the time elapsed since the last actuation is compared with the calculated time. If the calculated actuating time is less than or equal to the elapsed time, compressor actuation takes place provided the controlled variable p_0 is outside the neutral zone. The following diagram illustrates calculation of actuating time:



Compressor actuation with speed control:

Actuation of the relays for enabling the frequency changer and activating the bypass takes place according to the following times:

- The speed adjuster is enabled immediately. However, at minimum the basic time t = t_b must elapse between two successive events of enabling the speed adjuster.
- Power line bypass after the maximum temperature has been exceeded with speed control is enabled after the basic load time has elapsed.
- Unloading on elapse of basic time and variable time

Compressor actuation with refrigeration point control:

If the compressors are controlled directly via a refrigeration point and not via suction pressure, the variable actuating time t_v is 0. Actuating time then only consists of the basic time t = t_b.

Compressor actuation via refrigeration points is only meaningful with step control.

4.3.10 Determining the low-pressure setpoint

In the parameter list S3, i.e. under the menu item System Configuration (see chapter 7 - Parameter List and Menu Structure - Setpoints System Configuration) the parameters for

- Enable room temperature
- Enable humidity

are set to '0' (i.e. 'OFF') and the address of the controller from which the data should be obtained is set to '---'.

However, when the VS 300 is networked via a CAN Bus module (see chapter 1 - System Configuration) with other pack controllers (VS 3010, VS 3010 BS or FS 3010), it is possible to employ additional values for the t_0 setpoint evaluation.

The evaluation of the t_0 setpoint can then be carried out relative to the room temperature (setpoint adjustment). The parameter for 'Enable room temperature' must be set to 'ON' in this case.

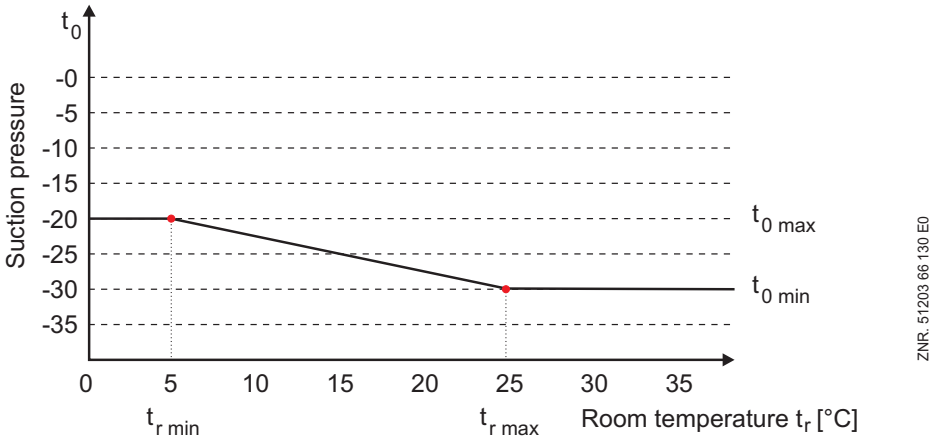
The room temperature must be provided via CAN Bus by another pack controller (VS 3010, VS 3010 BS or FS 3010) within the system. This controller must be addressed by the VS 300 via an appropriate parameter ('Node Number for Ambient Data' see chapter 7 - Parameter List and Menu Structure - Setpoints System Configuration).

t_0	= t_0 setpoint
t_{0_max}	= maximum t_0 setpoint
t_{0_min}	= minimum t_0 setpoint
tr	= current room temperature
t_{r_max}	= maximum room temperature for setpoint adjustment
t_{r_min}	= minimum room temperature for setpoint adjustment

With a room temperature of $t_r > t_{r\_max}$ or $t_r < t_{r\_min}$ the setpoint t_0 is specified as a constant as follows:

for $t < t_{r\_min}$	$t_0 = t_{0\_max}$
for $t > t_{r\_max}$	$t_0 = t_{0\_min}$

Low-pressure control



VS 300 low pressure control

t_{0_max}, t_{0_min}, t_{r_min} and t_{r_max} can be parameterised. The air humidity can also be factored in.

The pressure setpoint for actual control is determined from a conversion table contained in the software. Conversion of t_0 to the corresponding pressure can be made for the following refrigerants:
R22, R502, R134a, R404A, R402A, R717, R1270, R507, R407C, R410A, R290, R744 (transcritical operation not available), R407F, R422A, R422D, R408A, R407D, R407A, R427A, R438A, R512a, R170, R600, R600a, R449A, R450A, R448A, R455A, R447B, R1234ze, R1233zd, R41234yf

4.3.11 Second setpoint – Setpoint increase/decrease

A second characteristic can be programmed for low-pressure control and can be activated by the internal week timer or via a digital input of the controller. Setpoint increase/decrease allows better matching to night and week-end operation. Setpoint toggle is performed for the following values:

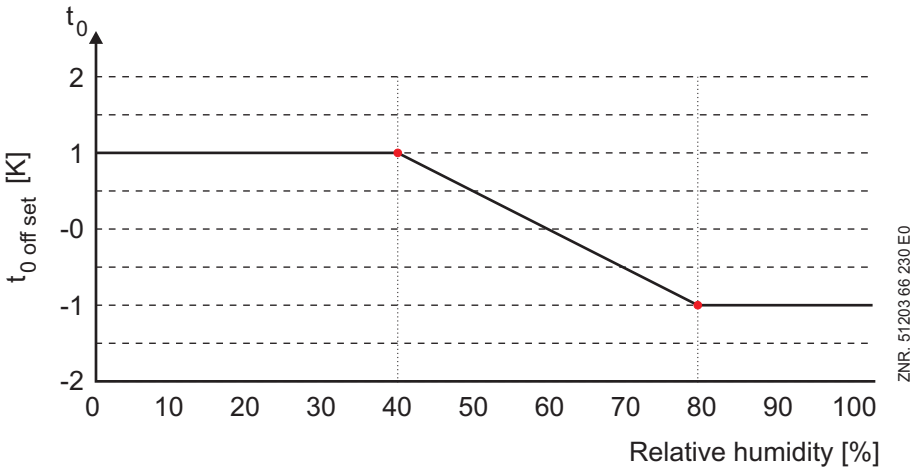
- Target temperature(s)
- Neutral zone
- Control constant

The polarity of digital input signals can be programmed (low or high active).

4.3.12 Humidity shift

The *Enab.Humid.* parameter an be used to define whether the t_0 setpoint is also to be matched as a function of air humidity. The air humidity must be provided via CAN Bus by another pack controller (see chapter 4.3.12.1) within the system. A temperature offset t_{0_Offset} is then formed as a function of the air humidity and added to $t_{0\ Setp}$:

Humidity shift



Allowance for air humidity can be made separately for operation at the first and second setpoints.

4.3.12.1 Ambient data for setpoint shift

The following quantities used for setpoint shift (see menu 3-1)

- Room temperature (setpoint shift of t_0, Parameter *Room temp.*)
- Outdoor temperature (setpoint shift of t_c, Parameter *Outdoor temp.*)
- Humidity (setpoint shift of t_0, Parameter *Humidity*)

can be supplied either via sensors connected from other pack controller (VS 3010, VS 3010 BS or FS 3010).

As required, the CAN bus address (node number) for the pack controller from which the missing ambient data is to be drawn from can be entered in the parameter *Node Number Ambient Data*.

If no ambient data is to be received via the CAN bus, the parameter *Node-Nr Env.dat* can be set to -- so as to deactivate setpoint shift.

4.3.13 Booster-/Satellite operation

The VS 300 provides an option for operating the compressor in booster or satellite mode when both control circuits are configured as LP controllers. In satellite and booster operation the two LP circuits are only operated with one condenser set and therefore with only one common high pressure line.

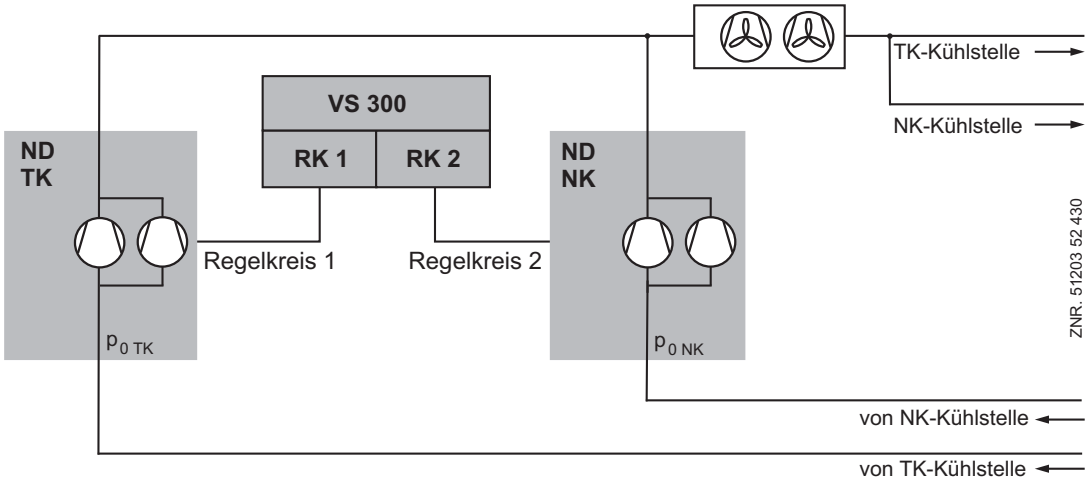
As the VS 300 is only equipped with two control circuits, an additional controller is required for the common HP regulation.

- **Satellite operation:**

In satellite mode, it is operated with one single condenser set by means of a simple combination of the high pressure lines for the compressor provided for each temperature level which is then fed through one condenser.

The refrigeration points are supplied from one common condensor receiver. During booster operation the refrigeration points are also supplied by the same condensor receiver. While the suction lines of the NT circuit feed directly into the main compressor, the refrigerant for the frozen food cases is initially fed through the so called booster stage.

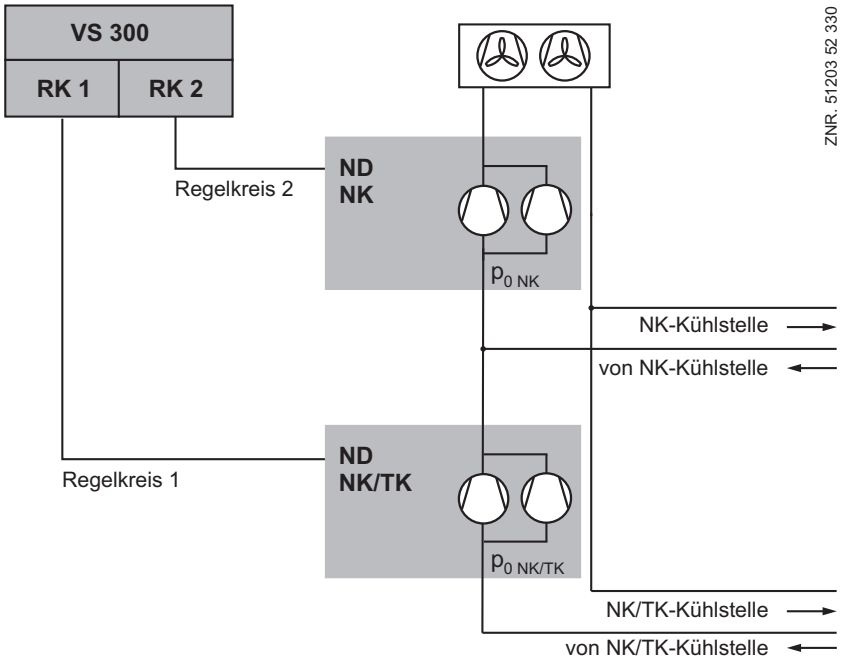
During satellite operation the compressors for the two temperature zones are controlled independently of each other via the suction pressure (Standard).



- **Booster operation:**

In the booster stage, the refrigerant pressure from the frozen food cases, which due to the lower evaporation temperature is also lower, is raised to the pressure of the suction lines of the normal temperature refrigeration points.

If all the NT compressors are at stillstand and LT compressors are activated, the first NT compressor is activated immediately following the overshoot of the setpoint plus half of the neutral zone, i.e. the switching times are ignored. The switching times are ignored by the first compressor. Every additional NT compressor is activated following the elapse of the basic and the variable preconnection time. If the suction pressure sinks in the NT zone, then the NT compressor is turned off following the elapse of the basic and variable reset time. One compressor remains operative, independent of the suction pressure. Only after all the LT compressors have been switched off is the remaining NT compressor still being controlled finally switched off.



Parameterisation of the booster / satellite operation:

If both of the VS 300 control circuits are configured as LP controllers, i.e. one of the following configurations is selected (see following table), then it is possible to select whether the compressors in control circuits 1 and 2 operate independently of one another (satellite operation) or whether the compressors from control circuit 2 can only be switched off following the disabling of all the compressors from control circuit 1 (booster operation). This can be set using the parameter *DisabCL2 w. CL1*.

Possible controller configuraion for booster- / satellite operation:

Integral operation VS 300 LED display	Display AL 300 or CI 3000	Control loop 1 is:	Control loop 2 is:
0	LTLT	LT	LT
1	LTNT	LT	NT
2	NTNT	NT	NT

4.3.14 Demand-dependent calculation of setpoint

This function is only available in conjunction with case/coldroom controllers that deliver load-level data (valve opening), e.g. UA 300 E.

In order to ensure optimum operation of a compressor pack and associate refrigeration points at minimum operating cost it is appropriate for the low pressure controlled by the compressor pack to be set as a function of refrigeration load at the refrigeration points.

The opening of the expansion valves at the refrigeration points lends itself as a reference input for this purpose. With a load level equal to a definable maximum at a minimum of one refrigeration point served by the compressor pack, it may be assumed that the temperature cannot be maintained reliably with the existing low pressure at this/these refrigeration point/s. The limit of the load-level are programmable. In this instance low pressure is decreased so as to be able t_0 supply sufficient refrigeration capacity.

Conversely, when the load level at **all** refrigeration points served by the compressor pack is less than a definable minimum, it may be assumed that the refrigeration capacity supplied by the pack is more than sufficient. In this instance the low pressure is increased in the interests of energy-efficient operation of the plant. The t_0 setpoint should not be shifted up when superheat control is active on a transmitting case/coldroom controller. In this instance the defined t_0 setpoint is retained or shifted down by increasing the valve opening.

4.3.15 Processing load-level information

Each case/coldroom controller on which load-level transmission is activated transmits up to four load levels to the respectively assigned pack controller at intervals.

Decrease of low-pressure setpoint takes place on the pack controller when a single load level exceeds the definable maximum load level. Increase of low-pressure setpoint takes place on the pack controller when the load level of all case/coldroom controllers falls below the definable minimum load level.

When neither of the above conditions applies, the t_0 setpoint remains at the given value. No suction pressure increase takes place as long as superheat control is active on at least one refrigeration point.

Only when superheat control is not active on any of the associated refrigeration points can low pressure be increased according to the above rules. The reason for this is that, during superheat control, the valve opening at the refrigeration point is normally small while refrigeration load continues high. In other words, this is a precaution against erroneously increasing low pressure.

Change of low-pressure setpoint takes place within definable limits at definable increments and a definable updating interval.

4.3.16 Response to fault conditions

Can bus fault on individual stations:

If no telegram is received from a given case/coldroom controller during a time longer than the timeout period for load level reception, the mean load level for the controller concerned will be ignored until such time as a new telegram is received.

Global bus fault:

The current t_0 setpoint is retained. At the end of a 10-minute alarm delay, a *No Load Level* fault is logged and is not reset until new load level information is received via the CAN bus.

4.3.17 Demand-dependent setpoint shift parameters

The range within which t_0 can be changed is defined by the parameters *t_0-max* and *t_0-min* (Menu 3-2-3). Change to the second setpoint does not take place with demand-dependent setpoint shift.

The *Max.LoadLevel* parameter (Menu 3-2-2 (RK1) / Menu 3-3-2 (RK2) / Parameter S501/S51) defines the maximum load level (valve opening) for decrease of the t_0 setpoint.

The *Min.LoadLevel* parameter (Menu 3-2-2 (RK1) / Menu 3-3-2 (RK2) / Parameter S502/S52) defines the minimum load level (valve opening) for increase of the t_0 setpoint.

The *Increment* parameter (Menu 3-2-2 (RK1) / Menu 3-3-2 (RK2) / Parameter S503/S53) defines the increment in Kelvin by which the t_0 setpoint is increased or decreased after a definable time interval expires.

The *Interval* parameter (Menu 3-2-2 (RK1) / Menu 3-3-2 (RK2) / Parameter S504/S54) defines the interval in minutes that must expire before the t_0 setpoint is updated as required.

4.3.18 Compressor control by refrigeration point

Control of compressors by either suction pressure or direct by the refrigeration point must be programmed on the pack controller. Parameter S315/345: 0 = Pressure control, 1 = Refrigeration point.

The CAN bus node address of the refrigeration point that controls the compressor pack must be defined by Parameter S316/346. The fault message *No UA300* or EA 224 will be displayed after a delay of 5 minutes if no UA 300 is available under the CAN address entered.

With control by refrigeration point, the method varies according to whether the compressors are controlled by step controller or speed controller.

Compressor control by step controller:

When control loop CLx contains only one compressor, the compressor output follows the refrigeration point's solenoid valve. When more than one compressor is installed, the first compressor is loaded without delay.

Additional loading of compressors takes place after a programmable basic time tb elapses. The compressor loaded each time is that having the shortest run time. If capacity stages are to be unloaded, a single compressor is shut down without delay. When more than one compressor is installed, the first compressor is unloaded without delay.

Additional unloading of compressors takes place after a programmable basic time tb elapses. The compressor unloaded each time is that having the longest run time. Suction pressure in control loop CLx is additionally monitored by the pressure transducer. When pressure drops below a definable low limit, the compressors are disabled until such time as pressure again rises above the low limit.

This low limit monitoring corresponds to limit monitoring in normal operation as a suction pressure controller (see Section 3.4.2 Low Pressure Monitoring). Monitoring of compressor starts is not active when compressor control by refrigeration point is in effect.

With compressor control by refrigeration point, request for compressor actuation is coupled to the refrigeration point solenoid valve. To ensure that cooling continues in the event of a CAN bus malfunction, the pack controller switches automatically to the suction pressure controller in occurrence of a fault condition.

The compressor is shut down on failure of the case or coldroom controller. During direct coupling, no setpoints are shown in the actual value screens.

Compressor control by refrigeration point is only available with UA 300 universal controllers for control of solenoid valve.

Compressor control by speed controller:

With speed control, suction pressure is controlled by t_0 shift through the refrigeration demand of the display case. For this purpose the UA 300 case controller supplies the control error to the VS 300 (deviation between measured case temperature and temperature setpoint). The UA 300 can control two temperature zones. With a two-zone controller the VS 300 forms the mean of the separate control errors. With a single-zone controller the control error of the first zone is taken. Depending on the control error, a new to setpoint is calculated by the formula:

$$t_{0_{new}} = t_{0_{alt}} - \Delta t_M * 0.1$$

$t_{0_{new}}$: New t_0 setpoint

$t_{0_{old}}$: Previous t_0 setpoint

Δt_M: Case control error

Cycle time is one minute, meaning that a new setpoint is calculated every minute. Shift of t_0 can only be made within defined limits. The upper limit is defined by parameter S100/110 and the lower limit by parameter S101/111. The VS 300 contains limits for day and night operation. If the t_0 value calculated during the daytime lies beyond the defined limits in nighttime operation, the t_0 setpoint is reset to the upper or lower limit. In the event of a bus fault or power failure, the lower t_0 setpoint (S101/111) is used for control. Following external fast unload or restart, the VS 300 starts with the t_0 setpoint (S101/111) defined under t_0-Min.

Minimum standstill time is 1 minute when compressor shutdown takes place during control with variable-speed controllers.

If case temperature is too low by 2 K or more, the pack performs fast unload. The pack is re-enabled when the case temperature is too high by 1 K or more after the minimum standstill time of 1 minute. The VS 300 then starts with a t_0 setpoint 1 K higher than that prior to shutdown.

Following externa fast unload, the VS 300 starts with the t_0 setpoint (S101/111) defined under t_0-Min. No t_0 shift takes place during forced shutdown of the VS 300 (oil equalization), meaning that the t_0 setpoint remains unchanged for such time.

4.3.19 Disabling refrigeration points

In the occurrence of a fault on the compressor pack, the pack controller can transmit a refrigeration point disable signal to all associate refrigeration points. The associate refrigeration points are case/coldroom controllers on which the node address of the pack controller has been programmed in the controller configuration.

The refrigeration point disable signal is sent to all associate refrigeration points when no compressor or refrigeration capacity is available. Possible causes of disabling of refrigeration points are:

- Auslösen des digitalen Eingangs der Sicherheitskette
- Betätigung des digitalen Eingangs für den Schnellrücklauf
- Vorübergehend über die Funktion Zwangsabschaltung Verdichter (Ölausgleich)

Refrigeration points are not disabled in the event of a low-pressure fault due to low suction pressure.

4.3.20 Forced shutdown of compressors / oil equalization

With compressor packs serving only a single refrigeration point, the display cases are usually not fitted with a solenoid valve. Continuous run monitoring can then be assumed by the VS 300. The forced shutdown function (see Section 7 Parameter List and Menu Structure) has three parameters for this purpose:

Forced OFF CL1/2, *Max.RunTime* and *Standstill*.

These parameters can be set within the ranges stated below:

Forced OFF CL1/2:	Y/N	Default: N
Max.RunTime:	60..180 minutes:	Default 180
Standstill:	1..5 minutes:	Default 2

The *Max.RunTime* parameter defines when (after the set run time) the pack is shut dow by fast unload. The pack is then disabled for the time set under Standstill, at the end of which compressors are again loaded.

4.3.21 Capacity-controlled compressors

The VS 300 Pack Controller can control capacity-controlled compressors with up to three capacity stages (base load plus two capacity stages (bypass valves)). It is also possible to operate non-capacity-controlled together with capacity-controlled compressors in the same control loop.

Operation of capacity-controlled compressors is only supported when the controller is configured as a step controller. Capacity-controlled compressors have no effect on the VS 300's control algorithm, only the actuating sequence changes. The base load of an available compressor is loaded first when the compressors are actuated.

Then the capacity stages of the compressor are loaded as refrigeration is demanded before the base load stage of an additional compressor can be loaded. Unloading of capacity stages takes place in the reverse sequence. Run time is always monitored when loading and unloading the base load stages so that the base load stage having the shortest run time is loaded and that having the longest run time is unloaded.

If both non-capacity-controlled and capacity-controlled compressors are programmed in one control loop, the capacity-controlled compressors will be loaded first. This again takes place in the sequence described above (first base load stage, then associate capacity stages).

When all capacity-controlled compressors are running at 100%, the compressors without capacity control are loaded as additional refrigeration capacity is demanded. So as to achieve finer graduation, the capacity stages of a capacity-controlled compressor are unloaded to leave only its base load stage working when a non-capacity-controlled compressor is loaded. The capacity stages are then re-loaded as additional refrigeration is demanded.

An example of system configuration for loading and unloading of compressors is as follows:

Control Loop 1:

- Number of base load stages: 2
- Number of capacity stages each capacity-controlled compressor: 3
- Number of capacity-controlled compressors: 1

Control Loop 2:

- Not detailed here!

Control Loop 1 – Compressor loading:

The following table is an example of the compressor loading sequence:

	VS 300 Basic configuration				First expansion stage			
Relay No.	S1	S2	S3	S4	S5	S6	S7	S8

Control loop	Control Loop 1 (CL1)				Control Loop 2 (CL2)			
Action	$GS1_{CL1}$	$LS2_{CL1}$	$LS3_{CL1}$	$GS4_{CL1}$	GS1	GS2	GS3	-
1	X							
2	X	X						
3	X	X	X					
4	X			X				
5	X	X		X				
6	X	X	X	X				

$GS1_{CL1}$ = Base load Compressor 1 (capacity-controlled)

LS2 - LS3 = Capacity Stage 2 – 3 associate to GS1

$GS4_{CL1}$ = Base load stage Compressor 2 (no capacity control)

Unloading takes placed by first shutting down the capacity stages of a capacity-controlled compressor. Compressors without capacity control are subsequently unloaded successively when the capacity-controlled unit is running at minimum capacity.

When unloading, the compressors without capacity control are unloaded first. So as to achieve finer graduation, the capacity stages of a capacity-controlled compressor are loaded for it to run at 100% when a non-capacity-controlled compressor is unloaded. These capacity stages are successively unloaded if refrigeration demand continues low.

The following table is an example of the compressor unloading sequence:

Control Loop 1 – Compressor unloading:

	VS 300 Basic configuration				First expansion stage			
Relay No.	S1	S2	S3	S4	S5	S6	S7	S8

Control loop	Control Loop 1 (CL1)				Control Loop 2 (CL2)			
Action	GS1	LS2	LS3	GS4	GS1	GS2	GS3	-
1	X	X	X	X				
2	X	X		X				
3	X			X				
4	X	X	X					
5	X	X						
6	X							

4.3.22 Load shedding

Forced shutdown of a refrigeration point may be necessary to prevent exceeding a defined energy consumption level. Load shedding can be called via a digital input on the VS 300 Pack Controller (see section 7 Parameter List and Menu Structure – Common Setpoints).

The number of stages to be disabled on load shedding can be defined for each control loop. Unloading of compressors takes place directly. A minimum refrigeration capacity must be maintained regardless of receipt of a load shedding signal, meaning that a minimum number of compressors must be enabled.

A minimum of one compressor is enabled at all times. A single-compressor system cannot be disabled by load shedding.

4.3.23 Base load rotation

Run time of each compressor is internally monitored. So as to achieve even run time of all compressors, the compressor having the longest run time at the end of a definable cycle time is disabled and that having the shortest run time is enabled.

Base load rotation is performed only with the *step controller* or *combined controller* control types. With capacity-controlled compressors, base load rotation takes place only when the base load stage of a compressor is available. Base load rotation consists of all stages (base load and any capacity stages) of the compressor having the longest run time being disabled and the base load stage having the shortest run time being loaded. Actuation state of any capacity stages is transferred to the capacity stages of the new base load stage. In base load rotation allowance is made for the number of capacity stages controlled on a compressor.

When operating capacity-controlled compressors and non-capacity-controlled compressors together, base load rotation can only be performed among a multiple number of capacity-controlled compressors or a multiple number of non-capacity-controlled compressors.

Compressors disabled by load shedding are taken into account during base load rotation. The number of running compressors is not changed on base load rotation. Especially with screw compressors, which have an oil return system and do not require base load rotation, the parameter for *Base Load Rotation Cycle Time* can be set to ”--”, thus deactivating base load rotation.

4.4 Monitoring functions

Monitoring functions as follows are integrated in the controller as well as control and regulating functions:

- High pressure
- Low pressure
- Compressor starts
- Monitoring of the digital inputs (fast unload, load shedding, second setpoint, external alarm, heat recovery mode, safety loop, see section 4.2 Configuring/Monitoring digital inputs).

4.4.1 High pressure monitoring

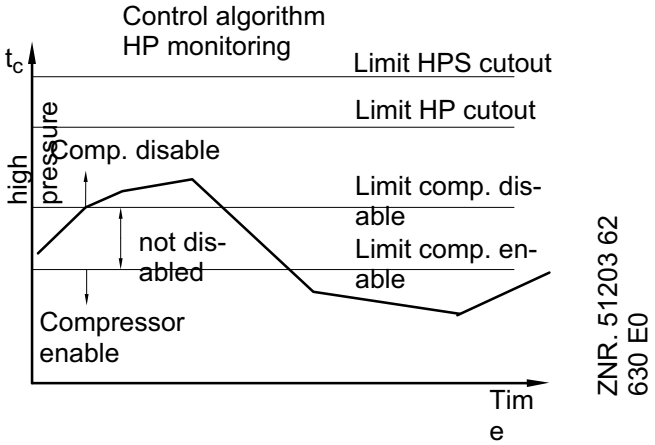
High pressure is detected in the high-pressure line by a continuous transducer with current output. When high pressure rises to a definable limit $t_{c\ max}$ (Parameter S265), the first stage is unloaded immediately on exceeding the $t_{c\ limit}$ regardless of the number of compressors running. Additional stages are unloaded after the basic unload time has elapsed. This continues until pressure drops to a level below the set limit or a definable number of compressors remain running.

The number of compressors remaining running after exceeding $t_{c\ max}$ can be defined (Parameter S277). The default value is a function of the number of compressor stages and must always be redefined following first start or after chaning the number of compressors. The following table shows the default as a function of number of compressor stages:

No. of compressor stages	Default: No. of compressor stages in HP fault
1 - 2	1
3 - 5	2
6 - 7	3
8 - 10	4
11 - 12	5

When all compressors are working, unloading of the first compressor takes place without delay. An exception is heat recovery (HR) mode.

Compressor unload does not take place in HR operating mode. No additional compressor is loaded when the pressure limit is attained, regardless of any demand for additional load.



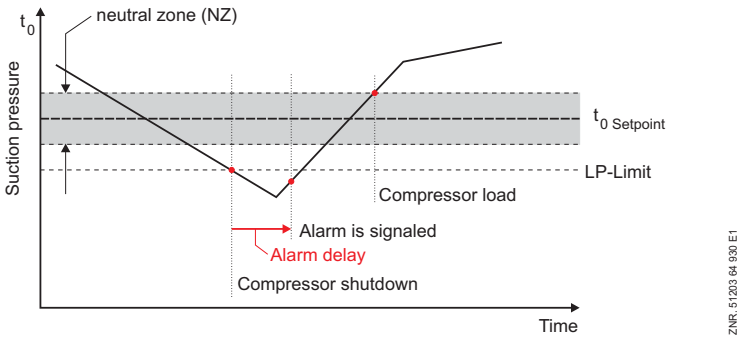
High HP alarm is generated after a definable delay if the limit set for Disable Comp. (Parameter S225 / S265) is exceeded. Alarm priority can be defined. No alarm is generated in heat recovery mode. No additional capacity stages are loaded when a HP alarm is active.

The *High HP* alarm and compressor disabling are not reset until pressure drops below the level set for *Enable Comp.* (Parameter S226 / S266).

4.4.2 Low pressure monitoring

All compressors are unloaded if low pressure drops to a definable limit. When the pressure rises to the level proportional to the t_0 setpoint, the compressors are re-loaded progressively as described above. Alarm is generated after a delay has elapsed. Delay and priority of the alarm are definable. The alarm limit is entered in °C (Parameter S227 / S267).

Control algorithm LP monitoring



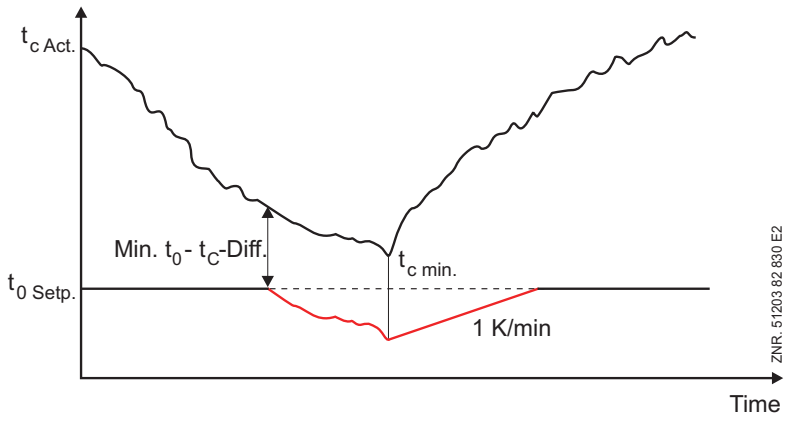
4.4.3 Monitoring of the t_c/t_0 difference

If the high pressure falls to a level below the LP setpoint the installation no longer starts. In order to prevent this a minimal temperature difference between the t_C actual value and the t_0 setpoint can be programmed. If the difference falls below the defined limit value, the t_0 setpoint is lowered so that the difference is maintained.

This leads to a compressor start-up which generates an increase in the high pressure. If the temperature difference exceeds the defined setpoint, the t_0 setpoint is raised by 1 Kelvin per minute until the setpoint derived from the t_0 characteristic curve has been reached again.

The temperature difference can be programmed in the menu 3-4 *Monitoring CL1/CL2* via the parameter *Min to diff*. If ”---” is entered then the t_0 lowering is deactivated.

t_0-Subsidence

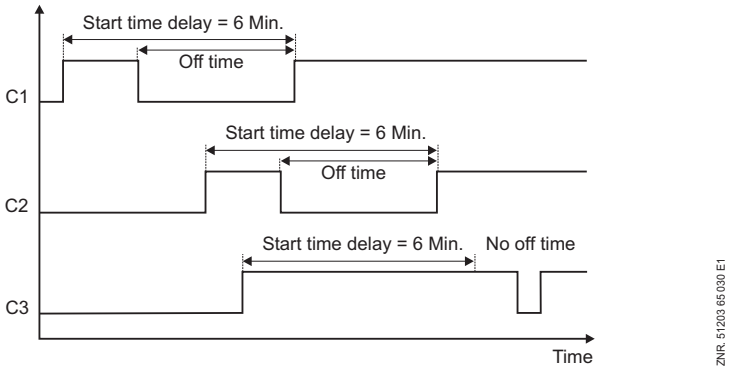


The function can only be activated when CL1 is parameterised as low pressure circuit (NT1 or LT1) and CL2 as high pressure circuit (HP) (see chapter 5.3.2.4 - Configuring the controller).

4.4.4 Compressor starts monitoring

The number of compressor starts per hour is limited as a means of avoiding short-cycling.

Starts monitoring



Limiting of the switching rate

The *Starts/h* parameter is used to determine the minimum intervals for starting a compressor. When set for example to 10 starts per hour, a compressor cannot start more frequently than every 6 minutes.

Compressor starts are only monitored with *step controller* control type.

The start frequency monitoring is also deactivated when the compressor start sequence is fixed (start mode 'According to operating times' deactivated).

4.4.5 Monitoring the digital inputs

The four digital inputs can each be parameterised for the following monitoring tasks:

- **Load shedding**
- **Setpoint toggle**
- **External alarm**
- **HRC (Heat recovery mode)**
- **Safety loop**
  - Im zugeordneten Regelkreis werden alle Schaltstufen sofort abgeschaltet
  - Es wird eine Meldung abgesetzt (verfügt die Steuerung über einen CAN-Bus-Schnittstelle, so kann dieser Meldung ein frei editierbaren Text zugewiesen werden.
  - Die Verbraucherfreigabe der zugehörigen Kühlstellenregler wird entzogen, es sei denn, der Niderdruck ist zu tief.
- **Fast unload / External OFF**
  - When the input is activated the following occurs:
  - Fans and compressors are turned off in quick succession (2 seconds unload time).
  - The consumer enable of the corresponding case controller UA 300 is revoked, unless the low pressure is too low.
  - The fault report *Fast unload CL1/CL2* is sent.
  - The pack controller is shown in grey in the store view of the PC software LDSWin.

When a digital input *Fast unload extern OFF* is used for a safety-critical application, additional measures for the purpose of monitoring must be undertaken.

4.5 High-pressure control / Condenser control

The refrigerant is chilled in the condenser by removing heat with the condenser fans. A physical relationship exists between high pressure and refrigerant temperature, meaning that high pressure or condensing temperature (condenser control) can be controlled with the condenser fans. The VS 300 Pack Controller provides three different methods for these control functions:

- **High-pressure control**
  - Step controller: Control by loading and unloading condenser capacity stages
  - Speed controller: Control by speed adjuster. High pressure is controlled by an analog signal that sets the required speed on the speed adjuster.
  - Combined controller: Control by combination of speed adjuster and additional loading and unloading of condenser capacity stages.

High-pressure control includes additional monitoring functions:

- Base load rotation
- Fan protection

With the VS 300 the actual value is measured by a pressure transducer with continuous current output (4-20 mA). The control type can be defined using the integral user interface or an external terminal (AL 300 Operator Terminal and CI 3000 Store Computer).

4.5.1 Setting HP transducer characteristic

The VS 300 Pack Controller works with continuous pressure transducers of linear characteristic. At the present time, exclusively pressure transducers with current output (4-20 mA) are usable.

Current hardware design of analog inputs on the pressure transducers for Control Loops 1 and 2 is as current inputs (4-20 mA)!

Care is required when installing the pressure transducers. The leads must be shielded and must not run parallel with power cables. Suitable precautions must be taken to prevent interference entering the transducer leads.

The following parameters are used to match the controller to the pressure transducers:

Integral operation **VS 300 LED display**	**Display** **AL 300 or CI 3000**	**Description**
See Section 7 Parameter List and Menu Structure/ Parameter List S3 - Pressure transducer parameter setting CL1/CL2 for 4 mA	`pc 4 mA`	Parameter defines pressure p_c at whicht the transducer delivers the 4 mA output signal.
See Section 7 Parameter List and Menu Structure/ Parameter List S3 - Pressure transducer parameter setting CL1/CL2 for 20 mA	`pc 20 mA`	Parameter defines pressure p_c at whicht the transducer delivers the 20 mA output signal.

A message is displayed when one of these parameters is changed:

Integral operation **VS 300 LED display**	**Display** **AL 300 or CI 3000**	**Description**
E203	`Sens.type change`	Parameter for pressure transducer has been changed.

Faulty setting of parameters can cause serious impairment of function.

4.5.2 High-pressure control neutral zone

When high-pressure control is performed by step controller, no fan actuation takes place until the control error remains within a definable neutral zone. With combined control the effect of the neutral zone is as follows.

As long as the control error remains within 1.5 times the neutral zone, high pressure is controlled by increasing or decreasing fan speed. Above or below 1.5 times the neutral zone, the fan runs at maximum or minimum speed to achieve fast control action.

4.5.3 Control algorithm for high-pressure control

The controller cycle time is 1 second. The control algorithm varies with the control type.

In the wet vapor range, temperature is a distinct function of refrigerant and pressure: t = f (p, refrigerant). The VS 300 makes calculation from the pressures measured as a function of the given refrigerant temperatures. Exclusively temperature values are used for control. Temperatures (t_0, t_c) listed in the documentation therefore substitute for pressures (p_0, p_c).

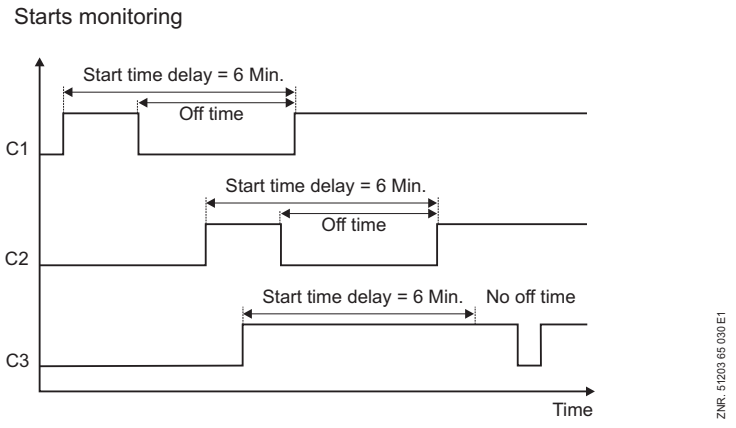
4.5.4 Control algorithm with step controller

High pressure detected by an A/D converter is compared with the setpoint (see section 4.5.10 Determining the High-pressure Setpoint). The following relationship applies:

Control error =

With a **positive** control error ($t_{c\_Act} > t_{c\_Setp}$ + 0.5 x Neutral Zone) and rising pressure, the step controller moves forward one step. This means that one additional condenser capacity stage is enabled. With a positive control error and falling pressure, no capacity stage is loaded in anticipation of pressure reaching the neutral zone in a short time.

With a **negative** control error ($t_{c\_Act} > t_{c\_Setp}$ - 0.5 x Neutral Zone) and falling pressure, the step controller moves back one step. This means that one additional condenser capacity stage is disabled. With a negative control error and rising pressure, no capacity stage is unloaded in anticipation of pressure reaching the neutral zone in a short time.



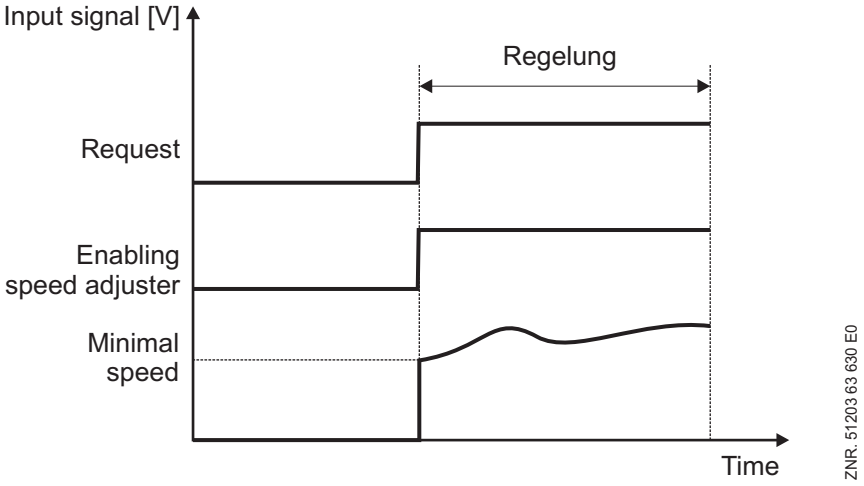
4.5.5 Control algorithm with speed control

High pressure detected by an A/D converter is compared with the setpoint (see section 4.5.10 Determining the High-pressure Setpoint). The following relationship applies:

Control error =

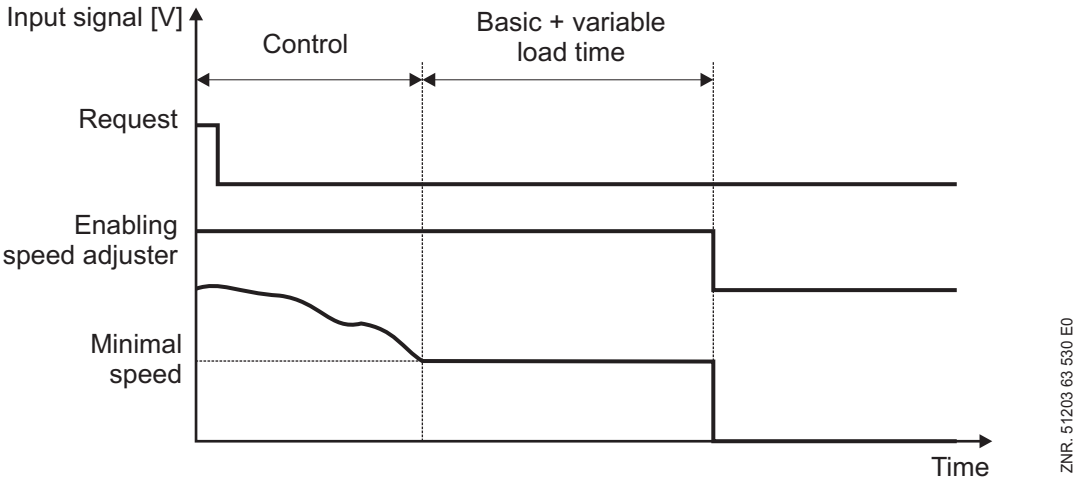
With a positive control error, a speed setpoint is calculated by a PI control algorithm and transmitted to the speed adjuster via analog output (0-10 V). The speed adjuster controls fan speed to the defined setpoint.

VS 300 Fan setup characteristic



With a negative control error, the speed adjuster is disabled by the first capacity stage of the allocated control loop of the VS 300 when speed drops to minimal speed and the basic and variable unload times have elapsed.

VS 300 Speed adjuster cutoff



Control can be influenced by three parameters:

- Minimum speed of speed adjuster in continuous control
- Analog output adjusting differential/control speed
- Maximum temperature in speed control

These parameters are only displayed when speed or combined control is activated as the control type (see section 7 Parameter List and Menu Structure – Common Setpoints for System Configuration).

Minimum speed of the speed adjuster can be set with the *Minimum Speed* parameter. Entry is made in percent for the 0-10 V analog output of the VS 300. Controller speed can be influenced with the *Analog Output Control Speed* parameter. If the controller is too slow, the parameter must be set higher. If hunting occurs, the parameter should be set lower.

One or two relay/control stages can be allocated to a speed controller. If only one stage is allocated to the speed controller, it is used for enabling/disabling of the speed adjuster. When two stages are allocated to the controller, the first is used for enabling/disabling the speed adjuster and the second for actuating a bypass for the speed adjuster. The connected fan then runs at constant speed, bypassing the speed adjuster.

If the limit set as *maximum temperature with speed control* is exceeded and a second relay/control stage is allocated to the speed controller, this second stage (bypass) is activated and the first stage disabled (enable speed adjuster).

On attaining the defined setpoint for t_c, the controller returns to control mode (bypass off, speed adjuster enable on).

When a bypass stage is programmed, it must actually be connected, as enabling of the speed adjuster is disabled at high temperature!

4.5.6 Determining the setpoint for speed control

Calculation of the setpoint for t_c is made as described in section 4.5.4 Control Algorithm with Step Controller. Additionally a speed setpoint is determined. The following relationship applies for calculation:

$$U_{Setp} = P_{Action} +$$

U_{Setp} = Speed adjuster setpoint (0-10 V)
P_{Action} = Proportional action of controller
I_{Action} = Integral action of controller

$$P_{Action} = t_{c\_Act} -$$

t_{c_Act} = Current value of t_c
t_{c_Setp} = Setpoint for t_c

The P action causes the controller to respond directly to control errors. The I action avoids sustained control errors.

$$I_{Action} = I_{Action} + \left[\frac{\left(t_{c\_Act} - t_{c\_Setp}\right)}{4} + adjust.\ diff. \right]$$

Adjusting differential = Definable controller speed

4.5.7 Control algorithm with combined controller

High pressure detected by an A/D converter is compared with the setpoint (see section 4.5.10 Determining the High-pressure Setpoint).

Depending on the control error, a controller output is calculated to control the fan speed as a 0-10 V signal. Since the controller acts as a PI controller, both P and I action are calculated.

Calculation of P action:

P action = Control error : 4

Calculation of I action:

The P action acts immediately on the speed in response to a change in pressure. The remaining control error is minimized by continuously increasing or decreasing the control signal (ramp function). Ramp speed (I action of controller) is a function of the control error. An excessively high ramp speed results in continuous high pressure overshoot.

An excessively low ramp speed results in the high-pressure setpoint only being attained with a long delay. The controller is then too slow. So as to match the I action to the system, the ramp speed can be influenced by means of the *Adjust Diff.* parameter.

$$I_{Action} = I_{Action} + control\ error + adjust.\ diff.$$

A positive adjusting differential results in steady state being obtained faster. A negative adjusting differential results in slower control action.

The I action is attenuated in order to avoid controller hunting at low part load conditions. If only the variable-speed fan is running, the control signal (0-10 V) is less than 50% and the control error is less than the neutral zone, the condenser is operated at low part load.

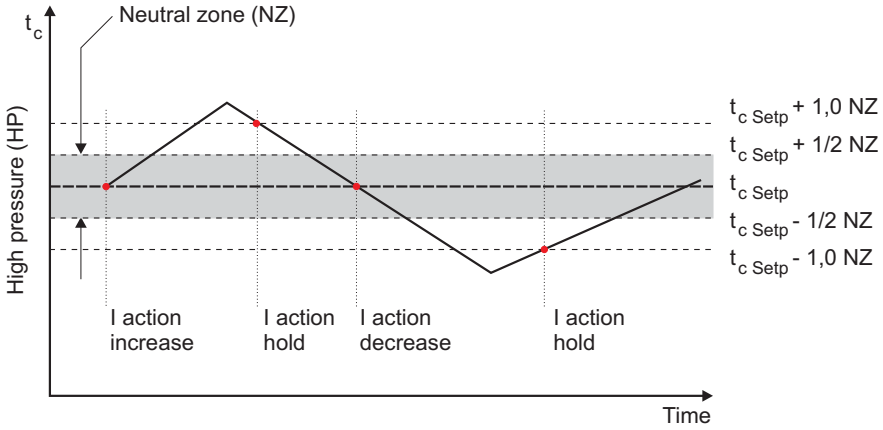
I action is then

$$I_{Action} = I_{Action} + \left[\frac{(control\ error + adjust.diff.)}{8} \right]$$

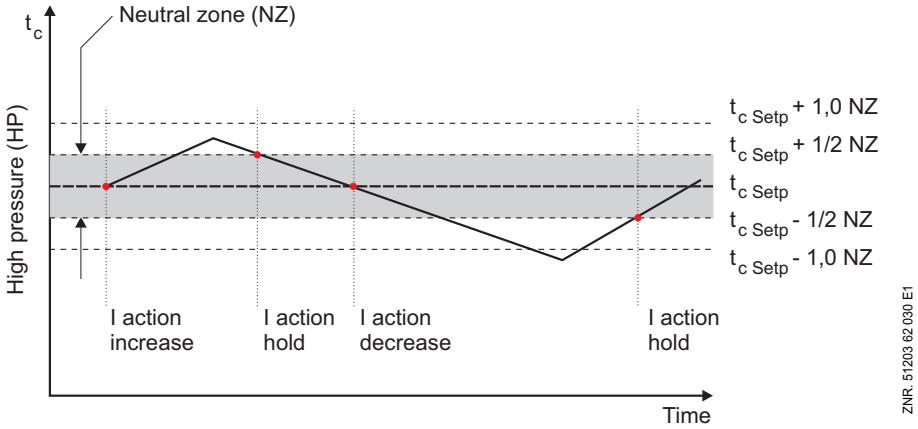
Allowance is made for the pressure change when the control error is small. If the control error is positive and pressure is falling and lower than the setpoint plus neutral zone in part-load operation or half the neutral zone in full-load operation, I action is not changed. The I action is also not changed when the control error is negative and the pressure is rising and greater than the setpoint less neutral zone in part-load operation or half the neutral zone in full-load operation.

So as to prevent speed increasing too fast, increase of the I action is limited to a maximum of 10% of the control signal (0-10 V). With control errors above or below 1.5 times the neutral zone, the fan runs at maximum or minimum speed.

Control algorithm HP combined controller
- part-load operation -



- load operation -



The controller output for the speed adjuster is calculated from the P and I action:

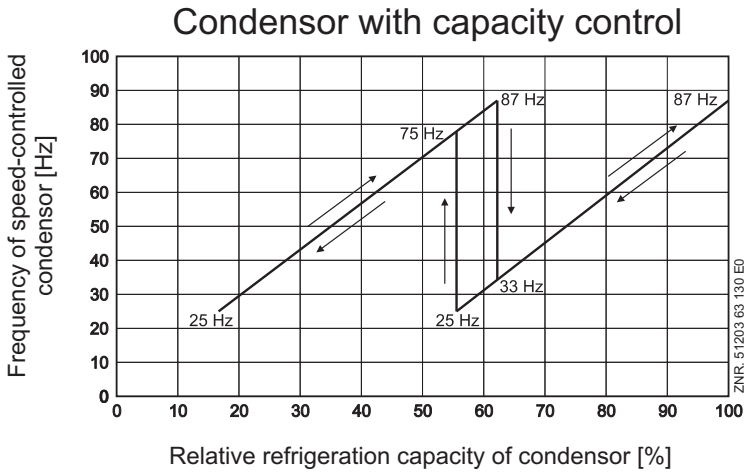
Controller output = P action + I action

If all fans are stopped and the actual value is greater than the setpoint (positive control error), the first fan (F1: enable frequency changer) is started immediately.

4.5.8 Loading and unloading of fixed-speed fans

Fixed-speed fans can be loaded or unloaded if the required capacity cannot be supplied by changing the fan speed. When the variable-speed fan attains maximum speed, the next fixed-speed fan is started. When the variable-speed fan attains minimum speed, a fixed-speed fan is stopped.

The variable-speed fan is increased to a speed at which the condenser capacity corresponds to the capacity prior to stopping the fixed-speed fan. The speed controlled fan is powered up again. The control sequence for a condensing unit equipped with two fans is shown in the following diagram.



4.5.9 Condenser fan actuating times with step action controller

If condensing pressure rises above or drops below the neutral zone, the first condenser capacity stage is immediately loaded or unloaded. Further actuation only occurs when a certain time for loading or unloading has elapsed and the control error exceeds a defined value (neutral zone).

If the control error is positive and greater than half the neutral zone but pressure is falling, no fan actuation takes place, as it may be anticipated that pressure will soon come within the neutral zone. Conversely, no fan actuation takes place when the control error is negative and greater than half the neutral zone but pressure is rising, as it may again be anticipated that pressure will soon come within the neutral zone.

Actuating time is a function of the actual control error. With a large control error, actuation takes place sooner than with a smaller control error. The actuating time is calculated as the total of basic time t_b and variable time t_v. On step controllers differentiation is made between loading and unloading.

The variable time is inversely proportional to the control error. At maximum control error the variable time t_v decreases to 0. As the control error becomes smaller, time t_v is automatically increased up to the defined maximum. Basic time and maximum variable time for loading and unloading are programmable parameters. The following relationships apply to calculating actuating times:

$t = t_b + t_v$ t_b definable

The following applies for t_v:

$$t_v = t_{v\_max} - \frac{(t_{v\_max} \cdot d_t)}{d_{t\_max}}$$

$d_t > d_{t\_max}$ is equivalent to $d_t = d_{t\_max}$

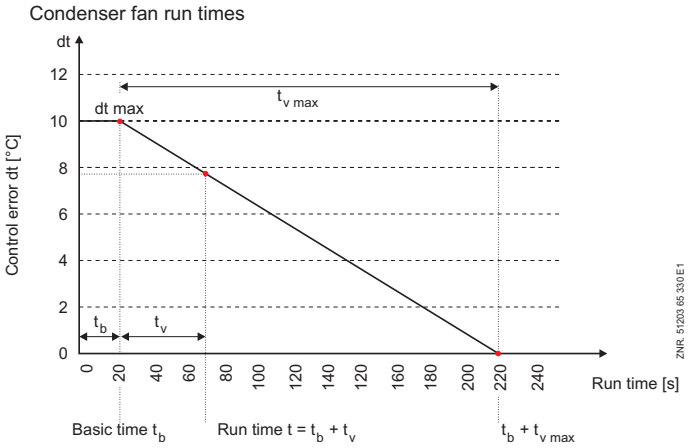
t_v = Variable actuating time

t_{v_max} = Max. actuating time (can be defined for each stage)

d_t = Control error

d_{t_max} = Max. control error (definable)

Actuating time is calculated at every controller cycle. The variable time is recalculated and the time elapsed since the last actuating time is compared with the calculated time. If the calculated actuating time is less than or equal to the elapsed time, fan actuation takes place when the control error is greater than the defined neutral zone. The following diagram illustrates calculation of actuating time.



4.5.10 Determining the high-pressure setpoint

As standard, the VS 300 Pack Controller works with a defined fixed setpoint for t_c.

In the parameter list S3, i.e. under the menu item 'System Configuration' (see chapter 7 - Parameter List and Menu Structure - Setpoints System Configuration) the parameters for

- Enable room temperature
- Enable humidity

are set to '0' (i.e. 'OFF') and the address of the controller from which the data should be obtained is set to '---'.

However, when the VS 300 is networked via a CAN Bus module (see chapter 1 - System Configuration) with other pack controllers (VS 3010, VS 3010 BS or FS 3010), it is possible to employ additional values for the tc setpoint evaluation.

integrierte Bedienung **LED-Anzeige VS 300**	**Display** **AL 300 oder CI 3000**	**Description**
See section 7 Parameter List an Menu Structure/Parameter List S3	`Freig. ta RK1/RK2 AUS`	Enabling of sensor for temperature shift in CL1/CL2
See section 7 Parameter List an Menu Structure/Parameter List S3	`FreiFeucht.RK1/RK2`	Enabling of sensor for humidity shift in CL1/CL2

The evaluation of the tc setpoint can then be carried out relative to the outside temperature (setpoint adjustment). The parameter for 'Enable outside temperature' must be set to 1 (i.e. 'ON') in this case.

The outside temperature must be provided via CAN Bus by another pack controller (VS 3010, VS 3010 BS or FS 3010) within the system.

The CAN Bus address of this controller (VS 3010, VS 3010 BS or FS 3010) is then entered in the VS 300 using an appropriate parameter ('Node Number Ambient Data' see chapter 7 - Parameter List and Menu Structure - Setpoints System Configuration).

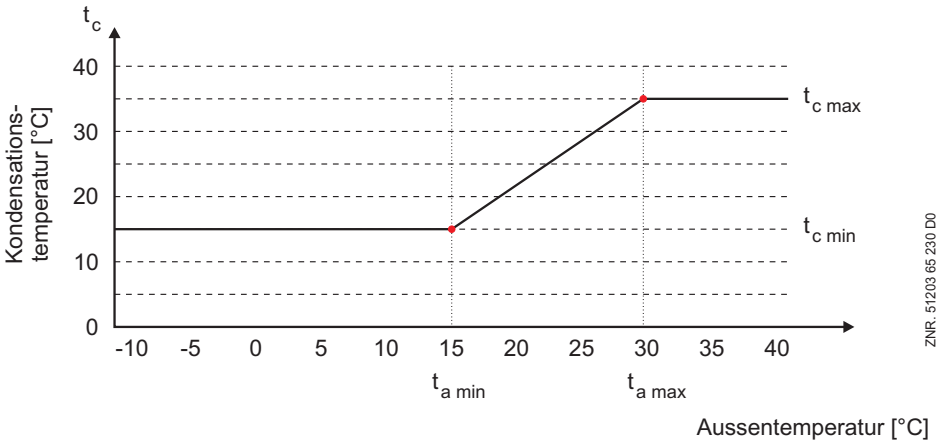
The evaluation of the tc setpoint can then be carried out relative to the outside temperature according to a programmable characteristic curve.

t_c	= t_c setpoint
t_{c_max}	= maximum tc setpoint
t_{c_min}	= minimum tc setpoint
t_a	= current outside temperature
t_{a_max}	= max. outside temperature for setpoint adjustment
t_{a_min}	= min. outside temperature for setpoint adjustment

With an outside temperature of $t_a > t_{a\_max}$ or $t_a < t_{a\_min}$ the following applies:

for $t_a > t_{a\_max}$: $t_c = t_{c\_max}$
for $t_a < t_{a\_min}$: $t_c = t_{c\_min}$

VS 300 HD-Sollwertermittlung



t_{c_min}, t_{a_min}, t_{c_max}, t_{a_max} can be parameterised.

The pressure setpoint for actual control is determined from a conversion table contained in the software. Conversion of t_0 to the corresponding pressure can be made for the following refrigerants:
R22, R502, R134a, R404A, R402A, R717, R1270, R507, R407C, R410A, R290, R744 (transcritical operation not available), R407F, R422A, R422D, R408A, R407D, R407A, R427A, R438A, R512a, R170, R600, R600a, R449A, R450A, R448A, R455A, R447B, R1234ze, R1233zd, R41234yf

4.5.11 Second setpoint - setpoint increase / decrease

A second characteristic can be programmed with high-pressure control and can be activated by the internal week timer or via a digital input of the controller. Setpoint increase/decrease allows better matching to night and weekend operation. Setpoint toggle is performed for the following values:

- Target temperature(s)
- Neutral zone
- Control constant

The polarity of digital input signals can be programmed (low or high active).

4.5.12 Heat recovery mode (HRC)

When a control loop is configured as a HP controller, operation at changed (higher) t_c setpoints (heat recovery mode) can be called up via a digital input (see section 4.2 Configuring/Monitoring Digital Inputs).

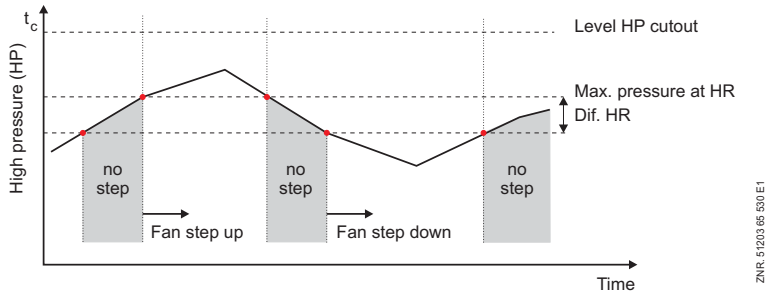
In heat recovery mode, HP control is controlled by the VS 300 with two parameters:

- The maximum condensing temperature allowed in HR mode is entered by the *Max.HR* parameter.
- A temperature differential is defined by the second parameter *Dif.HR*.

When pressure rises above *Max. HR*, the first fan stage is loaded immediately (without consideration to programmed actuating times). Each additional fan stage is loaded after the basic load time has elapsed (without consideration to variable actuating time).

When pressure drops below *Max. HR - Dif. HR*, fan stages are unloaded with consideration to the basic and variable unload times.

Control algorithm heat recovery mode (HR mode)



Changes in controller action during HR mode:

- No alarming of high-pressure fault.
- No compressor shedding in high-pressure fault.

HR mode is displayed n the actual values screen of the external terminal (CI 3000 or AL 300):

- HR mode active:

$t_{c\text{-}Setp}$	**HR**	45°C
$p_{c\text{-}Setp}$	**HR**	20.85 b

HR mode is also shown on the status display of the integral user interface (see section 6 Operation).

4.5.13 Relay / control stage actuating mode

The *Run Time Equalization* parameter can be used to determine the actuating sequence in the associate control loop (see section 7 Parameter List and Menu Structure - Control Loop 1/2 Basic Parameter Setpoints - Day and Night Operation).

Fixed actuating sequence

When the *Run Time Equalization* parameter is set to *0* or *N*, the fan actuating sequence remains unchanged. The fans are started in the order of F1 - Fn and stopped in the order of Fn - F1.

Actuation by run time

When the parameter is set to *1* or *Y*, the fan actuating sequence is changed. The fans are then started and stopped not in their respective order but according to run time.

- When a fan needs starting, the fan having the shortest run time is started.
- When a fan needs stopping, the fan having the longest run time is stopped.

4.5.14 Fan protection / HP base load rotation

Supplementary functions are implemented in the VS 300 Pack Controller for protection of the fan motors. During periods of low outdoor temperatures when only a small number of fans is needed for condensing, there is a likelihood of fans seizing after being idle for long periods.

Fan protection is active when base load rotation is activated (parameter for Base Load Rotation Cycle Time set other than ”--”) and Run Time Equalization mode is deactivated (fixed actuating sequence of relay/control stages). Base load rotation is activated when run time equalization is activated.

1. Fan protection

Fans that have been idle longer than a definable time (see *BaseRotCycle* parameter) are forcibly started for a period of 20 seconds, but only when actual temperature is within or above the neutral zone.

2. Base load rotation

Base load rotation of fans can be performed to achieve equal condenser run time. When the HP controller stays in the neutral zone for a definable time (see *BaseRotCycle* parameter*)*, the fan having the shortest run time – when such is available - is started at the end of the defined time and that having the longest run time is stopped.

2nd *BaseRotCycle* parameter

When a time is entered for this parameter, either fan actuation or base load rotation is performed at the end of the set time as a function of the operating modes described above.

***Cycletime BLR* parameter**

A vlaue can be entered to determine the time after which either fan actuation or base load rotation will take place as a function of the modes described above.

4.6 Controller start

Differentiation is made between two events for starting the VS 300 Pack Controller:

- First start
- Restart

4.6.1 First start

First start of the VS 300 can be made in two ways:

1. First start with loading of default settings

- On first starting the system
- After updating the firmware
- After changing the controller configuration (LTLT, LTNT, LTHP, NTNT, NTHP, HPHP,NTLT)
- Manually:
  First start with loading of default settings can be initiated by simultaneously pressing and holding the ESC/ RESET, ↑ and ↵ keys on starting the controller. Alternatively, the defaults can be loaded by means of a parameter (see section 7 Parameter List and Menu Structure – Basic Settings - System Configuration).

2. First start using parameter backup

First start is also performed when internal check finds parameter setting to be incorrect. The VS 300 enables a set of backup data to be saved and loaded in place of the defaults in the event of an internal error (inconsistency in parameter memory).

This requires the *Parameter Backup* function to be opened after setting parameters on the controller (see section 4 Startup – Parameter Backup).

On first start all parameters are loaded with the default values and all archives (messages/alarms and operating data such as run times, compressor starts, activity)
are deleted!

4.6.2 Restart

Restart takes place following return of power after an outage when the parameter settings have been preserved. All variables, except parameters, fault memory and archived data, are deleted.

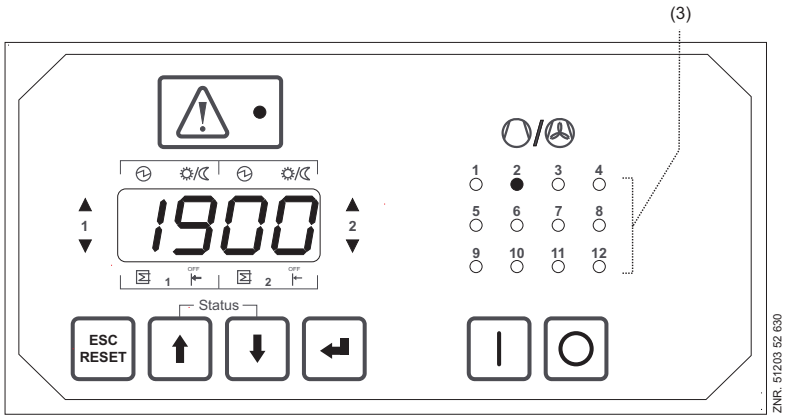
4.7 Archiving of operating data

4.7.1 Compressor/fan operating hours

Total run time of compressors/fans is recorded at 30-second intervals and saved to fail-safe memory every 30 minutes. Run time is shown in hours. On the local panel of the VS 300, the relay/control stage operating and status display (3) is used for indicating figures exceeding four digits (e.g. 21900 operating hours) by one of these LEDs flashing (see illustration below).

Value = Value of LED display [0 - 9999] + (Number of flashing operating and status display LED * 10000)

Example:	Figure shown on four-digit display:	1900 h
	Number of flashing operating and status display LED:	2
	Result: 1900 + (2 * 10000) =	21900 operating hours



Operating hours are displayed in clear text on the AL 300 or CI 3000 terminal. If compressors/fans or the complete controller is exchanged, operating hours can be reset to 0 (see section 7 Parameter List and Menu Structure – Basic Settings - System Configuration). Alternatively they can be programmed, but only using the external AL 300 or CI 3000 terminal connected via the CAN bus module.

The selected operating hours total (0 - 29999) can then be entered from the AL 300 or CI 3000 terminal using the appropriate functions.

4.7.2 Daily run times

In addition to operating hours, the run times, starts of separate control stages per day and activity (utilization) of the compressor pack can be recorded (only with the external CI 3000 or AL 300 terminal connected via the CAN bus module). Cycle time commences at midnight. The current status is displayed in hours and minutes. This data is additionally archived for a period of 32 days for use in assessing operation of the compressor pack.

4.7.3 Compressor / condenser daily run times

Daily run times of the control stages are recorded for each day and saved together with date and time of day. Cycle time commences at midnight. Daily run times are recorded separately for the first and second setpoint.

4.7.4 Compressor / condenser starts

Control stage starts are recorded for each day and saved together with date and time of day. Cycle time commences at midnight. Daily starts are recorded separately for the first and second setpoint.

4.7.5 Compressor pack activity / utilization

Activity is calculated by the following formula:

$$Activity = L / [n \cdot (T_1 - T_0)]$$

Activity : Percentage activity of compressor pack
L : Total of all run times
n : Number of control stages installed
T_1 : Current time
T_0 : Turn of day

The current status is displayed in percent. Daily activity of the compressor pack is calculated for the first and second setpoint and the total run time.

5 Startup of VS 300

The operator terminal AL 300, the store computer CI 3000 or the PC-Software LDSWin are used to set parameters on the controller at startup and for subsequent changes.

The controller should only be used with compatible versions of the PC software LDSWin, otherwise the range of functions could be restricted.
Tip: The latest version of LDSWin should be used at all times.

Before commissioning the VS 300 Pack Controller, preparations must be made for installing it in the control panel. Basic settings must also be made on the hardware and in the software.

5.1 Connection and safety notes

- This manual is an integral part of the equipment. It should be kept close to the equipment for ready reference whenever needed.
- For safety reasons, the equipment must not be used for any application other than described in the manual i.e. only for the intended purpose.
- Before using the equipment, always check that its limits are suitable for the intended application.
- Check that the electric power supply is correct for the equipment before connecting it to power.
- If required, a reverse voltage protection must be installed by the customer, e.g. by means of a coding of the plug.
- Specified ambient conditions (e.g. humidity and temperature limits) must be observed and complied with in order to avoid malfunctioning (see Section 10 - Specifications).
- Check correct wiring of the connections before switching on power to the equipment.
- Never operate the equipment without its casing. Before opening the casing the equipment must be switched to zero potential.

Beware of external voltage at the digital inputs and outputs!

- Contact the supplier in any malfunction or in case of doubt
- Note and observe maximum load on relay contacts (see Section 10 - Specifications).

All leads running to and from the VS 300 (except 230 V power supply and signal leads) must be shielded! This applies in particular to analog inputs (sensor leads) and CAN bus wiring. The leads must also be installed sufficiently clear of other leads carrying live power. Doing so will avoid faulty measurements and will protect the equipment from external interference via the analog inputs.

For further details please refer to the manual titled Introduction, General Safety and Connection Notes.

The error reporting dispatch is not yet functional according to experience during a start-up (no telephone line put etc.). It is urgently recommended in such cases to supervise the control over the CAN bus with a store computer CI 3000 and/or a control terminal AL 300 and to make the error reporting dispatch possible for example with a GSM modem by mobile telephone net. In stand-alone operation or as an alternative to monitoring by Store Computer/Operator Terminal, an alarm contact provided on the controller can be used to transmit alarms via telephone line.

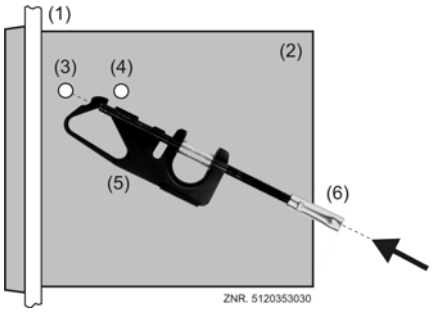
5.2 Installation

The VS 300 is housed in a plastic casing designed for control panel mounting. Power loss of the controller is approx. 10 VA. When installing, make sure that the ventilation slots on the controller are not covered and that sufficient clearance is maintained between devices or cable ducts above and below the controller for cooling air to circulate.

See section 9 Specifications for details of electrical enclosure, measurements and installation cutout.
See section 5 for pin and terminal assignments.

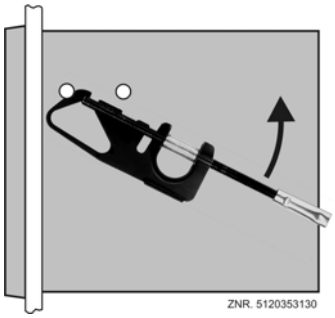
Attaching mounting braces and installation

The two mounting braces enclosed with the VS 300 must be attached on the left and right sides of the casing for installation:

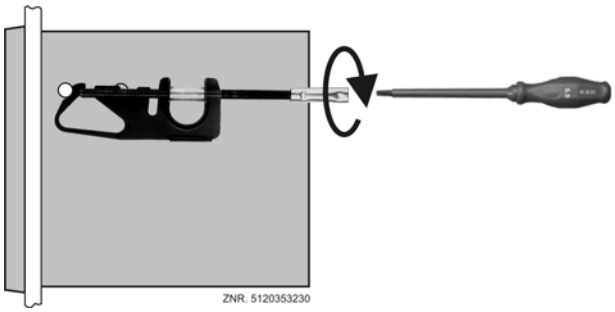


(1) Control panel with installation cutout (see section 9 Specifications)
(2) Casing of VS 300
(3) Front support pin
(4) Rear support pin
(5) Fastening brace
(6) Fastening brace

1. Push front of VS 300 (2) through cutout in control panel (1). Press fastening brace (5) on front support pin (3).



2. Turn fastening brace (5) up on front support pin (3) and press slightly to snap on second support pin (4).



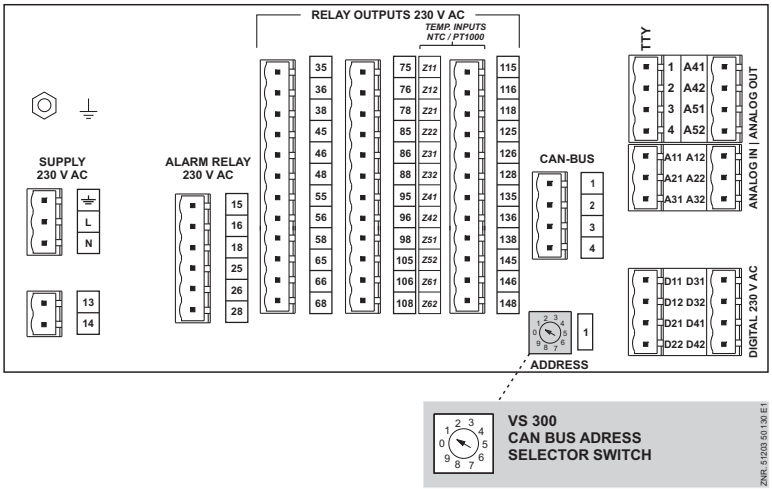
3. Usingg a screwdriver, tighten fastening screw (6) on control panel.
Then make electrical connections on VS 300 (see section 5).

After completing installation and electrical connections, parameter settings must be made on the hardware and in the software of the pack controller.

All leads running to and from the VS 300 – especially those for the analog inputs (sensor leads) and also for the CAN bus - must be screened!

5.3 Startup

5.3.1 Basic parameter settings on hardware



Depending on the add-ons fitted (only with CAN bus module - see section 1 System Configuration) an address selector switch (decade switch) is located on the rear of the VS 300 Pack Controller. This switch can be used to set the controller CAN bus address.

Decade switch

- Sets the Node No. (*Nd.nnn*) or CAN bus address (position of address selector switch 1 - 9 corresponds to CAN bus address 101 - 109).
- In order to activate the CAN Bus software address, the address 0 must be set on the address select switch. In this switch position (or when the CAN Bus address select switch is not fitted) the CAN Bus address can then be set via the software (see chapter 5.3.2.3).

A unique address must be assigned in the system to each CAN bus station in order to prevent malfunctioning.

After changing the switch position, the VS 300 must be cut off from power briefly for the new settings to take effect!

5.3.2 Software settings

The controller configuration must be selected before setting parameters of the VS 300. This can be done on the integral user interface on the front of the VS 300 or by connecting an external terminal (AL 300 or CI 3000). Superuser rights are required for setting the controller configuration.

5.3.2.1 First start – Loading default settings

Simultaneous pressing and holding the ESC/RESET, ↑ and ↵ keys when powering up the controller initiates first start and loads the default settings. The default settings can alternatively be loaded via a parameter (see section 7 Parameter List and Menu Structure - Basic Settings - System Configuration or Load Basic Settings).

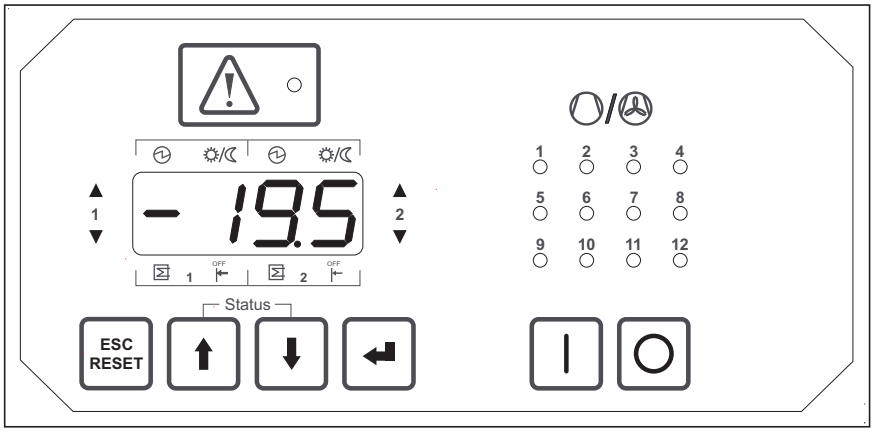
At first start, the default settings are loaded for all parameters and all archives (alarms/messages and operating data, e.g. starts, activity) are deleted!

5.3.2.2 Changing the access level

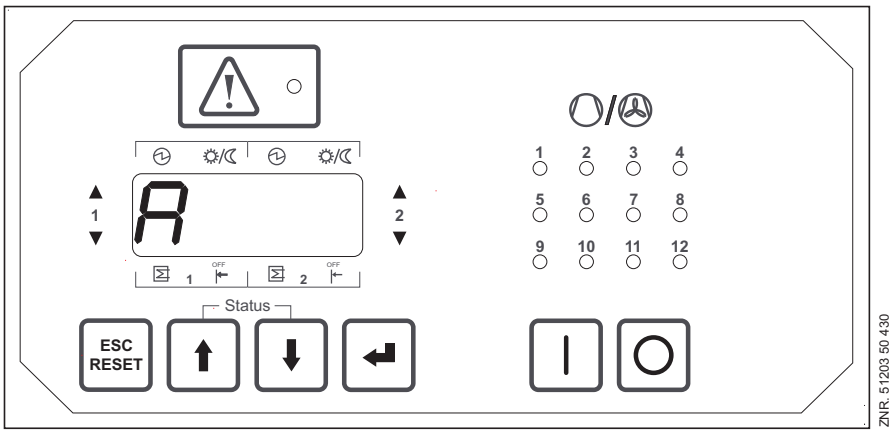
The controller configuration can only be changed in Superuser mode. Parameters to change the VS 300 basic parameter settings can only be accessed and changed at this user level. First, Parameter *A060* (password entry to change access level, see Parameter List A) must be opened to request extended rights for

- controller configuration (see section 5.3.2.4) and
- parameter backup (see section 5.3.2.7)

1. On powering up the controller, LED check is first performed with all status LEDs and all display segments briefly illuminating and then extinguishing, after which the controller switches to basic display mode. The actual value for t_1 (Control Loop 1) is displayed (see illustration).



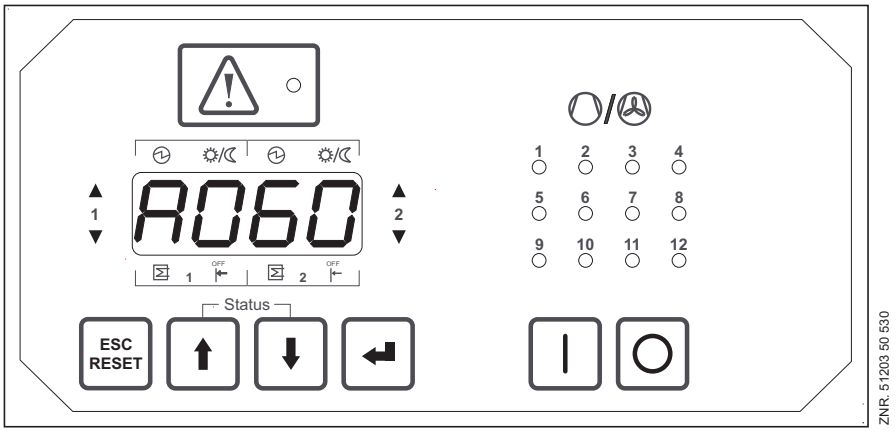
2. Pressing the ↵ key moves to parameter list selection and Parameter List A is displayed (see illustration).



The ↑ and ↓ keys can be used to select the following parameter lists:

A	Actual Values	System Data
S1	Setpoints	Controller Basic Parameters
S2	Setpoints	Controller Auxiliary Parameters
S3	Setpoints	System Configuration
S4	Setpoints	Alarm Priorities
S5	Setpoints	Additional parameters
t	Setpoints	Timers
C	Service Mode	(Check Mode)
F	Alarms	Process and System Fault Reports

3. Pressing the ↵ key again opens Parameter List A (*A000* is shown on display). Use the ↑ and ↓ keys to select Parameter *A060* (see illustration).



4. Pressing the ↵ key again moves to entry or parameter setting mode. The display shows *0* flashing. Press the ↑ key to select Parameter *10* for *Superuser Mode* access level:

0	=	Display only
1	=	Setpoint adjustment enabled
10	=	Superuser mode – additional parameters can be accessed and changed

Pressing the ↵ key confirms the entry and moves back to Parameter List A (*A060* is shown on display).

5. Pressing the ESC/RESET moves back to parameter list selection (*A* is shown on display). Pressing the ESC/RESET again returns to basic display mode, which displays the actual value of t1 (Control Loop 1) - (see illustration under item 1, page 42).

See section 6 Operation for further details on the display and operation of the VS 300.

5.3.2.3 Setting the CAN Bus address

Only with VS 300 versions without fitted CAN Bus address select switch is it necessary to set the address via a parameter. This is only possible using the controller's integrated operator interface:

The addressing is carried out via the parameter S290. For further details see chapter 7 - Parameter List and Menu Structure - Parameter List S2.

5.3.2.4 Configuring the controller

Parameter *S390* (see section 7 Parameter List and Menu Structure - Parameter List S3) can be used to set the controller configuration according to the table below:

The controller configuration can only be changed in terminal mode and Superuser mode (see section 5.3.2.2 Changing the Access Level).

Parameter	Controller Configuration	
0	LT LT	Control Loop 1 = LT control Control Loop 2 = LT control
1	LT NT	Control Loop 1 = LT control Control Loop 2 = NT control
2	LT HP	Control Loop 1 = LT control Control Loop 2 = HP control
3	NT NT	Control Loop 1 = NT control Control Loop 2 = NT control
4	NT HP	Control Loop 1 = NT control Control Loop 2 = HP control
5	HP HP	Control Loop 1 = HP control Control Loop 2 = HP control
6	NT LT	Control Loop 1 = NT control Control Loop 2 = LT control

For satellite and booster operation please seee chapter 4.3.13.
The controller must be configured prior to making individual parameter settings, as first start will be performed after changing the configuration!

At first start, the default settings are loaded for all parameters and all archives (alarms/messages and operating data, e.g. starts, activity) are deleted!

Faulty parameter setting can result in severe impairment of system function!

5.3.2.5 Setting the current date and time

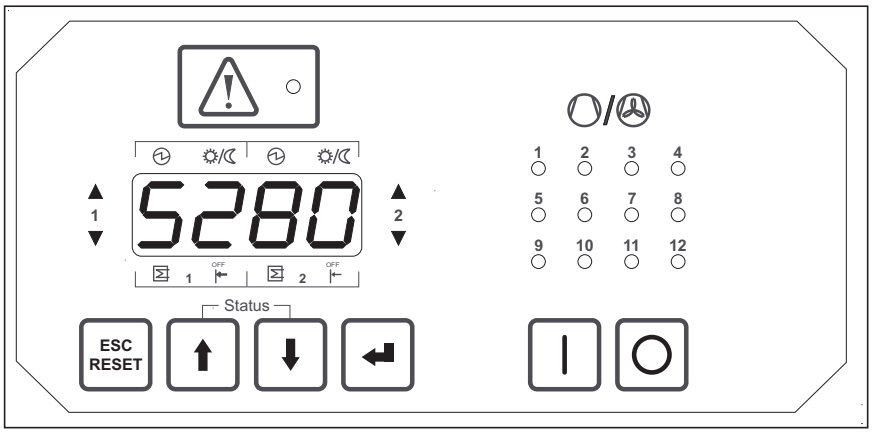
The current date and time of day can be changed under Parameter List S2 (see section 7 Parameter List and Menu Structure). Parameter *S280* is taken as an example to explain how the setpoints for date and time are changed.

Date and time settings are only needed in stand-alone operation and can only be made in this mode! If the VS 300 is connected through the CAN bus module to a master clock (CI 3000 or AL 300), the date and time will be supplied by the master and applied to the VS 300, meaning that they can then not be changed.

Adjustment of setpoints is only allowed at the setpoint adjustment access level (see section 5.3.2.2 Changing the Access Level)! The LED display flashes as an indication when values (setpoints) can be changed!

Pressing the ↵ key in basic display mode moves to parameter list selection and Parameter List A is shown on the display. Use the ↑ key to select Parameter List S2. Pressing the ↵ key again (*S200* is then shown on display) enables the parameters of Parameter List S2 to be selected with the ↑ and ↓ keys.

When the parameter wanted (e.g. *S280*) is shown on the display (see illustration), press the ↵ key to change to parameter setting mode. The current setpoint for the hour of day (*0-23*) is displayed:



The value can then be changed within the permissible range by pressing the ↓ and ↑ keys. See section 7 Parameter List and Menu Structure for detailed information on the VS 300 parameter list. A description is given of the parameters that are available, the conditions under which they can be changed and the range within which they can be changed.

Pressing the ↵ key again applies the set value and returns to parameter selection mode. When setpoint adjustment is not enabled, any selected setpoint will be displayed but cannot be changed with the ↑ and ↓ keys. This is indicated by the display not flashing in this instance.

Parameters for setting date and time

S280	Current time, hour	S283	Current date, month
S281	Current time, minute	S284	Current date, year
S282	Current date, day	S285	Daylight saving time change

5.3.2.6 Other parameters to be set

There are a number of other parameters that need to be set for startup:

- **System configuration: Allocation of relay/control stages, refrigarant**
  Menu 3-1 respectively parameter list S3 – Setpoints - System Configuration - Control Loop 1 and 2
- **LP/HP sensor characteristic setting / pressure transducer configuration**
  Menu 3-1 respectively parameter list S3 - Setpoints - System Configuration - Control Loop 1 and 2
- **Dispatching of the internal alarm outputs**
  Menu 3-1 respectively parameter list S3 - Common setpoints system configuration - Control loop 1 and 2
- **Operating mode selection/Refrigeration point control**
  Parameter List S3 - Common Setpoints - System Configuration - Control Loop 1 and 2
- **Control mode setting (step, speed or combined controller)**
  Menu 3-2-1 (CL1) and 3-2-2 (CL2) respectively parameter list S3 – Common Setpoints - System Configuration - Control Loop 1 and 2. For details see section 3 *Control Algorithm with Speed Controller* for high-pressure control
- **Configuration of the four digital inputs**
  Menu 3-5 respectively parameter List S3 - Common Setpoints - System Configuration - Control Loop 1 and 2
- **Setpoint configuration**
  Menu 3-2-4 (CL1) and 3-2-5 (CL2) respectively parameter list S3 - Common Setpoints - System Configuration - Control Loop 1 and 2

For details and further information see section 3 Function of VS 300.

Faulty parameter setting can result in severe impairment of system function.

5.3.2.7 Parameter backup

The VS 300 Pack Controller allows of backing up parameters as set. After making individual parameter setting on the controller, these parameters can be backed up by choosing Parameter *Parameter Backup* (menu 3-7) respectively *S392* in Parameter List S3 or with an external terminal (AL 300 or CI 3000). Should the controller parameters become inconsistent for any reason during operation, the controller will load the parameters from backup memory instead of the defaults.

Parameter backup should be made **following** successful individual parameter setting and startup of the system.

5.4 Battery replacement

Never dispose of this product with other household waste. Please inform yourself of the local regulations for the separate disposal of electrical and electronic products. The correct disposal of your old equipment will protect people and the environment from possible negative effects.

Replacement of the battery after expiry of the warranty is subject to a charge.

Never dispose of this product with other household waste. Please inform yourself of the local regulations for the separate disposal of electrical and electronic products. The correct disposal of your old equipment will protect people and the environment from possible negative effects.
You will find further information in the chapter ”Decommissioning and Disposal”.

5.5 Firmware update

When available and necessary, update of the VS 300 Pack Controller firmware can be made via the TTY port (see section 5 Pin and Terminal Assignments).

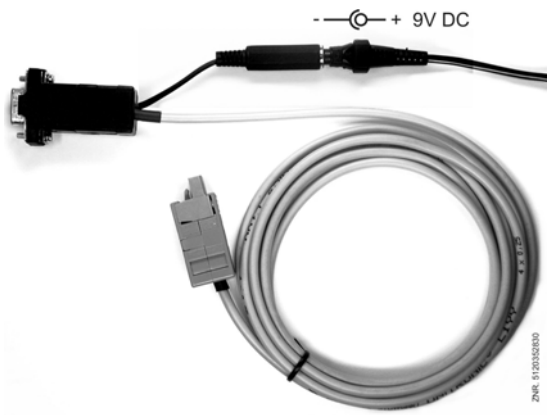
First start is performed following firmware update. This loads the default settings for all parameters and deletes all archives (messages/alarms and operating data, e.g. run times, starts, activity)!

For this reason, the VS 300 parameters should be saved as a parameter index in LDSWin **before** a firmware update from version X to version Y.
- The firmware update is now ready to be carried out (see chapter 5.5.2)
- Following this, the VS 300 is to be set as version X in LDSWin and the previously saved version X parameter index loaded.
  The setpoint values are then to be transmitted to the controller.
- Afterwards, press the button ”update” in the setpoint screen:
  now the screen in LDSWin is changed to the new version Y.
- The parameters from version X added to version Y are now to be checked and adjusted as required.

5.5.1 Requirements

The following conditions and preparations are required for firmware update:

1. **TTY cable with 9 V DC power supply**



Power for the PC/TTY adapter is provided by an external power supply.

Before connecting to the VS 300 or a computer (PC or notebook), check for
- correct setting of the power supply to 9 V DC and
- correct polarity of the 9 V DC power supply plug!

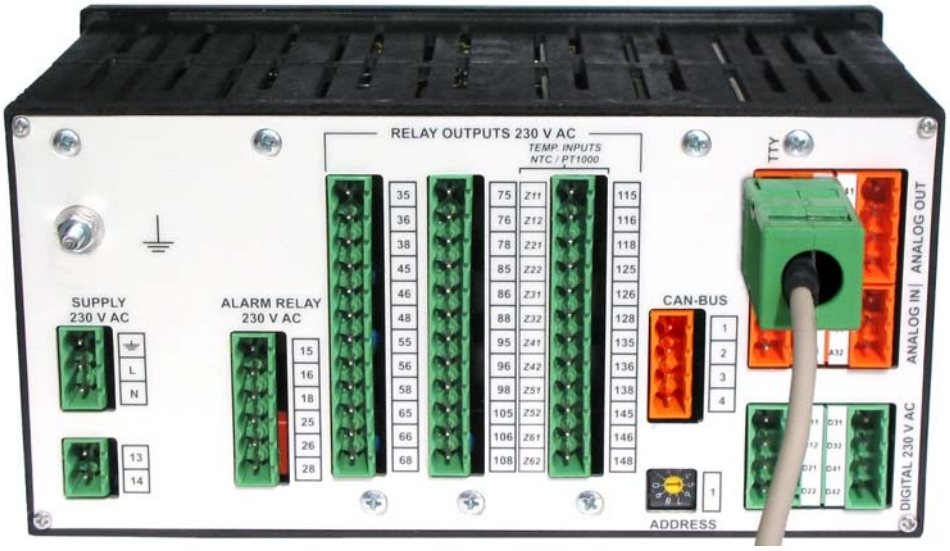
2. **PC or notebook** with serial (COM) port
3. **Selfextracting update archive VS-300-upd.exe**

   Copy the *VS-300-upd.exe* file in any directory and start it. The selfextracting update archive would copy the following files in the directory C:\VS-300: *Wetupd.exe*, *VS_300_xxx.bin* and *Wetupd.INI* files.

5.5.2 Updating the firmware

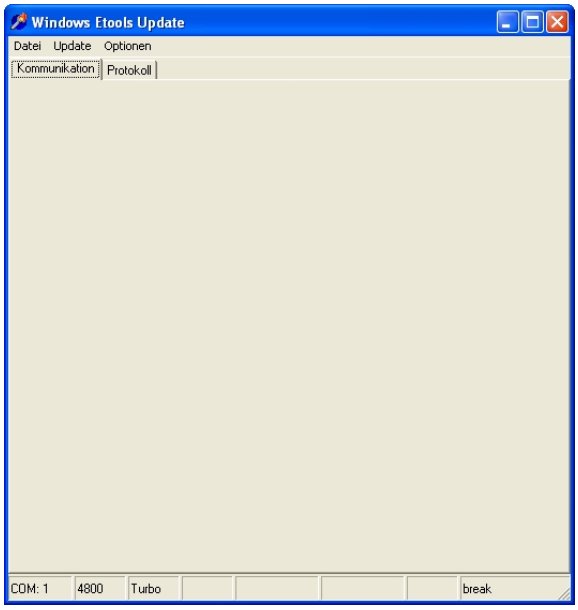
The following steps discribes the firmware update for the VS 300:

1. Disconnect the VS 300 Pack Controller from power.
2. Connect the power supply to the TTY cable
3. Connect the TTY cable to the VS 300 (see illustration) and to the serial (COM) port of the PC or notebook computer.

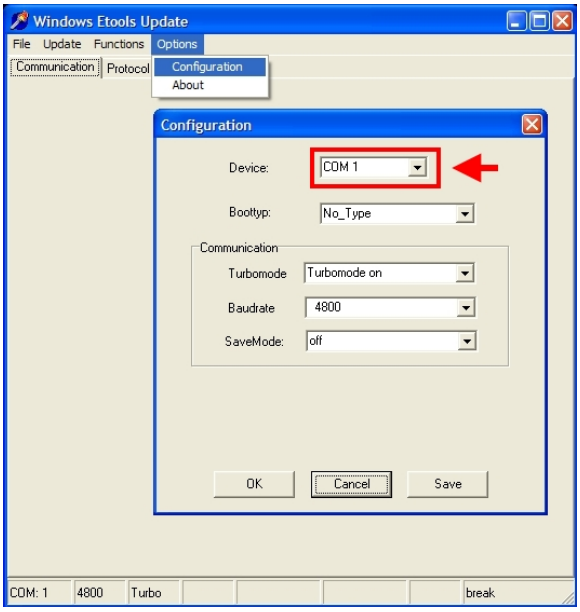


4. Start the computer.
5. Connect the pack controller to the COM port of the PC or COM adapter of the notebook.

6. Start the Wetupd.exe file in the directory C:\VS-300. The Windows Etools Update programm starts:

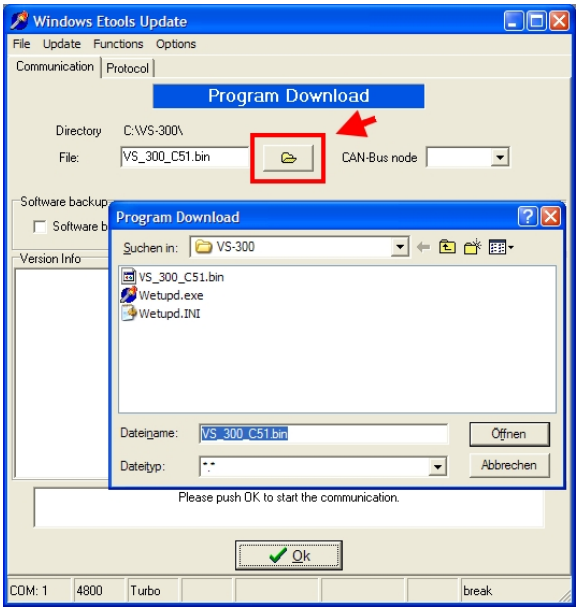


7. Choose the Options menu and then the Configuration item, which opens the Configuration screen. Choose the appropriate COM port and do not change the other settings. Click on OK to confirm.

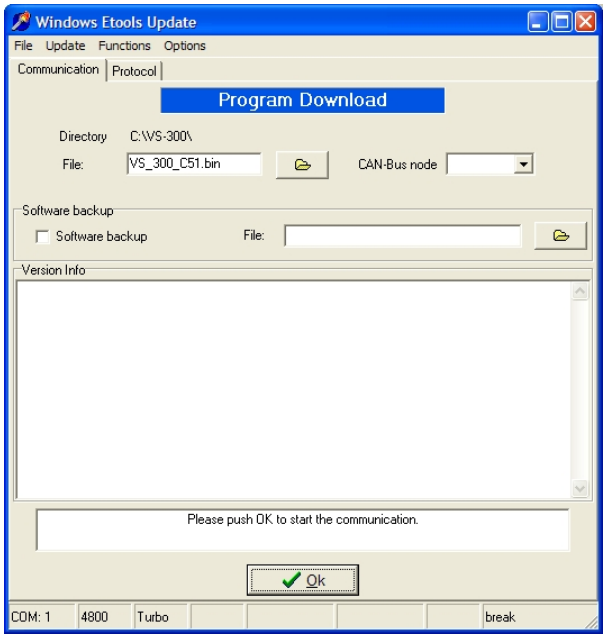


8. Choose the Update menu, then Program Files, then Download.

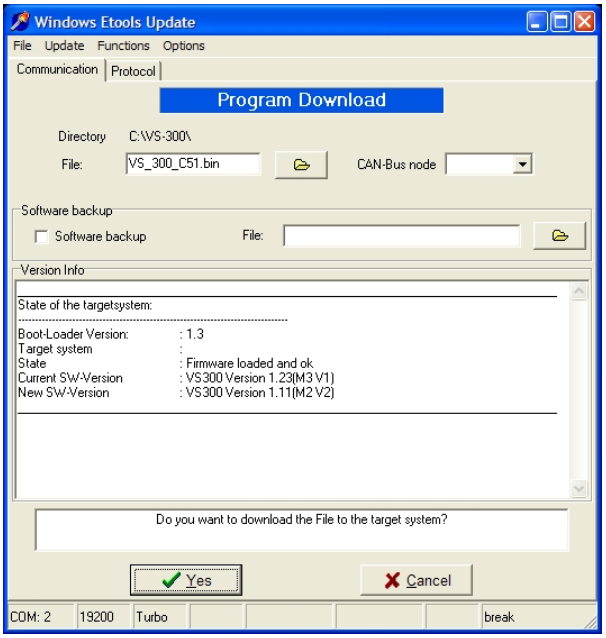
9. This opens the Program Download screen. Select the file VS_300_C51.bin containing the current firmware and click on Open



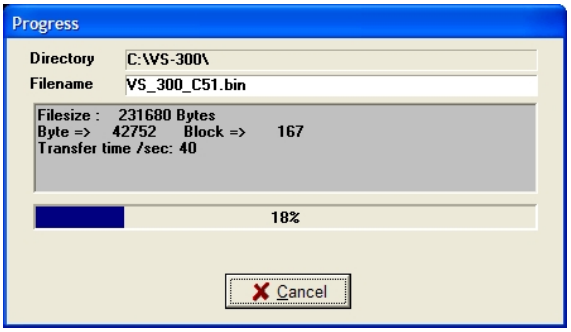
10. Click on OK to initiate communication between the computer and the VS 300. The VS 300 must be switched on **within the next 10 seconds**!



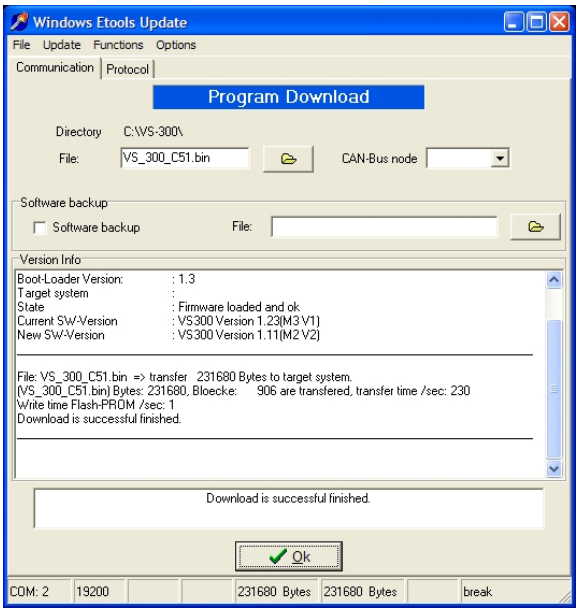
11. The following screen shows the firmware version contained in the controller and which firmware is to be updated. Click on Yes to start downloading.



12. It takes about 5 minutes to download the current firmware to the VS 300.



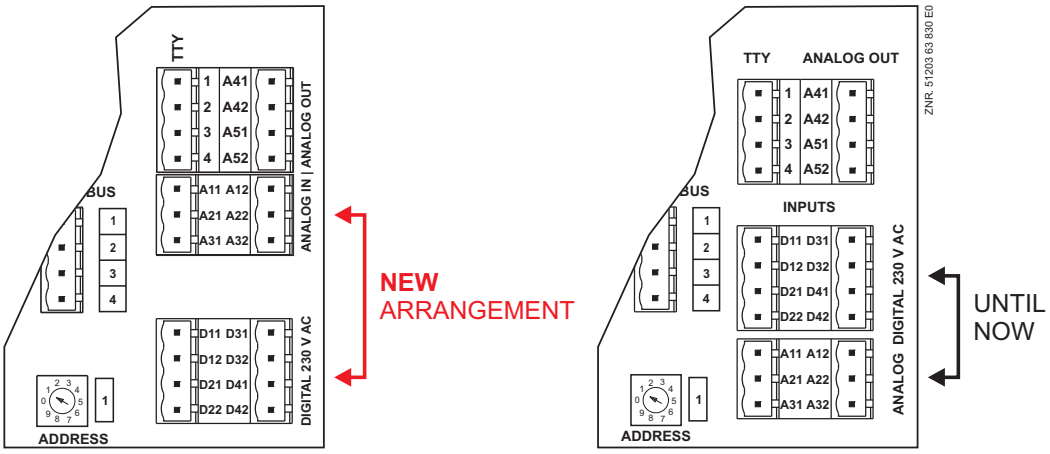
13. The following screen opens when download has been completed successfully. Confirm by clicking on OK. The Windows Etools Update program can then be closed by choosing the File menu, then Finish.



First start is performed following firmware update. This loads the default settings for all parameters and all archives (alarms/messages and operating data, e.g. starts, activity) are deleted!
Your must now repeat complete startup of the system (see section 4 Startup).

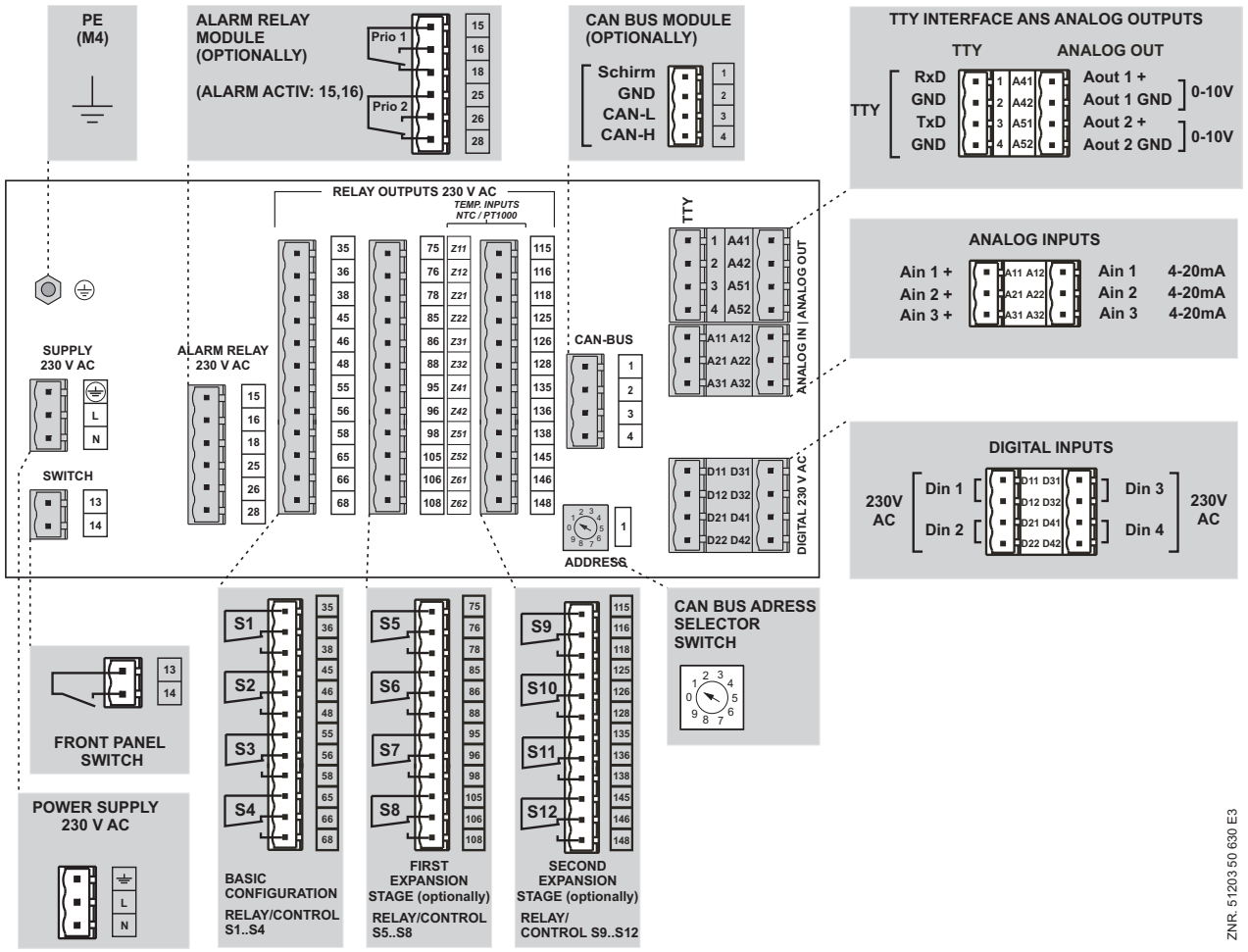
6 Pin and Terminal Assignments of VS 300

As of November 01, 2006, the pack controller is produced in a new unit version!
A point to note in wiring is that arrangement of the connections for digital and analog inputs has been modified as part of advanced technical design (see illustration):



6.1 View of connecting terminals

As described in section 1 System Configuration, the VS 300 Pack Controller is of modular design. The following view of pin and terminal assignments describes the VS 300 with all expansion stages and add-on modules fitted.



Rear of VS 300: Position of connecting terminals (all expansion stages and add-on modules fitted)

Attention is required to the following items when installing and connecting wiring:
All connecting leads from and to the VS 300 - except digital inputs and relay outputs - must be screened in order to rule out faulty measurements and other malfunctions.

Correct polarity must be ensured on inputs and outputs with a current or voltage interface (0-10 V or 4-20 mA). Short circuiting or incorrect signal or power input can result in impairment of function or even in destruction of VS 300 components. Always disconnect the system from power before making or separating connections on the VS 300.

6.2 Pin assignments and their function

Power supply

Basic configuration - Function	Terminal No.
230 V AC	N, L
Ground conductor	⏚

A PE screw connector (M4 thread) is provided on the rear panel for grounding and shielding use.

Digital inputs

Basic configuration - Function		Terminal No.
Digital Input 1	230 V AC, floating	D11, D12
Digital Input 2	230 V AC, floating	D21, D22
Digital Input 3	230 V AC, floating	D31, D32
Digital Input 4	230 V AC, floating	D41, D42

When a digital input *Fast unload extern OFF* is used for a safety-critical application, additional measures for the purpose of monitoring must be undertaken.

Relay outputs (all changeover contacts 230 V AC)

Basic configuration - Function		Terminal No.
S1 - Relay/control stage 1	Stage loaded: 35, 38	35, 36, 38
S2 - Relay/control stage 2	Stage loaded: 45, 48	45, 46, 48
S3 - Relay/control stage 3	Stage loaded: 55, 58	55, 56, 58
S4 - Relay/control stage 4	Stage loaded: 65, 68	65, 66, 68
1st expansion stage - Function		
S5 - Relay/control stage 5*	Stage loaded: 75, 78	75, 76, 78
S6 - Relay/control stage 6*	Stage loaded: 85, 88	85, 86, 88
S7 - Relay/control stage 7*	Stage loaded: 95, 98	95, 96, 98
S8 - Relay/control stage 8*	Stage loaded: 105, 108	105, 106, 108
2nd expansion stage - Function		
S9 - Relay/control stage 9**	Stage loaded: 115, 118	115, 116, 118
S10 - Relay/control stage 10**	Stage loaded: 125, 128	125, 126, 128
S11 - Relay/control stage 11**	Stage loaded: 135, 138	135, 136, 138
S12 - Relay/control stage 12**	Stage loaded: 145, 148	145, 146, 148

* From 1st expansion stage
** From 2nd expansion stage

Analog inputs

Basic configuration - Function		Terminal No.
Control Loop 1 Pressure transducer input	+ (Power) 4 - 20 mA	A11 A12
Control Loop 2 Pressure transducer input	+ (Power) 4 - 20 mA	A21 A22

Analog outputs

Basic configuration - Function		Terminal No.
Control Loop 1 Variable-speed fan/compressor control	+ 0 - 10 V GND	A41 A42
Control Loop 2 Variable-speed fan/compressor control	+ 0 - 10 V GND	A51 A52

Front panel switch

Basic configuration - Function		Terminal No.
Front panel switch (to control external devices, contacts lead out on rear)	230 V AC / 5 A	13, 14

TTY port

Basic configuration - Function		Terminal No.
TTY port Firmware update and parameter setting	RxD GND TxD GND	1 2 3 4

CAN bus module

CAN bus module - Function		Terminal No.
CAN bus module	Shield GND (green) CAN-L (brown) CAN-H (white)	1 2 3 4

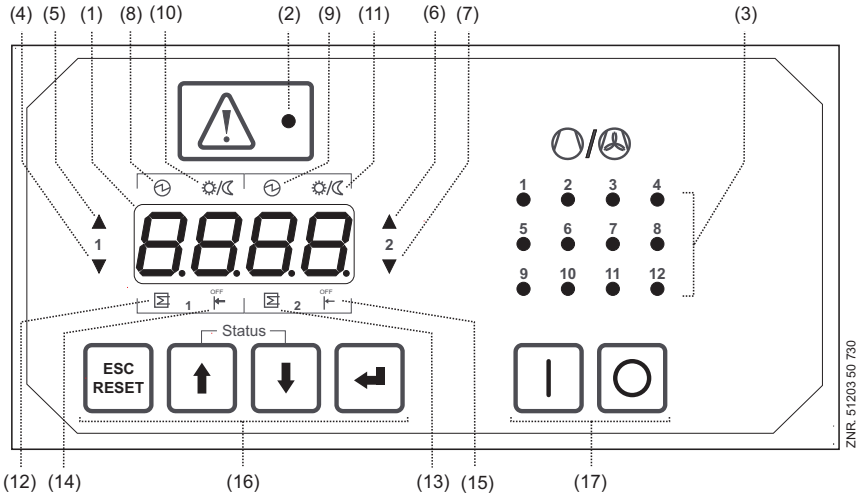
7 Operation of VS 300

7.1 Integral display, indicators and controls

The front panel of the VS 300 Pack Controller contains a four-digit seven-segment LED display, a number of status LEDs and an alarm/message LED (see illustration). Depending on the operating level, the display and LEDs show actual values and setpoints, parameter numbers or alarms and messages.

Four keys on the VS 300 can be used for local configuring, parameter setting and operation by means of parameters described in detail in section 7 Parameter List and Menu Structure. A separate switch on the right of the control panel is used to control external devices.

7.1.1 Display and LEDs



(1) Four-digit seven-segment LED display to show actual values/setpoints, parameter numbers during configuration and parameter setting, compressor/condenser numbers and alarms/messages.

(2) Alarm/message LED (red).

(3) Twelve green LEDs as operating and status indicators for relay/control stages (one per stage). Depending on the expansion stage 4, 8 or 12 relay/control stages are available for compressor/condenser control (see section 1 Design). Depending on the operating level, all of these LEDs are used to support entry of values or choices during parameter setting (e.g. indicating the associate compressor or condenser).

(4/5/6/7) Green trend LEDs for Control Loop 1 (4/5) and for Control Loop 2 (6/7):

▲	Upper LED:	(5)	or	(6)	Temperature/pressure high, above neutral zone
	Both LEDs:	(4/5)	or	(6/7)	Temperature/pressure within neutral zone
▼	Lower LED:	(4)	or	(7)	Temperature/pressure low, below neutral zone

Status display by simultaneously pressing the ↑ and ↓ keys:

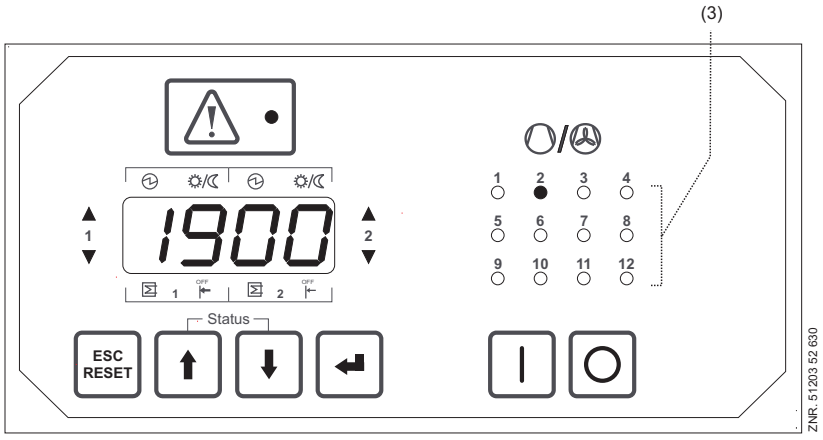
(8/9)	Load shedding:	Status display by LED segment below symbol (8) for Control Loop 1 / below symbol (9) for Control Loop 2
(10/11)	2nd setpoint active:	Status display by LED segment below symbol (10) for Control Loop 1 / below symbol (11) for Control Loop 2
(12/13)	Heat recovery mode:	Status display by LED segment above symbol (12) for Control Loop 1 / above symbol (13) for Control Loop 2
(14/15)	Fast unload:	Status display by LED segment above symbol (14) for Control Loop 1 / above symbol (15) for Control Loop 2

Other indicating functions

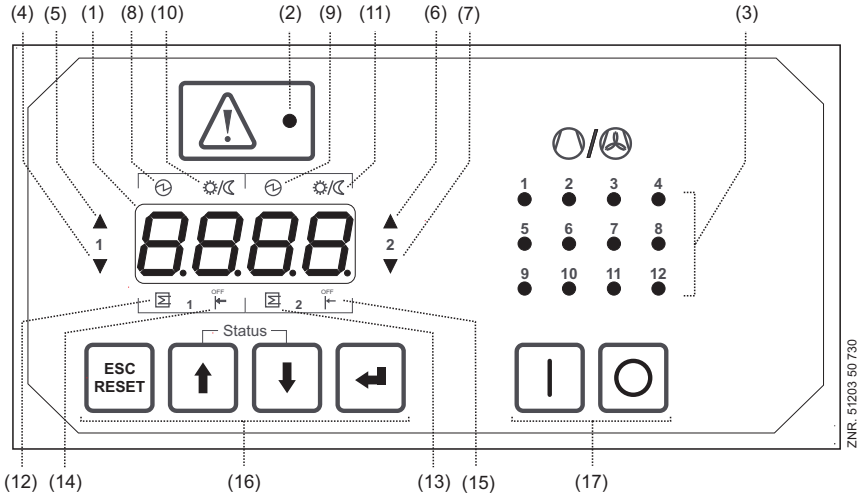
The relay/control stage operating and status display (3) is used for indicating figures exceeding four digits (e.g. 21,900 operating hours) by one of these LEDs flashing, as shown below.

Value = Value of LED display [0 - 9999] + (Number of flashing operating and status display LED * 10000)

Example:	Figure shown on four-digit display:	1900 h
	Number of flashing operating and status display LED:	2
	Result: 1900 + (2 * 10000) =	21900 operating hours



7.1.2 Controls



Description of controls and their function (see illustration).

	Key/Switch	Function in basic display mode (see chapter 7.5)	Function in parameter setting mode
(16)	ESC/RESET	Short press: quit messages/alarms Delete message display Long term press: delete message - condition: message has a send time stamp	Cancel entry at any operating level Exit operation level (moves back one entry level every time key is pressed)
	↑ Up	Change to other control loope and display temperature for **CL1:** 4, 4/5 or 5 flashing or **CL2:** 6, 6/7 or 7 flashing	Select parameter lists/parameters Increase values within their range (see chapter 7 Parameter List)
	↓ Down	Change to other control loope and display temperature for **CL1:** 4, 4/5 or 5 flashing or **CL2:** 6, 6/7 or 7 flashing	Select parameter lists/parameters Decrease values within their range (see chapter 7 Parameter List)
	↵ ENTER	Start parameter setting (Open parameter list selection)	Enter parameters/confirm entries Move to next operating level
(17)	I-O	On-off switch for external devices Contacts lead out on rear of controller casing (see section 5 Pin and Terminal Assignments).	

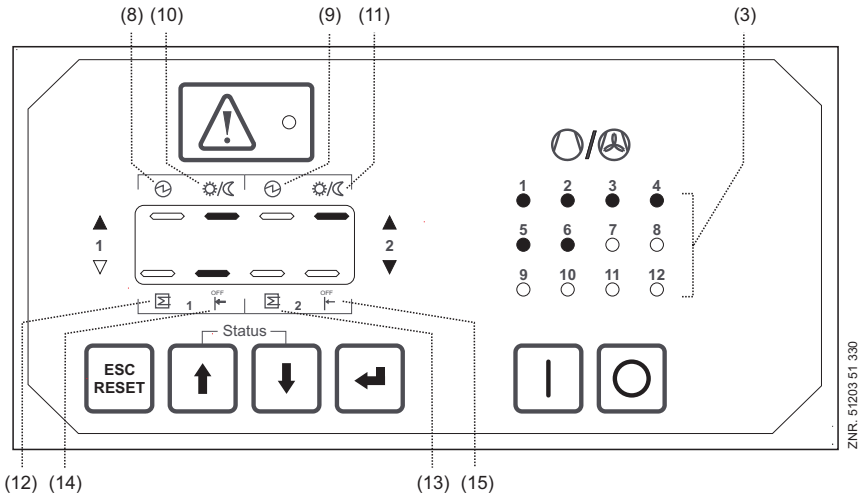
Flashing of values on the seven-segment LED display indicates that these values can be changed (setpoints, type of refrigerant, number of compressor stages, etc.).

Other functions of control keys

Simultaneously pressing the ↑ and ↓ keys at any operating level, except while entering values (flashing display), actuates status display to indicate additional status information by the upper (8/9/10/11) and lower segments (12/13/14/15) on the display. The left segments (8/10/12/14) on the LED display relate to Control Loop 1, the right segments (9/11/13/15) to Control Loop 2.

At the same time relay/control stages indicators (3) are switched so that the status LEDs for the compressor or condenser relays of Control Loop 1 continue to light normally and those of Control Loop 2 flash.

This allows identification of the relay/control stages assigned to the separate control loops for differentiation of the relay/control stages of the two loops (normally compressor and condenser contro).



Example: The illustration shows the controller performing fast unload on Control Loop 1 (14) and working with the second (nighttime) setpoint (10/11) (in both control loops). The status LEDs 1-4 (3) assigned to Control Loop 1 light normally, the status LEDs 5-6 (3) for Control Loop 2 are flashing. Pressing the ESC/RESET or ↵ key returns to basic display mode from any menu.

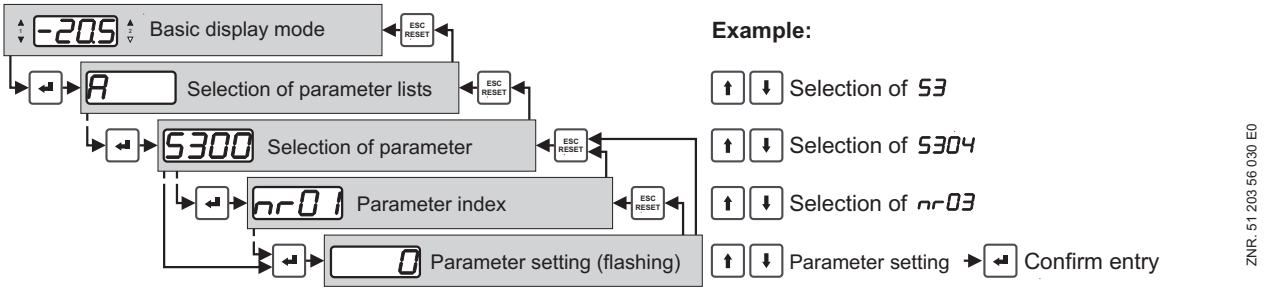
For additional convenience the ↑ and ↓ keys incorporate an accelerated auto-repeat function when pressed and held down, enabling rapid scrolling and selection of parameter numbers or setpoints.

7.2 First start – Loading default values

Simultaneously pressing and holding the ESC/RESET, ↑ and ↓ keys on powering up the controller initiates first start, which loads the default settings. The default settings can also be loaded by means of a parameter (see section 7 Parameter List and Menu Structure).

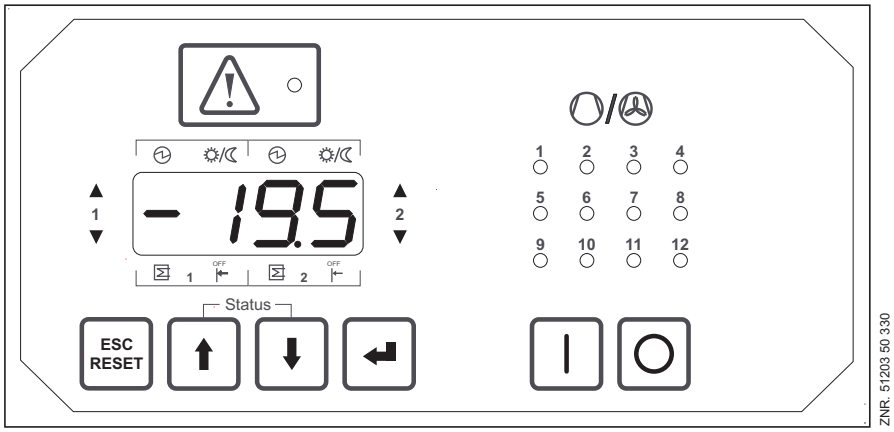
At first startup, the default settings for all parameters are loaded and all archives, messages/alarms and operating data (e.g. run times, starts, activity) are deleted!

7.3 Menu and operating structure of VS 300



7.4 Parameter setting – general

The parameters used for configuring and setting the VS 300 Pack Controller are described in detail in section 7 Parameter List and Menu Structure. On powering up the controller, an LED check is first performed with all status LEDs and segments on the display briefly illuminating and then extinguishing. After that the controller switches to basic display mode.



7.5 Basic display mode

On powering up or after 5 minutes during which no entry is made, the VS 300 switches to basic display mode and displays the actual value for t_1 (Control Loop 1 temperature). The control loop for which the value is shown in basic display mode is additionally indicated by flashing of the status LEDs for *Control Loop 1 Pressure High / Neutral Zone / Low* on the left of the four-digit display.

High pressure in Control Loop 1 is indicated by only the left upper LED flashing, low pressure by the lower LED flashing and pressure within the neutral zone by both LEDs flashing. Pressing the ↑ or ↓ key changes the display to t_2 (Control Loop 2 temperature). Values displayed for Control Loop 2 are indicated by flashing of the status LEDs for *Control Loop 2 Pressure High / Neutral Zone / Low* on the right of the four-digit display. Press the ↑ or ↓ key to change the display back to t_1 (Control Loop 1 temperature).

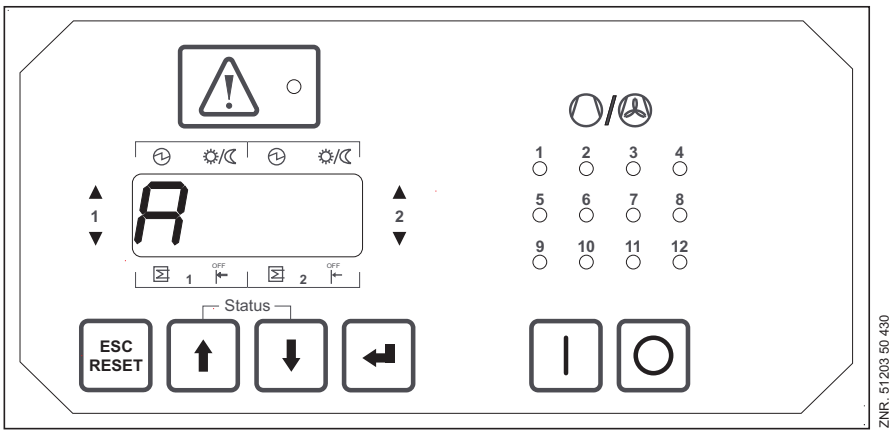
Actual values and setpoints for pressure [bar] and temperature [°C] are indicated on the four-digit seven-segment LED display as follows:

Pressure:	Two digits before and two digits after the decimal	e.g. 11.50
Temperature:	Two digits before and one digit after the decimal	e.g. -20.3

A Priority 1 or Priority 2 fault is reported by a fault code on the display. Pressing the ESC/RESET key hides the code, but it will be displayed again after about 10 seconds if the fault is still active (see section 7.13 Displaying reported faults (Parameter List F).

7.6 Selecting parameter lists

Pressing the ↵ key in basic display mode opens parameter list selection and Parameter List A is shown on the display.



Use the ↑ and ↓ keys to select one of the following parameter lists (one lists appears at a time on the display):

A	Actual Values	System data
S1	Setpoints	Basic controller parameters
S2	Setpoints	Auxiliary controller parameters
S3	Setpoints	System configuration
S4	Setpoints	Alarm priorities
S5	Setpoints	Suction pressure shift / Additional parameters
t	Setpoints	Timers
C	Check Mode	Service Mode (outputs can be actuated manually)
F	Alarms/Messages	Process and system fault reports

Depending on which parameter list is selected with the ↵ key, the parameters for actual values, setpoints, system configuration settings, alarm priorities, timers, service mode or alarms/messages are displayed.

See section 7 Parameter List and Menu Structure for details of the VS 300 parameter list. This section contains detailed descriptions of the parameters available, their allowed range and the conditions under which they can be changed.

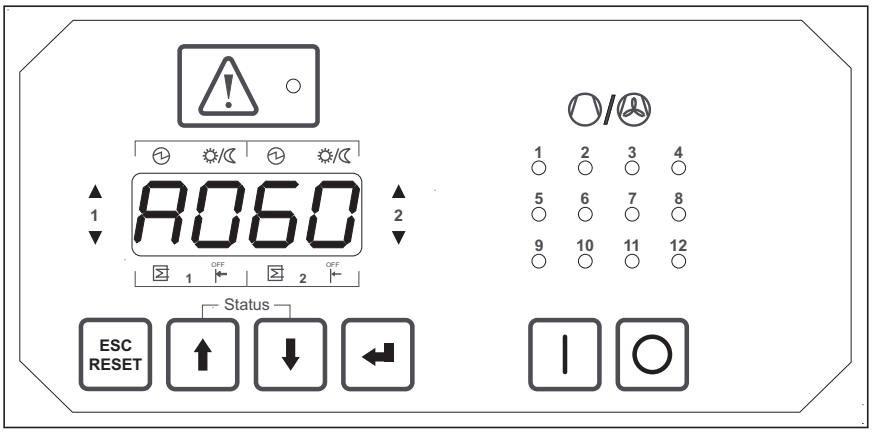
The VS 300 can be operated at various access levels, which means that parameters cannot be changed at every access level!

For example, changing of setpoints is only allowed at the **Setpoint Adjustment Enabled** access level (see section 7.7 Changing the Access Level)!

If no key is pressed for a certain time (5 minutes), the controller automatically changes to basic display mode and entry of setpoints is blocked.

7.7 Changing the access level

Pressing the ↵ key in basic display mode moves to parameter list selection and Parameter List A is shown on the display. Press the ↵ key again to open Parameter List A (*A000* is shown on the display). Use the ↑ or ↓ keys to select *A060*.



Pressing the ↵ key again changes to entry or parameter setting mode. The character *0* flashes on the display, indicating that the value can be changed. Use the ↑ key to select *1* for the *Setpoint Adjustment Enabled* access level (see also section 7 Parameter List and Menu Structure):

0	=	Display only
1	=	Setpoint adjustment enabled
10	=	Superuser mode – additional parameters can be accessed and set

Press the ↵ key to confirm the entry and return to Parameter List A (*A060* is shown on the display).

Figures other than 0, 1 or 10 are not valid for access level and any other figure entered will be ignored! If no key is pressed for a certain time (5 minutes), the controller automatically changes to basic display mode and entry of setpoints is blocked.

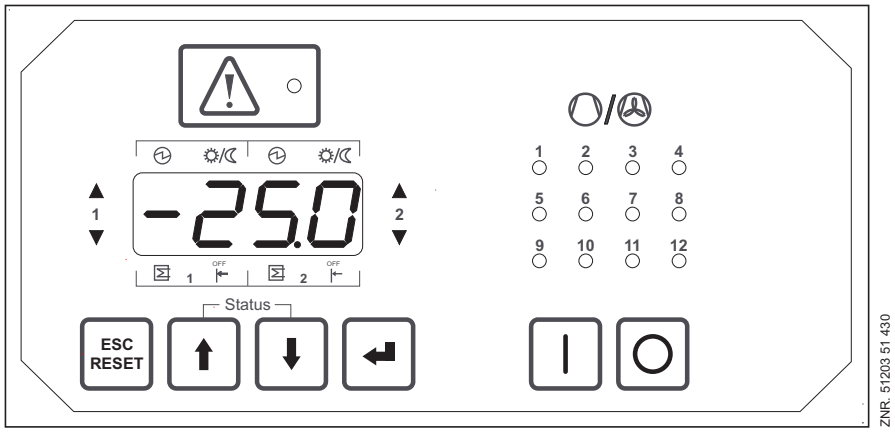
Pressing the ESC/RESET key returns to parameter list selection (*A* is shown on the display). The ↑ key can be used to select a parameter list. Pressing the ESC/RESET key again returns to basic display mode and the actual value for t_1 (Control Loop 1) is displayed.

7.8 Displaying actual values and setting parameters (Parameter Lists A and S1 - S4)

System actual values are displayed with Parameter List A (System Data). These values cannot be changed (**except** Parameter *A060* to enable access level)! Parameter Lists S1 - S4 contain the setpoints, which can be changed (see section 7 Parameter List and Menu Structure). Parameter *S100* is taken as an example to describe operation of the VS 300 and changing of setpoints in the parameter lists (S1 - S4).

Setpoints can only be changed at the Setpoint Adjustment Enabled access level (see section 7.7 Changing the Access Level). The LED display flashes to indicate when values (setpoints) can be changed.

Press the ↵ key in basic display mode to move to parameter list selection (Parameter List A is shown on the display). Use the ↑ key to select Parameter List S1. Press the ↵ key again (*S100* is then shown on the display) and use the ↑ and ↓ keys to select the parameters in Parameter List S1. When the parameter wanted (*S100* in this example) is shown on the display, press the ↵ key to enter parameter setting mode. The current setpoint is displayed.



Use the ↓ and ↑ keys to change the value within its allowed range. See section 7 Parameter List and Menu Structure for detailed information on the VS 300 parameter lists. This section contains details of the parameters available, their allowed range and the conditions under which they can be changed.

Press the ↵ key again to apply the change and return to parameter selection mode. If setpoint adjustment is not enabled, a selected setpoint will be displayed but cannot be changed with the ↑ and ↓ keys. This is indicated by the display then not flashing (generally applicable to actual values of Parameter List A).

For additional convenience the ↑ and ↓ keys incorporate an accelerated auto-repeat function when pressed and held down, enabling rapid scrolling and selection of parameter numbers or setpoints.

7.9 Setting the current date and time (Parameter List S2)

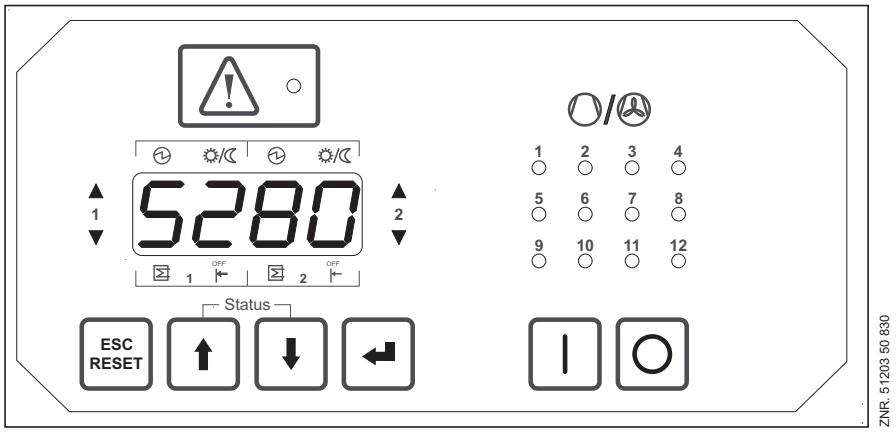
The current date and time can be set with Parameter List S2 (see section 7 Parameter List and Menu Structure). Parameter *S280* (current time - hour) is taken as an example to explain how to change the setpoints for date and time.

Date and time only need to be set, and only can be set, in stand-alone operation! When the VS 300 is connected via CAN bus module to a master clock (CI 3000 or AL 300), the date and time will be supplied by this master and applied to the VS 300, meaning that they then cannot be changed.

Setpoints can only be changed at the Setpoint Adjustment Enabled access level (see section 7.7 Changing the Access Level). The LED display flashes to indicate when values (setpoints) can be changed.

Pressing the ↵ key in basic display mode moves to parameter list selection and Parameter List A is shown on the display. Press the ↑ key to select Parameter List S2. Press the ↵ key again (*S200* is then shown on the display) and use the ↑ and ↓ keys to select the parameter in Parameter List S2.

When the parameter wanted (*S280* in this example) is shown on the display, press the ↵ key to change to parameter setting mode. The current hour setpoint (*0-23*) is displayed.



Use the ↓ and ↑ keys to change the value within the allowable range. See section 7 Parameter List and Menu Structure for detailed information on the VS 300 parameter lists. This section describes the parameters available, their allowable range and the conditions under which they can be changed.

Press the ↵ key again to apply the setting and return to parameter selection mode. If setpoint adjustment is not enabled, a selected setpoint will be displayed but cannot be changed with the ↑ and ↓ keys. This is indicated by the display then not flashing.

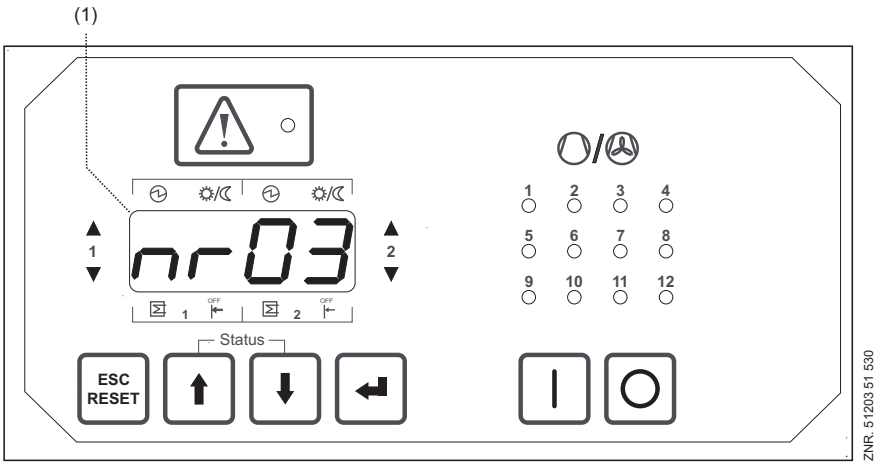
Parameters for setting date and time:

S280	Current time, hour	S283	Current date, month
S281	Current time, minute	S284	Current date, year
S282	Current date, day	S285	Daylight saving time adjustment

7.10 Parameter groups

Some parameters contain a group of setpoints, for example to set enabling for each separate relay/control stage. These setpoints are accessible as a group under a parameter number (see for example section 7 Parameter List and Menu Structure - Parameter List C)

In this instance a slightly different setting method is used. Select the parameter number and press the ↵ key as for individual setpoints. Then, by way of difference, first select the relay/control stage for which the setpoint is to be changed. The display (1) then shows the relay number (in this example No. 03).

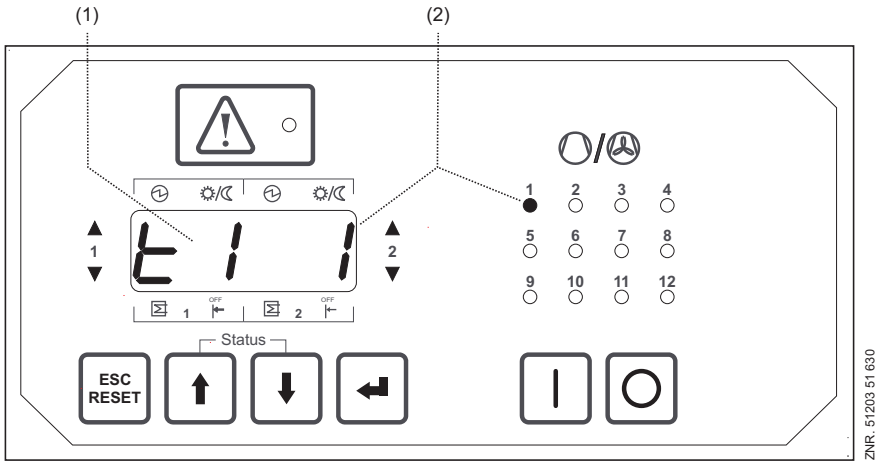


Again select the relay number with the ↑ and ↓ keys. Press the ↵ key and enter the setpoint (0 for output not actuated or 1 for output actuated) - (see section 7 Parameter List and Menu Structure - Parameter List C).

Setpoints can only be changed at the Setpoint Adjustment Enabled access level (see section 7.7 Changing the Access Level). The LED display flashes to indicate when values (setpoints) can be changed.

7.11 Setting parameters for the week timer (Parameter List t)

Parameter are set for the timers in Parameter List t. The VS 300 contains 7 timers for each of the two control loops. Select the timers with the corresponding parameter by pressing the ↵ key (see section 7 Parameter List and Menu Structure - Parameter List t - Timers).



The illustration shows timer 1 (2) selected for Control Loop 1. Press the ↵ key to open the entry fields for this timer. Entry is required in all fields to ensure that the timer is correctly set and the values are applied (see Parameter List t). Move from one entry field to the next by pressing the ↵ key. These timers (1 - 7) have a start time and an end time. These must always be entered pairwise, for which there are six fields to be completed for each entry, labelled as follows:

Display	Meaning
SD	Start day
SH	Start hour
SM	Start minute
ED	End day
EH	End hour
EM	End minute

After completing the last entry field (*EM*) the display returns to parameter selection mode.

Setpoints can only be changed at the Setpoint Adjustment Enabled access level (see section 7.7 Changing the Access Level). The LED display flashes to indicate when values (setpoints) can be changed.

7.12 Manual control / Service mode (Parameter List C)

Parameter List C takes you to service mode. In check (service) mode, all analog outputs and the digital relay/ control stages can be actuated manually. First, the two controllers are deactivated or all relay/control stages are unloaded. During this time, a moving light on the display signals that the controllers are deactivated. The parameters specified in Parameter List C can then be used to adjust the corresponding outputs as required (see section 7 Parameter List and Menu Structure – Parameter List C).

Setpoints can only be changed at the Setpoint Adjustment Enabled access level (see section 7.7 Changing the Access Level). The LED display flashes to indicate when values (setpoints) can be changed.

7.13 Displaying reported faults (Parameter List F)

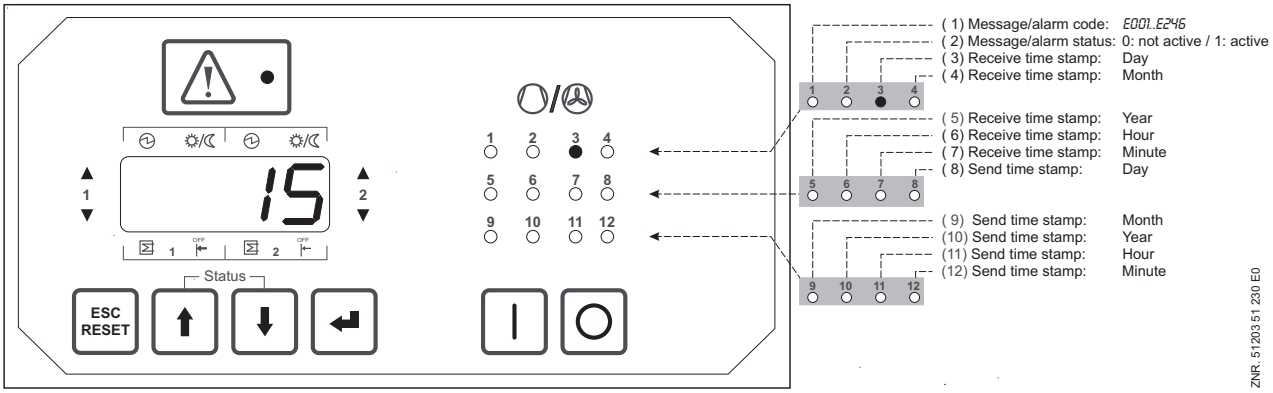
Parameter List F takes you to a list of messages. Faults and messages are displayed in two ways:

1. **In basic display mode:** The respectively most recent message is indicated in basic display mode by its associate fault code (*E001 – E246*, see section NO TAG Process Fault Reports or System Fault Reports for details). The alarm/message LED flashes. Pressing the ESC/RESET key quit the display and returns to displaying control loop actual temperature. When the message is no longer current or when no more faults are effective, press the ESC/RESET (longer than 5 sec.) to cancel the message and delete it from the fault report memory.
2. **In message display mode:** From Parameter List F you can change to message display mode. On pressing the ↵ key while in Parameter List F, *F001* is displayed if a message is current, meaning not yet cancelled. This indicates the most recent message. Use the ↑ key to move to the preceding messages (*F002* to max. *F100*). If no messages exist, '- - - -' is shown on the display.

Messages that are still current flash to distinguish them from those no longer current.

Pressing the ↵ key again while in message display mode (*F002* - max. *F100*) displays details of the selected message. The details consist of the message code (*E001* - .*E246*, see section 8 Process Fault Reports or System Fault Reports for details), message status (0 or 1), the incoming time stamp (date-year-time) and outgoing time stamp (date-year-time). Use the ↑ and ↓ keys to view these message details. The status LEDs of the relay/ control stages illuminate to indicate which message detail is currently displayed.

Status LED	Message details displayed	
1	Message/alarm code:	E001...E246 - For details see section 10.5 Message Types Menu Structures - Parameter List F or section 10.5 System/ Process Fault Reports
2	Message/alarm code:	0: Message not active 1: Message active
3	Receive time stamp:	Day
4	Receive time stamp:	Month
5	Receive time stamp:	Year
6	Receive time stamp:	Hour
7	Receive time stamp:	Minute
8	Send time stamp:	Tag
9	Send time stamp:	Month
10	Send time stamp:	Year
11	Send time stamp:	Hour
12	Send time stamp:	Minute



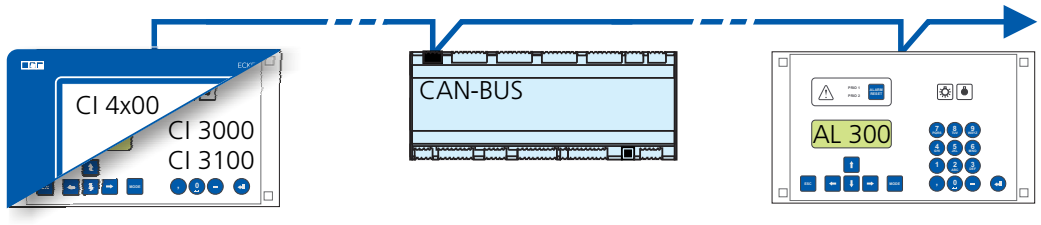
Items 8 - 12 are not displayed when the message status is 1 (message active)!

7.14 Operation System Centre / Store Computer / Operator Terminal

7.15 Operation possibilities

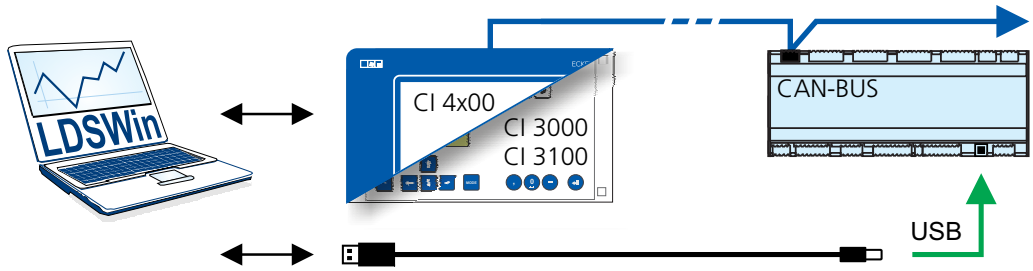
The controller provides menus and screens for the display and adjustment of values. However, no operation for this is provided on the controller itself. The actual operation of these menus is performed externally using the following possibilities:

- **Remote control via the terminal:** The controller can be operated remotely (e.g. from the machine room) using the system centre, a store computer or an operator terminal. The communication with the controller is performed via the CAN bus



See chapter 7.16 for details for the operation.

- **Remote control with PC software LDSWin:** A PC with LDSWin installed is connected to the system centre or the store computer. The connection can be made here, for example, via the serial interface, a modem, a network or the PC-CAN bus adapter. In this way, the controller can be operated very conveniently with the PC software and its powerful functions such as controller analysis, evaluations, storing parameter sets, creating lists, etc.



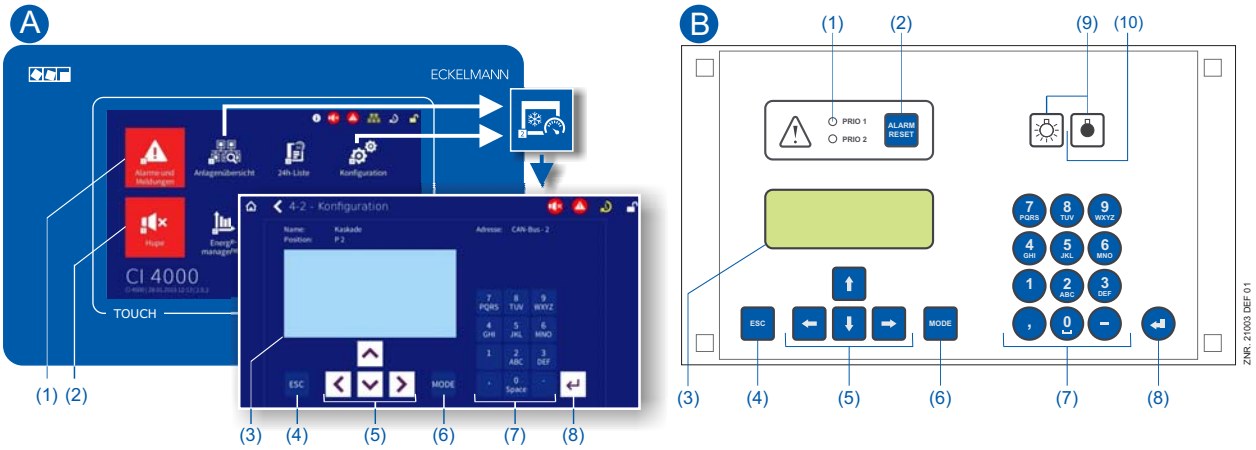
See the LDSWin operating instruction for details about the range of functions.

7.16 Remote control via a terminal

Further details for the operation of a system centre, store computer or operator terminal can be found in their operating manuals.

For the remote control of a controller, it makes no difference whether this is done with a system centre (A), a store computer or with an operator terminal (B) as the user interfaces on the terminals are almost identical and the same functions are available. See chapter 7.3.2 for details about remote control.

The system centre only emulates the "hardware front" of its "store computer" predecessor or of the operator terminal by software on its touchscreen which is demonstrated by the following comparison between the terminals of the CI 4x00 and CI 3x00 / AL 300:



(1) CI 4x00: "Alarms and messages" button in the main menu for display of whether alarms are pending.
Alarms are acknowledged in the "alarm list".

CI 3x00 / AL 300: Red LED signal lamps to indicate whether alarms are pending.

(2) CI 4x00: "Horn" button in the main menu for muting of the buzzer and for reset of the AUX relay.

CI 3x00 / AL 300: Button for muting of the buzzer, for reset of the AUX relay* and for acknowledgement of alarms.

(3) Display (4 lines x 20 characters) for display of the menu of the controller.

(4) **ESC** button

(5) Cursor buttons

(6) **MODE** button for, e.g. toggle upper case / lower case for text input.

(7) Alphanumeric keypad

(8) **ENTER** button (↵)

Only CI 3x00 / AL 300:

(9) On/Off button for, e.g. lighting

(10) Green LED signal lamp for status indicator whether the button is activated (then green) or deactivated.

7.16.1 Menus and operating screens

If the system centre, store computer or operator terminal remain locked down, settings on the controller are read-only.
Changes and inputs are not possible. However, if any parametrisation is required, the lock-down for the input must be removed first, see chapter 7.16.3.

Numbering of menus and screens:

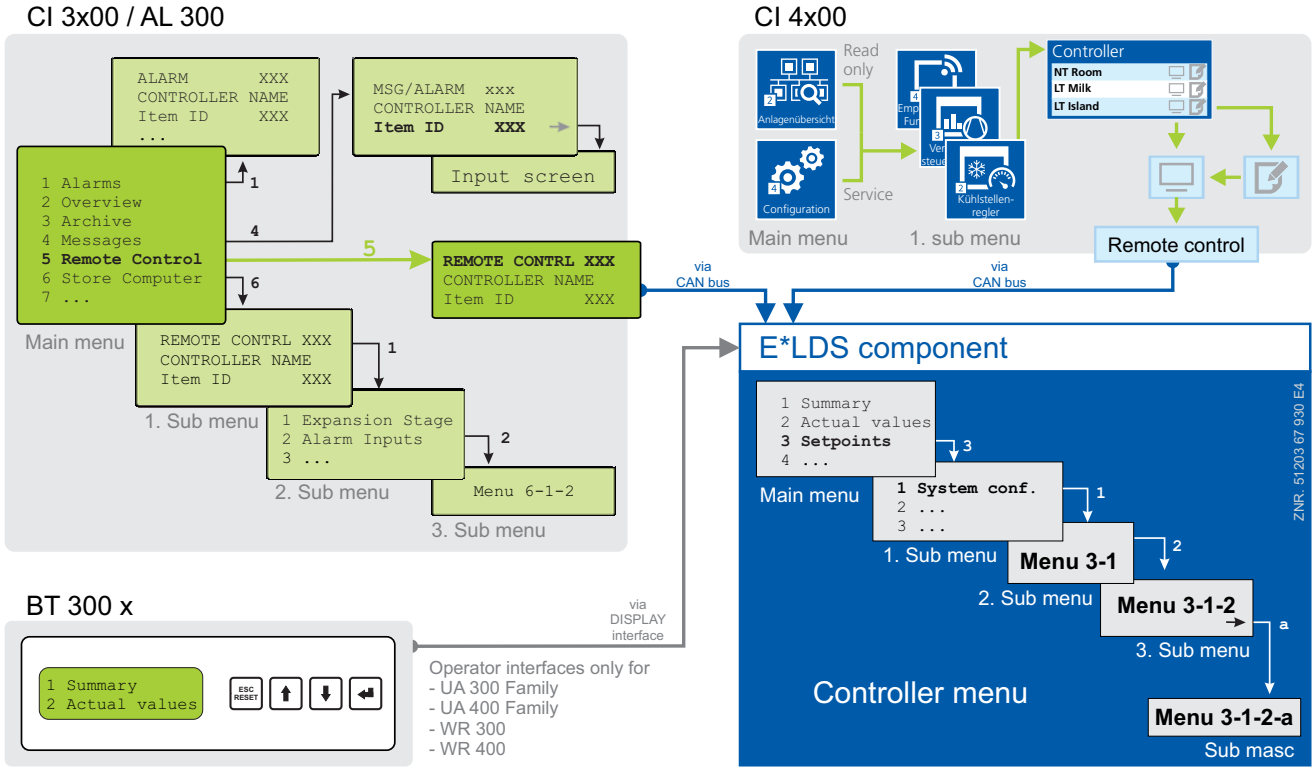
Every menu in the menu tree can be reached using a specific number and every operating screen in a menu can be reached using a specific selection in the menu. This is identified in the operating manual by a unique identifier of digits (and letters if necessary) in the menu tree (e.g. Menu 3-1-2-a). Thereby, the digits 1, 2, .. stand for the identification of the corresponding menu, and the letters a, b, .. stand for the sequence of the corresponding operating screens in the menu.

Example for the numbering of a menu / screen

Any reference to, for example Menu 3-1-2 in the operating manual means that the required menu of the E*LDS component is called by entering the digits or selection of "3 - 1 - 2" via the remote control in the system centre, store computer or operator interface. The menu item "Remote control" is the interface for the E*LDS controller; see chapter 7.16.2 for details.

If any letter is appended (e.g. Menu 3-1-2-a), this means that another submenu (operating screen or selection list) can be reached using the cursor right button (→). The letters indicate their sequence in the screen.

If any menu or operating screen consists of more lines than are possible in the display, scrolling is possible using the cursor buttons (↑) and (↓).



In contrast to the system centre, store computer or operator terminal, the menu of the controller is displayed directly on the operator interface.

Menus

A menu can contain up to ten menu items (0 .. 9; 0 for menu item 10). After the selection of a menu item using the cursor buttons (↑) and (↓) and by tapping the ENTER button (↵) or by tapping the buttons 0..9), other submenus or operating screens are displayed.

Selection of the menu items

Each line of this selection list in the display has a digit between 1 and 9 and 0 for menu item 10 with the associated name of the corresponding menu item. The various menu items can be selected directly by tapping the digit buttons 0 .. 9.

If a menu provides more than 3 submenus, the cursor buttons (↑) and (↓) can be used for paging in the menu to display the remaining menu items.

A menu item can be selected by pressing the respective numeric key regardless of whether the item itself is visible on the display.

Screens

An operating screen shows values for output and/or input. There may be more values for output and/or input than fit into the display at one time. The cursor keys can be used to scroll through these additional values. The screen may also contain more than one page, in which case the pages can be viewed one at a time.

Arrows appear on the right of the display to indicate whether you can scroll or page through a menu or screen.

Scrolling

Using the cursor buttons (↑) and (↓)

- scrolling can be line by line, e.g. for selection of a variable in a line from a list of predefined variables.
- scrolling can be block by block so that values can be shown that cannot be displayed with the others due to the limited capacity of the display

Paging

If an operating screen contains multiple pages (e.g. the alarm list), these can be paged through using the cursor buttons (←) and (→). In menus that provide more than 3 submenus, these can be paged through using the cursor buttons (↑) and (↓) to display the remaining menu items.

MODE + 9 three lines upwards and
MODE + 3 three lines downwards

Input of values and text

Select the required line using the cursor buttons (↑) and (↓) and then tap the ENTER button (↵). The cursor jumps to the input field. Values can now be entered and changed using the cursor buttons (↑) and (↓) or digit buttons.
If the cursor buttons (↑) and (↓) are kept pressed, the adjustment is made in high speed mode.

Deleting input text

The **MODE** button and **-** must be pressed simultaneously to delete the complete text line.
A character is deleted using the button combination **MODE** and **,** .

Cancelling of an entry

The entry of a value can be cancelled by tapping the **ESC** button. The value is not applied.

Entering text

In fields that allow text entry, text can also be entered by the alphanumeric keypad. Repeatedly press the numeric keys to generate letters. Press the ENTER key (↵) to confirm the entered value or text.

Key	Letter/Character
0	äöüß0, space character
1	1
2	abc2
3	def3
4	ghi4
5	jkl5
6	mno6
7	pqrs7
8	tuv8
9	wxyz9
-	. _ -
,	Insert space character

Upper case and lower case can be toggled by tapping the **MODE** button.

Exit from the menus and operating screens

Press the **ESC** key to exit the menu or screen you are in at any time. This returns you to the next higher menu. All menus and screens are closed automatically if no key is pressed for 10 minutes. The display then jumps to the Main Menu or to the Alarm menu if any fault report is currently active (only CI 3x00 / AL 300).

7.16.2 Calling the controller menu via remote control

If the system centre, store computer or operator terminal remains locked down, settings on the controller are read-only. Changes and inputs are not possible.

However, if any parametrisation is required, the lock-down for the input must be removed, see chapter 7.16.3.

Tip: Detailed descriptions for the basic configuration of the controller and its position designation or about the settings of important parameters can be found in chapter 5.6.

7.16.2.1 System Centre CI 4x00

The terminal for remote control of the controller (Menu 2-2 or Menu 4-2) is called in the system centre as follows:

Step 1: Tap "**2 - System overview" or "4 - Configuration**" in the main menu.
If "2" is selected, the values below are only displayed as read-only,
for "4", lock-down must previously be removed by logging in (see chapter 7.3.3) so that settings below can be made.

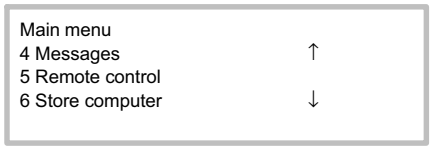
Step 2: Tap "**2 Case controllers**" and select the required controller in the list that is then displayed using the cursor buttons (↑) and (↓). In the screen that opens, the
name, position designation and the alarm priority of the controller can be input as required.

Step 3: The main menu of the controller is then displayed by tapping the "**Remote control**" button:

7.16.2.2 Store computer CI 3x00 / operator terminal AL 300

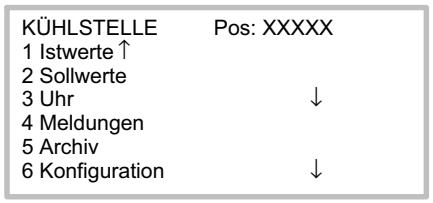
The main menu of the controller is called in the store computer or operator terminal as follows:

Step 1: Select the submenu "**5 Remote control**" in the main menu (see graphic).



Step 2: Select the required controller using the cursor buttons (↑) und (↓) or
by input of the CAN bus address (node number nnn) using the digit buttons.
Thereby, the following screen is displayed:

Step 3: The main menu of the controller is then displayed in the terminal by tapping the **ENTER** button



7.16.3 Deactivating the input lock-down

Operation via system centre, store computer or operator terminal is only possible for controllers with CAN bus connection; the removal of the lock-down is then applicable for all components in the CAN bus system. The lock-down is automatically reactivated 15 minutes after the last button tap.

The release of the lock-down must only be carried out by service personnel.

Before entering values, the input lock-down must be removed as follows:

7.16.3.1 System centre CI 4x00

Login to and logout (unlock and lock-down) of the system centre:

Benutzername: *Service*
Passwort: *0000*

Benutzername: *Master (*Erweiterte Rechte z. B. für spezielle Einstellungen am UA 410 E)
Passwort: *0000*

7.16.3.2 Store computer CI 3x00 / operator terminal AL 300

Before entering values, the input lock must be removed from the store computer or operator terminal as follows:

Step 1: Select menu item 9 "Parametrisation" in the main menu.

Step 2: Select menu item 3 "Lock-down" in this menu.

Step 3: **A. Unlocking store computer (standard)**
Tap the ENTER button (↵) to set the marker (√).
The lock-down has now been deactivated and it is possible to make settings.

or

B. Unlocking store computer and activating Superuser mode (Superuser permissions)
Input current date backwards (nothing is shown on the display).
Example: The current date is April 17, 2016, i.e. 17/04/16;
the required input for enabling Superuser permissions is then 614071.

Confirm the input with the **ENTER** button (↵); an "**S**" is shown on the display.

Step 4: Exit the operating screen and return to the main menu by tapping the **ESC** button twice.

Tip: If you are already in the user interface of a CAN bus node but have forgotten to release the input lock-down, you can unlock the input lock-down for this controller using the button combination **MODE** and **,**. The input lock-down is active again as soon as you exit the user interface of the controller.

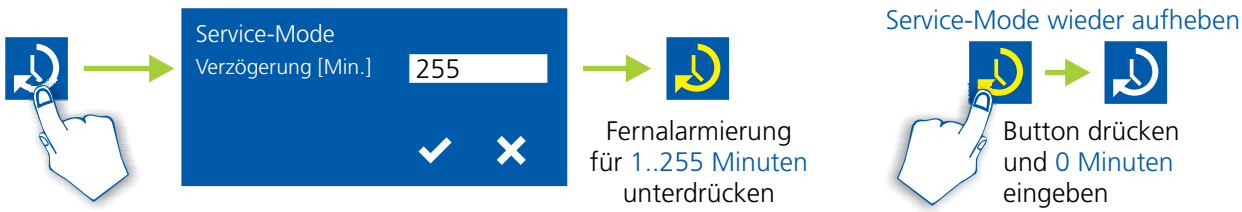
7.16.4 Activating service mode

For repair and maintenance work, service personnel can deactivate the remote alarm function of the system centre and of the store computer for a limited period using the service mode.

The activation of the service mode must only be carried out by service personnel.
If there are still pending alarms (with the priority 1..2) after the time of the Service Mode has elapsed, the audible warning devices and the alarm relays are activated and the alarms are forwarded using the automatic transmission of alarms.

7.16.4.1 System centre CI 4x00

Activating/deactivating service mode



The service mode can only be activated if the system centre has previously been unlocked; see chapter 7.16.3.1.

7.16.4.2 Store computer CI 3x00

Activating/deactivating service mode

Step 1: Select menu item 9 "Parametrisation" in the main menu.

Step 2: Select menu item 3 "Lock-down" in this menu.

Step 3: Tap the buttons **MODE + ENTER** (↵) simultaneously to open the screen for the suppression of the remote alarm signalling and input the service duration (1..255 minutes).
The service mode is now activated for the duration entered above.

Step 4: The service mode can be reset / revoked again by the input of 0 minutes.

8 Parameter List and Menu Structure of VS 300

The integral user interface or an external terminal (CI 3000 Store Computer and AL 300 Operator Terminal) can be used for configuring, parameter setting and operation of the VS 300 Pack Controller by means of menus and screens. The following sections describe the parameter list of the VS 300 and the menu structure of the external in detail.

The following abbreviations are used in the parameter lists and menu structure:

Dim.	Dimension/SI unit	**CL#**	Control Loop 1/Control Loop 2
I1..I4	Input 1 to 4	**CL1**	Control Loop 1
FC	Frequency changer	**CL2**	Control Loop 2
HP	High pressure	**SP**	Setpoint
AV	Actual value	**D**	Day operation
N	Night operation	**LT**	Low-temperature refrigeration
LP	Low pressure	**+**	High temperature/pressure, above neutral zone
NT	Normal-temperature refrigeration	**-**	Low temperature/pressure, below neutral zone
Prio	Priority	**=**	Temperature/pressure, within neutral zone
		(2)	Shown only when CL is configured as HP controller

8.1 Parameter list

The parameter list of the VS 300 is divided into separate groups:

A	(A000..A060)	Actual Values	System data
S1	(S100..S113)	Setpoints 1	Basic Controller Parameters
S2	(S200..S290)	Setpoints 2	Auxiliary Controller Parameters
S3	(S300..S394)	Setpoints 3	System Configuration
S4	(S400..S432)	Setpoints 4	Alarm Priorities
S5	(S400..S554)	Setpoints 5	Suction pressure shift / Additional parameters
t	(t000..t027)	Timer Setpoints	Timers
C	(C000..C040)	Check-Modus	Service Mode (outputs can be actuated manually)
F	(F001..F100)	Fault Reports	Process and System Fault Reports

Setpoints can only be changed at access level 1 (setpoint adjustment enabled) or 10 (Superuser mode) - (see section 7.7 Changing the Access Level)! Unless stated otherwise, parameters are always configured at **setpoint adjustment enabled** access level in the following descriptions. The LED display flashes to indicate when values (setpoints) can be changed.

Faulty parameter setting can cause serious impairment of function.

8.1.1 Parameter List A: Actual Values System Data

CL1	CL2	Function/ Description	Range	Dim.	Displayed / Condition (1): Minimum of one stage must be defined in CL: CL1: ***S301*** > **0** / CL2: ***S331*** > **0**
A000	***A010***	Actual value / Pressure	[1]	bar	Always shown
A001	***A011***	Setpoint / Pressure		bar	(1)
A002	***A012***	Actual value / Temperature		°C	
A003	***A013***	Setpoint / Temperature		°C	
A004	***A014***	Controller output Analog output	0..100	%	(1), an CL not step-by-step switch: CL1: ***S300*** > **0** / CL2: ***S330*** > **0**
A005	***A015***	Temperature setpoint for setpoint shift	[1]	°C	(1), and temperature shift must be activated in CL1: S310 = 1 / CL2: S340 = 1
A06	***A016***	Actual value Hunidity	[1]	%	(1), and humidity shift must be activated in CL1: S311 = 1 / CL2: S341 = 1

[1] Range depends on controller configuration (see Parameter List **S3**) and operating mode!

8.1.2 Parameter List A: Common Actual Values System Data

CL 1 / CL 2	Function/ Description	Range	Dim.	Displayed / Condition (1): Minimum of one stage must be defined in CL: CL1: ***S301*** > **0** / CL2: ***S331*** > **0**
A020.[1] .. ***A020.[m]*** and ***A020.[n]*** .. ***A020.[o]***	Operating hours of relay stages 1 - 12 [2]	0..29999 [3]	h	**CL1: S301 > 0** [m]= Basic configuration (<=4): [**Value *S301***] 1st expansion (<=8): [**Value *S301***] 2nd expansion (<=12): [**Value *S301***] **CL2: S331 > 0** [n]= [**Value *S301***] + 1 [o]= Basic configuration (<=4): [n] + [**Value *S331***] 1st expansion (<=8): [n] + [**Value *S331***] 2nd expansion (<=12): [n] + [**Value *S331***]
A030	Status digital input I1 - I4 [4]	0 / 1 = Actuated	-	Always shown
A035	Status Alarm output A1 and A2 [5]	0 / 1 = Actuated	-	
A051	Version no. [x.y]	1.3x	-	
A060	**Enter password** **Change access level**	**0:** Setp. adjust. not enabled **1:** Setp. adjust-ment enabled **10:** Superuser mode	-	

[2] Number of relay stages CL1 [**Value S301**] + Number of relays CL2 [**Value S331**] + number internal alarm relay <= Number of relay stages VS 300 (varying with expansion stage/number of relay stages can be 4/8/12)

3) Values of more than 4 digits (e.g. 21900 operating hours) are displayed with the help of the relay stage operating and status indicators (LED flashing) as follows:
Value = Value of LED display [0 - 9999] + (Number of flashing operating and status indicator LED * 10000)

4) Status of digital inputs I1 - I4 is shown on the 4-digit LED display as follows, from left to right:
1st digit = Input 1 ***2nd digit = Input 2***
3rd digit = Input 3 ***4th digit = Input 4***

5) Status of alarm outputs A1 - A2 is shown on the 4-digit LED display as follows, from left to right:
1st digit = 0 ***2nd digit = 0***
3rd digit = Alarm output 1 ***4th digit = Alarm output 2***

Parameter List A: Entries cannot be made (actual values)! **Exception:** Parameter A060 only (used to enable access level)!

8.1.3 Parameter List S1: Overview of Main Setpoints - Day/Night Operation

CL1	CL2	Function/ Description	Range	Default			Dim.	Displayed / Condition
				NT	LT	HP		
S100	***S110***	First setpoint t_{max}	-50..45	-12	-38	25	°C	(1)
S101	***S111***	First setpoint t_{min}	-50..35	-16	-40	25	°C	(1), and temperature shift must be activated in CL: CL1: S310 = 1 / CL2: S340 = 1
S102	***S112***	Second setpoint t_{max}	-50..45	-10	-38	25	°C	(1)
S103	***S113***	First setpoint t_{min}	-50..35	-14	-36	25	°C	(1), and humidity shift must be activated in CL: CL1: S310 = 1 / CL2: S340 = 1

8.1.4 Parameter List S2: Setpoints Basic Parameters - Day Operation

CL1	CL2	Function/ Description	Range	Default			Dim.	Displayed / Condition
				NT	LT	HP		
S200	***S240***	First setpoint t_{max}	-50..45	-12	-38	25	°C	Minimum of stage must be defined in CL: CL1: ***S301*** > **0** / CL2: ***S331*** > **0**
S201	***S241***	First setpoint t_{min}	-50..35	-16	-40	25	°C	(1), and temperature shift must be activated in CL: CL1: S310 = 1 / CL2: S340 = 1
S202	***S242***	first setpoint t-adjust._max	16..45	25	25	30	°C	
S203	***S243***	first setpoint t-adjust._min	0..20	15	15	0	°C	
S204	***S244***	Neutral zone 1st SP	1..10	4	4	6	K	Minimum of stage must be defined in CL: CL1: ***S301*** > **0** / CL2: ***S331*** > **0**
S205	***S245***	Control constant 1st SP	1..10	10	7	10		
S206	***S246***	Activate humidity shift	0: nicht aktiv 1: aktiv	0	0	0	-	(1), and humidity shift must be activated in CL: CL1: S311 = 1 / CL2: S341 = 1

8.1.5 Parameter List S2: Setpoints Basic Parameters - Night Operation

CL1	CL2	Function/ Description	Range	Default			Dim.	Displayed / Condition
				NT	LT	HP		
S210	***S250***	Second setpoint t_{max}	-50..45	-10	-38	25	°C	Minimum of stage must be defined in CL: CL1: ***S301*** > **0** / CL2: ***S331*** > **0**
S211	***S251***	First setpoint t_{min}	-50..35	-16	-40	25	°C	(1), and temperature shift must be activated in CL: CL1: S310 = 1 / CL2: S340 = 1
S212	***S252***	first setpoint t-adjust._max	16..45	25	25	30	°C	
S213	***S253***	first setpoint t-adjust._min	0..20	15	15	0	°C	
S214	***S254***	Neutral zone 2nd SP	1..10	4	4	6	K	Minimum of stage must be defined in CL: CL1: ***S301*** > **0** / CL2: ***S331*** > **0**
S215	***S255***	Control constant 2nd SP	1..10	10	7	10		
S216	***S256***	Activate humidity shift	0: nicht aktiv 1: aktiv	0	0	0	-	(1), and humidity shift must be activated in CL: CL1: S311 = 1 / CL2: S341 = 1

Parameter List S1 and S2: To change values set access level to setpoint adjustment enabled (Parameter A060=1, see section 7.7 Changing the Access Level).

8.1.6 Parameter List S2: Setpoints Basic Parameters - Day/Night Operation

CL1	CL2	Function/ Description	Range	Default			Dim.	Displayed / Condition (1): Minimum of one stage must be defined in CL: CL1: ***S301*** > **0** CL2: ***S331*** > **0** (2): Only shown when CL configured as HP controller
				NT	LT	HP		
S220	***S260***	Basic load time	3..250	30	60	10	s	(1)
S221	***S261***	Variable load time	3..250	250	250	30	s	
S222	***S262***	Basic unload time	3..250	10	10	20	s	
S223	***S263***	Variable unload time	3..250	30	20	30	s	
S224	***S264***	Limit starts	4..60	6	6	-	1/h	
S225	***S265***	Temperature t_{max} in CL# for *High Pressure CLK#* alarm **Only CL2:** Stages in CL1 are disabled when temperature rises above this level, if S343 = 1	-30..55	0	-20	52	°C	(1)
S226	***S266***	Temperature in CL# to reset *High pressure CL#* alarm **Only CL2:** Stages in CL1 are re-enabled when temperature falls below this level, if S343 = 1	-35..48	-5	-25	45	°C	
S227	***S267***	Temperature in CL# for *Low Pressure in CL#.* Stages of CL# are shut down when temperature falls below this level (LP control only).	-50..20	-25	-46	10	°C	(1)
S228	***S268***	Target temperature in heat recovery mode (t_{max} HR)	30..50	-	-	46	°C	(1) and respective CL must be activates as HP controller (see **S390**)!
S229	***S269***	Control hysteresis in heat recovery mode (Dif_HR)	1..10	-	-	4	K	
S230	***S270***	*Low Pressure CL#* alarm delay	0..60	10	10	10	min	(1)
S231	***S271***	*High Pressure CL1* alarm delay	0..60	10	10	10	min	(1) and (2)
S232	***S272***	Cycle time for base load rotation / fan protection	5..720 / ---	45	45	45	min	(1)
S233	***S273***	Actuating mode: 0: Fixed sequence 1: By run time	0..1	1	1	0	-	(1) and (2)

CL1	CL2	Function/ Description	Range	Default			Dim.	Displayed / Condition (1): Minimum of one stage must be defined in CL: CL1: ***S301*** > **0** CL2: ***S331*** > **0** (2): Only shown when CL configured as HP controller
				NT	**LT**	**HP**		
S234	***S274***	Minimum FC speed with continuous control	0..50	0	0	0	%	(1) and speed controller must be active in respective CL: CL1: **S300 > 0** CL2: **S330 > 0**
S235	***S275***	Regulating speed for analog controller output with continuous control	-15..15	0	0	0	-	
S236	***S276***	Maximum temperature with speed control	-35..45	-8	-25	40	°C	
	S277	No. of compressors running in CLK1 at HP fault in CL2	0..[1)]	-	-	[1)]	-	(1) and CL1 configured as LP controller (NT or LT) and CL2 as HD controller.
S238		Minimum allowed difference between to and tc	5..15 / ---	---	---	-	K	

Parameter List S1 and S2: To change values set access level to **setpoint adjustment enabled** (Parameter A060=1, see section 7.7 Changing the Access Level).

[1)] After changing compressor stages in CL1, this value is reset to the new default according to the table below:

No. of compressor stages	Default No. of compressor stages at HP fault
1 - 2	1
3 - 5	2
6 - 7	3
8 - 10	4
11 - 12	5

8.1.7 Parameter List S2: Common Setpoints

Parameter No.	Function/ Description	Range	Dim.	Displayed / Condition
S280	Current time, hour	0..23	Hour	Always shown
S281	Current time, minute	0..59	Minutes	
S282	Current date, day	1..31	Day	
S283	Current date, month	1..12	Month	
S284	Current date, year	1900..2155	Year	
S285	Adjustment for daylight saving time changes	0: Not adjusted 1: Adjusted	-	
S290	CAN bus adress	---, 101..109	-	

Date and time only need to be set, and only can be set, in stand-alone operation! When the VS 300 is connected via CAN bus module to a master clock (CI 3000 Store Computer or AL 300 Operator Terminal), the date and time will be supplied by this master and applied to the VS 300, meaning that they then cannot be changed.

Parameter List S2: To change values set access level to **setpoint adjustment enabled** (Parameter A060=1, see section 7.7 Changing the Access Level).

8.1.8 Parameter List S3: Setpoints System Configuration

CL1	CL2	Function/ Description	Range	Default			Dim.	Displayed / Condition (1): Minimum of one stage must be defined in CL: CL1: ***S301*** > **0** CL2: ***S331*** > **0**
				NT	LT	HP		
S300	***S330***	Control type	0: Step control 1: Speed control 2: Combined control	0	0	0	-	(1) and **only** available in conjunction if CL is configured as HP controller
S301	***S331***	Number of base load stages	**S300/330=0:** 0 - max [1] **S300/330=1:** 1 or 2 **S300/330=2:** min 2 - max [1]	2/4/8 [2]			-	Always shown
S302	***S332***	Number of capacity stages each base load stage	**S300/330=0:** 1 - 3[1] **S300/330=1:** = 1 **S300/330=2:** = 1	1	1	1	-	(1) **Only** available in conjunction with step control!
S303	***S333***	Number of capacity-controlled base load stages	**S300/330=0:** 0.. [**Value S301/331**] [1] **S300/330=1:** = 0 **S300/330=2:** = 0	0	0	0	-	

CL1	CL2	Function/ Description	Range	Default			Dim.	Displayed / Condition (1): Minimum of one stage must be defined in CL: CL1: ***S301*** > **0** CL2: ***S331*** > **0**
				NT	LT	HP		
S304.1.. S304.12	***S334.11. . S334.12***	Enable/disable relay/ control stage 1 - 12 [1]	0: Disabled 1: Enabled	1	1	1	-	(1)
S305	***S335***	Number of disabled relays on load shedding	0..3	0	0	0	-	
S306	***S336***	Enter refrigerant	For details see 3)	3	3	3	-	
S308	***S338***	Set pressure transmitter parameter: Pressure at 4 mA	0,0..2,0	0,0	0,0	1,0	bar	
S309	***S339***	Set pressure transmitter parameter: Pressure at 20 mA	8,0..60,0	10,0	10,0	26,0	bar	
S310	***S340***	Enable temperature shift	0: Disabled 1: Enabled	0	0	0	-	
S311	***S341***	Enable humidity shift		0	0	0	-	
S312	***S342***	CAN Bus node number for ambient data CL#	**1..9 or disabled**	---	---	---	-	
-	***S343***	Enable max. temperature disable CL2	0: Disabled 1: Enabled	0	0	0	-	(1) and CL1 must be LP controller and CL2 must be HP controller (see S390)
S314	***S344***	Enable min. temperature disable CL1/CL2		1	1	-	-	Respective CL must not be HP controller
S315	***S345***	Refrigeration point control	0: Control by suction pressure 1: Control by refrigeration point	0	0	-	-	
S316	***S346***	Refrigeration point CAN Node No.	1 - 99 or disabled	---	---	-	-	
S317	***S347***	Forced shutdown/ Activate oil equalization function	0: Not activated 1: Activated	0	0	-	-	
S318	***S348***	Maximum run time	60...180	180	180	-	min	Respective CL must not be HP controller Forced shutdown must be activated in CL
S319	***S349***	Standstill time	1...5	2	2	-	min	

[1] Maximum values varying with expansion stage/Number of relay stages can be 4/8/12
[2] Dependent on expansion stage/number of relay stages
[3] Refrigerant: 0=R22, 1=R502, 2=R134a, 3=R404A, 4=R402A, 5=R717, 6=R1270, 7=R507, 8=R407C, 9=R410A, 10=R290, 11=R744, 12=R407F, 13=R422A, 14=R422D, 15=R408A, 16=R407D, 17=R407A, 18=R427A, 19=R438A, 20=R152a, 21=R170, 22=R600, 23=R600a, 24=R449A, 25=R450A, 26=R448A, 27=R455A, 28=R447B, 29=R1234ze, 30=R1233zd, 31=R1234yf

Parameter List S3: To change values set access level to **setpoint adjustment enabled** (Parameter A060=1, see section 7.7 Changing the Access Level).

8.1.9 Parameter List S3: Common Setpoints System Configuration

Parameter No.				Function / Description	Range	Default			Dim.	Displayed / Condition
I1	I2	I3	I4			NT	LT	HP		
S360	***S364***	***S368***	***S372***	Function of digital input 1 - 4	0: Off 1: Fast unload 2: Load shedding 3: Setpoint toggle 4: Alarm recording 5: HR mode 6: Safety loop	4	4	4	-	Always shown
S361	***S365***			Allocation of digital input 1 - 4	0: CL1 1: CL2 2: Both control loops	0	0	0	-	(1)
		S369	***S373***			1	1	1		
S362	***S366***	***S370***	***S374***	Polarity of digital input 1 - 4	0: Low active 1: High active	0	0	0	-	Always shown
S363	***S367***	***S371***	***S375***	Alarm delay for digital input 1 - 4	0 - 60	0	0	0	s	
S376				Number internal alarm relay	0..2 *	0	0	0	-	
S377				Booster operation: Shutdown disable CL2 when compressor in CL	0: NOT disabled 1: Disabled	0	0	-	-	(1) and neither CL1 or CL2 are permitted to be HP controllers

I1 to I4: Digital inputs 1 - 4

(1): Minimum of one stage must be defined in CL:

CL1: ***S301*** **> 0**

CL2: ***S331*** **> 0**

Parameter List S3: To change values set access level to **setpoint adjustment enabled** (Parameter A060=1, see section 7.7 Changing the Access Level).
* Maximum value, depends on VS 300 system / number of alarm ralais: 4/8/12!

8.1.10 Parameter List S3: Basic Settings System Configuration

Parameter No.	Function / Description	Range	Default			Dim.	Displayed / Condition
			NT	LT	HP		
S390	Select controller configuration	0: CL1 = LT control CL2 = LT control	-	-	-	-	Requires Superuser mode access rights (Parameter **A060 = 10**)
		1: CL1 = LT control CL2 = NT control					
		2: CL1 = LT control CL2 = HP control					
		3: CL1 = NT control CL2 = NT control					
		4: CL1 = NT control CL2 = HP control					
		5: CL1 = HP control CL2 = HP control					
		6: CL1 = NT control CL2 = LT control					
S391	Load default settings	0: Preserve existing settings 1: Load default settings	0	0	0	-	
S392	Parameter backup	0: No parameter backup 1: Back up parameters	0	0	0	-	
S393	Delete run time archives	0: Preserve archives 1: Delete archives	0	0	0	-	
S394.1[1].. S394.[m] ***und*** ***S394.[n].. S394.[o]***	Reset operating hours for relay stages 1 - 12 [1)]	0: Preserve operating hours 1: Reset operating hours to 0	-	-	-	-	Requires Superuser mode access rights (Parameter **A060 = 10**) CL1: **S301 > 0** [m]= Basic configuration (<=4): [***Value S301***] 1st expansion stage (<=8): [***Value S301***] 2nd expansion stage (<=12): [***Value S301***] or CL1: **S331 > 0** [n]= ***Value S301***] + 1 [0]= Basic configuration (<=4): [n] + [***Value S331***] 1st expansion stage (<=8): [n] + [***Value S331***] 2nd expansion stage (<=12): [n] + [***Value S331***]

[1)] Maximum values varying with expansion stage/Number of relay stages can be 4/8/12

Controller configuration must be made prior to making individual parameter settings, as first start is performed after changing configuration!

In first start, default settings are loaded for all parameters and all archives (alarms and operating data, e.g. run times, starts, activity) are deleted!

8.1.11 Parameter List S4: Setpoints Alarm Priorities

Parameter No.	Alarm priorities for:	Range	Default			Displayed / Condition
			NT	LT	HP	
S400	High pressure CL1	-: Not recorded 0: Only entered in report list 1: Alarm priority 1 2: Alarm priority 2	2	2	2	Always shown
S401	High pressure CL2		2	2	2	
S402	Low pressure CL1		2	2	2	
S403	Low pressure CL2		2	2	2	
S404	Pressure measuring loop error CL1		2	2	2	
S405	Pressure measuring loop error CL2		2	2	2	
S409	Service mode active		0	0	0	
S410	Load shedding activated		0	0	0	
S411	Fast unload activated		0	0	0	
S416	Setpoint changed		0	0	0	
S417	Controller configuration changed LT, NT, HP		0	0	0	
S418	External alarm via digital inputs 1 - 4		2	2	2	
S419						
S420						
S421						
S422	Sensor type changed		2	2	2	
S430	Power failure/restart		0	0	0	
S431	First start		2	2	2	
S432	Low battery		2	2	2	
S433	Internal error		2	2	2	

Parameter No.	Alarm priorities for:	Range	Default			Displayed / Condition
			NT	LT	HP	
S434	No UA300 available (with control by refrigeration point activated)	-: Not recorded 0: Only entered in report list 1: Alarm priority 1 2: Alarm priority 2	2	2	-	Al ways shown
S435	No load level information received CL1 (with to shift by refrigeration point activated in CL1)		2	2	-	
S436	No load level information received CL2 (with to shift by refrigeration point activated in CL2)		2	2	-	

Parameter List S4: To change values set access level to **setpoint adjustment enabled** (Parameter A060=1, see section 7.7 Changing the Access Level).

8.1.12 Parameter List S5: Suction pressure shift / Additional Parameters

CL1	CL2	Function/ Description	Range	Dimension	Default			Displayed / Condition
					NT	LT	HP	
S500	***S550***	Suction pressure shift mode CL1/CL2	0: No shift 1: Shift by refrigeration point	-	0	0	-	Minimum of one stage must be defined in CL: CL1: S301 > 0 CL2: S331 > 0 Control loop must be low-pressure loop (LT or NT)
S501	***S551***	Maximum load level for t_o shift CL1/CL2	70..100	%	100	100	-	
S502	***S552***	Minimum load level for t_o shift CL1/CL2	10..60	%	50	50	-	
S503	***S553***	Increment CL1/CL2	0,0..10,0	K	1,0	1,0	-	
S504	***S554***	Time interval t_o shift CL1/CL2	1..20	min	5	5	-	

Parameter List S3: To change values set access level to **setpoint adjustment enabled** (Parameter A060=1, see section 7.7 Changing the Access Level).

8.1.13 Parameter List t: Setpoints Timers

CL1	CL2	Function/ Description	Range	Dimension		Default			Displayed / Condition
						NT	LT	HP	
t000	***t020***	Setpoint toggle internal/external	0: External 1: Internal	-		0	0	0	Minimum of one stage must be defined in CL: CL1: ***S301*** **> 0** CL2: ***S331*** **> 0**
t001	***t021***	Timer 1	Sd 0..10	0: Mon 1: Tue 2: Wed 3: Thu 4: Fri 5: Sat	6: Sun 7: Mon-Sun 8: Mon-Fri 9: Mon-Sat 10: Sat-Sun	--	--	--	
			Sh 0..23	Hour		0	0	0	
			S⊓ 0..59	Minute		0	0	0	
			Ed 0..10	0: Mon 1: Tue 2: Wed 3: Thu 4: Fri 5: Sat	6: Sun 7: Mon-Sun 8: Mon-Fri 9: Mon-Sat 10: Sat-Sun	--	--	--	
			Eh 0..23	Hour		0	0	0	
			E⊓ 0..59	Minute		0	0	0	
t002	***t022***	Timer 2	As above	As above		As above			
t003	***t033***	Timer 3							
t004	***t024***	Timer 4							
t005	***t055***	Timer 5							
t006	***t026***	Timer 6							
t007	***t027***	Timer 7							

Parameter List t: To change values set access level to **setpoint adjustment enabled** (Parameter A060=1, see section 7.7 Changing the Access Level).

8.1.14 Parameter List C: Service / Check Mode - Defaults Analog Outputs

Parameter No.	Function Description	Range	Default	Dim.	Displayed
C000	CL1 Controller output default Analog output	0..10,0	0,0	V	Always shown
C001	CL2 Controller output default Analog output	0..10,0	0,0	V	

8.1.15 Parameter List C: Service / Check Mode - Defaults Relay Outputs

Parameter No.	Function Description	Range	Default	Dim.	Displayed / Condition
C010 nr 01 .. ***nr [m]***	CL1 Default actuating status of relay/control stages	0: Output not actuated 1: Output actuated	0	-	Minimum of one stage must be defined in CL1: **S301 > 0** [m] = Basic configuration (<=4): [***Value S301***] 1st expansion stage (<=8): [***Value S301***] 2nd expansion stage (<=12): [***Value S301***]
C020 nr [n] .. ***nr [o]***	CL2 Default actuating status of relay/control stages		0	-	Minimum of one stage must be defined in CL2: **S331 > 0** [n] = [**Value *S301***] + 1 [o] = Basic configuration (<=4): [n][***Value S331***] 1st expansion stage (<=8): [n][***Value S331***] 2nd expansion stage (<=12): [n][***Value S331***]
C030 nr [p] .. ***nr [q]***	Default actuating status of internal alarm relay / alarm control stages		0	-	Only visible when at least 1 stage is parameterised as an alarm relay: S376 >0: S376 = 1 [p] = not applicable [q] = Basic configuration: 4 1st expansion stage: 8 2nd expansion stage: 12 S376 = 2 [p] = Basic configuration: 3 1st expansion stage: 7 2nd expansion stage: 11 [q] = Basic configuration: 4 1st expansion stage: 8 2nd expansion stage: 12
C040 nr 01 .. ***nr 02***	Alarm card Default actuating status of alarm relays		0	-	Always shown (Outputs can however **only** be actuated when VS 300 is fitted with optional alarm relay module.)

Number of relay stages CL1 **[ValueS301]** + Number of relays CL2 **[Values S331]** + number internal alarm relay <= Number of relays stages VS 300 (varying with expansion stage/number of relay stages can be 4/8/12)

Parameter List C: To change values set access level to **setpoint adjustment enabled** (Parameter A060=1, see section 7.7 Changing the Access Level).

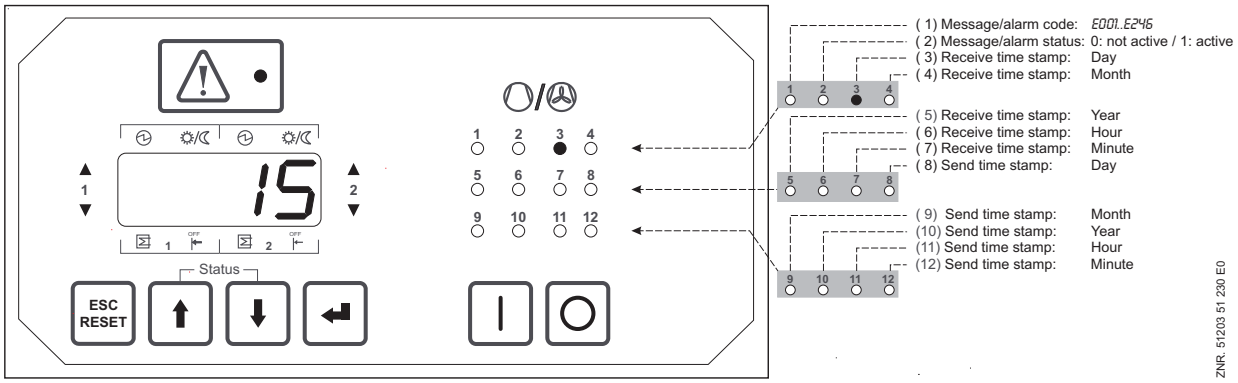
8.1.16 Parameter List F: Alarms - System and Process Fault Reports

The status LEDs of the relay/control stages indicate the currently displayed alarm detail (see illustration: day (15th) of receive time stamp is displayed):

Parameter No.	Function Description	Range	Dimension	Displayed
F001.1 ***...*** ***F001.12***	**Most recent alarm:**			Only shown when alarms are still active (indicated by flashing) or when alarms have not been cancelled by ESC/ RESET.
	.1: Message/alarm code	**E001..E246**		
	.2: Message/alarm status	0: Alarm not active 1: Alarm active, alarm still current	-	
	.3: Receive time stamp: day	1..31	Day	
	.4: Receive time stamp: month	1..12	Month	Only shown when alarms are still active (indicated by flashing) or when alarms have not been cancelled by ESC/ RESET.
	.5: Receive time stamp: year	1900..2155	Year	
	.6: Receive time stamp: hour	0..23	Hour	
	.7: Receive time stamp: minute	0..59	Minute	
	.8: Send time stamp: day	1..31	Day	
	.9: Send time stamp: month	1..12	Month	
	.10: Send time stamp: year	1900..2155	Year	
	.11: Send time stamp: hour	0..23	Hour	
	.12: Send time stamp: minute	0..59	Minute	
F002.1 ***..*** ***F002.12***	**2nd most recent alarm:** As above	As above		
Fnnn.1 ***..*** ***Fnnn.12***	**Oldest alarm:** As above			

Values of Fnnn: F001 - F100 (maximum number of alarms 99)

Parameter List F: Access level does not require enabling!
By contrast with alarms that are no longer current (have been cancelled), current alarms are shown flashing. Alarms can be cancelled by pressing the ESC/RESET key.



Identification of displayed value by relay-control stage status LEDs

Items 8 to 12 are not displayed when alarm status is 1 (alarm active)!

8.2 Overview of alarm types

The following alarms are recorded by the VS 300 and saved to report memory:

- System fault reports
- Process fault reports

Parameter No.	System fault reports
E000	Internal fault
E004	EEPROM parameter memory defective/not responding
E005	Defective EEPROM contents (checksum)
E008	Internal clock defective
E009	Internal bus system fault
E010	Internal battery low
E050	First start loading default parameters
E051	Restart after power failure
	Process fault reports
E180	Service mode active
E181	Fast unload active in Control Loop #
E182	Load shedding active in Control Loop # active
E203	Pressure sensor parameter changed
E207	High pressure in Control Loop 1; (LT1, NT1 or HP1)
E208	High pressure in Control Loop 2; (LT2, NT2 or HP2)
E209	Low pressure CL1
E210	Low pressure CL2
E211	Pressure sensor measuring loop error CL1
E212	Pressure sensor measuring loop error CL2
E222	No Load Level in Control loop 1
E223	No Load Level in Control loop 2
E224	No UA 300 found with refrigeration point control
E240	Setpoint changed
E241	Controller configuration changed
E243	Digital input 1 active
E244	Digital input 2 active
E245	Digital input 3 active
E246	Digital input 4 active

8.3 Menu structure of AL 300 Operator Terminal and CI 3000 Store Computer

Parameters can be set on the VS 300 Pack Controller by the internal user interface or by a connected external terminal. It makes no difference whether an AL 300 Operator Terminal or a CI 3000 Store Computer is used to operate the VS 300. The user interface is identical an the functions available are the same as for integral operation.

External operation requires a CAN bus module to allow communication with the VS 300 (see section 1 Design). When operating the VS 300 by an external terminal, entries cannot be made with the keys on the VS 300 and the display of the VS 300 show "---".

Working with menus and screens

See section 6 Operation with External Terminal (AL 300 or CI 3000) for detailed information.

Numbering of menus and screens

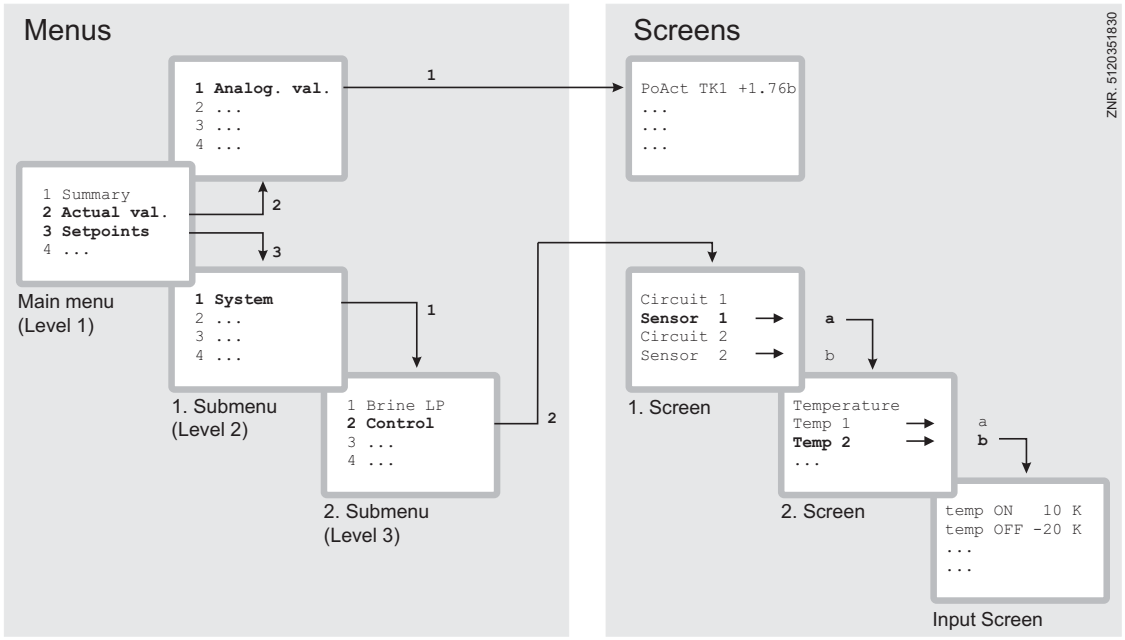
Each menu can be opened by entering a specific number and each screen in a menu can be opened by choosing a specific menu item. This is characterized by unique identification consisting of numerals and letters in the menu tree. Numbers 1, 2, etc. identify the menus and letters a, b, etc. identify the order of the screens in the respective menu.

Example of screen numbering

2-1 means that the appropriate screen can be opened from the menu tree by entering the numbers 2 - 1. This may be a display screen or operating screen.

Example of operating screen numbering

3 - 1 - 2 - a - b means that the higher-level screen is opened from the menu tree by entering the numbers 3 -1 - 2. The following letter (or letters) indicate that an additional screen or selection list is available for selection (→). The letters indicate the order within the screen.



8.4 Menu structure

Main Menu overview

Depending on type, expansion stage and configuration of the system, alternative terms may be used in menus and screens. These terms are shown in *italics* in the menus and screens that follow.

Example: *Compressor / Fan CL2*

- The display of the operator terminal will show either *Compressor* **or** *Fan* depending on whether the control loop is configured for high or low pressure!
- CL2 stands for either NT2 - normal-temperature refrigeration, LT2 - low-temperature refrigeration **or** HP2 - high pressure in Control Loop 2.

Level 1	Level 2	Level 3	Screen No.	Screen Name
Main menu			0	VS 300
Overview	Show actual values		1	--
Actual values			2	ACT.VALUES
	Analog values	Show actual values	2-1	ANALOGV.
	Compressor / Fan CL1	Show relay stage status *CL1*	2-2	*CL 1 COMP / COND*
	Compressor / Fan CL2	Show relay stage status *CL2*	2-3	*CL 2 COMP / COND*
	Internal Alarm	Show internal alarm relay	2-4	Int. Alarm
	System	Show input/output status	2-5	SYSTEM
Setpoints			3	SETPOINTS
	System configuration		3-1	CONFIG
		Enable/disable control stages CL1	3-1-a	*CL 1 COMP / COND*
		Refrigerant CL1	3-1-b	REFRIGT
		Sensor matching CL1	3-1-c	TRANSD.CL1
		Select refrigeration point/ suction pressure CL1	3-1-d	CONT TYPE
		Enable/disable control stages CL2	3-1-e	CL2-COND/FAN
		Refrigerant CL2	3-1-f	REFRIGT
		Sensor matching CL2	3-1-g	TRANSD.CL2
		Select refrigeration point/ suction pressure CL2	3-1-h	CONT TYPE
		Controller configuration	3-1-i	Config

Level 1	Level 2	Level 3	Screen No.	Screen Name
Setpoints	CL1 Control		3-2	SETPOINTS
		Control type	3-2-1	*CL1*-CONT
		to-adjustment	3-2-2	to-adjust.
		Actuating times CL1	3-2-3	LOAD TIMES
		LP/HP control day *CL1*	3-2-4	*LP/HP*-CONT D
		LP/HP control night *CL1*	3-2-5	*LP/HP*-CONT N
	CL2 Control		3-3	SETPOINTS
		Control type	3-3-1	*CL1*-CONT
		to-adjustment	3-3-2	to-adjust.
		Actuating times CL2	3-3-3	LOAD TIMES
		LP/HP control day *CL2*	3-3-4	*LP/HP*-CONT D
		LP/HP control night *CL2*	3-3-5	*LP/HP*-CONT N
	Monitoring	Show/change setpoints	3-4	Monitoring
	Inputs		3-5	INPUTS
		Input 1	3-5-1	INPUT 1
		Input 2	3-5-2	INPUT 2
		Input 3	3-5-3	INPUT 3
		Input 4	3-5-4	INPUT 4
	Alarms	Show/change priority setpo-ints	3-6	MESSAGE
	Parameter backup	Back up basic parameters	3-7	VS 300
Clock			4	CLOCK
	Current time		4-a	CLOCK
	Setpoint toggle *CL1*		4-b	CLOCK
	Setpoint toggle *CL2*		4-c	CLOCK
Alarms			5	MESSAGE
	Display	Show alarms	5-1	MESSAGE
	Delete	Delete/reset alarms	5-2	MESSAGE
Operating Data			6	OP DATA
	Run times *CL1*	Show run times *CL1*	6-1	OP DATA
	Run times *CL2*	Show run times *CL2*	6-2	OP DATA
	Daily operating data *CL1*		6-3	History CL1
		Run times	6-3-1	History CL1
		Run times day	6-3-2	History CL1
		Run times night	6-3-3	History CL1
		Starts	6-3-4	History CL1
		Starts day	6-3-5	History CL1

Level 1	Level 2	Level 3	Screen No.	Screen Name
Operating Data	Daily operating data CL1	Starts night	6-3-6	History CL1
		Activity	6-3-7	History CL1
		Activity day	6-3-8	History CL1
		Activity night	6-3-9	History CL1
	Daily operating data CL2		6-4	History CL2
		Run times	6-4-1	History CL2
		Run times day	6-4-2	History CL2
		Run times night	6-4-3	History CL2
		Starts	6-4-4	History CL2
		Starts day	6-4-5	History CL2
		Starts night	6-4-6	History CL2
		Activity	6-4-7	History CL2
		Activity day	6-4-8	History CL2
		Activity night	6-4-9	History CL2
	Delete archive	Delete operating data archives	6-5	VS 300
Basic Settings	Load basic settings		7	VS 300
Service Mode			8	SERVICE
	Analog values	Default analog values CL1/2	8-1	SERVICE
	Compressor/fAN CL1	Default relay outputs *CL1*	8-2	SERVICE
	Compressor/fan CL2	Default relay outputs *CL2*	8-3	SERVICE
	System	Default alarm outputs	8-4	SERVICE

8.4.1 Menu 0 Main menu

VS 300 POS: XXXXX	
1 Summary	Next: Menu 1
2 Actual Values	Next: Menu 2
3 Setpoints	Next: Menu 3
4 Clock	Next: Menu 4
5 Messages	Next: Menu 5
6 Operating Data	Next: Menu 6
7 Default settings	Next: Menu 7
8 Service Mode	Next: Menu 8

8.4.2 Menu 1 Summary

Act.tx *CL1* +/-/= XXX °C	CL1: Actual value of evaporating/condensing temperature
Setp.tx *CL1* *D/N/HR* XXX °C	CL1: Calculated setpoint of evaporating/condensing temperature
Act.tx *CL2* +/-/= XXX °C	CL2: Actual value of evaporating/condensing temperature
Setp.tx *CL2* *D/N/HR* XXX °C	CL2: Calculated setpoint of evaporating/condensing temperature

D	Day operation
N	Night operation
tx	t_0 or t_c
HR	Heat recovery mode
+	Temperature high, above neutral zone
-	Temperature low, below neutral zone
=	Temperature within neutral zone

8.4.3 Menu 2 Actual values

ACT.VALUES POS: XXXXX	
1 Analog values	Next: Menu 2-1
2 Compressor/Cond.Fan CL1	Next: Menu 2-2
3 Compressor/Cond.Fan CL2	Next: Menu 2-3
4 INT ALARM	Next: Menu 2-4, only shown if parameter *No.AlRelays <0*, see menu 3-1
5 System	Next: Menu 2-5

- Menu 2-1 Analog values

ANALOV.			POS: XXXXX	
Act.px	*CL1*	+/-/=	X.XX bar	Current evaporating/condensing pressure Control Loop 1
Setp.px	*CL1*	D/N/HR	X.XX bar	Target evaporating/condensing pressure Control Loop 1 for comparison
Act.tx	*CL1*	+/-/=	X.XX °C	Current evaporating/condensing temperature Control Loop 1
Setp.tx	*CL1*	D/N/HR	X.XX °C	Target evaporating/condensing temperature Control Loop 1 for comparison
tuIst	RK1		XX °C	Current room/outside temperature Control Loop 1 (only shown when activated)
Feuchte	RK1			Current air humidity Control Loop 1 (only shown when activated)
AnalogOut		*RK1*	XXX %	Current controller output at analog output for Control Loop 1 (only shown when speed control or combined control is activated)
Act.px	*CL2*	+/-/=	X.XX bar	Current evaporating/condensing pressure Control Loop 2
Setp.px	*CL2*	D/N/HR	X.XX bar	Target evaporating/condensing pressure Control Loop 2 for comparison
Act.tx	*CL2*	+/-/=	X.XX °C	Current evaporating/condensing temperature Control Loop 2
Setp.tx	*CL2*	D/N/HR	X.XX °C	Target evaporating/condensing temperature Control Loop 2 for comparison
tuIst	RK2		XX °C	Current room/outside temperature Control Loop 1 (only shown when activated)
Feuchte	RK2			Current air humidity Control Loop 2 (only shown when activated)
AnalogOut		*CL2*	XXX %	Current controller output at analog output for Control Loop 2 (only shown when speed control or combined control is activated)

N	Night operation
px	P_0 or P_c
D	Day operation
tx	t_0 or t_c
HR	Heat recovery mode
+	Temperature high, above neutral zone
-	Temperature low, below neutral zone
=	Temperature within neutral zone

- Menu 2-2 Compressor/Fan Control Loop 1

CL1-COMP./COND	POS: XXXXX	
Stage 1	XXX	Display ON/OFF: Actuating status of digital output, relay/control stage 1
...		Only actual number of compressor/fans in Control Loop 1 is shown
Stage 12	XXX	Display ON/OFF: Actuating status of digital output, relay/control stage 12 [1)]

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relay <= Number of relay/control stages VS 300 (max. 4/8/12 depending on expansion stage and configuration), see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menun 2-3 Compressor/Fans Control Loop 2

CL2-COMP./COND POS: XXXXX		
Stage 1	XXX	Display ON/OFF: Actuating status of digital output, relay/control stagee 1
...		Only actual number of compressor/fans in Control Loop 2 is shown
Stage 12	XXX	Display ON/OFF: Actuating status of digital output, relay/control stage 12 [1)]

[1)] First relay/control stage of Control Loop 2 directly follows last stage of Control Loop 1. Position of first relay/control stage of Control Loop 2 is accordingly determined by control loop configuration.

Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relay <= Number of relay/control stages VS 300 (max. 4/8/12 depending on expansion stage and configuration), see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 2-4 Internal Alarm

INT ALARM POS: XXXXX		
Stage	1	Display ON/OFF: Actuating status of digital alarm output 1
Stage	2	Display ON/OFF: Actuating status of digital alarm output 2

Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relay <= Number of relay/control stages VS 300 (max. 4/8/12 depending on expansion stage and configuration), see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 2-5 System

SYSTEM POS: XXXXX		
Ext INPUT 1	XXX	Display ON/OFF: Actuating status of digital input 1
Ext INPUT 2	XXX	Display ON/OFF: Actuating status of digital input 2
Ext INPUT 3	XXX	Display ON/OFF: Actuating status of digital input 3
Ext INPUT 4	XXX	Display ON/OFF: Actuating status of digital input 4
Alarm-Output 1	XXX	Display ON/OFF: Actuating status of alarm output 1 (only when optional alarm relay module is fitted)
Alarm-Output 2	XXX	Display ON/OFF: Actuating status of alarm output 2 (only when optional alarm relay module is fitted)

8.4.4 Menu 3 Setpoints

SETPOINTS POS: XXXXX	
1 System config.	Next: Menu 3-1
2 *CL1* control	Next: Menu 3-2
3 *CL2* control	Next: Menu 3-3
4 monitoring	Next: Menu 3-4
5 Inputs	Next: Menu 3-5
6 Messages	Next: Menu 3-6
7 Param.Backup	Next: Menu 3-7

- Menu 3-1 System Configuration (CL1)

CONFIG POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
No. Comp./Cond CL1	XX	Number of compressors/fans (base load stages) in CL1 With step control: With speed control: With combined control:	 0 - max. 1) 1 or 2 min. 2-max.1)	2/4/6 1)	2/4/6 1)	2/4/6 1)	-
Cap.Stages *CL1*	XX	Number of capacity stages each capacity-controlled base load stage CL1 With step control: With speed control: With combined control:	 1 - 3 1) = 1 = 1	1	1	1	-
No.multist. *CL1*	XX	Number of capacity-controlled base load stages CL1 With step control: With speed control: With combined control:	 0 - max. 1) = 0 = 0	0	0	0	-
Enable *CL1*-stages	→	Enable/disable control stages in CL1	→	see Screen 3-1-a			
Stg.Ld.Shed. *CL1*	X	Number of disabled relay/control stages on load shedding CL1	0..3	0	0	0	-
Refrig. *CL1*	XXXXX →	Select refrigerant in Control Loop 1	→	see Screen 3-1-b			
TRANSD.*CL1*	→	Sensor matching Control Loop 1	→	see Screen 3-1-c			
Enab. tr CL1		Activate room/outside temperature analysis CL1 (only available with CAN Bus)	↑, ↓, (ON/OFF)	OFF	OFF	OFF	-
Enab.Humid.CL1		Activate analysis of air humidity	↑, ↓, (ON/OFF)	OFF	OFF	OFF	-
Node-Nr Env.CL1		CAN Bus node number of the VS 3000/VS 3000 BS from which CL1 draws ambient data (humidity, outside/room temperature)	1..9	-	-	-	-
to-MinMon CL1		Activation of compressor shutdown by shortfall relative to min. temperature CL1 (only LP control) 2)	↑, ↓, (ON/OFF)	ON	ON	-	-
Conumer.cont.*CL1*	→	Select control by refrigeration point or suction pressure Control Loop 1 2)	→	see Screen 3-1-d			
Cons.nodeNo.*CL1*		Enter refrigeration point to control 1st control loop of pack	1..99 or ---	--	--	--	-
forced ret. *CL1*	X	Select forced shutdown/oil equalization function Control Loop 1 2)	↑, ↓, (N/Y)	N	N	-	-
Max. Off Time	XXXm	Enter maximum allowed run time before forced shutdown2). Only shown when forced shutdown function activated.	60..180	180	180	-	min
Off Time	XXXm	Enter standstill time after forced shutdown2). Only shown when forced shutdown function activated.	1..5	2	2	-	min

1) 0 to 4/8/12 depending on expansion stage and configuration
(see section 3 Function - System Configuration/Allocation of Relay/Control Stages).
2) CL1 must not be HP controller.

- Menu 3-1 System Configuration (CL2)

CONFIG POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
No. Comp./Cond CL2 XX	Number of compressors/fans (base load stages) in CL2 With step control: With speed control: With combined control:	 0 - max. [1] 1 or 2 min. 2-max.[1]	2/4/6 [1]	2/4/6 [1]	2/4/6 [1]	-
Cap.Stages *CL2* XX	Number of capacity stages each capacity-controlled base load stage CL2 With step control: With speed control: With combined control:	 1 - 3 [1] = 1 = 1	1	1	1	-
No.multist. *CL2* XX	Number of capacity-controlled base load stages CL2 With step control: With speed control: With combined control:	 0 - max. [1] = 0 = 0	0	0	0	-
Enable *CL2*-stages →	Enable/disable control stages in CL2	→	See Screen 3-1-e			
Stg.Ld.Shed. CL2 X	Number of disabled relay/control stages on load shedding CL2	0 - 3	0	0	0	-
Refrig. *CL2* XXXXX →	Select refrigerant in Control Loop 2	→	See Screen 3-1-f			
TRANSD.*CL2* →	Sensor matching Control Loop 2	→	See Screen 3-1-g			
Enab. tr CL2	Activate room/outside temperature analysis CL2 (only available with CAN Bus)	↑, ↓, (ON/OFF)	OFF	OFF	OFF	-
Enab.Humid.CL2	Activate analysis of air humidity	↑, ↓, (ON/OFF)	OFF	OFF	OFF	-
Node-Nr Env.CL2	CAN Bus node number of the VS 3000/VS 3000 BS from which CL2 draws ambient data (humidity, outside/room temperature)	1..9	-	-	-	-
to-MinMon CL2	Activation of compressor shutdown by shortfall relative to min. temperature CL1 (only LP control) [2] [4]	↑, ↓, (ON/OFF)	ON	ON	-	-
tc-MaxMon CL2	Activation of compressor shutdown by shortfall relative to max. temperature CL2 (only HP control) [2]	↑, ↓, (ON/OFF)	-	-	OFF	-
Conumer.cont.*CL2* →	Select control by refrigeration point or suction pressure Control Loop 2 [3]	→	See Screen 3-1-h			
Cons.nodeNo.*CL2*	Enter refrigeration point to control 2nd control loop of pack	1 - 99 or ---	--	--	--	-
forced ret. *CL2* X	Select oil equalization function Control Loop 2 [3]	↑, ↓, (N/Y)	N	N	-	-
Max. Off Time XXXm	Enter maximum allowed run time before forced shutdown[2]. Only shown when forced shutdown function activated.	60..180	180	180	-	min
Off Time XXXm	Enter standstill time after forced shutdown[2]. Only shown when forced shutdown function activated.	1..5	2	2	-	min
No.AlRelays XXXX	Number internal alarm relay	0..1	0	0	0	-

SperrRK2 m. RK1 XXX	Booster operation: disable shutdown CL2, when compressor running in CL2 (only shown in Superuser mode)	↑, ↓, (ON/OFF)	OFF	OFF	-	-
Config XXXX	Controller configuration (NT/LT/HP) (only configuarble in terminal mode and Superuser mode)	→	See Screen 3-1-i			

1) 0 to 4/8/12 depending on expansion stage and configuration (see section 3 Function - System Configuration/Allocation of Relay/Control Stages).
2) CL1 must not be HP controller.
3) CL2 must not be HP controller.
4) CL2 must be HP controller.

- Screen 3-1-a CL1 Compressors/Fans: Enable/Disable Control Stages

CL1-Comp/COND POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
Stage 1 1) XXX	Shows only relay/control stages allocated to Control Loop 1	↑ , ↓ (ON/OFF)	ON	ON	ON	-
...						
Stage 12 1) XXX						

1) 0 to 4/8/12 depending on expansion stage and configuration (see section 3 Function - System Configuration/Allocation of Relay/Control Stages).

- Screen 3-1-b Refrigerant Control Loop 1

REFRIGT. POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
R 22		√	-	-	-	-
R 502		√	-	-	-	-
R 134a		√	-	-	-	-
R 404A √		√	√	√	√	-
R 402A		√	-	-	-	-
R 717		√	-	-	-	-
R 1270		√	-	-	-	-
R 507		√	-	-	-	-
R 407C		√	-	-	-	-
R 410A		√	-	-	-	-
R 290		√	-	-	-	-
R 744		√	-	-	-	-
R407F		√	-	-	-	-
R422A		√	-	-	-	-
R422D		√	-	-	-	-
R422D		√	-	-	-	-
R408A		√	-	-	-	-
R407D		√	-	-	-	-
R407A		√	-	-	-	-
R427A		√	-	-	-	-
R438A		√	-	-	-	-
R152a		√	-	-	-	-
R170		√	-	-	-	-
R600		√	-	-	-	-
R600a		√	-	-	-	-
R449A		√	-	-	-	-
R450A		√	-	-	-	-
R448A		√	-	-	-	-
R455A		√	-	-	-	-
R447B		√	-	-	-	-
R1234ze		√	-	-	-	-
R1233zd		√	-	-	-	-
R1234yf		√	-	-	-	-

- Screen 3-1-c Sensor *Control Loop 1*

TRANSD.CL1 POS: XXXXX			Input	Default			
				NT	LT	HP	Dim.
px 4mA	XXX b	Set sensor parameter: Pressure at 4mA	0,0..2,0	0,0	0,0	1,0	bar
px 20mA	xxx b	Set sensor parameter: Pressure at 20mA	8,0..60,0	10,0	10,0	75,0	bar

p_x equivalent to either p_0 or p_c (depending on expansion stage and configuration).

- Screen 3-1-d Select Control Type for Control Loop 1

CONT TYPE POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
Pressure	√	Default	√	√	√	√	-
Consumer			√	-	-	-	-

Faulty parameter setting can cause severe impairment of function.

- Screen 3-1-e *Control Loop 2* - Compressors/Fans

CL2-COMP/COND. POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
Stage 1 [1)]	XXX	Shows only relay/control stages allocated to Control Loop 1	↑ , ↓ (ON/OFF)	ON	ON	ON	-
...							
Stage 12 [1)]	XXX						

[1)] 0 to 4/8/12 depending on expansion stage and configuration (see section 3 Function - System Configuration/Allocation of Relay/Control Stages).

- Screen 3-1-f Select refrigerant *Control Loop 2*

See Screen 3-1-b.

- Screen 3-1-g Sensor *Control Loop 2*

See Screen 3-1-c.

- Screen 3-1-h Select Control Type for Control Loop 2

See Screen 3-1-d.

Faulty parameter setting can cause severe impairment of function.

- Screen 3-1-i Controller configuration - only shown in Superuser mode!

Config POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
LTLT	Controller configuration must be made prior to making individual parameter setting, as first start is performed when configuration is changed.	√	-	-	-	-
LTNT		√	-	-	-	-
LTHP		√	-	-	-	-
NTNT		√	-	-	-	-
NTHP		√	-	-	-	-
HPHP		√	-	-	-	-
NTLT		√	-	-	-	-

On first start, default values are loaded for all parameters and all archives (alarms and operating data, e.g. run times, starts, activity) are deleted!

- Menu 3-2 Setpoints for CL1 control

SETPOINTS POS: XXXXX	
1 Control type	Next: Screen 3-2-1
2 to adjustment CL1	Next: Screen 3-2-2 1)
3 Load times CL1	Next: Screen 3-2-3
4 LP/HP cont. day CL1	Next: Screen 3-2-4
5 LP/HP cont.night CL1	Next: Screen 3-2-5

1) Only shown when control loop is configured as LP controller.

- Menu 3-2-1 Control Type Control Loope 1

CL1-CONT POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
Control type →	Control type selection list CL1	→	Next: Screen 3-2-1-a			
Min.speed XXX %	Minimum speed of variable-speed compressor/fan with continuous control 1)	0 - 50	0	0	0	%
Adjust diff. XX	Speed controller adjusting speed (I action) 1)	-15 - 15	0	0	0	-
t-max SpeedC. XX °C	Max. temperature in CL1 with speed control (bypass actuation) 1)	-35 - 45	-8	-25	40	°C
Cycle time BLR XXX	Cycle time for base load rotation/fan protection CL1	5 - 720 or --	45	45	45	min
On time cond. X	Actuation mode: By run time (Y) or sequential actuation (N) in CL1 2)	↑ , ↓ (N/Y)	Y	Y	Y	-
Max. HR *CL1* XX °C	Max. temperature in heat recovery mode 2)	30 - 50	-	-	46	°C
HR dif. *CL1* XX K	Control hysteresis HR mode 2)	1 - 10	-	-	4	K

1) Only shown when CL control type is speed or combined controller - Screen 3-2-1-a.
2) Only shown when control loop is configured as HP controller.

- Screen 3-2-1-a Control type *CL1*

CONTROL POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
Step controller √	Select control type for CL1	√	√	√	√	-
Speed controller		√	-	-	-	-
Combi controller		√	-	-	-	-

- Menu 3-2-2 to adjustment *control loop 1*

to adjust. POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
to-Schiebung →	Select input quantity for to shift	→	See Screen 3-2-2-a			
Max.LoadLevel XXX %	Enter maximum load level for suction pressure shift	70..100	100	100	-	%
Max.LoadLevel XXX %	Enter minimum load level for suction pressure shift	10..60	50	50	-	%
Increment XX.X K	Enter increment for suction pressure shift	0,0..10,0	1,0	1,0	-	K
Interval XX m	Enter time interval for suction pressure shift	1..20	5	5	-	min

Only shown when control loop is configured as LP controller.

- Screen 3-2-2-a to adjustment *control loop 1*

to adjust. POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
none √	to shift deactivated	√	√	√	-	-
Room temp. √	to shift by room temperature		-	-	-	-
Consumer	to shift by refrigeration point		-	-	-	-

Screen is only shown when control loop is configured as LP controller.

- Menu 3-2-3 Load times CL1

LOAD TIMES POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
Bas. load time XXX s	Basic load time for compressor/fan stages in CL1	3 - 250	30	60	10	s
Vari.load time XXX s	Variable load time for compressor/fan stages in CL1	3 - 250	250	250	30	s
Bas. unlo.time XXX s	Basic unload time for compressor/fan stages in CL1	3 - 250	10	10	20	s
Vari.unlo.time XXX s	Variable unload time for compressor/fan stages in CL1	3 - 250	30	20	30	s

- Menu 3-2-4 LP/HP Control Day *Control Loop 1*

LP/HP-COND D POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
tx-Max. *CL1* XXX°C	t_0-/t_c setpoint for CL1; with setpoint shift activated: max. t_0-/t_c setpoint for setpoint shift CL1	-50 - 45	-12	-38	25	°C
tu - Min. XXX	min. tr-/ta for setpoint shift CL1 (only shown when setpoint shift activated menu 3-3-2-a)	-50..35	-16	-40	25	°C
tx - Min. XXX	min. t0-/tc setpoint for setpoint shift CL1 (only shown when setpoint shift activated menu 3-3-2-a)	0..20	15	38	0	°C
tu - Max. XXX	max. tr-/ta for setpoint shift CL1 (only shown when setpoint shift activated menu 3-3-2-a)	0..20	15	38	0	°C
Dead band XX °C	Control hysteresis	1 - 10	4	4	6	°C
Control const. XX °C	Max. control error for variable actuating times	1 - 10	10	7	10	°C
Feuchteschieb XXX	Humidity shift activated in CL1 (only shown when humidity recording activated, menu 3-1)	(N/Y)	N	N	N	-

- Menu 3-2-5 LP/HP Control Night *Control Loop 1*

LP/HP-COND N POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
tx-Max. *CL1* XXX°C	t_0-/t_c setpoint for CL1; with setpoint shift activated: max. t_0-/t_c setpoint for setpoint shift CL1	-50 - 45	-14	-38	25	°C
tu - Min. XXX	min. tr-/ta for setpoint shift CL1 (only shown when setpoint shift activated menu 3-3-2-a)	-50..35	-16	-40	25	°C
tx - Min. XXX	min. t0-/tc setpoint for setpoint shift CL1 (only shown when setpoint shift activated menu 3-3-2-a)	0..20	15	38	0	°C
tu - Max. XXX	max. tr-/ta for setpoint shift CL1 (only shown when setpoint shift activated menu 3-3-2-a)	0..20	15	38	0	°C
Dead band XX °C	Control hysteresis	1 - 10	4	4	6	°C
Control const. XX °C	Max. control error for variable actuating times	1 - 0	10	7	10	°C
Feuchteschieb XXX	Humidity shift activated in CL1 (only shown when humidity recording activated, menu 3-1)	(N/Y)	N	N	N	-

- Menu 3-3 Setpoints for CL2 Control

SETPOINTS POS: XXXXX	
1 Control type	Next: Screen 3-3-1
2 to adjustment CL2	Next: Screen 3-3-2
3 Load times CL2	Next: Screen 3-3-3
4 LP/HP cont. day CL2	Next: Screen 3-3-4
5 LP/HP cont.night CL2	Next: Screen 3-3-5

- Menu 3-3-1 Control Type Control Loop 2

CL2-COMP/COND POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
Contorl Type	→	Selection list for control type CL2	→	Next: Screen 3-3-1-a			
Min.speed	XXX %	Minimum speed of variable-speed condenser/fan with continuous control [1]	0 - 50	0	0	0	%
Adjust diff.	XX	Speed controller adjusting speed (I action) [1]	-15 - 15	0	0	0	-
t-max SpeedC.	XX °C	Max. temperature in CL2 with speed control (bypass actuation) [1]	-35 - 45	-8	-25	40	°C
Cycle time BLR	XXX	Cycle time for base load rotation/fan protection CL2	5 - 720 or --	45	45	45	min
On time cond.	X	Actuation mode: By run time (Y) or sequential actuation (N) in CL1 [2]	↑ , ↓ (N/Y)	Y	Y	Y	-
Max. HR *CL2*	XX °C	Max. temperature in heat recovery mode [2]	30 - 50	-	-	46	°C
HR dif. *CL2*	XX K	Control hysteresis HR mode [2]	1 - 10	-	-	4	K

[1] Only shown when CL control type is speed or combined controller - Screen 3-2-1-a.

[2] Only shown when control loop is configured as HP controller.

- Screen 3-3-1-a Control Type *Control Loop 2*

CONTROL POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
Step controller	√	Select control type in CL2	√	√	√	√	-
Speed controller			√	-	-	-	-
Combi controller			√	-	-	-	-

- Menu 3-3-2 to adjustment *control loop 2*

to adjust. POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
to-Schiebung →	Select input quantity for to shift	→	See Screen 3-3-2-a			
Max.LoadLevel XXX %	Enter maximum load level for suction pressure shift	70..100	100	100	-	%
Max.LoadLevel XXX %	Enter minimum load level for suction pressure shift	10..60	50	50	-	%
Increment XX.X K	Enter increment for suction pressure shift	0,0..10,0	1,0	1,0	-	K
Interval XX m	Enter time interval for suction pressure shift	1..20	5	5	-	min

Only shown when control loop is configured as LP controller.

- Screen 3-3-2-a to adjustment *control loop 1*

to adjust. POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
none √	to shift deactivated	√	√	√	-	-
Room temp. √	to shift by room temperature		-	-	-	-
Consumer	to shift by refrigeration point		-	-	-	-

Screen is only shown when control loop is configured as LP controller.

- Menu 3-3-3 Actuating Times *Control Loop 2*

LOAD-TIMES POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
Bas. load time XXX s	Basic load time for compressor/fan stages in CL2	3 - 250	30	60	10	s
Vari.load time XXX s	Variable load time for compressor/fan stages in CL2	3 - 250	250	250	30	s
Bas. unlo.time XXX s	Basic unload time for compressor/fan stages in CL2	3 - 250	10	10	20	s
Vari.unlo.time XXX s	Variable unload time for compressor/fan stages in CL2	3 - 250	30	20	30	s

- Menu 3-3-4 LP/HP Control Day *Control Loop 2*

HP-CONT D POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
tx - Max.	XXX °C	t_0-/t_c setpoint for CL2; when setpoint shift activated: max. t_0-/t_c setpoint for setpoint shift CL2	-50 - 45	-12	-38	25	°C
tu - Min.	XXX	min. tr-/ta for setpoint shift CL2 (only shown when setpoint shift activated menu 3-3-2-a)	-50..35	-16	-40	25	°C
tx - Min.	XXX	min. t0-/tc setpoint for setpoint shift CL1 (only shown when setpoint shift activated menu 3-3-2-a)	0..20	15	38	0	°C
tu - Max.	XXX	max. tr-/ta for setpoint shift CL2 (only shown when setpoint shift activated menu 3-3-2-a)	0..20	15	38	0	°C
Dead band	XX °C	Control hysteresis	1 - 10	4	4	6	°C
Control const.	XX °C	Max. control error vor variable actuating times	1 - 10	10	7	10	°C
Feuchteschieb	XXX	Humidity shift activated in CL2 (only shown when humidity recording activated, menu 3-1)	(N/Y)	N	N	N	-

- Menu 3-3-5 LP/HP Control Night *Control Loop 2*

LP/HP-CONT N POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
tx-Max.	XXX °C	t_0-/t_c setpoint for CL2; when setpoint shift activated: max. t_0-/t_c setpoint for setpoint shift CL2	-50 - 45	-10	-38	25	°C
tu - Min.	XXX	min. tr-/ta for setpoint shift CL2 (only shown when setpoint shift activated menu 3-3-2-a)	-50..35	-16	-40	25	°C
tx - Min.	XXX	min. t0-/tc setpoint for setpoint shift CL2 (only shown when setpoint shift activated menu 3-3-2-a)	0..20	15	38	0	°C
tu - Max.	XXX	max. tr-/ta for setpoint shift CL2 (only shown when setpoint shift activated menu 3-3-2-a)	0..20	15	38	0	°C
Dead band	XX °C	Control hysteresis	1 - 10	4	4	6	°C
Control const.	XX °C	Max. control error vor variable actuating times	1 - 10	10	7	10	°C
Feuchteschieb	XXX	Humidity shift activated in CL2 (only shown when humidity recording activated, menu 3-1)	(N/Y)	N	N	N	-

- Menu 3-4 Monitoring CL1/CL2

Monitoring POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
tx-Hi Warn. CL1	XXX °C	*High Pressure CL1* alarm is generated if temperature in CL1 rises above this level 1)	-30 - 55	0	-20	52	°C
tx-Hi Res. CL1	XXX °C	Reset *High Pressure CL1* alarm when temperature drops below this level 1)	-35 - 48	-5	-2	45	°C
tx-Lo CL1	XXX °C	*Low Pressure CL1* alarm is generated if temperature in CL1 rises above this level; when activated, compressors of CL1 are disabled at temperature below this level -> only with LP control	-50 - 20	-25	-46	10	°C
Del.to-Hi CL1	XXX m	*High Pressure CL1* alarm delay 1)	0 - 60	10	10	10	min
Del.to-Lo CL1	XXX m	*Low Pressure CL1* alarm delay	0 - 60	10	10	10	min
Min Diff.toCL1	XXX K	Minimum allowed difference to - tc 2)	5..15	---	---	-	K
Starts/h CL1	XX	Max. number of hourly compressor/fan stage starts in CL1; only with actuating mode by run time.	4 - 60	10	10	60	1/h
tx-Hi Warn. CL2	XXX °C	*High Pressure CL2* alarm is generated if temperature in CL2 rises above this level; when activated, compressors in CL1 can be disabled - only with combination of LP controller in CL1 and HP controller in CL2.	-30 - 55	0	-20	52	°C
tx-Hi Res. CL2	XXX °C	Reset *High Pressure CL2* alarm when temperature drops below this level; reset compressor disabling CL1	-35 - 48	-5	-2	45	°C
tx-Lo CL2	XXX °C	*Low Pressure CL2* alarm is generated if temperature in CL2 rises above this level; when activated, compressors of CL2 are disabled at temperature below this level -> only with LP control.	-50 - 20	-25	-46	10	°C
Del.to-Hi CL2	XXX m	*High Pressure CL2* alarm delay 1)	0 - 60	10	10	10	min
Del.to-Lo CL2	XXX m	*Low Pressure CL2* alarm delay	0 - 60	10	10	10	min
Starts/h CL2	XX	Max. number of hourly compressor/fan stage starts in CL2; only with actuating mode by run time.	4 - 60	10	10	60	1/h
Stg.tmax HP2.	XX m	No. of compressors running3) in CL at HP fault in CL2.	0..3)	-	-	3)	-

1) Only shown when control loop is configured as HP controller.

2) Only show when Control Loop 1 is configured as LP controller and Control Loop 2 as HP controller.

3) After changing compressor stages in CL1, this value is reset to the new default according to the table below. Only shown when CL1 is configured as LP controller (NT or LT) and RK2 as HP controller:

No. of compressor stages	Default No. of compressor stages at HP fault
1 - 2	1
3 - 5	2
6 - 7	3
8 - 10	4
11 - 12	5

- Menu 3-5 Inputs

INPUTS POS: XXXXX	
1 INPUT 1	Next: Screen 3-5-1
2 INPUT 2	Next: Screen 3-5-2
3 INPUT 3	Next: Screen 3-5-3
4 INPUT 4	Next: Screen 3-5-4

- Menu 3-5-1 INPUT 1

INPUT 1 POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
Time delay XX s	External alarm delay in seconds	0 - 60	0	0	0	s
Alarm message: XXXXXXXXXXXXXXXXXXXXXXXXX	Text displayed on occurrence of external alarm (through digital input 1): Default *Ext. Alarm I1*	Text	-	-	-	-
Function: ExtAlarm →	Function performed when digital input 1 is activated		Screen 3-5-1-a			
linked to: →	Enter control loop to receive function initiated through digital input 1		Screen 3-5-1-b			
Polarity X	Polarity of digital input 1 0: Low active (activated at signal voltage 0/cable break) 1: High active (activated at signal voltage = 230 V AC)	0 - 1	0	0	0	-

- Screen 3-5-1-a Function Digital Input 1

Function POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
OFF	Off	√	-	-	-	-
FastRet.	Initiate fast unload	√	-	-	-	-
LoadShed..	Initiate load shedding	√	-	-	-	-
SetpTog.	Initiate setpoint toggle	√	-	-	-	-
ExtAlarm √	Initiate alarm recording	√	√	√	√	-
HR	Initiate HR mode	√	-	-	-	-
Safetyl.	Safety loop: Initiate loop disable	√	-	-	-	-

- Screen 3-5-1-b Control Loop Allocation Digital Input 1

linked to: POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
CL1 √	Allocated to CL1	√	√	√	√	-
CL2	Allocated to CL2	√	-	-	-	-
All	Allocated to CL	√	-	-	-	-

- Menu 3-5-2 INPUT 2: See Screen 3-5-1
- Screen 3-5-2-a Function Digital Input 2: See Screen 3-5-1-a
- Screen 3-5-2-b Control Loop Allocation Digital Input 2: See Screen 3-5-1-b
- Menu 3-5-3 INPUT 3: See Screen 3-5-1
- Screen 3-5-3-a Function Digital Input 3: See Screen 3-5-1-a
- Screen 3-5-3-b Control Loop Allocation Digital Input 3: See Screen 3-5-1-b
- Menu 3-5-4 INPUT 4: See Screen 3-5-1
- Screen 3-5-4-a Function Digital Input 4: See Screen 3-5-1-a
- Screen 3-5-4-b Control Loop Allocation Digital Input 4: See Screen 3-5-1-b

- Menu 3-6 Alarms

MELDUNG POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
px high CL1	X	High pressure CL1 [1]	-, 0, 1, 2 [2]	2	2	2	-
px high CL2	X	High pressure CL2 [1]		2	2	2	-
px low CL1	X	Low pressure CL1		2	2	2	-
px low CL2	X	Low pressure CL2		2	2	2	-
Meas.err. px CL1	X	Pressure measuring loop error CL1		2	2	2	-
Meas.err. px CL2	X	Pressure measuring loop error CL2		2	2	2	-
Service Mode	X	Service mode activated		0	0	0	-
Load shed	X	Load shedding activated		0	0	0	-
Fast return	X	Fast unload activated		0	0	0	-
Setpoint changed	X	Setpoint changed		0	0	0	-
Config. changed	X	Controller configuration changed: LT, NT, HP		0	0	0	-
Ext. Messages E1	X	External alarm through digital input 1		2	2	2	-
Ext. Messages E2	X	External alarm through digital input 2		2	2	2	-
Ext. Messages E3	X	External alarm through digital input 3		2	2	2	-
Ext. Messages E4	X	External alarm through digital input 4		2	2	2	-
Senstype change	X	Sensor type changed		2	2	2	-
Power failure	X	Power failure/restart		1	1	1	-
First start	X	First start		2	2	2	-
Battery voltage	X	Battery low		2	2	2	-
Int.Error	X	Internal error		2	2	2	-
No UA300	X	No UA 300 found with refrigeration point control		2	2	-	-

[1] Only shown when CL is configured as HP controller.

[2]
- - Not recorded
- 0 Only entered in report list
- 1 Alarm priority 1
- 2 Alarm priority 2

- Menu 3-7 Parameter Backup

VS 300 POS: XXXXX		Entry
Save Parameters? Are you sure ? No: ESC Yes: ↵	Back up parameters: The VS 300 allows of saving a backup set of data that will be loaded instead of the default settings in occurrence of an internal error (inconsistency in parameter memory).	ESC, ↵

Parameter backup should be carried out following individual and successful parameter setting and system startup.

8.4.5 Menu 4 Clock

CLOCK POS: XXXXX		Entry	Default			
			NT	LT	HP	Dim.
Current time →	Show current date/time		Screen 4-a			
Setp.toggle CL1 XXX	Setpoint toggle external or by internal clock CL1	↑, ↓ (EXT, INT)	EXT	EXT	EXT	-
Toggle time CL1 →	Toggle times CL1; shown only with toggle by internal clock		Screen 4-b			
Setp.toggle CL2 XXX	Setpoint toggle external or by internal clock CL2	↑, ↓ (EXT, INT)	EXT	EXT	EXT	-
Toggle time CL2 →	Toggle times CL2; shown only with toggle by internal clock		Screen 4-c			

- Screen 4-a Current Time

CLOCK POS: XXXXX		Entry
Date: XX TT.MM.JJ	XX = current weekday, DD = day, MM: month, YY = year	-
Time:	Current time	-
Auto dayl. savg X	Adjust for automatic daylight saving changes	-

Date, time and adjustment for daylight saving change cannot be changed in this screen! Changes can only be made in main menu of operating terminal (Menu 9 Parameter Setting - 1 Date/Time).

- Screen 4-b Setpoint Toggle CL1

TOGGLE POS: XXXXX		Entry
dd hh:mm dd hh:mm	Enter up to 7 start/end times for 2nd setpoint ON in CL1 Start/End dd: Mon, Tue, Wed, Thu, Fri, Sat, Sun, Mon-Sun hh: Hour mm: Minute	↑, ↓, ↵
...		
dd hh:mm dd hh:mm		

- Screen 4-c Setpoint Toggle CL2

TOGGLE POS: XXXXX		Entry
dd hh:mm dd hh:mm	Enter up to 7 start/end times for 2nd setpoint ON in CL2 Start/End dd: Mon, Tue, Wed, Thu, Fri, Sat, Sun, Mon-Sun hh: Hour mm: Minute	↑, ↓, ↵
...		
dd hh:mm dd hh:mm		

8.4.6 Menu 5 Alarms

MESSAGE POS: XXXXX	
1 Display	Next: Screen 5-1
2 Delete	Next: Screen 5-2

- Menu 5-1 Show

MESSAGE POS: XXXXX		Entry
XXXXXXXXXXXXXXXXXXXXXXXXXXXX dd.mm.yy hh:mm EIN/AUS	Show alarm text with date and time ON/OFF: Alarm active / Alarm no longer active	↑, ↓

- Menu 5-2 Delete

MESSAGE POS: XXXXX		Entry
Delete ! Are you sure ? No: ESC Yes: ↵	Safety prompt for deleting alarms	ESC, ↵

8.4.7 Menu 6 Operating Data

OP DATA POS: XXXXX	
1 On time CL1	Next: Screen 6-1
2 On time CL2	Next: Screen 6-2
3 History CL1	Next: Screen 6-3
4 History CL2	Next: Screen 6-4
5 Clear Archive	Next: Screen 6-5

- Screen 6-1 Run Times CL1

OP DATA POS: XXXXX		Entry
On time S 1 XXXXX h	Show operating hours for compressor/fan stage 1 [1)]	↵, number
...		
On time S 12 XXXXX h	Show operating hours for compressor/fan stage 12 [1)]	↵, number

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-2 Run Times CL2

OP DATA POS: XXXXX			Entry
On time S 1	XXXXX h	Show operating hours for compressor/fan stage 1 [1)]	↵, Number
...			
On time S 12	XXXXX h	Show operating hours for compressor/fan stage 12 [1)]	↵, Number

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-3 Daily Operating Data CL1

HISTORY CL1 POS: XXXXX	
1 Run times	Next: Screen 6-3-1
2 Run times D	Next: Screen 6-3-2
3 Run times N	Next: Screen 6-3-3
4 Starts	Next: Screen 6-3-4
5 Starts D	Next: Screen 6-3-5
6 Starts N	Next: Screen 6-3-6
7 Activity	Next: Screen 6-3-7
8 Activity D	Next: Screen 6-3-8
9 Activity N	Next: Screen 6-3-9

- Menu 6-3-1 Run Times

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	↑, ↓
R.time CL1	→	Next: Screen 6-3-1-a	→
	↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-3-1-a Run Times CL1 Total

R.time CL1 POS: XXXXX			Entry
Stage 1	hh.mm	Show run times for compressor/fan stage 1 [1)]	↑, ↓
...			
Stage 12	hh.mm	Show run times for compressor/fan stage 12 [1)]	↑, ↓

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-3-2 Run Times Day

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	↑, ↓
R.time CL1 D	→	Next: Screen 6-3-2-a	→
	↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-3-2-a Run Times CL1 Day (1st Setpoint)

R.times CL1 D POS: XXXXX			Entry
Stage 1	hh.mm	Show run times for compressor/fan stage 1 [1)]	↑, ↓
...			
Stage 12	hh.mm	Show run times for compressor/fan stage 12 [1)]	↑, ↓

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-3-3 Run Times Night

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	↑, ↓
R.times CL1 N	→	Next: Screen 6-3-3-a	→
	↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-3-3-a Run Times CL1 Night (2nd Setpoint)

R.times CL1 N POS: XXXXX			Entry
Stage 1	hh.mm	Show run times for compressor/fan stage 1 [1)]	↑, ↓
...			
Stage 12	hh.mm	Show run times for compressor/fan stage 12 [1)]	↑, ↓

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-3-4 Starts

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	↑, ↓
Starts CL1	→	Next: Screen 6-3-4-a	→
	↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-3-4-a Starts CL1

Starts CL1 POS: XXXXX			Entry
Stage 1	hh.mm	Daily starts compressor/fan stage 1 [1)]	↑, ↓
...			
Stage 12	hh.mm	Daily starts compressor/fan stage 12 [1)]	↑, ↓

1) Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-3-5 Starts Day

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	↑, ↓
Starts CL1 D	→	Next: Screen 6-3-5-a	→
	↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-3-5-a Starts CL1 Day

Starts CL1 D POS: XXXXX			Entry
Stage 1	hh.mm	Daily starts compressor/fan stage 1 [1)]	↑, ↓
...			
Stage 12	hh.mm	Daily starts compressor/fan stage 12 [1)]	↑, ↓

1) Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-3-6 Starts Night

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	↑, ↓
Starts CL1 N	→	Next: Screen 6-3-6-a	→
	↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-3-6-a Starts CL1 Night

Imp CL1 N POS: XXXXX		Entry
Stage 1 hh.mm	Daily starts compressor/fan stage 1 [1)]	↑, ↓
...		
Stage 12 hh.mm	Daily starts compressor/fan stage 12 [1)]	↑, ↓

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-3-7 Activity

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	↑, ↓
Activity CL1 XX %	Activity in % (utilization of compressor pack/condenser)	
↓	Select date by ↑ ↓ , max. 31 days past	

- Menu 6-3-8 Activity Day

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	↑, ↓
Activity CL1 XX %	Activity in % (utilization of compressor pack/condenser)	
↓	Select date by ↑ ↓ , max. 31 days past	

- Menu 6-3-9 Activity Night

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	↑, ↓
Activity CL1 XX %	Activity in % (utilization of compressor pack/condenser)	
↓	Select date by ↑ ↓ , max. 31 days past	

- Menu 6-4 Daily Operating Data CL2

HISTORY CL2 POS: XXXXX	
1 Run times	Next: Screen 6-4-1
2 Run times D	Next: Screen 6-4-2
3 Run times N	Next: Screen 6-4-3
4 Starts	Next: Screen 6-4-4
5 Starts D	Next: Screen 6-4-5
6 Starts N	Next: Screen 6-4-6
7 Activity	Next: Screen 6-4-7
8 Activity D	Next: Screen 6-4-8
9 Activity N	Next: Screen 6-4-9

- Menu 6-4-1 Run Times

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	↑, ↓
R.time CL2 →	Next: Screen 6-4-1-a	→
↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-4-1-a Run Times CL2 Total

R.time CL2 POS: XXXXX		Entry
Stage 1 hh.mm	Show run times for compressor/fan stage 1 [1)]	↑, ↓
...		
Stage 12 hh.mm	Show run times for compressor/fan stage 12 [1)]	↑, ↓

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-4-2 Run Times Day

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	↑, ↓
R.time CL2 D →	Next: Screen 6-4-2-a	→
↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-4-2-a Run Times CL2 Day (1st Setpoint)

R.times CL2 D POS: XXXXX		Entry
Stage 1 hh.mm	Show run times for compressor/fan stage 1 [1)]	↑, ↓
...		
Stage 12 hh.mm	Show run times for compressor/fan stage 12 [1)]	↑, ↓

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-4-3 Run Times Night

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	↑, ↓
R.times CL2 N →	Next: Screen 6-4-3-a	→
↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-4-3-a Run Times CL2 Night (2nd Setpoint)

R.times CL2 N POS: XXXXX		Entry
Stage 1 hh.mm	Show run times for compressor/fan stage 1 [1)]	↑, ↓
...		
Stage 12 hh.mm	Show run times for compressor/fan stage 12 [1)]	↑, ↓

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-3-4 Starts

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	↑, ↓
Starts CL2	→	Next: Screen 6-3-4-a	→
	↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-4-4-a Starts CL2

Starts CL2 POS: XXXXX			Entry
Stage 1	hh.mm	Daily starts compressor/fan stage 1 [1)]	↑, ↓
...			
Stage 12	hh.mm	Daily starts compressor/fan stage 12 [1)]	↑, ↓

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-4-5 Starts Day

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	↑, ↓
Starts CL2 D	→	Next: Screen 6-4-5-a	→
	↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-4-5-a Starts CL2 Day

Starts CL2 D POS: XXXXX			Entry
Stage 1	hh.mm	Daily starts compressor/fan stage 1 [1)]	↑, ↓
...			
Stage 12	hh.mm	Daily starts compressor/fan stage 12 [1)]	↑, ↓

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-4-6 Starts Night

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	↑, ↓
Starts CL2 N	→	Next: Screen 6-4-6-a	→
	↓	Select date by ↑ ↓ , max. 31 days past	↑, ↓

- Screen 6-4-6-a Starts CL2 Night

Imp CL2 N POS: XXXXX		Entry
Stage 1 hh.mm	Daily starts compressor/fan stage 1 [1)]	↑, ↓
...		
Stage 12 hh.mm	Daily starts compressor/fan stage 12 [1)]	↑, ↓

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 6-4-7 Activity

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	↑, ↓
Activity CL2 XX %	Activity in % (utilization of compressor pack/condenser)	
↓	Select date by ↑ ↓ , max. 31 days past	

- Menu 6-4-8 Activity Day

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	↑, ↓
Activity CL2 XX %	Activity in % (utilization of compressor pack/condenser)	
↓	Select date by ↑ ↓ , max. 31 days past	

- Menu 6-4-9 Activity Night

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	↑, ↓
Activity CL2 XX %	Activity in % (utilization of compressor pack/condenser)	
↓	Select date by ↑ ↓ , max. 31 days past	

- Menu 6-5 Delete Archives

VS 300 POS: XXXXX		Entry
Clear Archives? Are you sure ? No: ESC Yes: ↵	Safety prompt for deleting archives	ESC, ↵

8.4.8 Menu 7 Basic Settings

VS 300 POS: XXXXX		Entry
Load default Are you sure ? No: ESC Yes: ↵	Safety prompt for loading basic settings	ESC, ↵

8.4.9 Menu 8 Service Mode

SERVICE POS: XXXXX	
1 Analog Values	Next: Screen 8-1
2 Compressor/Cond. fan CL1	Next: Screen 8-2
3 Compressor/Cond. fan CL2	Next: Screen 8-3
4 System	Next: Screen 8-4

- Menu 8-1 Analog Values

SERVICE POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
AnalogOut1	XX.XV	Voltage at analog output 1	↑, ↓ (0,0 - 10,0)	0.0	0.0	0.0	V
AnalogOut2	XX.XV	Voltage at analog output 2	↑, ↓ (0,0 - 10,0)	0.0	0.0	0.0	V

- Menu 8-2 Compressors/Fans CL1

SERVICE POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
Stage 1	XXX	Actuating state compressor/fan stage 1 [1)]	↑, ↓ (ON/OFF)	OFF	OFF	OFF	-
...							
Stage 12	XXX	Actuating state compressor/fan stage 12 [1)]	↑, ↓ (ON/OFF)	OFF	OFF	OFF	-

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 8-3 Compressors/Fans CL2

SERVICE POS: XXXXX			Entry	Default			
				NT	LT	HP	Dim.
Stage 1	XXX	Actuating state compressor/fan stage 1 [1)]	↑, ↓ (ON/OFF)	OFF	OFF	OFF	-
...							
Stage 12	XXX	Actuating state compressor/fan stage 12 [1)]	↑, ↓ (ON/OFF)	OFF	OFF	OFF	-

[1)] Number of relay/control stages CL1 [1..n] + Number of relays CL2 [n+1..m] + Number internal alarm relais <= Number of relay/control stages VS 300 (max. 4, 8, 12 depending on expansion stage and configuration); see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

- Menu 8-4 System

SERVICE POS: XXXXX			Enry	Default			
				NT	LT	HP	Dim.
Alarm-Output 3/7/11[1)]	XXX	Actuating state alarm output 1 3/7/11 [1)]	↑, ↓ (ON/OFF)	OFF	OFF	OFF	-
Alarm-Output 4/8/12[1)]	XXX	Actuating state alarm output 2 4/8/12 [1)]	↑, ↓ (ON/OFF)	OFF	OFF	OFF	-

This screen is only displayed when the VS 300 is configured with an internal alarm relay (1 or 2)!

[1)] see section 4.1.1 System Configuration - Allocation of Relay/Control Stages

Notice:

9 Decommissioning and disposal

9.1 Decommissioning / Demounting

The disassembly of the equipment is only to be carried out by trained and authorised personnel.

Warning - hazardous electrical voltage!
Danger of electric shock! During disassembly the same safety instructions and hazard warnings are to be observed as in the case of installation, commissioning and maintenance,
see chapter 1, ”Industrial safety notes”.

During disassembly the reverse procedure is to be observed as that during assembly,
see chapter ”Installation and Startup”.

9.2 Disposal

The scope of our delivery is designated as a component exclusively for further processing.

As a consequence of this fact, Eckelmann AG does not undertake any measures for the taking back or municipal recycling of this product as it is not supplied directly to the free market.

Never dispose of this product with other household waste. Please inform yourself of the local regulations for the separate disposal of electrical and electronic products. The correct disposal of your old equipment will protect people and the environment from possible negative effects.

The provisions and regulations for the disposal of the equipment are to be observed.
In accordance with the contractual agreement, the customer is beholden to dispose of electrical and electronic waste in compliance with the statutory regulations based on the Directive 2002/96/EC on waste electrical and electronic equipment.

Notice:

10 Alarms and Messages of VS 300

10.1 Reporting system

A number of report conditions are detected by the system and are saved to the system's internal report memory with date, time and priority. *Receive/send time stamps* are entered in the report memory. Time resolution is 1 second.

Messages/alarms are logged in the report memory in the order of their occurrence. The report memory has a capacity of 100 log entries. When the memory is full, the newest message/alarm overwrites the oldest entry (ring buffer).

Battery backup ensures that messages/alarms stored in the report memory are preserved in a power failure.

Messages/alarms stored in report memory can be accessed on the integral user interface or – when the CAN bus add-on module is installed - on a connected AL 300 Operator Terminal or CI 3000 Store Computer. The most recent message/alarm is displayed first.

Contents of the report memory can be deleted either on the integral user interface or a connected external terminal. When the CAN bus add-on module is installed, messages/alarms can be transmitted via the CAN bus to display the current message/alarm in real language. If the system contains a CI 3000 Store Computer, a central fault report memory will be created on this computer for messages/alarms received from all controllers for the complete refrigeration installation.

10.2 Message / alarm structure

Messages/alarms are shown both as message/alarm codes on the four-digit seven-segment LED display of VS 300 integral user interface and in real language on the display of the external AL 300 Operator Terminal or CI 3000 Store Computer when connected.

Messages/alarms in the VS 300 consist of message/alarm code, message/alarm status, date and time. On a connected external terminal the device name, alarm priority, CAN bus address and real-language text specific to the event are displayed together with alarm number, date and time.

Four alarm priorities are used:

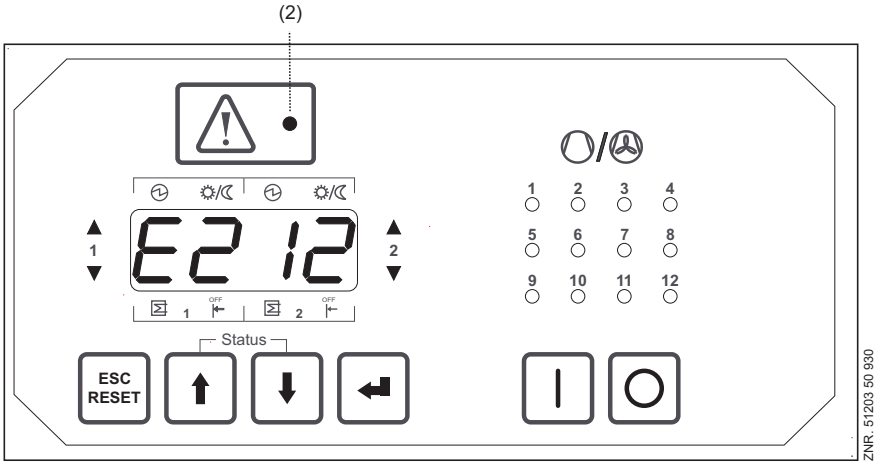
- No entry in message/alarm list

0 Entered in message/alarm list without forwarding to higher-level system components

1 Entered in message/alarm list and forwarded to higher-level system components with Priority 1 (Priority 1 alarm relay operates, when installed)

2 Entered in message/alarm list and forwarded to higher-level system components with Priority 2 (Priority 2 alarm relay operates, when installed)

10.3 Messages / alarms in the VS 300



Message/alarm code shown on display - process fault report *E212* in this example

These message/alarm codes can be displayed in more detail by opening Parameter List F on the integral user interface. Faults and messages/alarms occurring are displayed in two ways:

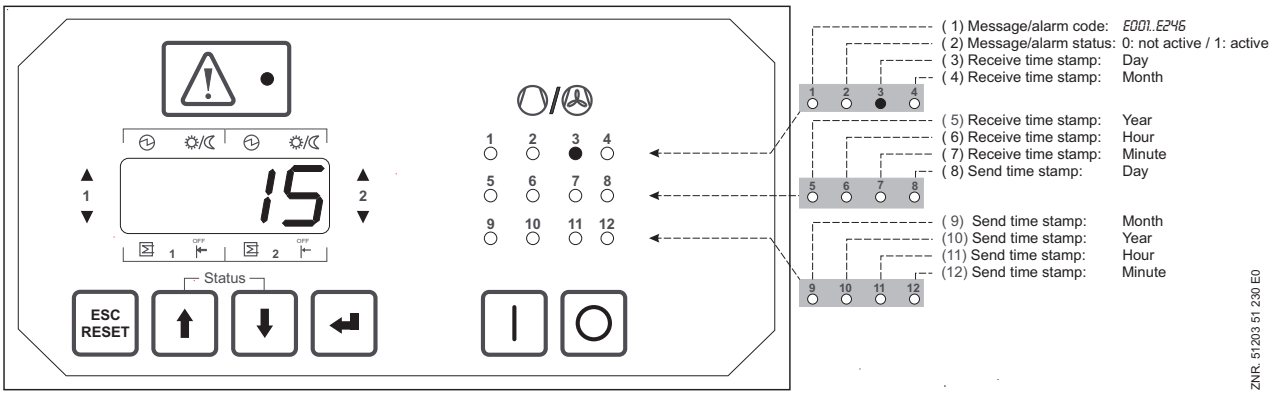
1. **In basic display mode:** The respectively most recent message is indicated in basic display mode by its associate fault code (*E001 – E246*, see section NO TAG Process Fault Reports or System Fault Reports for details). The alarm/message LED flashes. Pressing the ESC/RESET key quit the display and returns to displaying control loop actual temperature. When the message is no longer current or when no more faults are effective, press the ESC/RESET (longer than 5 sec.) to cancel the message and delete it from the fault report memory.
2. **In message display mode:** From Parameter List F you can change to message display mode. On pressing the ↵ key while in Parameter List F, *F001* is displayed if a message is current, meaning not yet cancelled. This indicates the most recent message. Use the ↑ key to move to the preceding messages (*F002* to max. *F100*). If no messages exist, '- - - -' is shown on the display.

Messages/alarms that are still active are shown flashing to distinguish them from inactive messages/ alarms.

Pressing the ↵ key again in message/alarm display mode (*F002* - max. *F100*) displays details for the selected message/alarm. Message/alarm details consist of the message/alarm code (*E001 - E246*, see section 8 Process Fault Reports and System Fault Reports for details), message/alarm status (*0* or *1*), incoming time stamp (date-year-time) and outgoing time stamp (date-year-time).

These message/alarm details can be interrogated with the ↑ and ↓ keys. The relay/control stage status LEDs indicate which message/alarm detail is currently displayed. For example, the day date (15th) of the incoming time stamp is shown in the illustration above.

Status LED (see illustration on previous page)	Message/alarm details displayed	
1	Message/alarm code:	E001...E246 For details see section 8.3 Message/Alarm Types or section 7 Parameter List and Menu Structure - Parameter List F
2	Message/alarm status:	0: Message/alarm not active / 1: Message/alarm active
3 4 5 6 7	Receive time stamp:	Day Month Year Hour Minute
8 9 10 11 12	Send time stamp:	Day Month Year Hour Minute

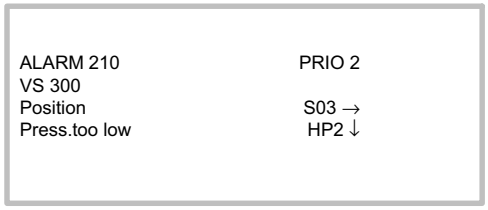


Value shown on display identified by relay/control stage status LEDs

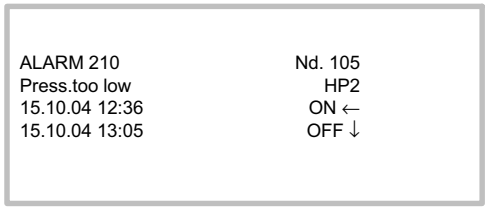
Items 8 - 12 are not displayed when the message/alarm status is 1 (active)!

10.4 Messages / alarms AL 300 Operator Terminal or CI 3000 Store Computer

Messages/alarms are shown on the four-line display of an external terminal (AL 300 Operator Terminal and CI 3000 Store Computer) as follows:



Pressing the → key on the AL 300 Operator Terminal or CI 3000 Store Computer (see section 7.14 Operation with External Terminal) opens the following submenu:



The following table explains the four-line display in the above example:

Display line	Display readout	Explanation
1	`ALARM 210 Nd.105`	Alarm number and CAN bus address of VS 300
2	`Press.too low HP2`	Low pressure in CL2 (HP2 in example)
3	`15.10.04 12:36 ON ←`	Date and time of message/alarm (incoming time stamp)
4	`15.10.04 13:05 OFF ↓`	Date and time of message/alarm (outgoing time stamp)

The outgoing time stamp (Line 4) is only shown when the message/alarm is no longer active!

See section 7 Parameter List and Menu Structure for detailed information on the menu structure of the AL 300 Operator Terminal or CI 3000 Store Computer.

10.5 Message / alarm types

The following messages/alarms are recorded by the VS 300 controller and saved to the report memory:

- Process fault reports
- System fault reports

Different terms may be used in the menus and screens depending on type, scope and configuration of the system. These terms are shown in *italics* in the two tables that follow.

Example: `Fast Unlo.` *`CL1/2`*

- `Fast unlo.` Stands for fast unload
- *`CL`* Stands for either NT = normal-temperature refrigeration, LT = low-temperature refrigeration **or** HP = high pressure
- *`1/2`* Stands for Control Loop 1 **or** Control Loop 2

10.6 System fault reports

RAM error is a fatal error and causes the VS 300 Pack Controller to go into fault status, as correct running of the program is then no longer likely. The watchdog attempts to reset the controller and force a restart. The controller will not start if the RAM error is permanent.

Message/alarm No. LED display VS 300	**Display text AL 300 or CI 3000**	**System fault report**
E000	Internal error	Internal error
E004	EEPROM error	EEPROM parameter memory defective - not responding
E005	EEPROM checks.	Faulty EEPROM content (checksum)
E008	RTC error	Internal clock defective
E009	I/O module error	Internal bus system fault
E010	Battery voltage	Internal battery low
E050	First start	First start with default parameters
E051	Power failure	Restart following power failure

10.7 Process fault reports

Message/alarm No. LED Display VS 300	**Display text AL 300 or CI 3000**	**System fault report**
E180	Service mode	Service mode active
E181	Fast return *CL1/2*	Fast unload active in Control Loop 1 or 2
E182	Load shed *CL1/2*	Load shedding active in Control Loop 1 or 2
E203	Sens.type change	Pressure sensor parameter changed
E207	Press.too high HP1	High pressure in Control Loop 1; (LT1, NT1 or HP1)
E208	Press.too high HP2	High pressure in Control Loop 2; (LT2, NT2 or HP2)
E209	Press.too low *CL1*	Low pressure in Control Loop 1 (LT1, NT1 oder HP1)
E210	Press.too low *CL2*	Low pressure in Control Loop 2 (LT2, NT2 oder HP2)
E211	Meas.err. *CL1*	Pressure sensor measuring loop Control Loop 1
E212	Meas.err. *CL2*	Pressure sensor measuring loop Control Loop 2
E222	No Load Level CL1	No Load Level in Control loop 1
E223	No Load Level CL2	No Load Level in Control loop 2
E224	No UA 300	No UA 300 found with refrigeration point control
E240	Setpoint changed	Setpoint changed
E241	config. changed	Controller configuration changed: LTLT, LTNT, LTHP, NTNT, NTHP, HPHP, NTLT
E243	Ext. Message E1	Digital alarm input 1 active
E244	Ext. Message E2	Digital alarm input 2 active
E245	Ext. Message E3	Digital alarm input 3 active
E246	Ext. Message E4	Digital alarm input 4 active

Notice:

11 Specifications of VS 300

11.1 Electrical data

Overvoltage category III / pollution degree 2:
All device connections designed for use with 230 V AC supply voltage **must** be connected to the same phase conductor.
400 V AC between neighbouring connection terminals is **not** permitted!

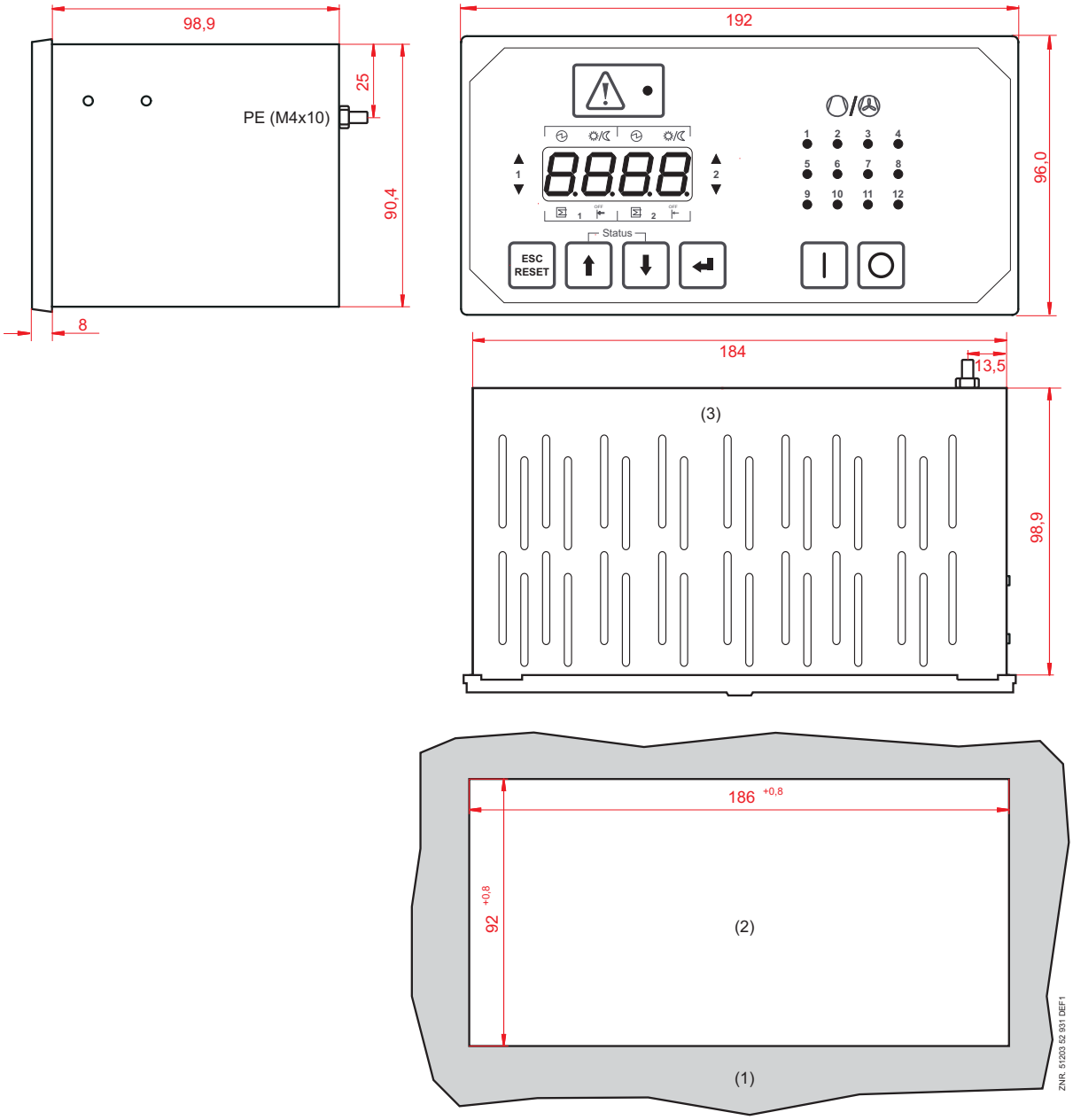
Overvoltage category II / pollution degree 2 or
Overvoltage category II / pollution degree 1:
Different phase conductors may be used.
400 V AC between neighbouring connection terminals is permitted!

	VS 300
Power supply	230 V AC, 50/60 Hz
Rated power	10 VA
Digital inputs	4 x 230 V AC
Relay outputs	Per expansion stage 4/8/12 x 230 V AC / 2,5 A, changeover relays, floating
Analog inputs 1)	2x pressure transducers 4..20 mA  Inputs not shortcircuit-proof!
Analog outputs 1)	2 x 0..10 V (Leads to analog inputs must be screened.)
External device switch	1 x 230 V AC / 5 A (ohmic load), N.O. single-pole, floating
Fieldbus port	CAN bus, floating
Data ports	TTY (passive)
Archive memory	Compressor run times, starts, activity, messages/alarms
Monitoring function	Watchdog
Real-time clock	Battery-backed, Lithium cell, typically 12 min./yr at 25°C
Temperature range	Transport: -20 °C ... +80 °C Operation: 0 °C ... +50 °C
Temperature change	Transport: max. 20 K/h Operation: max. 10 K/h
Relative humidity (non-condensing)	Transport: 8 % ... 80 % Operation: 20 % ... 80 %
Atmospheric pressure	Transport: 660 hPa ... 1060 hPa Operation: 0 °C ... +50 °C
Shock to DIN EN 60068-2-27	Transport and operation: 30 g
Vibration 10-150 Hz to DIN EN 60082-2-6	Transport and operation: 2 g

	VS 300
Weight	4 Relay 970 g (without CAN bus) 8 Relay 1110 g (with CAN bus) 12 Relay 1220 g (with CAN bus)
Enclosure	IP20
CE conformity	- 2014/35/EU (Low Voltage Directive); Official Journal of the EU L96, 29/03/2014, p. 357-374 - 2014/30/EU (EMC Directive); Official Journal of the EU L96, 29/03/2014, p 79-106 - 2011/65/EU (RoHS Directive); Official Journal of the EU L96, 01/07/2011, p. 88-110

1) Leads to analog inputs must be screene.

11.2 Mechanical data



(1) Control panel (2) Installation cutout (3) Air circulation clearance

Notice:

12 Order No.'s and accessories of VS 300

12.1 VS 300 Compact pack controller

Type	Description	Order number
VS 300 - 4 relay	Compact pack controller with 4 relay outputs stand alone (without CAN bus)	EVS300A001
VS 300 - 8 relay	Compact pack controller with 8 relay outputs and CAN bus module	EVS300A003
VS 300 - 12 relay	Compact pack controller with 12 relay outputs and CAN bus module	EVS300A004

12.2 Components for VS 300

Component	Description	Order number
NP-pressure transmitter	LP-pressure transmitter 0..10 bar	KGLZDRUCK3
HP-pressure transmitter	HP-pressure transmitter 1..26 bar	KGLZDRUCK4
HP-pressure transmitter	HP-pressure transmitter 1..61 bar	KGLZDRUCK5
Adapter for DIN rail	Adapter for DIN rail mounting	KGLZVSDIN1
TTY Interface adpater	TTY interface adapter for firmware update and parameterisation via PC software LDSWin	EAGTTYR232

Notice: