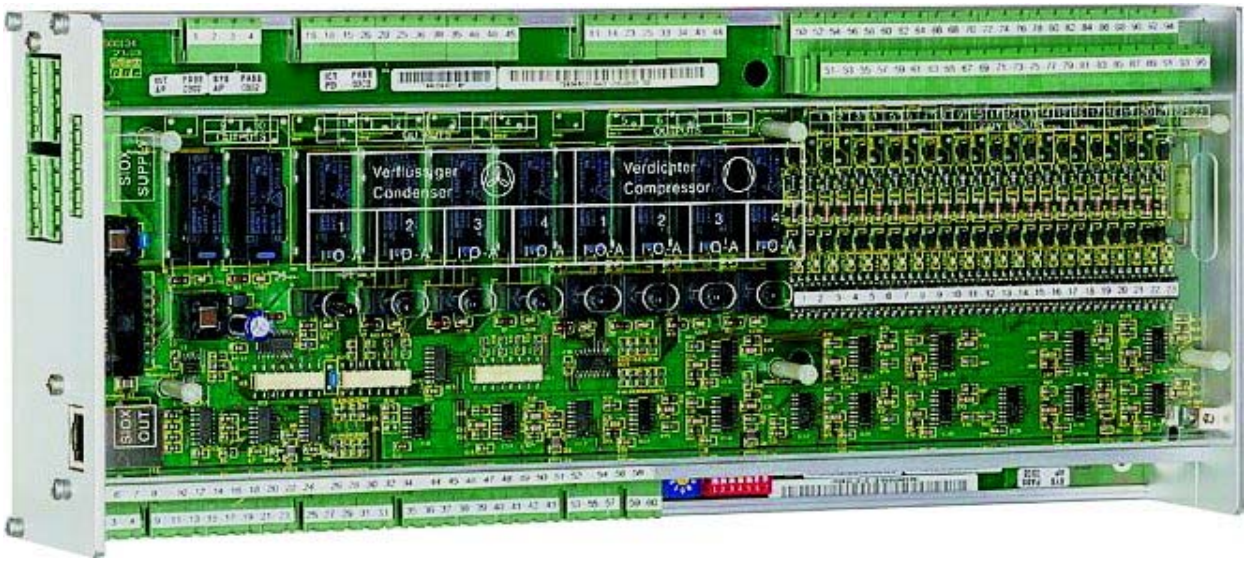
VS 3000 BS Pack Controller Firmware V2.22

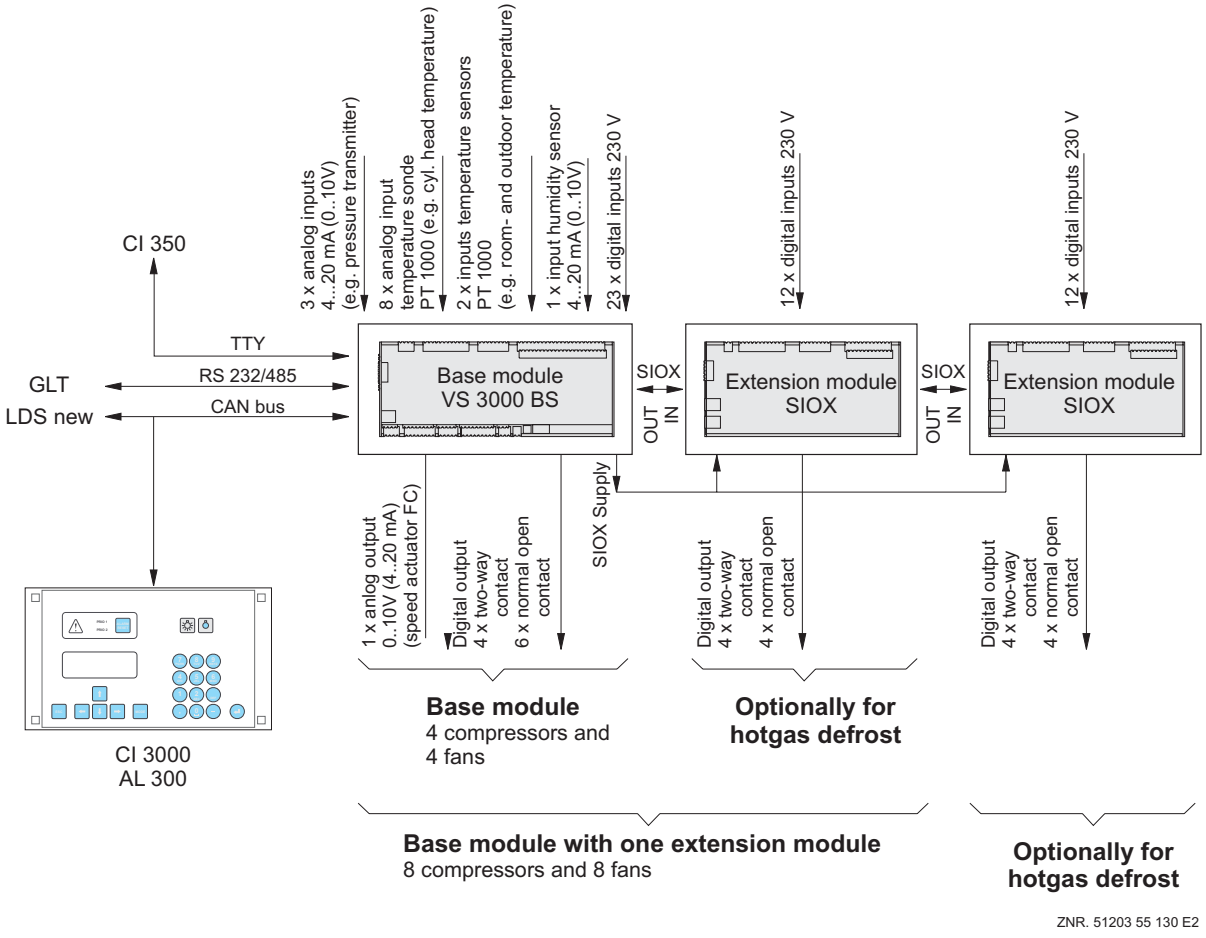


1 System Design of VS 3000 BS

The basic module of the VS 3000 BS (Booster/Satellite) Pack Controller consists of:

- One analog module
- One SIOX expansion module (digital I/O module)

The controller is of modular design and can be upgraded to a maximum of two SIOX extension modules (see illustration below). The following expansion stages are available:



See Section 5 - Pin and Terminal Assignments for electrical connections of the VS 3000 BS Pack Controller.

Basic version:

Digital inputs/outputs

23 inputs 230 V

10 outputs 230 V - Relay outputs

Analog inputs/outputs

8 inputs PT1000 - Connection for PT1000 temperature sensors (cylinder head temperature sensors)

2 inputs PT1000 - Connection for PT1000 temperature sensors (room and outdoor temperature sensors)

3 inputs / 4-20 mA (0-10 V) - Connection for pressure transducers

1 input / 4-20 mA (0-10 V) - Connection for humidity sensor

1 output / 0-10 V (0-20 mA) - Connection for speed adjuster for continuous fan control

SIOX Supply - Power supply for SIOX extension module

Ports:

CAN bus:	Communication within new LDS System
TTY:	Communication within earlier LDS System
RS232:	Communication between LDS System and building control system, connection for firmware update
RS485:	Connection for building control system (BCS)
SIOX OUT:	Connection for data transfer to SIOX extension modules

2 Application of VS 3000 BS

Functions provided in the VS 3000 BS Pack Controller for refrigeration compressor packs and condensers are as follows:

- Control
- Regulation
- Fault reporting
- Fault archiving
- Monitoring
- Archiving

These functions are as follows:

Compressor control for two temperature ranges equipped with maximum
4 compressors each with 2 capacity stages or
2 compressors each with 3 capacity stages or
8 stand-alone compressors without capacity control in booster or satellite operation

Low-pressure control/compressor control:
- Step controller

Base load rotation

Compressor monitoring

Load shedding

High-pressure control/fan control
- Step controller
- Speed controller

Base load rotation/Fan overload protection

Data archiving
- Messages
- Starts
- Run times
- Activity/Utilization

Liquid level monitoring

Monitoring

- Motor overload cutout (fans)
- Motor overload cutout (compressors)
- Bursting disk
- Low oil pressure cutout
- Cylinder head temperature
- High pressure
- Low pressure
- Refrigerant level
- External alarm

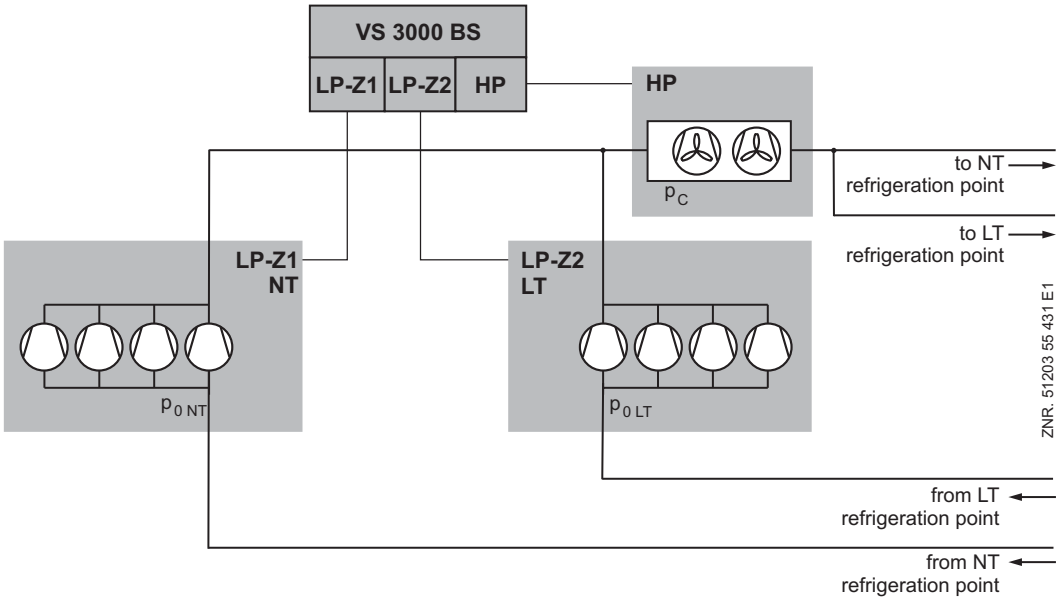
Discharge gas defrosting

- Two-pipe discharge gas defrosting D2D

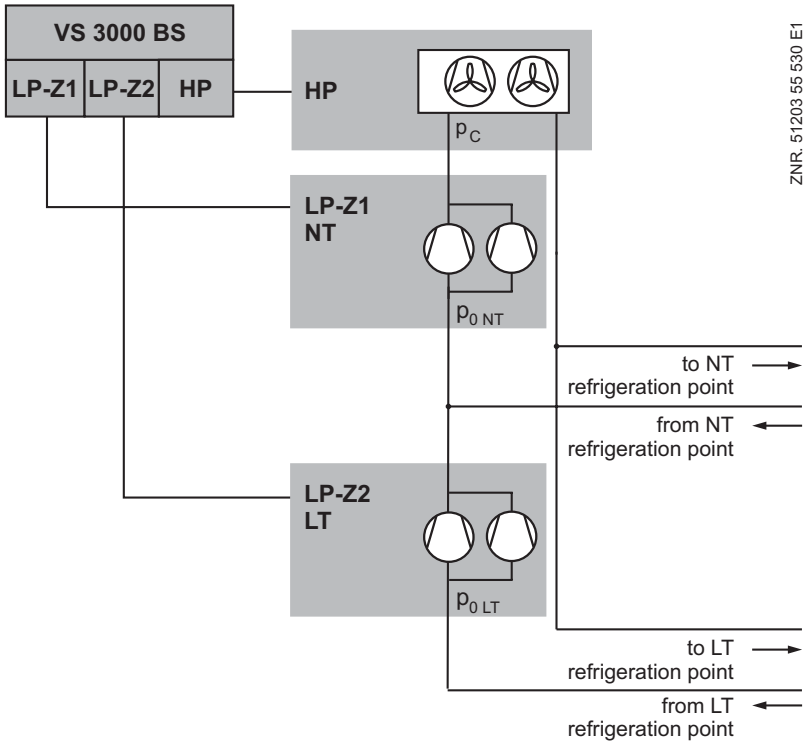
2.1 System extension options

The following diagrams show typical applications of the VS 3000 BS Pack Controller. Depending on the extension stage, control can be provided for either 4 or maximum 8 relay/control stages for compressor stages or condenser stages (see Section 1 - System Design):

Satellite operation - with common condenser



Controller for booster operation - with common condenser



Notice:

3 Function of VS 3000 BS

3.1 System configuration

The VS 3000 BS Pack Controller contains two low-pressure control loops (LP, compressor control) and one high-pressure control loop (HP, condenser control). Two different temperature ranges are provided for compressor control; see also Section 2 - Application).

As standard, the Z1 temperature range is operated in the normal-temperature (NT) range and Z2 in the low-temperature (LT) range. However, Z2 can also be operated in the NT range, enabling the controller to control two NT loops.

Compressor control largely covers the following control and regulating functions:

Low-pressure control (LP, compressor control) for single-circuit systems

- Low-pressure control (LP, compressor control) for single-circuit systems, normal-temperature (NT) and low-temperature (LT) ranges
- Load shedding
- Base load rotation
- Compressor monitoring
- Safety loop
- Two-pipe discharge gas defrosting D2D

High-pressure control (HP, condenser control) for single-circuit systems

3.2 Low-pressure control / Compressor control

The purpose of low-pressure control is to maintain pressure on the low (suction) side of the system at a defined setpoint. The VS 3000 BS provides the following control method for this purpose:

- Step controller
  - Control by loading and unloading compressor stages or compressor capacity stages

The setpoint for the Z1 and Z2 temperature ranges is defined as a function of room (ambient) temperature. Actual values are detected by two pressure transducers, one for each temperature range, with continuous current output (4 to 20 mA) or voltage output (0 to 10 V).

3.2.1 Setting parameters for LP sensor characteristic

The VS 3000 BS Pack Controller works with linear-characteristic continuous pressure transducers. The pressure inputs can be matched to various transducers with linear characteristic. Transducers with either current output (4 to 20 mA) or voltage output (0 to 10 V) may be used.

Jumpers must be changed accordingly on the controller for voltage-output transducers!
The default configuration is for current inputs!

The following parameters (Menu 3-1-a) are used to match the controller to the pressure transducer:

1. *Z1 sensor*
   - The Z1 sensor must be selected for either continuous current output 4 to 20 mA or continuous voltage output 0 to 10 V.
2. *Z2 sensor*
   - The Z2 sensor must be selected for either continuous current output 4 to 20 mA or continuous voltage output 0 to 10 V.
3. On the VS 3000 BS, the sensor characteristic parameters for the Z1and Z2 temperature ranges are entered separately.

p_0-Z1 4 mA / p_0-Z1 0 V	Pressure at 4 mA or 0 V at output of Z1 pressure sensor Z1
p_0-Z1 20 mA / p_0-Z1 10 V	Pressure at 20 mA or 10 V at output of Z1 pressure sensor Z1
p_0-Z2 4 mA / p_0-Z2 0 V	Pressure at 4 mA or 0 V at output of Z1 pressure sensor Z2
p_0-Z2 20 mA / p_0-Z2 10 V	Pressure at 20 mA or 10 V at output of Z1 pressure sensor Z2

Changing any of these parameters causes a Sensor Type Change message to be generated.

Incorrect parameter setting can result in severely impaired function.

3.2.2 Neutral zone

No compressor actuation takes place as long as the control error remains within a definable *neutral zone*.

3.2.3 Control algorithm

Low pressure as detected by an A/D converter is compared with the setpoint:

$$Control\ error = Actual\ value\ (t_{0\_Act}) - Setpoint\ (t_{0\_Setp})$$

Pressure change within the controller cycle time is also evaluated. When the control error is positive and pressure is rising, the step switch moves one step up. As a result the compressor having the shortest run time is enabled.

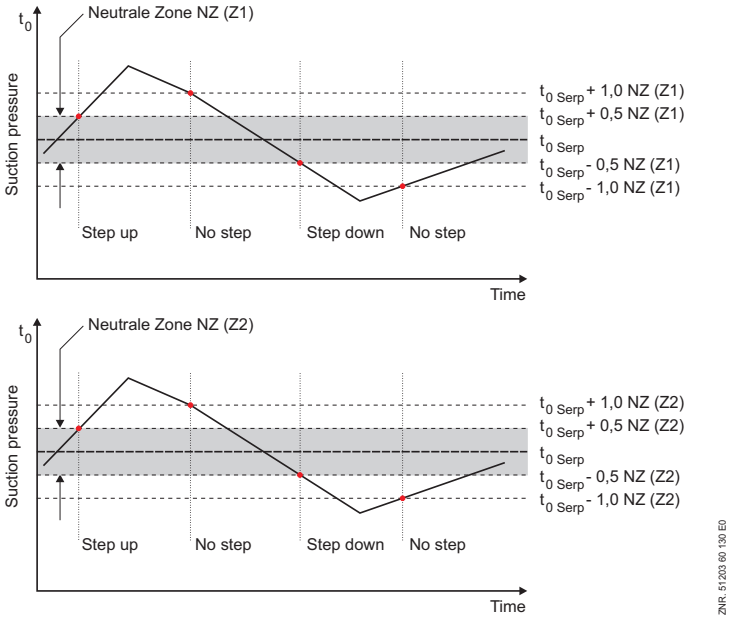
When the control error is negative and pressure is falling, the step switch moves one step down. As a result the compressor having the longest run time is disabled.

No compressor actuation takes place when the control error is within a definable neutral zone.

On the VS 3000 BS, both temperature ranges have neutral zones. The control algorithm is identical for both temperature ranges. Controller cycle time is 1 second.

In the wet vapor range the temperature is clearly governed by the refrigerant and pressure: t = f (p, refrigerant). The VS 3000 BS calculates temperatures from the pressures measured as a function of the refrigerant used. Exclusively temperature measurements are used for control. In this manual therefore, temperatures (t_0, t_c) stand for pressures (p_0, p_c).

VS 3000 BS control algorithm LP step controller



3.3 Compressor control times

Compressor actuation takes place only outside the neutral zone, after a certain time for loading or unloading has passed and when the control error has exceeded a defined level (neutral zone).

The time delay is dependent on the actual control error. With a large control error, actuation takes place in a shorter time than when the control error is smaller. The control time is calculated as the sum of basic time tb and variable time tv. Differentiation is made between up and down stepping of the step controller.

The variable time is inversely proportional to the control error. At maximum control error the variable time is tv = 0. As the control error decreases, time tv automatically increases up to a defined maximum. Basic time and maximum variable time for loading (starting) and unloading (stopping) can be programmed as parameters for each capacity stage.

Relationships for determining control times are as follows:

$$t = t_b + t_v$$

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

t_v = Variable control time

For t_v :

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

The following applies:

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

t_v = Variable control time
t_{v_max} = Maximum variable control time (definable for each capacity stage)
d_t = Control error
d_{t_max} = Maximum control error/constant (definable)

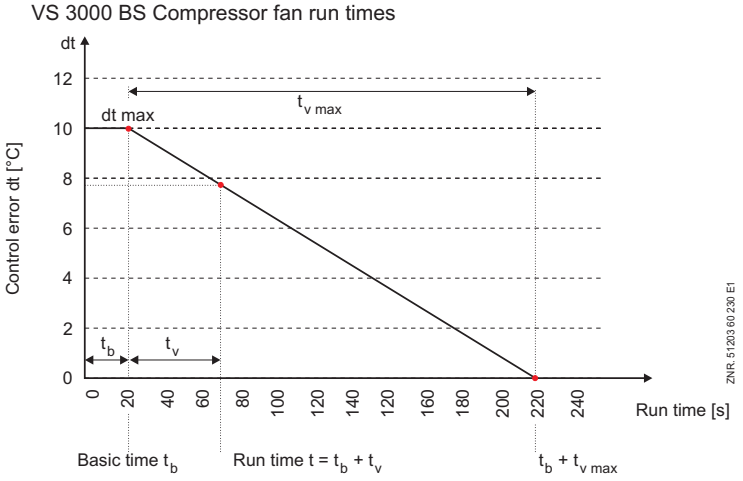
The start delay commences after loading a compressor capacity stage or when low pressure reaches a value greater than the upper limit of the neutral zone. The stop delay commences after unloading a compressor capacity stage or when the low pressure reaches a value less than the lower limit of the neutral zone.

Control time is calculated on every run of the controller. This entails recalculating the variable time and comparing the time elapsed since the last control time to the calculated time. If the calculated control time is less than or equal to the elapsed time, compressor actuation takes place when the controlled variable p_0 is outside the neutral zone.

Calculation of control times is identical for both temperature ranges. Variable control time is $t_v = 0$ when the booster/satellite compressors are directly controlled by the refrigeration points, the control time then consisting of only the basic time $t = t_b$.

Calculation of control time is shown in the following diagram:

$t = t_b$.



3.4 Calculating setpoint

3.4.1 Calculating setpoint by room temperature

The t_0 setpoint is calculated as a function of room temperature (setpoint shift). Room (ambient) temperature is supplied either by a PT1000 sensor connected direct to a pack controller input or via the CAN bus by another controller in the system.

$$t_0 = t_{0\_min} + \frac{\left[\left(t_{0\_max} - t_{0\_min}\right) \cdot \left(t_r - t_{r\_max}\right)\right]}{\left[\left(t_{r\_min} - t_{r\_max}\right)\right]}$$

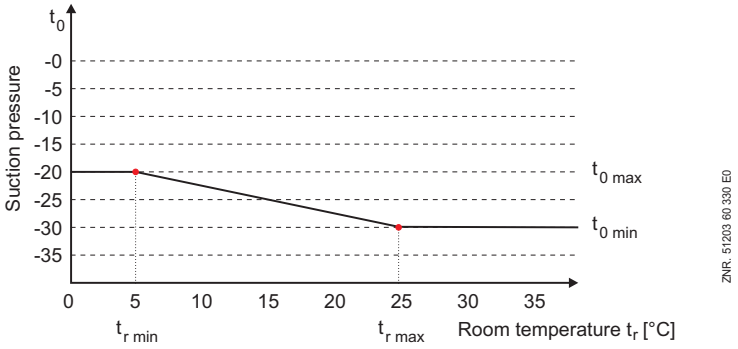
t_0	= t_0 setpoint
t_{0_max}	= Maximum t_0 setpoint
t_{0_min}	= Minimum t_0 setpoint
t_r	= Current room temperature
t_{r_max}	= Maximum room temperature for setpoint shift
t_{r_min}	= Minimum room temperature for setpoint shift

With a room temperature of $t_r > t_{r\_max}$ or $t_r < t_{r\_min}$ the setpoint t_0 is defined 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



Temperatures t_{0_max}, t_{0_min}, t_{r_min} and t_{r_max} can be set as parameters. Additionally, allowance can be made for the air humidity via an analog input. The pressure setpoint for actual control is determined from a conversion table stored in the program. Provision is currently made for the following refrigerants when converting t_0 to the corresponding pressure:

R22, R502, R134a, R402A, R404A, R717, R1270, R507, R407c, R410a, R290,
R744 (no transcritical operation)

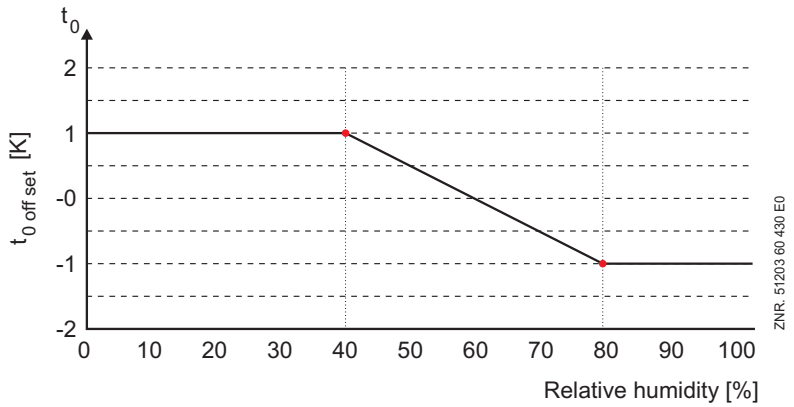
Calculation of setpoint is identical for both temperature ranges. Temperatures t_{0_max}, t_{0_min}, t_{r_min} and t_{r_max} can be set as parameters for both temperature ranges.

3.5 Humidity shift

The *humid. adapt.* parameter can be used to define whether the t_0 setpoint is also to be matched as a function of air humidity. Shift of the to setpoint by the air humidity can be activated separately for the Z1 and Z2 temperature ranges and for operation at the first and second setpoint
(Menu 3-2-1 *Z1-Day*, Menu 3-2-2 *Z1-Night*, Menu 3-2-3 *Z2-Day*, Menu 3-2-4 *Z1-Night*).

The air humidity signal can be supplied either by the humidity sensor or via the CAN bus by another pack controller. A temperature offset $t_{0\ offset}$ is then formed as a function of the air humidity and added to t_{0_Setp}:

Humidity shift



Ambient data

The following quantities used for setpoint shift can be supplied either via sensors connected to the pack controller or via the CAN bus from another pack controller.

- Room temperature (t_0 shift)
- Outdoor temperature (tc shift)
- Humidity (t_0 shift)

Response of the controller is determined by the parameters *Room temp.*, *Outd.temp.*, *Humidity* and *NodeNr Env.dat. Data* (Menu 3 -1).

The parameters *Room temp.*, *Outd.temp*. and *Humidity* can be used to define whether sensors are connected direct to the controller. If one of these parameters is set to *N*, the additional parameter *NodeNr Env.dat.* will be shown in the operating screen and can be used as required to enter the Node No. of the pack controller that supplies the required ambient data.

If no ambient data is to be received via the CAN bus, the parameter *NodeNr Env.dat. Data* can be set t_0 --. This deactivates setpoint shift.

3.6 Second setpoint - Setpoint increase/decrease

With low-pressure control there is the option of programming a second characteristic that can be activated by the internal week timer or a digital input of the controller. Polarity of the digital input signal is definable. Setpoint increase/decrease allows better matching to night and weekend operation.

Setpoint toggle changes the following controller parameters:

- Temperature setpoints Z1/Z2
- Neutral zone Z1/Z2
- Control constant Z1/Z2
- Control times Z1/Z2
- Humidity shift Z1/Z2

Setpoint toggle takes place jointly for the two temperature ranges Z1 and Z2.

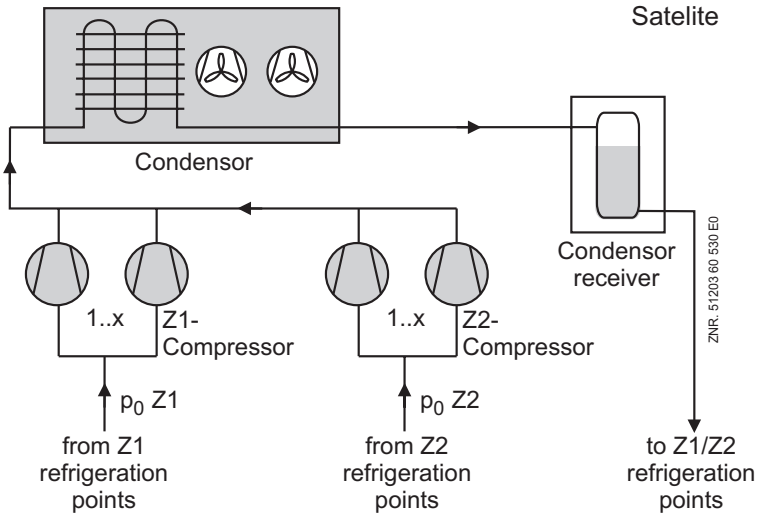
3.7 Booster/satellite operation

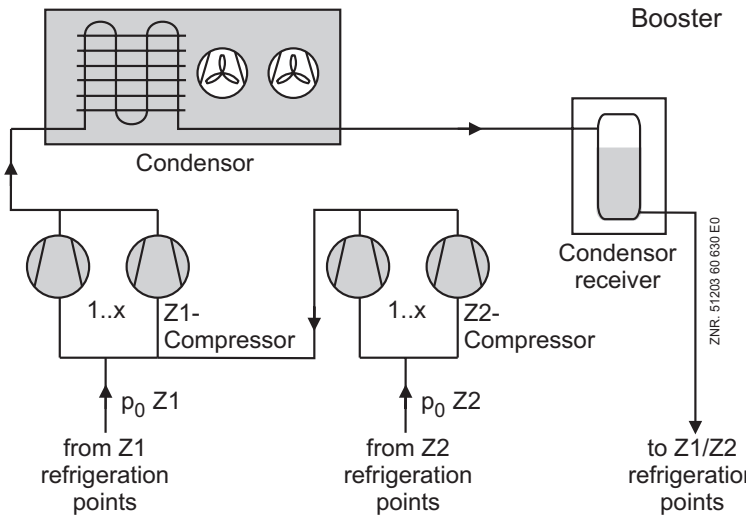
In the layout of refrigeration systems differentiation is made between three modes: normal, satellite and booster mode. In normal mode, refrigeration circuits at different evaporating temperature levels are operated in fully independent systems. Each circuit contains a compressor unit, a condensing unit and connected refrigeration points (display cases, coldrooms).

By contrast, in satellite and booster mode the different refrigeration circuits are operated with only one condensing unit and according only one common high-pressure line. The VS 3000 BS Pack Controller is specifically designed for booster or satellite mode.

In satellite mode, operation with a single condensing unit is achieved by simply combining the high-pressure lines of the compressors provided for each temperature level and conducting them through one condenser. Refrigerant is fed to the refrigeration points from a common receiver.

In booster mode the refrigeration points are similarly supplied by the same liquid line. Whereas the suction lines of the Z1/NT circuit connect direct to the main compressors, refrigerant from the Z2/LT refrigeration points first passes through the booster stage. Pressure of the refrigerant from the Z2/LT refrigeration points is lower owing to the lower evaporating temperature. In the booster stage it is increased to the pressure level in the suction lines from the Z1/NT refrigeration points. The illustrations below show the schematic layout for satellite and booster mode.





- Satellite mode

In satellite mode the compressors of both temperature ranges are controlled independently by the low pressure.

- Booster mode

When all Z1 compressors are at standstill and Z2 compressors are loaded, the first Z1 compressor is loaded immediately on exceeding the setpoint plus half of the neutral zone. In other words, control times are ignored! The control times remain ignored for the first compressor.

Each additional Z1 compressor is loaded after the basic and variable load time elapses. When low pressure decreases in the Z1 range, the Z1 compressors are unloaded after the basic and variable unload time elapses. However one compressor remains in operation regardless of suction pressure. The last remaining Z1 compressor is not stopped until all Z2 compressors have been unloaded.

3.8 Compressor control by refrigeration point

Control of the booster/satellite compressors (Z2 temperature range) either by low pressure or direct by refrigeration point (case/coldroom) must be programmed on the pack controller. In Menu 3-1 choosing the parameter *Booster/Sat.cont* → opens the following list:

- *Refrig pt*
- *Pressure* ✓

Compressor control by refrigeration point requires refrigeration point control to be activated in this list. On exiting the list, the parameter *Refr.Pt.Nd.No.* xx (Refrigeration Point Node No.) appears behind the parameter *Booster/Sat.cont* →.

The refrigeration point CAN bus node address entered tells the controller which case/coldroom controller can load or unload the booster/satellite compressor (CAN bus address 1 to 99). If only one compressor is installed, the compressor output follows the solenoid valve of the refrigeration point. When several compressors are installed, the first compressor is loaded without delay.

Additional compressors are loaded after the programmable basic time tb elapses. The compressor loaded is always that having the shortest running time. If compressor capacity stages are to be unloaded, a single compressor will be stopped immediately. When several compressors are installed, the first compressor is unloaded without delay.

Additional compressors are unloaded after the programmable basic time tb elapses. The compressor unloaded is always that having the longest running time. Low pressure is monitored with the help of the Z2 pressure transducer. If pressure drops below a definable low limit, the compressor is disabled until pressure again rises above the limit.

This limit (t_0 *Comp OFF Z2*) can be defined in Menu 3-4. Monitoring of starts per hour is not active when compressors are controlled by refrigeration point. In compressor control by refrigeration point the compressor is

always coupled to the solenoid valve of the refrigeration point.
The refrigeration point will be disabled by the Disable Refr. Point signal in occurrence of any of the following conditions:

- No compressor available for operation (due to manual shutdown, HP fault or motor overload trip).
- Oil equalization being carried out by controller.

So as to ensure continued cooling in a CAN bus fault, the pack controller automatically switches to the low-pressure controller in occurrence of a fault. The compressor is shut down in the event of failure of the case/coldroom controller. The actual values screens do not show setpoints with direct coupling.

3.9 Compressor packs with suction gas bypass (evaporating pressure controller)

A suction bypass can be used when the VS 3000 BS Pack Controller is used for compressor packs where both temperature ranges are controlled at above 0°C. The suction gas bypass allows of connecting the two suction lines in part-load (nighttime) operation. The required refrigeration capacity can then supplied by the Z2 compressor, which is normally smaller.

Function

The suction gas bypass opens when pressure in the Z1 suction line rises above the pressure set on the evaporating pressure controller. To ensure that the evaporating pressure controller is only active during nighttime operation, the setting for the evaporating pressure controller must be greater than the daytime to setpoint and approximately equal to the nighttime to setpoint of the Z1 compressors.

In nighttime operation, suction pressure of the Z2 compressor may increase due to loading of a Z1 or Z2 refrigeration point. Z2 capacity stages are loaded when pressure at the Z2 compressor is greater than the setpoint. In nighttime operation the Z2 compressors are capable of meeting the refrigeration requirements of the Z1 and Z2 refrigeration points. Increasing load of the Z1 refrigeration points results in suction pressure of the Z1 compressors increasing above the nighttime to setpoint, causing a Z1 compressor to be loaded.

Example:

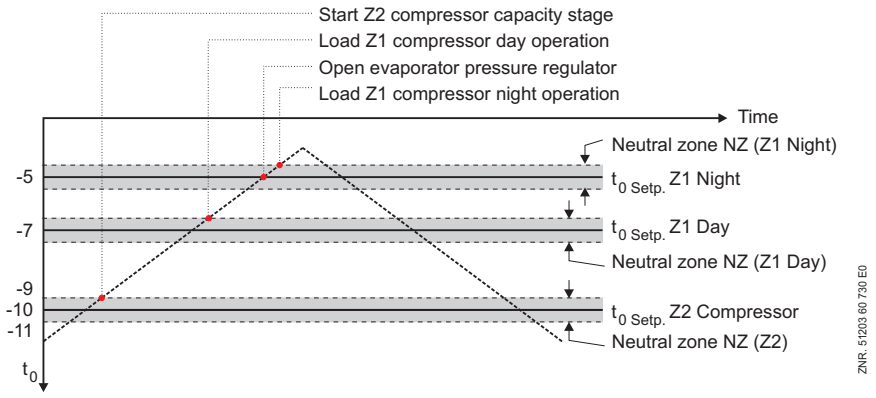
Setpoint t_0 Z1 Day	= -7 °C
Setpoint t_0 Z1 Night	= -5 °C
Neutral zone Z1 Night	= 4 K
Setpoint t_0 Z2 Day	= -11 °C
Setpoint t_0 Z2 Night	= -9 °C
Evaporating pressure controller setting	= -5 °C

Suction pressure of the Z2 compressors increases when a Z2 refrigeration point is loaded. Z2 capacity stages are loaded when suction gas temperature rises above -9 °C plus half the neutral zone.

Suction pressure of the Z1 compressors increases when a Z1 refrigeration point is loaded. When suction gas temperature rises above -5°C, the evaporating pressure controller (suction gas bypass) opens and causes suction pressure of the Z2 compressors to increase.

This procedure results in all available Z2 compressors being loaded first in nighttime operation. Only then can Z1 compressors be loaded. The evaporating pressure controller is not active in daytime operation, because the lower daytime to setpoint causes a Z1 compressor to be loaded before this controller can open. Setpoint toggle can be initiated by an external signal or the internal timer of the VS 3000 BS.

VS 3000 BS control algorithm for suction bypass
(Evaporator pressure regulator)



The suction gas bypass option can be entered with the *Sauggas-Bypass* (Suction Gas Bypass) Y/N parameter (Menu 3-1):

When entering *Sauggas-Bypass* = N, suction pressure is controlled independently for Z1 and Z2.

When entering *Sauggas-Bypass* = Y, control is only influenced in nighttime operation.

Z1 compressors can only be loaded when all Z2 capacity stages have been loaded. Start times for the Z1 compressor do not commence until suction pressure of the Z1 compressor has increased to a value greater than the setpoint plus half the neutral zone and all Z2 capacity stages have been loaded.

In any failure of all Z2 compressors (manual shutdown, motor overload cutout actuated, etc.), the Z1 compressors are actuated independently of the Z2 compressors. Function is preserved in a low-pressure fault condition on the Z2 compressors (low t_0 or LP pressure cutout actuated).

If cutover from daytime to nighttime operation is made while Z1 compressors are running, the function described above does not become active until all Z1 compressors have shut down.

Sauggas-Bypass = Y can only be entered when pressure control is provided for the Z2 compressors. This parameter is not shown when the Z2 compressors are controlled direct by a refrigeration point (*Booster/Sat. cont* parameter in Menu 3-1 set to *Refrig pt*. (Refrigeration Point)).

3.10 Compressor packs with plate-type heat exchanger

When the VS 3000 BS Pack Controller is used for compressor pack systems in which both temperature ranges are controlled above 0°C, a plate-type heat exchanger can be employed for one LT refrigeration point. The purpose of the plate cascade is to transfer the heat of condensation from the LT circuit to the Z1 compressors.

So as to avoid pressure faults in the LT circuit, the LT refrigeration point may only be enabled when a Z1 compressor is on. If the system is additionally equipped with a suction gas bypass, the refrigeration point can be enabled when either a Z1 or a Z2 compressor is working. Disabling and enabling of the LT refrigeration point is made by a refrigeration point enabling signal via the CAN bus.

The node address of the LP refrigeration point is defined by the *Kn.Nr.Kaskade xxx* (Node No. of Cascade) parameter (Menu 3-1). Entering *Kn.Nr.Kaskade* --- (default setting) deactivates the function.

3.11 Compressor packs with oil equalizer

Oil level in the compressors differs due to varying suction pressures. So as to achieve equalization of oil level between the separate compressors, the system is stopped for 2 minutes after one or more compressors has been operating longer than 3 hours.

At the end of the maximum operating time, fast unload takes place with compressor capacity stages being unloaded at the rate of one every 2 seconds. Refrigeration point enabling is disabled when the last capacity stage is unloaded. The refrigeration point is re-enabled after the standstill time has elapsed. Compressor capacity stages are then again loaded step by step. Forced shutdown can be disabled or enabled by the *Oil eq. line* parameter (Menu 3-1).

In satellite operation, oil equalization is performed separately for the two temperature ranges. In booster operation, all Z2 compressors are disabled when oil equalization is active for the Z1 compressors.

3.12 Capacity-controlled compressors

The VS 3000 BS Pack Controller can be used to control capacity-controlled compressors having up to three capacity stages (base load plus two capacity stages (bypass valves)). The number of capacity stages is separately definable for Z1 and Z2 compressors. Capacity-controlled compressors do not have any effect on the control algorithm of the VS 3000 BS. Only the control sequence is changed.

When the compressors are actuated, the base load of an available compressor is first switched on. Capacity stages of the compressor are then loaded as refrigeration is demanded before the base load stage of the next compressor can be switched on. Capacity stages are unloaded in the reverse order.

The number of capacity stages actuated for one compressor is taken into account for compressor base load rotation. The base load stage of a compressor can be controlled by the integral manual switches. When the base load stage is shut down, the controller also shuts down the associate capacity stages.

3.13 Load shedding

Forced shutdown of compressors may be needed as a means of preventing energy consumption from rising above a specified level. Two digital inputs are provided on the VS 3000 BS Pack Controller for load shedding of Z1 compressors and one digital input for load shedding of Z2 compressors.

Z2 load shedding is only available when the Z2 compressors are controlled by low pressure. Compressors are shut down directly. The maximum number of Z1/Z2 compressors disabled by load shedding is equal to the number of activated Z1/Z2 load shedding inputs. This means that the maximum number of compressors that can be disabled by load shedding is two in the Z1 temperature range and one in the Z2 circuit. Regardless of load shedding signals, a minimum refrigeration capacity must be maintained in both the Z2 and the Z1 temperature range, which means that a minimum number of compressors must be enabled.

At minimum, one compressor remains enabled at all times in the Z2 and Z1 temperature range. Compressors cannot be disabled by load shedding in a system equipped with only one Z2 and one Z1 compressor.

3.14 Compressor base load rotation

Running time of each compressor is internally monitored. So as to ensure uniform run time of all compressors, the compressor having the longest running time is disabled and that having the shortest running time is enabled at the end of a definable cycle time. Base load rotation is made separately for Z1 and Z2 compressors. The time interval for base load rotation is set by a common parameter.

Base load rotation is only performed with capacity-controlled compressors when the base load stage of a compressor is available. With base load rotation, the compressor having the longest run time is disabled and the compressor having the shortest running time is loaded.

The control state of the capacity stage(s) is also applied for the new compressor in base load rotation with capacity-controlled compressors. Base load rotation makes allowance for compressors disabled by load shedding. The number of compressor stages operating is not changed by compressor base load rotation. Compressor base load rotation is active only when the following conditions are satisfied:

- When all defined compressors are enabled, base load rotation takes place only at rising pressure within the neutral zone.
- If compressors have been disabled by load shedding, base load rotation only takes place at rising pressure.

Compressor base load rotation can be set with the *Cycle time C.* parameter (Menu 3-7). Especially when the system is equipped with screw compressors, which have an oil return feature that does not necessitate base load rotation, this parameter can be set to --, thereby deactivating base load rotation.

3.15 Compressor monitoring

The controller is equipped with monitoring functions as well as control and regulating functions.
The following monitoring functions are integrated in the controller:

- Motor overload cutout (Z1 and Z2)
- Low oil pressure cutout (Z1 and Z2)
- Compressor cylinder head temperature (Z1 and Z2)
- High pressure
- Low pressure (Z1 and Z2)
- Compressor starts

3.16 Safety loop

So as to provide redundancy of the monitoring system, provisions are made in addition to the VS 3000 BS monitoring functions for all or individual compressors of a pack to be disabled in critical operating situations.

Due to the type of wiring in the system the control contacts used for this purpose are prioritized in descending order as follows:

Disabling of all compressors

1. Safety high-pressure cutout
2. High-pressure cutout
3. If installed: Discharge gas defrosting high-pressure cutout (Z2, Z2R and Z1)
4. LP cutout

Disabling of compressors respectively affected

5. Low oil pressure cutout
6. Motor overload cutout

As a result, actuation of a high-priority safety contact (e.g. high-pressure cutout) also de-energizes and thus activates all low-priority alarm contacts. So as to prevent the pack controller from transmitting all secondary alarms, transmission of low-priority alarm signals is blocked in the simultaneous occurrence of a higher-priority alarm event.

3.17 Monitoring low oil pressure cutout

Oil pressure is monitored on each compressor by the low oil pressure cutout equipped with a floating contact. The contact is open in the alarm state. The compressor is stopped directly and disabled for all further control actions when the low oil pressure cutout is actuated. On resetting the low oil pressure cutout, the compressor is re-enabled. Low oil pressure cutout monitoring can be set separately for the Z1 and Z2 compressors.

With scroll compressors particularly, no low oil pressure cutouts are used. Monitoring of the low oil pressure cutout can therefore be activated or deactivated via parameter .

3.18 Monitoring cylinder head temperature

Compressor cylinder head temperature is monitored to keep it from exceeding a defined maximum so as to prevent damage to the compressor. The maximum cylinder head temperature at which a compressor is disabled and also the compressor enabling temperature are definable by the parameters *Comp. Off temp* and *Comp. ON temp* (Menu 3-4).

The respective compressor is stopped after a definable delay elapses (Menu 3-4 *Del.Comp.temp*) and disabled for all further control actions when temperature exceeds the set maximum.

The compressor remains disabled until temperature drops below the enabling level. If this action is repeated several times in a single day (five actuations) and if more than one compressor is available in the pack, the compressor will be disabled permanently and must then be re-enabled manually (Menu 3-1-d *Enab. Z1 comp.* or Menu 3-1-e *Enab. Z2 comp.*). This generates alarm by automatic compressor disabling (A*uto Disable Z1* Sx or *Auto Disable Z1 Sx*). The last available compressor (Z1/Z2) cannot be disabled.

3.19 Monitoring high pressure

High pressure is measured in the high-pressure line by a continuous transmitter delivering an output current/ voltage). Pressure is also monitored by the safety high-pressure cutout and high-pressure cutout. These devices deliver a digital signal when the set pressure level is exceeded. Both of these digital signals are connected to the controller in series.

Forced shutdown of all compressors takes place if the limit set on the safety high-pressure cutout or high-pressure cutout is exceeded. The compressors are loaded stagewise after internally resetting the cutout.

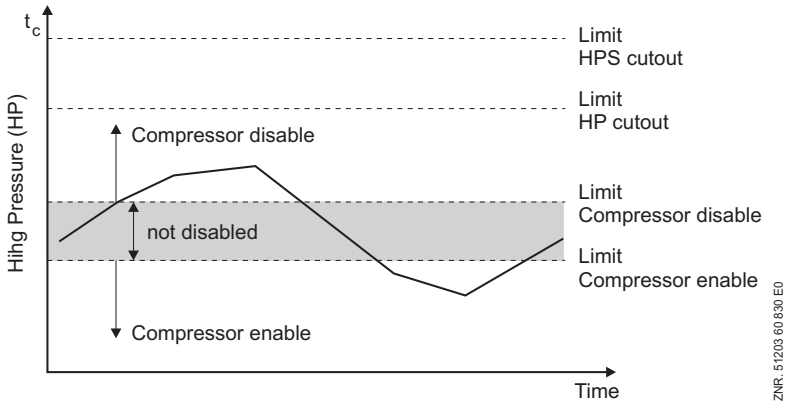
If high pressure exceeds the definable compressor disable limit (Menu 3-4 t_c *Comp. OFF*), up to 40% of the compressor capacity stages will be successively disabled until the pressure drops below the definable compressor enable limit (Menu 3-4 t_c *Comp. OFF*). When all compressors are on, the first compressor is stopped without delay. High HP alarm is generated after a definable delay on exceeding the limit set for t_c *Comp. OFF* (Menu 3-4). Priority of the alarm is definable. No fault is reported in heat recovery mode.

No additional compressor capacity stages are loaded as long as HP alarm is active.

Additional compressors are disabled at the end of the basic unload time. Heat recovery mode is an exception to this rule. No compressor shutdown takes place in this mode. When pressure rises to the set limit, no further compressor is loaded regardless of any being demanded.

A minimum of one compressor remains working in each temperature range. Compressor disabling commences in the circuit (Z1 or Z2), in which the most compressors have been loaded.

VS 3000 BS control algorithm HP monitoring

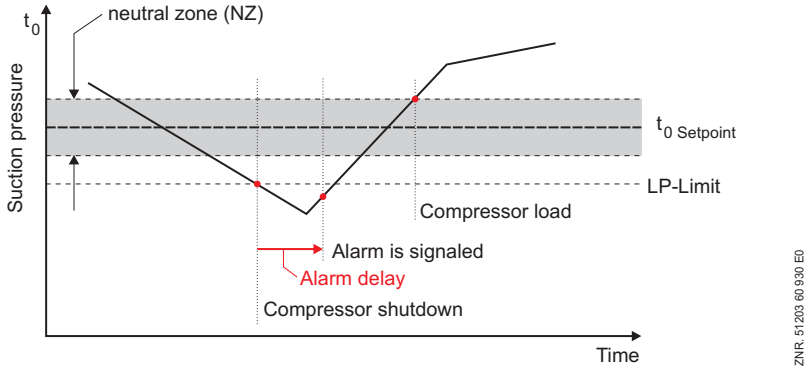


3.20 Monitoring low pressure

Low-pressure is monitored separately for the Z1 and Z2 temperature ranges. All compressors are shut down if low pressure drops below a definable limit (Menu 3-4 *t_0 Comp. OFF Z1/Z2*). As previously described, the compressors are loaded stagewise when low pressure rises to the level proportional to the t_0 setpoint plus half the neutral zone.

Alarm is signalled after a set delay. Delay (Menu 3-4 *Del. t_0 OFF Z1/Z2*) and priority are definable. The value of the limits is entered in °C, from which the controller then calculates an absolute proportional pressure value. Additionally the LP cutout is evaluated. Forced shutdown of all compressors takes place if pressure drops below the limit set on the LP cutout.

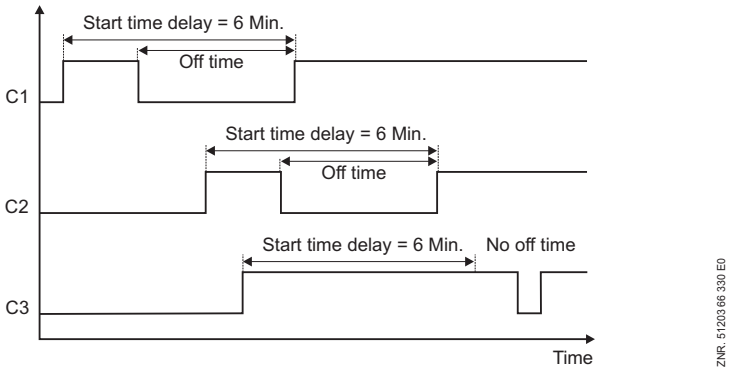
VS 3000 BS Control algorithm
LP monitoring Z1 and LP monitoring Z2



3.21 Monitoring compressor starts

The number of compressor starts per hour is limited as a means of preventing short cycling of compressors.

VS 3000 BS Starts monitoring



The Compressor *Starts/h* parameter (Menu 3-4) determines the minimum time intervals at which a compressor can be started. If, for example, the parameter is set to 10 starts per hour, the compressor cannot be started earlier than every 6 minutes.

3.22 High-pressure control / Condenser control

Cooling of the refrigerant takes place in the condenser by removing heat with the condenser fans.
A physical relationship exists between high pressure and refrigerant temperature. Therefore the high pressure or condensing temperature can be controlled with the condenser fans. Two modes are provided for high-pressure control:

- *Step controller*
  Stagewise loading or unloading of several condenser fans
- *Speed controller*
  Continuous HP control by means of speed adjuster (frequency changer or phase control)

Condenser control comprises the control and monitoring functions for the high-pressure loop.

3.22.1 Setting parameter for HP sensor characteristic

The VS 3000 BS Pack Controller works with continuous pressure transducers of linear characteristic. The pressure inputs can be matched to various linear-characteristic transducers. Transducers delivering either an output current (4 to 20 mA) or an output voltage (0 to 10 V) can be used.

Jumpers must be changed accordingly on the controller for voltage-output transducers!
The default configuration is for current inputs!

The following sensor matching parameters (Menu 3-1-a) are used to match the controller to the pressure transducer:

1. *HP sensor*
   Choose between sensor delivering continuous current output 4 to 20 mA or continuous voltage output 0 to 10 V.
2. Parameter for HP pressure sensor characteristic:

p_c 4 mA / pc 0 V	Pressure at 4 mA or 0 V at output of HP pressure sensor
p_c 20 mA / pc 10 V	Pressure at 20 mA or 10 V at output of HP pressure sensor

Changing any of these parameters causes a Changed Sensor Type message to be generated.

Faulty parameter setting can result in severe impairment of function and may lead to damage to merchandise and equipment.

3.22.2 Neutral zone

No actuation of compressor stages takes place within a definable neutral zone.

3.22.3 Control algorithm

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

In the wet vapor range the temperature is clearly governed by the refrigerant and pressure:
t = f (p, refrigerant). The VS 3000 BS calculates temperatures from the pressures measured as a function of the refrigerant used. Exclusively temperature measurements are used for control.
In this manual therefore, temperatures (t_0, t_c) stand for pressures (p_0, p_c).

3.22.4 Control algorithm with step controller

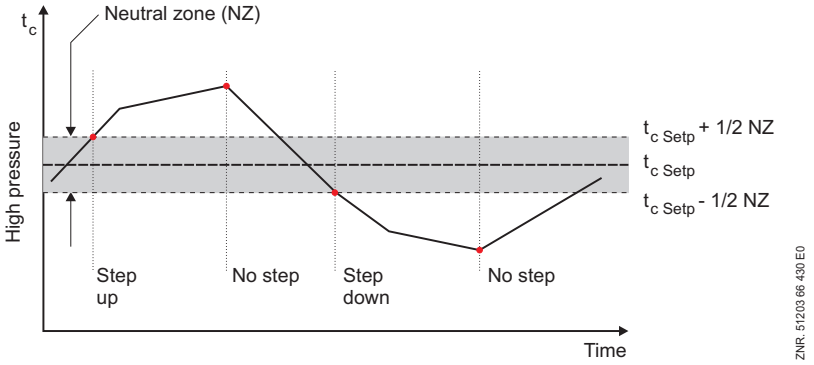
High pressure as detected by an A/D converter is compared with the setpoint. The following relationship applies:

$$\textit{Contorl error} = \textit{Actual value}\ (t_{c\_Act}) - \textit{Setpoint}\ (t_{c\_Setp})$$

When the control error is positive and pressure is rising, the step switch moves one step up, meaning that one additional condenser capacity stage is enabled. When the control error is negative and pressure is falling, the step switch moves down one stage, meaning that one condenser capacity stage is disabled.

When selected by parameter *Fan off w/comp*, Condenser capacity stages are also disabled when all compressors are off.

VS 3000 BS control algorithm HP step controller



3.22.5 Calculating setpoint with step controller

The setpoint for t_c is determined by a programmable characteristic as a function of outdoor temperature.

Outdoor temperature is supplied either by a PT1000 sensor connected direct to an input of the pack controller or via the CAN bus by another pack controller in the system.

$$t_c = t_{c\_min} + \frac{\left[\left(t_{c\_max} - t_{c\_min}\right) \cdot \left(t_a - t_{a\_min}\right)\right]}{\left(t_{a\_max} - t_{a\_min}\right)}$$

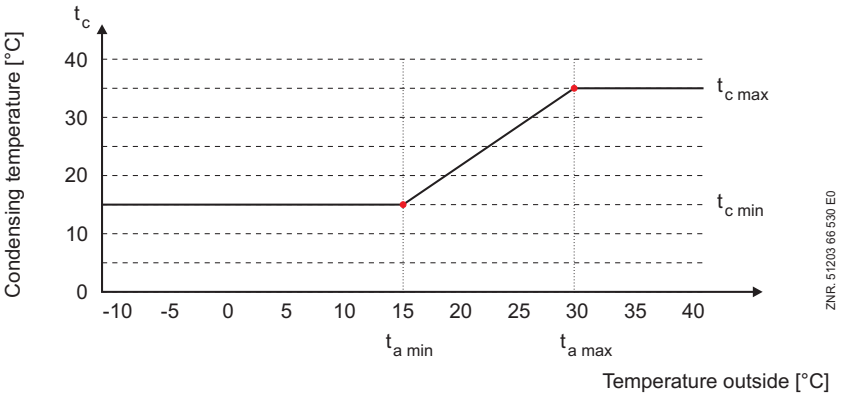
t_c	= t_c setpoint
t_{c_max}	= Maximum t_c setpoint
t_{c_min}	= Minimum t_c setpoint
t_a	= Current outdoor temperature
t_{a_max}	= Max. outdoor temperature for setpoint shift
t_{a_min}	= Min. outdoor temperature for setpoint shift

Given an outdoor 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 3000 BS HP control setpoints determination



Temperatures t_{c_min}, t_{a_min}, t_{c_max}, t_{a_max} are definable.

The pressure setpoint for actual control is determined from a conversion table stored in the program. Provision is made for the following refrigerants when converting tc to the corresponding pressure value:

R22, R502, R134a, R402A, R404A, R717, R1270, R507, R407c, R410a, R290,
R744 (no transcritical operation)

3.22.6 Condenser fan control times with step controller

If the condensing pressure rises or falls to a value outside the neutral zone, the first condenser capacity stage is immediately loaded or unloaded. Every further actuation takes place only after a certain time has elapsed for loading or unloading and the control error has exceeded a specified value (neutral zone).

The time is dependent on the actual control error. Actuation takes place in a shorter time with a large control error than with a smaller control error. The control time is calculated as the sum of a basic time tb and a variable time tv. Differentiation is made between forward and back switching of the step controller.

The variable time is inversely proportional to the control error. At maximum control error the variable time tv approaches zero. As the control error decreases, time tv automatically increases up to the specified maximum.

Basic time and maximum variable time for switching forward (on) and back (off) are definable as parameters for each loading/unloading of a condenser stage. The following relationships apply for determining control times:

$$t = t_b + t_v$$

The following applies for t_v :

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

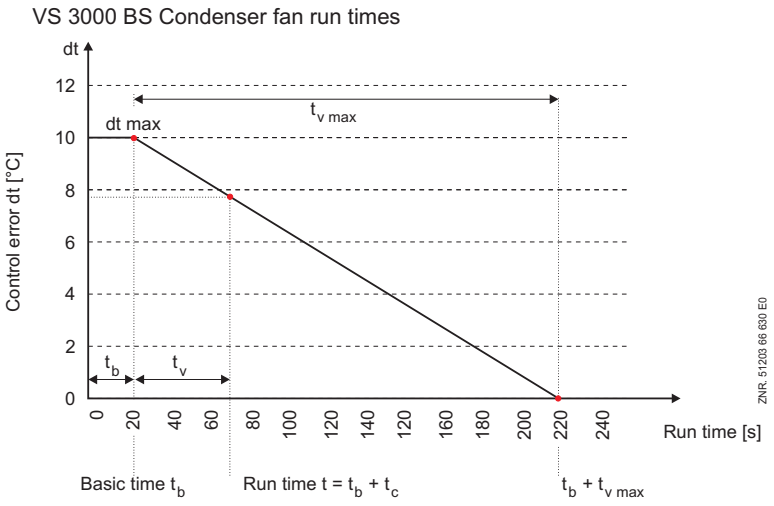
The following applies:

For $d_t > d_{t\_max}$ $d_t = d_{t\_max}$

t_b	= Basic control time (definable for each stage)
t_v	= Variable control time
t_{v_max}	= Max. control time (definable for each stage)
d_t	= Control error
d_{t_max}	= Max. control error (definable)

Control time is calculated at every controller run. The variable time is calculated anew and the time elapsed since the last control time is compared with the calculated time. If the calculated control time is smaller than or equal to the elapsed time, fan actuation takes place when the control error is greater than the specified neutral zone.

The following diagram shows calculation of the control time:



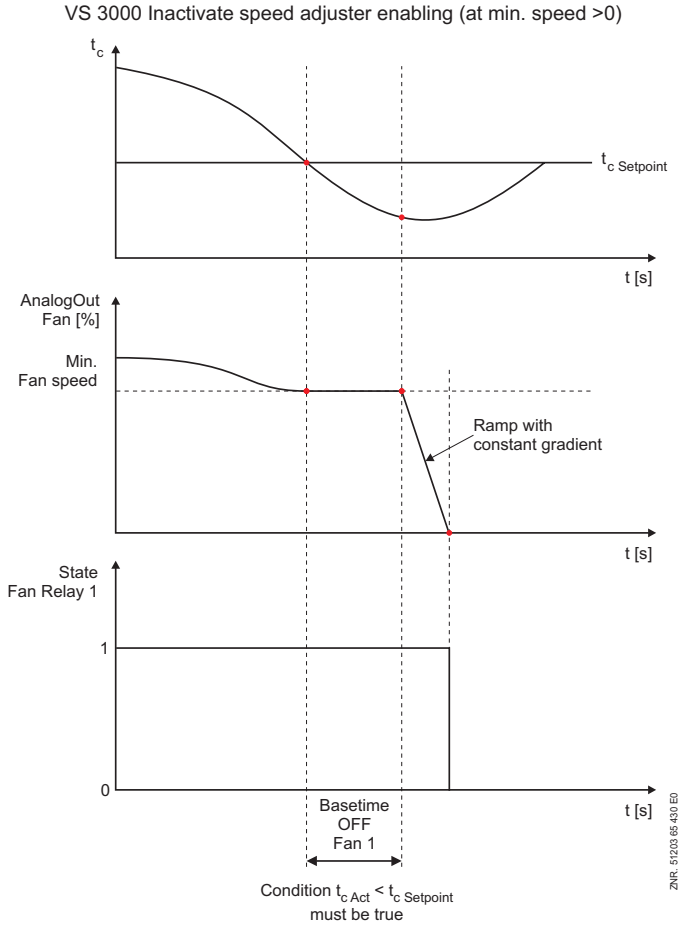
3.22.7 Control algorithm with continuous control

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

Contorl error = *Actual value* (t_{c_Act}) − *Setpoint* (t_{c_Setp})

When the control error is positive, a PI control algorithm calculates a speed setpoint that is supplied to the speed adjusters through an analog output (0 to 10 V). The speed adjuster control fan speed to the specified setpoint.

When the control error is negative, the speed adjuster is disabled through the first fan output, L1, of the VS 3000 BS as soon as speed drops to 0. If a minimum speed adjuster speed greater than 0 has been set by the *Min. Speed* parameter (Menu 3-3-1), speed is ramped down to 0 after a definable time (*Bas.unload time F1*) and Fan Output L1 is deactivated.



Control can be influenced by three parameters. The following parameters (Menu 3-3-1) can be programmed with a setup unit (AL 300 Operator Terminal or CI 3000 Store Computer).

```
3 Setpoints - 3 HP control - 1 Control
1 Control type          →
2 Min. Speed            XX%
3 Adjust diff.          XX
4 tc-max                XX °C
```

The parameters in Lines 2 to 4 are only shown when speed controller has been activated as the control type. The *Min. Speed* parameter is used to define minimum speed of the speed adjuster. Entry is made as a percentage and refers to the 0 - 10 V analog output of the VS 3000 BS. The *Adjust Diff*. parameter can be used to influence controller speed. It must be set higher if the controller is too slow or should be set lower if hunting of the controller occurs.

If condensing temperature exceeds the tc-Max limit, the second capacity stage of the controller is activated and the first capacity stage is disabled (speed adjuster enable). The second capacity stage then makes a bypass to connect the variable-speed fans to fixed-speed power supply. The controller returns to control mode when temperature falls below the specified setpoint.

When operating the VS 3000 BS with variable-speed condenser fans, a bypass must be made to the fan motor for the speed adjuster via the bypass stage (Fan Output 2), because speed adjuster enabling is not available when t_c-max is exceeded and control passes to the bypass stage.

3.22.8 Calculating setpoint with continuous control

The t_c setpoint is calculated as described in Section 3.22.5 Calculating Setpoint With Step Controller. Additionally, a speed setpoint is determined. The following relationships applies to calculation:

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

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

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

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

The P action governs the controller's direct response to control errors. The I action avoids persistent control errors.

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

Adj. Diff. = Definable controller speed

3.22.9 Heat recovery mode

Heat recovery mode (HR) of the VS 3000 BS is implemented with three parameters:

- The *Ht rec. mode* Y/N parameter (Menu 3-1) activates or deactivates heat recovery mode. When the HR Mode parameter is activated, Digital Input 22 (*Heat Recovery / Bursting Disk*) is used to request HR mode. Otherwise it is used to detect status of the bursting disk.

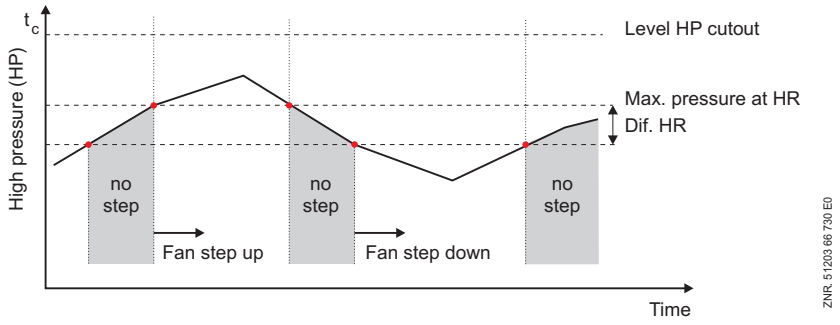
- The *Max. ht. rec.* parameter (Menu 3-3-2) specifies the maximum condensing temperature allowed in HR mode. For control purposes the temperatures are converted to pressure of the selected refrigerant:

- The *Dif. ht. rec.* parameter (Menu 3-3-2) defines a temperature difference.

If pressure rises to a level greater than *Max. ht. rec.*, the first fan stage is loaded immediately (ignoring programmed control times). Each additional fan stage is loaded at the end of the basic load time (ignoring variable control time).

If pressure drops to a level smaller than *Max. ht. rec.*. - *Dif. ht. rec*, fan stages are unloaded subject to the basic and variable unload time. Heat recovery mode is activated through Digital Input 22.

VS 3000 BS Control algorithm heat recovery mode (HR mode)



Changes to control action in HR mode:

- High-pressure fault is not signalled.
- No compressor load shedding in high-pressure fault.

HR mode is indicated on the display of the CI 3000 Store Computer or AL 300 Operator Terminal:

- HR mode active:
  tc-Setp HR 45 °C
  pc-Setp HR 20.85b
- HR mode not active:
  tc-Setp 45 °C
  pc-Setp 20.85b

The appropriate settings must be made under Menu 3 Setpoints - 1 System Configuration - Ht. rec. mode when the VS 3000 BS is to be operated in HR mode. The function of Digital Input 22 changes from Burst Disk Monitoring to Activate HR Mode.

3.23 HP setpoint increase

The option is given with the VS 3000 BS of entering a temperature offset tc-Offset N (Menu 3-3-2), which is added to the setpoint temperature tc_Setp when LP setpoint toggle is active (through timer or Digital Input 20, terminals 88,89).

3.24 Fan protection / HP base load rotation

Additional functions for protection of the fan motors have been implemented in the VS 3000 BS. During periods of low outdoor temperatures, when only few of the condenser fans are needed, it is possible for fans to seize after being idle for an extended time.

This can be avoided by preventing extending standstill of fans with the Fan Rotation parameter (Menu 3-7).

When base load rotation is activated, the following additional entries appear in the operating screen:

1. *On time cond.*

   One of two modes can be selected:

   - Fan protection

   When *On time cond*. is set to N, the fan control scheme remains unchanged. Fans are loaded in the sequence from L1 to Ln and unloaded from Ln to L1. Fans that have been off for longer than the definable *Fan Cycle Time* (Menu 3-7) are then started for a period of 20 seconds.

   - Run time equalization

   When *On time cond.* is set to Y, the fan control sequence is changed. Fans are then not loaded and unloaded in sequence but according to running time. When a fan needs to be loaded, the fan then having the shortest run time will be started. When a fan needs to be unloaded, the fan then having the longest run time will be stopped.

   Fan base load rotation is also effective in this operating mode. When the HP controller remains in the neutral zone for the definable *Fan Cycle Time* (Menu 3-7), the fan then having the shortest run time will be started - if available - and the fan having the longest run time will be stopped.

2. *Cycle time F.*

   A value can be entered to determine the time after which either fan actuation or base load rotation is carried out as a function of the modes described above.

3.25 Monitoring condenser fan motors

Step control:

Digital inputs are provided for monitoring of condenser fan motors. When the floating contact of the motor overload cutout opens, the corresponding fan output is reset and a fault report is logged in fault memory. Forwarding of the report takes place according to the preselected priority. When the contact is closed, the fan is enabled for control. Some types of system require the fan output to remain activated after actuation of the motor overload cutout. Resetting of the fan output can therefore be deactivated by parameter setting (*Fan off by al.*, Menu 3-3-1).

Speed control:

Digital inputs are provided for monitoring of condenser fan motors. When the floating contact of the motor overload cutout opens, a fault report for the fan motor concerned is logged in fault memory. Forwarding of the report takes place according to the preselected priority. With variable-speed fans, the number of fans to be monitored is specified by the parameter *No.cap.stages* (Menu 3-1). Two stages are used for control.

3.26 Starting characteristics

Differentiation is made between two conditions when starting the controller:

- First start
- Restart

3.26.1 First start

First start of the VS 3000 BS Pack Controller can be initiated in various ways:

- On first starting the system (default parameters are loaded on controller first start)
  - After updating the firmware
  - After changing the operating mode by the coding switches of DIP switch S1
    (See Section 4 - Installation and Startup for details)
    - Number of external SIOX extension modules (0 or 1)
    - With or without discharge gas defrosting (optional SIOX extension module)

- If parameter setting is found to be incorrect by internal check

All variables, except the parameters, are set to zero. Default parameters are loaded. Owing to the large number of parameters, the basic settings can also be loaded by using a setup unit.

3.26.2 Restart

Restart takes place following return of power after an outage, provided the parameter settings have been preserved.

All variables, except the parameters, the fault memory and the archived data, are deleted.

3.27 Monitoring refrigerant level

A liquid level switch (Digital Input 23) signals to the controller when liquid level in the receiver falls below the low-level setpoint. Low refrigerant level does not affect control and regulating functions. Alarm is actuated after a definable time.

3.28 Monitoring burst disk

The controller can monitor a bursting disk via Digital Input 22. Alarm is generated if the input is de-energized. Forwarding of the alarm takes place according to the preselected priority. The digital input has no effect on the control and regulating functions.

When heat recovery mode is activated (Menu 3), the bursting disk digital input is used to activate HR mode and is then not available for monitoring the bursting disk.

3.29 Monitoring external alarm / speed adjuster

An external alarm can be transmitted via Digital Input 15 of the controller. When the input is de-energized, the alarm is forwarded after a definable delay according to the preselected priority. The input has no effect on control functions of the controller.

When operating the controller with HP control defined as step switch, this input is available for free use to transmit user-defined alarms. The message text can be entered in Menu 3-6 (*Alarm Text*). The default text loaded on first start is *External Alarm*.

When operating the controller with HP control defined as speed controller, the function of this input is predefined as the input to record faults on the fan control speed adjuster. In this instance the alarm text is predefined, as *Speed adjuster*.

3.30 Disabling refrigeration points

In the occurrence of a fault on the compressor pack, the pack controller can transmit a Z1/Z2 refrigeration point disable signal via CAN bus to all associate Z1/Z2 refrigeration points. The associate refrigeration points are case/coldroom controllers on which the node address and allocation to the Z1 or Z2 circuit of the pack controller have 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 failure are:

- Tripping of high-pressure cutout
- Tripping of all motor overload cutouts Z1/Z2
- Tripping of all low oil pressure cutouts Z1/Z2
- Manual shutdown of all compressors Z1/Z2

Refrigeration points are not disabled in the event of a low-pressure fault due to low suction pressure or tripping of the LP cutout. Additionally, refrigeration point enable signals are supplied through Digital Outputs 9 (Z1) and 10 (Z2)to allow of incorporating external controllers:

Refrigeration point enabling is made for both temperature ranges.

3.31 Discharge gas defrosting

Discharge gas defrosting (D2D) is a method of defrosting evaporators by passing compressed vapor from the compressor through them. It may be performed with either hot gas taken from the discharge line upstream of the condenser or cold gas taken from the receiver located downstream of the condenser.

Discharge gas defrosting as described herein is a two-pipe D2D system that can only be performed with hot refrigerant gas. Otherwise a risk is entailed of liquid refrigerant being drawn in by the compressors.

The VS 3000 BS allows of performing discharge gas defrosting on a single-circuit system with two LP temperature ranges, Z1 and Z2, served by a common condenser. All control devices required for control of both temperature ranges are contained in the one VS 3000 BS. The Z2 temperature range can be operated in the LT or NT range, while the Z1 temperature ranges is always NT.

Allocation of the case/coldroom controllers to temperature range Z1 or Z2 is made by defining the temperature ranges as Z1 or Z2 on the case/coldroom controller (or NT instead of Z1 and LT instead of Z2 on earlier types of controller). The CAN bus Node No. of the associate VS 3000 BS must also be communicated to each case/coldroom controller (see description of UA 300 Case/Coldroom Controller).

When performing discharge gas defrosting of Z2 refrigeration points, Z2 display cases and Z2 coldrooms can be defrosted jointly or separately. Separate defrosting requires a separate suction line for the Z2 coldrooms. Separate defrosting is not provided for the Z1 temperature range. Z1 cases and Z2 coldrooms are always defrosted jointly.

For discharge gas defrosting the VS 3000 BS requires an additional digital input/output module (SIOX).
Two temperature zones are needed for discharge gas defrosting: Z1 and Z2. Discharge gas is supplied by the Z1 refrigeration points for defrosting Z2 refrigeration points and by the Z2 refrigeration points for defrosting Z1 refrigeration points.

Coding switch 4 of DIP switch S1 on the VS 3000 BS must be set ON in order to activate discharge gas defrosting and display the corresponding setpoints and actual values (see Section 4 - Installation and Startup). Defrosting can then be activated by the internal defrost timer or by digital inputs of the controller.

3.31.1 Setpoints for discharge gas defrosting

Setpoints for discharge gas defrosting can be checked and adjusted by the AL 300 Operator Terminal, CI 3000 Store Computer or a PC. When discharge gas defrosting is activated (DIP Switch 4 set ON), a separate submenu *D2D* (Menu 3-9) is listed in the Setpoints menu.

Choosing the screen entry Defrost opens a selection list containing the following options:

- *Z2 and Z1* Defrosting is performed for the Z2 circuit and then, after a definable time has elapsed, for the Z1 circuit.
- *Z2 Only* Defrosting is performed only for the Z2 circuit.

Choosing the Defr. Z2R screen entry opens a submenu, in which the defrost method for Z2 coldrooms is defined:

- *With Cases*
  Defrosting is performed simultaneously with the Z2 display cases via a common suction line.
- *Aux. defrost*
  Joint defrosting via separate suction lines. Auxiliary defrosting can be performed on Z2 coldrooms.
- *Separate*
  Z2 display cases and Z2 coldrooms are defrosted independently via separate suction lines.
- *El. UA300*
  Z2 display cases and Z2 coldrooms have a common suction line. The Z2 cases are defrosted by D2D, the Z2 coldrooms by electric heater through the coldroom controller.

Choosing the *Defrost Timer* screen entry opens a submenu showing defrost times for joint defrosting (Z2 cases and Z2 coldrooms).

Choosing the *Defrost Timer Z2R* screen entry opens a submenu showing defrost times for auxiliary defrosting or separate defrosting of Z2 coldrooms. This line is only shown when auxiliary defrosting or separate defrosting has been defined for Z2 coldrooms.

One capacity stage of the Z1 compressor pack is unloaded on exceeding the t_c com. OFF limit.

No additional capacity stages of the Z1 compressor pack are loaded on exceeding the t_c *Disable Comp.* limit. The *Drain. Htr. Z2* parameter is the start delay for the Z2 coldrooms drain heater. Actual defrosting commences after this time has elapsed.

Defrost duration of Z2 display cases is governed by the Defrost Z2 parameter. The *Comp. OFF Z2* parameter defines whether the Z2 compressors are to be disable during defrosting or whether the suction pressure controller is to remain operating.

The Z2 compressors must be disabled after Z2 defrosting for oil to equalize between the Z2 and Z1 compressor pack. The t_0 *Comp. ON Z2* parameter is used to enter a value for t_0 at which the Z2 compressors are disabled until temperature reaches the set limit.

If the system is equipped with an oil equalizer, the Z2 compressors will be enabled when the t_0 value of the Z2 pack reaches the t_0 value of the Z1 pack. Compressor disabling is limited to 5 minutes maximum.

The parameter *t_0-Setp. Z1* is used to enter the to setpoint required in the Z1 loop of the VS 3000 BS during defrosting. This setpoint does not become active when only the Z2 coldrooms are being defrosted (joint or auxiliary defrosting).

The parameters *Bas. Time ON Z1* and *Bas. Time OFF Z1* are used to enter the basic load and unload times for loading and unloading compressor capacity stages of the Z1 circuit during Z2 defrosting. Variable control times are not active during defrosting.

The *Delay Z1 Defr.* Parameter is used to set the delay between Z2 defrosting and Z1 defrosting. With this delay, Z1 defrosting takes place following Z2 defrosting when the option Z2 And Z1 is selected in the Defrost menu.

The only way in which Z1 defrosting can be performed separately is by manual defrosting with the corresponding manual switch. Defrost duration of Z1 cases and coldrooms is governed by the Defrost Z1 parameter. The t_0-Setp. Z2 parameter is used to enter the t_0 setpoint that is to be controlled in the Z2 circuit of the VS 3000 BS during Z1 defrosting.

The parameters *Bas. Time. ON Z2* and *Bas. Time OFF Z2* are used to enter the basic load and unload times for loading and unloading compressor capacity stages of the Z2 circuit during defrosting. Variable control times are not active during defrosting.

3.31.2 Actual values for discharge gas defrosting

All digital inputs and outputs required for discharge gas defrosting can be checked with the AL 300 Operator Terminal, CI 3000 Store Computer or by PC. A setup unit can be used to display the D2D actual values (menu 2-6).

See also Section 5 - Pin and Terminal Connections of VS 3000 BS.

3.31.3 Manual control of D2D

The *Defrost Z2* input initiates joint defrosting in systems equipped with only one suction line for Z2 cases and Z2 coldrooms. The coldrooms can be defrosted manually through the *Defrost Z2R* input. The *Defrost Z1* input initiates Z1 defrosting without prior Z2 defrost.

Allocation of the case/coldroom controllers to temperature range Z1 or Z2 is made by defining the temperature ranges as Z1 or Z2 on the case/coldroom controller (or NT instead of Z1 and LT instead of Z2 on earlier types of controller). The CAN bus Node No. of the associate VS 3000 BS must also be communicated to each case/coldroom controller (see description of UA 300 Case/Coldroom Controller).

3.31.4 Sequence of joint Z2 discharge gas defrosting

	Signal:	**Start delay for drain heater 5 to 30 min**	**Unload to one stage**	**Pump down to low pressure at *Low LP Z2***	**Defrost time 10 to 30 min**			
1	Drain heater Z2 coldrooms	■	■	■	■			No start delay if power failure occurs during defrosting and for separate defrosting
2	SV2.2/1 and SV2.2/2 close suction line			■	■			4 min. monitoring time for pumpdown
3	SV3.2/1, SV3.2/2 discharge gas feed and SV1 common discharge line				■			
4	Defrost command to Z2 refrigeration points via bus				■			
5	Setpoint toggle (no shift) Z1 circuit				■	■		AL 300/ CI 3000 displays an *A* before t_0 _Z1 setpoint in overview
6	Forced cooling of all Z1 refrigeration points via bus				■			
7	Disable *Meas. Loop Fault LP_Z2* alarm					■		5 min. after opening suction line
8	Disable Z2 compressors 1.5 min before defrost termination				Pump-down or disable compressors	■		Without oil equalizer: Enable compressors when t_0-Z2 < t_0-Enable With oil equalizer: Enable compressors when t_0-Z2 < t_0-Z1 Max. disable after defrosting 5 min.

3.31.5 Sequence of Z2 display case discharge gas defrosting

	Signal:	**Pump down time 30 sec**	**Defrost time 10 to 30 min**		
2	SV2.1/1 and SV 2.2/2 close suction line	■	■		
3	SV3.2/1, SV 3.2/2 discharge gas feed and SV1 common discharge line		■		
4	Defrost command to Z1 refrigeration points via bus		■		
5	Setpoint toggle Z1 circuit (no shift)		■		AL 300/ CI 3000 displays an *A* before t_0 _Z1 setpoint in overview
6	Forced cooling of all Z2 refrigeration points via bus		■		
7	Disable *Meas. Loop Fault LP_Z2* alarm			■	5 min. after opening suction line

3.31.6 Sequence of Z2 coldroom discharge gas defrosting

	Signal:	**Start delay for drain heater 5 to 30 min.**	**Pumpdown time 30 sec**	**Defrost time 10 to 30 min.**	
1	Drain heater Z2 coldrooms	■	■	■	No start delay if power failure occurs during defrosting
2	SV2.2/1 and SV2.2/2 close suction line		■	■	4 min. monitoring time for pumpdown
3	SV3.2/1, SV3.2/2 discharge gas feed and SV1 common discharge line			■	
4	Defrost command to Z2 coldrooms via CAN bus			■	

3.31.7 Sequence of Z1 discharge gas defrosting

	Signal:	**Unload to one stage**	**Pumpdown to low pressure at *Low LP Z1***	**Defrost time 10 to 30 min.**		
2	SV2.1/1 and SV 2.2/2 close suction line					4 min. monitoring time for pumpdown
3	SV3.2/1, SV 3.2/2 discharge gas feed and SV1 common discharge line					Disable Z2 coldrooms with electric defrost. Defrost termination for Z1 case by temperature or time.
4	Defrost command to Z1 refrigeration points via bus					
5	Setpoint toggle Z2 circuit (no shift)					AL 300/ CI 3000 displays an *A* before t_0 _Z2 setpoint in overview
6	Forced cooling of all Z2 refrigeration points via CAN bus					
7	Disable *Meas. Loop Fault LP_Z1* alarm					5 min. after opening suction line

3.31.8 Sequence of Z2 discharge gas defrosting with defrost mode set to El. With UA 300

	Signal:	**Start delay for drain heater 5 to 30 min.**	**Unload to one stage**	**Pump-down to low pressure at *Low LP Z2***	**Defrost time 10 to 30 min.**		
1	Drain heater Z2 coldrooms	■	■	■	■		No start delay if power failure occurs during defrosting and for separate defrosting
2	SV2.2/1 and SV2.2/2 close suction line			■	■		4 min. monitoring time for pumpdown
3	SV3.2/1, SV3.2/2 discharge gas feed and SV1 common discharge line				■		Disable Z2 coldrooms for electric defrosting. Defrost termination on Z1 cases by temperature or defrost duration.
4	Defrost command exclusively to Z2 cases (not Z2 coldrooms) via CAN bus				■		
5	Disable cooling of Z2 coldrooms by refrigeration point disabling				■		
6	Setpoint toggle Z1 pack (no shift)				■		AL 300 / CI 3000 displays an A before t_0 setpoint in overview
7	Forced cooling of all Z1 refrigeration points via CAN bus				■		
8	Disable LP *Measuring Loop Error LP_Z2* alarm					■	5 min. after opening suction line
9	Disable Z2 compressors 1.5 min. before defrost termination when defrost duration equal to maximum defrost time				Pump-down or disable compressors	■	<u>Without oil equalizer:</u> Enable compressors when t_0 -Z2 < t_0 -enable <u>With oil equalizer</u>: Enable compressors when t_0-Z2 < t_0-Z1 Max. disable after defrosting 5 min.

3.31.9 Discharge gas defrosting in fault conditions

- Defrosting is repeated if power failure occurs within the first 10 minutes of defrosting. Start delay for the drain heater is not started however.
- Defrosting is cancelled if power failure occurs after defrosting has been running for at least 10 minutes.
- Defrosting is cancelled if low pressure does not drop to the t_0 limit *t_0 comp. OFF* (Menu 3-4) within 4 minutes of closing the suction line during Z2 defrosting. Fault report *Fault D2D Z2* is logged in fault memory.
- The fault report *Disab D2D Z2* or *Disab D2D Z2R* is logged in fault memory if defrosting is initiated by the internal timer and defrosting is disabled via the *Disable Defrost Z2* or *Disable Defrost Z2 Rooms* digital input.
- Defrosting is not initiated if a severe fault (safety loop) is signalled. The fault report *Fault D2D Z2* or *Fault D2D Z2R* is logged in fault memory together with the system fault.
- Defrosting is cancelled if low pressure does not drop to the t_0 limit *t_0 Low Z1* within 4 minutes of closing the suction line during Z1 defrosting. Fault report *Fault D2D Z1* is logged in fault memory.
- The fault report *Disab D2D Z1* is logged in fault memory if defrosting is initiated by the internal timer and defrosting is disabled via the *Disable Defrost Z1* digital input.
- Defrosting is not initiated if a severe fault (safety loop) is signalled. The fault report *Fault D2D Z1* is logged in fault memory together with the system fault.

4 Installation and Startup of VS 3000 BS

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.

It is also used to read out actual values and archived long-term data. Before commissioning the VS 3000 BS Pack Controller, basic settings of parameters must be made on the hardware and in the software.

4.1 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).
- Note that all leads running to and from the equipment (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.

All leads running to and from the VS 3000 BS (except the 230 V power supply and signal leads) must be shielded! This applies especially 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.

Experience shows that transmission of alarms is often not operational (telephone line not yet installed, etc.) at the time of commisioning the system. In such instances it is urgently recommended to monitor the controller with a CI 3000 Store Computer or AL 300 Operator Terminal via the CAN bus and allow transmission of alarms via a mobile telephone system using a GSM modem for example.

4.2 DIN rail mounting

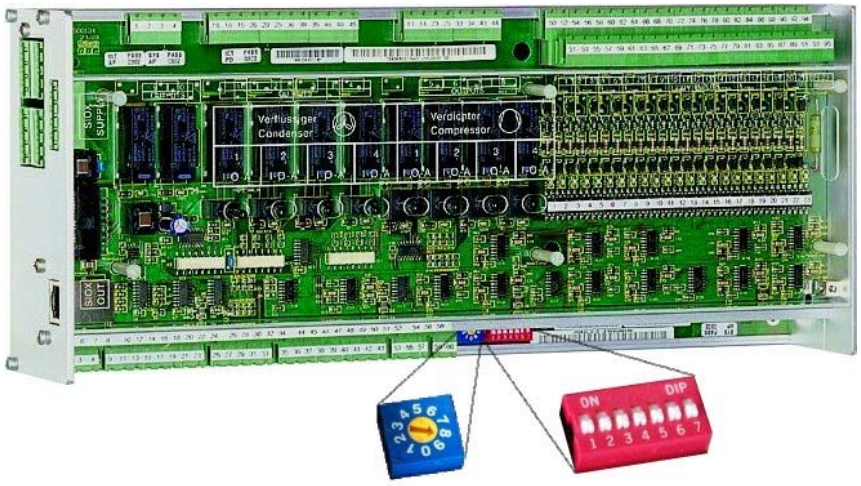
The VS 3000 BS Pack Controller is designed for cap rail mounting. It fastens on the cap rail by snapping on with two clips (on the underside). Power loss of the controller is 6 W and allowance must be made for this in installation. The pack controller is ready for operation after completing mechanical and electrical installation.

All leads running to and from the VS 3000 BS (except the 230 V power supply and signal leads) must be shielded! This applies especially to analog inputs (sensor leads) and CAN bus wiring.

See Section 10 - Specifications of VS 3000 BS for electrical enclosure and measurements.

4.3 Basic parameter settings on hardware

Basic parameter settings for the pack controller are configured with DIP Switch S1 and Decade switch S2. These switches are located beside the cover on the circuit board of the pack controller (see illustration).



Use the setting switches S1 and S2 to configure the following basic settings:

S1 - DIP switch for setting of

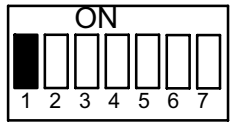
- (Not used)	Coding switch	1
- No. of SIOX extension modules	Coding switch	2
- (Not used)	Coding switch	3
- With/without discharge gas defrosting	Coding switch	4
- Service mode	Coding switch	5
- Firmware update mode	Coding switch	6 and 7

S2 - Decade switch for

- Setting Node No. (Nd.nnn) or CAN bus address	Position	1 to 9	Address 101 to 109
- Deactivating as CAN bus station	Position	0	NO address

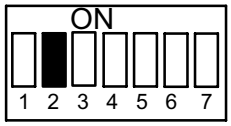
4.3.1 Basic settings with S1

Coding switch 1 of DIP switch S1:

DIP switch S1 Coding switch 1	Switch position	
	**ON**	Not used
	OFF	Not used

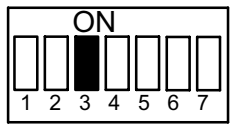
Setting the number of extension modules (number of capacity stages)

Coding switch 2 of DIP switch S1 defines whether a SIOX extension module is used.
In the basic version the VS 3000 BS can control 4 compressor and 4 fan capacity stages.
One additional SIOX extension module is required for maximum 8 compressor and 8 fan capacity stages.

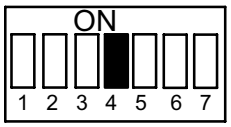
DIP switch S1 Coding switch 2	Switch position	Number of SIOX extension modules
	**ON**	**1 external SIOX module** **- Max. 8 compressor stages** **- Max. 8 fans**
	OFF	**No extension module** **- Max. 4 compressor stages** **- Max. 4 fans**

One SIOX extension module maximum can be used to provide the required inputs and outputs (see Section 1 - System Design).

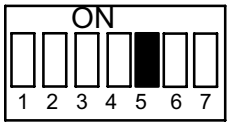
Coding switch 3 of DIP switch S1:

DIP switch S1 Coding switch 3	Switch position	
	**ON**	Not used
	OFF	Not used

Setting discharge gas defrosting

DIP switch S1 Coding switch 4	Switch position	Discharge gas defrosting
	**ON**	With discharge gas defrosting
	OFF	Without discharge gas defrosting

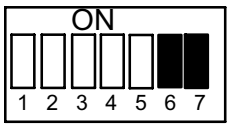
Setting service mode

DIP switch S1 Coding switch 5	Switch position	Service-Modus
	**ON**	Service mode
	OFF	Normal operating mode

Following an electric power failure, the system starts in service mode with default parameters for service purposes. Changes to parameters are not permanently saved (power failure).
Coding switch 5 of DIP switch S1 may **only** be set ON to invoke service mode.

Service mode must always be deactivated for normal system operation
(Coding switch 5 of DIP switch S1 **must** be set OFF)!

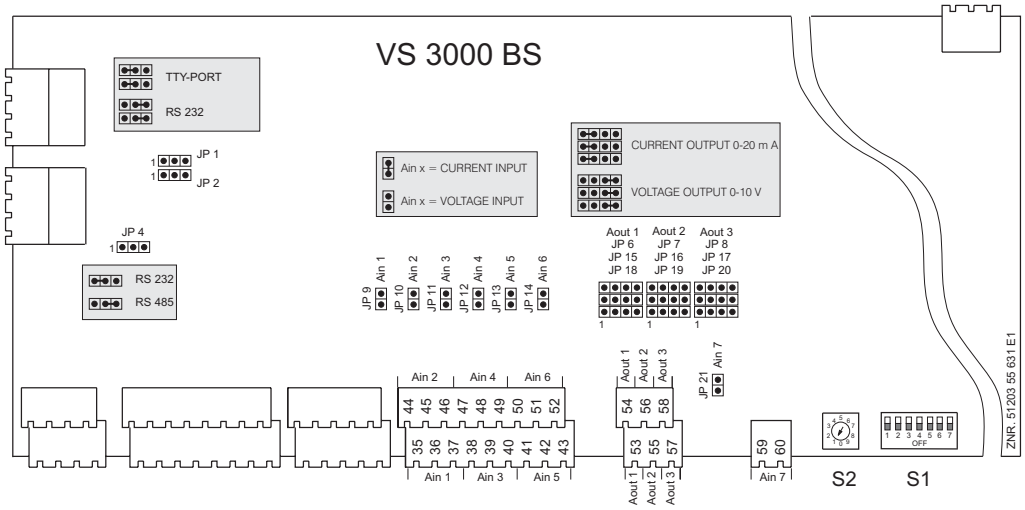
Setting firmware update mode

DIP switch S1 Coding switches 6 and 7	Switch position	Firmware update mode
	**ON**	Normal operating mode
	OFF	Firmware update mode

Coding switches 6 and 7 of DIP switch S1 may **only** be set OFF for downloading firmware.
At this setting the controller awaits firmware update from a connected Service PC.
Firmware update mode must **always be deactivated** for normal system operation (Coding switches 6 and 7 of DIP switch S1 **must** be set ON)!

If a switch position is changed after startup, the basic parameters for the set temperature range will be loaded the next time the controlled is started (power failure) and the controller will perform first start. In view of the large number of parameters, the basic parameters can also be loaded with the operating terminal (see Section 8 - Menu Structure).

After changing switch positions on S1 or S2, the VS 3000 BS must be turned off briefly for the new settings to take effect!



4.3.2 Basic settings with S2

Setting the Node No. / Deactivating CAN bus communication

Decade switch S2 defines the Node No. (Nd.nnn) or CAN bus address. This setting is normally made by the manufacturer of the switchgear.

Decade switch S2	Switch position	Node No. (Nd.nnn) / CAN bus address	Function
	**0**	NONE	CAN bus communication of pack controller disabled
	1..9	101..109	Node No. nnn assigned to pack controller

After changing switch positions on S1 or S2, the VS 3000 BS must be turned off briefly for the new settings to take effect!

4.4 Basic parameter settings in software

On the CI 3000 Store Computer or AL 300 Alarm Terminal, choose Menu 5 Remote Operation and, in the operating screen that opens, select the VS 3000 BS Pack Controller by the set Node No. (S2 - see Section 4.2.2). The parameters listed below must then be set in the appropriate VS 3000 BS screens.

System Configuration parameters (Menu 3-1)

- *Refrigerant*
  - Scroll with the UP and DOWN cursor keys (↓) (↑) and select the appropriate refrigerant
- *Sensor match*

  The VS 3000 BS Pack Controller works with continuous pressure transducers of linear characteristic. Pressure inputs can be matched to various linear-characteristic transducers. Both transducers with current output (4 to 20 mA) and those with voltage output (0 to 10 V) can be used. The following parameters are used to match the controller to the pressure transducers:

  1. *Z1/Z2 Sensor and HP Sensor:*
     Select sensors of continuous current output or continuous voltage output type.
  2. Parameter setting for pressure transducers:

p_0-Z1 4 mA / p_0-Z1 0 V	Parameter defining pressure at which Z1 transducer delivers 4 mA / 0 V output signal
p_0-Z1 20 mA / p_0-Z1 10 V	Parameter defining pressure at which Z1 transducer delivers 20 mA / 10 V output signal
p_0-Z2 4 mA / p_0-Z2 0 V	Parameter defining pressure at which Z2 transducer delivers 4 mA / 0 V output signal
p_0-Z2 20 mA / p_0-Z2 10 V	Parameter defining pressure at which Z2 transducer delivers 20 mA / 10 V output signal
p_c 4 mA / p_c 0 V	Parameter defining pressure at which HP transducer delivers 4 mA / 0 V output signal
p_c 20 mA / p_c 10 V	Parameter defining pressure at which HP transducer delivers 20 mA / 10 V

Changing any of these parameters generates a Changed Sensor Type message.

Jumpers must be changed on the controller when using voltage-output transducers! The default configuration is for current inputs!

- *No. comps.Z1* and *No. comps.Z1*
  - Number of compressor stages in Z1 and Z2
- *No.cap.stagesZ1* and *No.cap.stagesZ2*
  - Number of capacity stages in Z1 and Z2
- *No.cond. stages*
  - Number of condenser capacity stages

Menu 3-4 Comp.Monitor

- *t_0 Comp. OFF Z1 and t_0 Comp. OFF Z2*
  – t_0 limit for disabling compressors in Z1 and Z2

The t_0 limit must be higher than the value manually set on the pressure switch.

- *t_c Comp OFF Verd* and *t_c Comp ON*
  – t_c limit for *compressor unload* / compressor enable

t_c limits for compressor unload/enable must be lower than the value manually set on the HP cutout

Faulty parameter settings can result in severe impairment of function.

4.5 Commissioning of speed controlled condenser fans / compressors

For the activation of speed controlled condenser fans, i.e. compressors, a frequency converter, i.e. speed actuator is required in addition to the VS 3000 BS. When wiring an installation with FCs/speed actuators a range of further measures are required, in particular for interference suppression:

1. All low voltage signal inputs and outputs of the VS 3000 BS must be contacted using shielded cable. With installations deploying FCs/speed actuators, the correct execution of the shielding is of special importance. In the event of inadequate shielding, the high level of interference radiation generated by the FCs/speed actuators can lead to a significant impairment of the measured values.

2. With the temperature inputs (PT1000 inputs) special care must be taken to avoid a connection between the sensor leads and the signal ground or the shielding.

3. Analog inputs and outputs are sensitive to interference supply and reverse polarity! It is **essential** to check that the polarity is correct when connecting the VS 3000 BS to the control input of the FC/ speed actuator. Furthermore, FCs/speed actuators are frequently equipped with a supply for sensors or potentio meters which can be used to set the speed default. **Under no circumstances** is this supply to be connected to the analog output of the VS 3000 BS. In the event of a faulty connection between the VS 3000 BS and the FU/speed actuator subassemblies within the VS 300 can be permanently damaged.

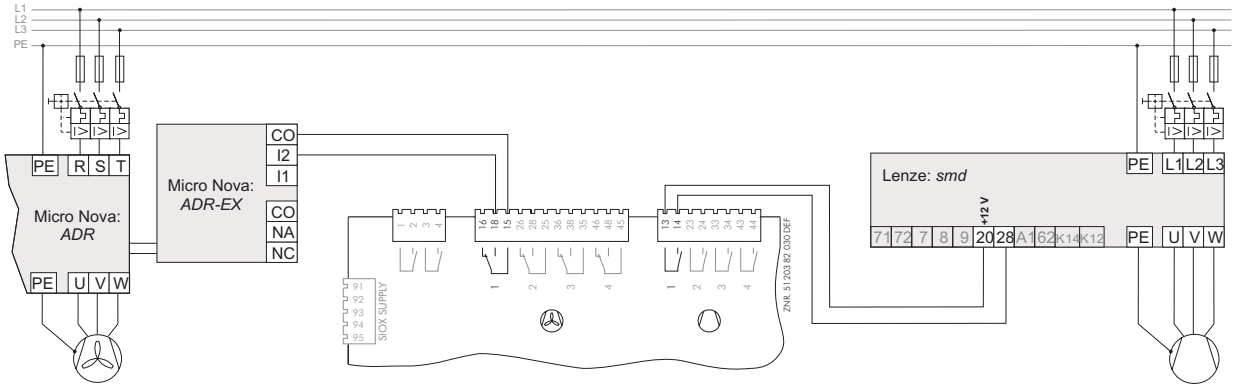
4.5.1 Procedure for commissioning an installation

The following circuit diagrams are simplified diagrams of the connections between the VS 3000 BS and the FC (using the example of the *smd* series from *Lenze*), i.e. speed actuator (using the example of the *ADR* series from *Micro Nova*). Detailed safety measures (e.g. lock-down) are not illustrated in the simplified diagrams and must be taken into account during assembly.

For the correct activation of the FCs/speed actuators the following signals are provided by the pack controller:

1. Enable FC/speed actuator:

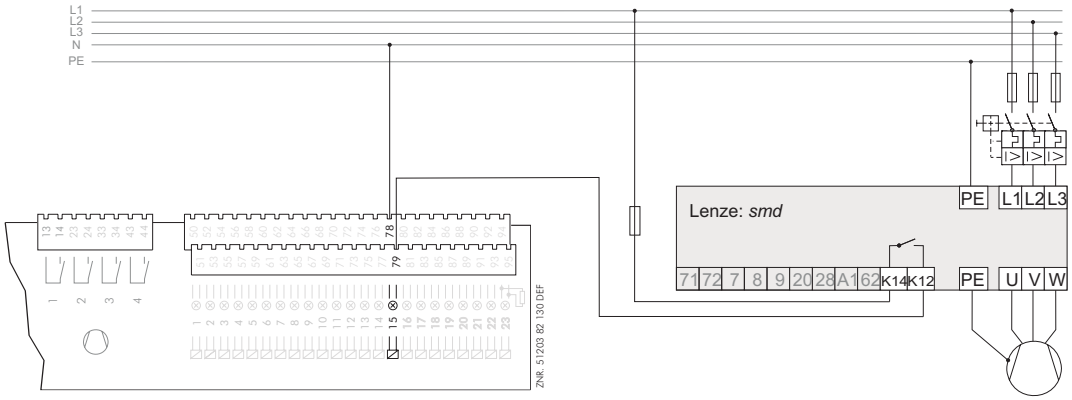
With combined compressor regulation, the frequency converter is enabled via the digital output for compressor 1 (terminals 13/14). With speed controlled condenser fans the enable command for the FC/speed actuator is transmitted via the digital output for fan 1 (terminals 15/18). In normal operation the enable command is withdrawn if the suction/condenser pressure is too low. The following picture shows an installation **without** power supply bridging.



The FC/speed actuator must be parameterised so that the enable command is issued when the contact is closed, i.e. a voltage is applied.

2. Fault indication input speed actuator / external alarm:

During continual compressor or condenser control, the fault indication input of the FCs/speed actuators are monitored via digital input 15 (terminals 78/79) of the pack controller. The indicator text for the input *Speed contr./ External alarm* when parameterised for continual control is automatically set to *Speed contr.*

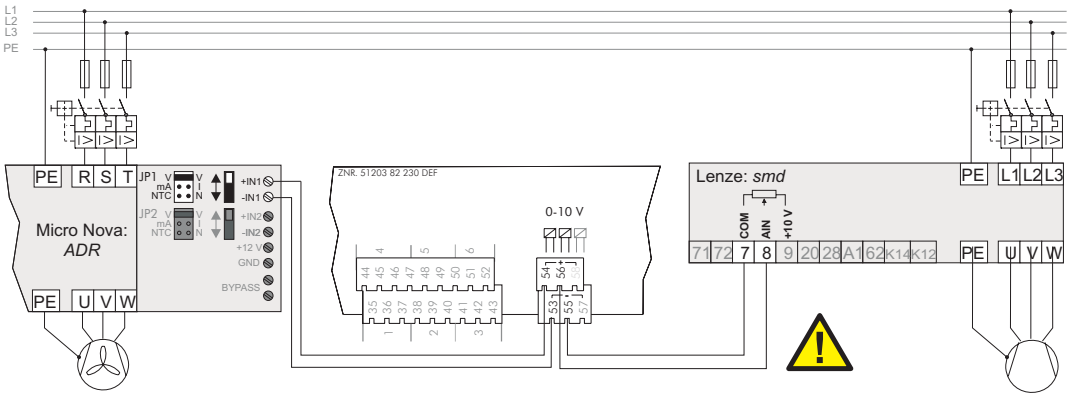


This fault indication is active when there is no voltage at the input of the FC/speed actuator, i.e. the FC/speed actuator must be parameterised, i.e. connected so that 230 VAC is present at input 15 under normal conditions.

If both the compressor and the condenser regulation are executed as speed controlled, the input *Speed contr./ External alarm* monitors the fault indication output of the frequency converter for the condenser control and must be wired accordingly. In this case the fault indication output of the FC/speed actuator for the condenser fan cannot be monitored.

3. Analog actuating variable for the compressor speed / fan speed:

Via the analog output 1 (terminals 53/54) a 0-10 V signal for the condenser fan is emitted. Via the analog output 2 (terminals 55/56) a 0-10 V signal for the speed of the speed controlled compressor is emitted.

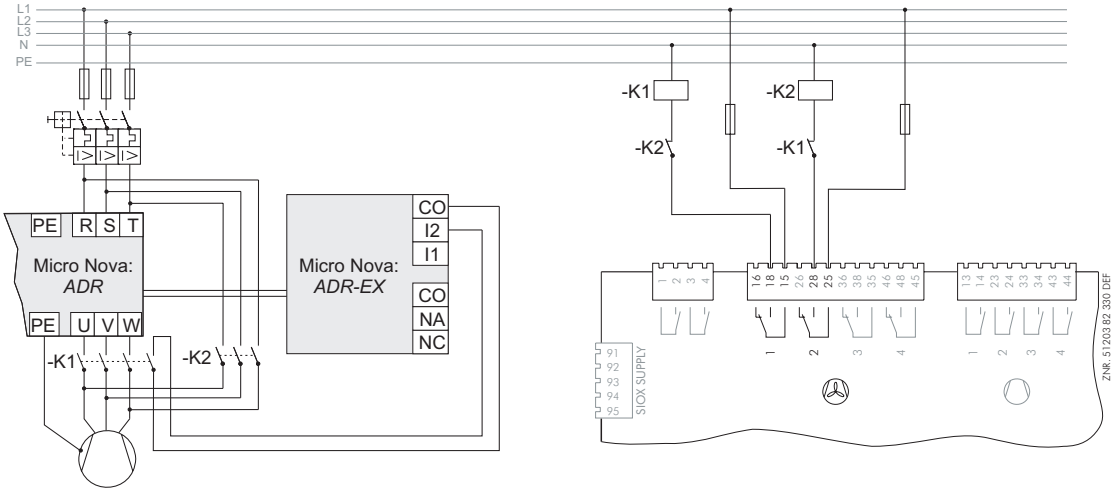


When connecting these outputs special precautions need to be taken (see instructions in chapter 4.5).

In addition to the adjustment of the frequency converter input for the receipt of a 0-10 V signal, the operating point of the FC/speed actuator needs to be set. A request from the pack controller for 0 V at the analog output means minimum speed, a request for 10 V means maximum speed. The FU/speed actuator must be operated in the speed control mode for this purpose, i.e. the speed of the fan/compressor is directly proportional to the voltage emitted by the pack controller.

4. Digital output for power supply bridging with speed controlled condenser fans:

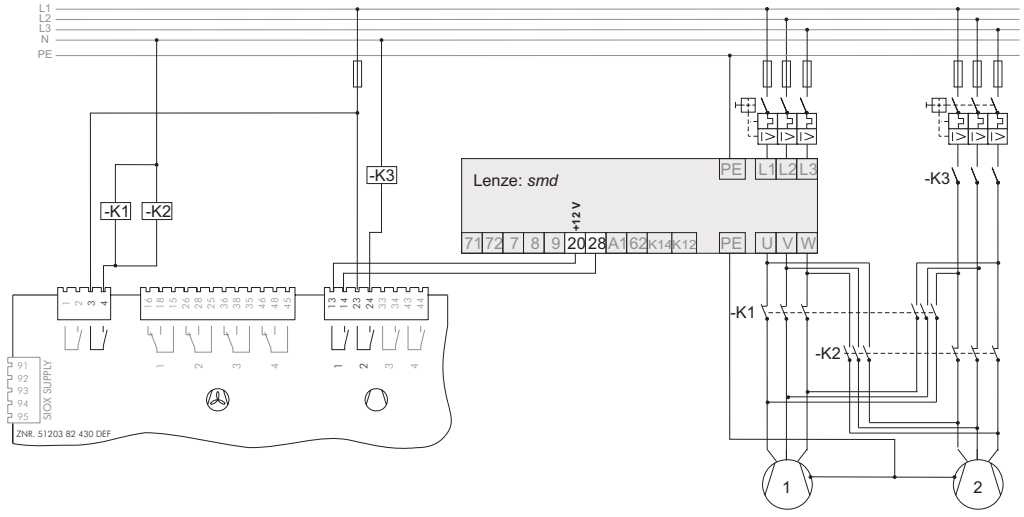
The digital output for fan 2 (terminals 28/25) serves to bridge the FC/speed actuator for the speed controlled fan. If the parameterisable temperature tc-Max. (menu 3-2-2-1) is exceeded, then the speed actuator enable is withdrawn (terminals 15/18, fan output 1 switches off) and instead, fan output 2 is set (power supply bridging).



It is essential to ensure that the power supply bridging is also realised in the switch cabinet or that the power supply bridging function is deactivated by setting the tc-Max. parameter to ”---”, otherwise when tc is too high (tc > tc max.) no condenser capacity is available!

5. Digital output for the base load rotation of the speed controlled compressor with combined regulation

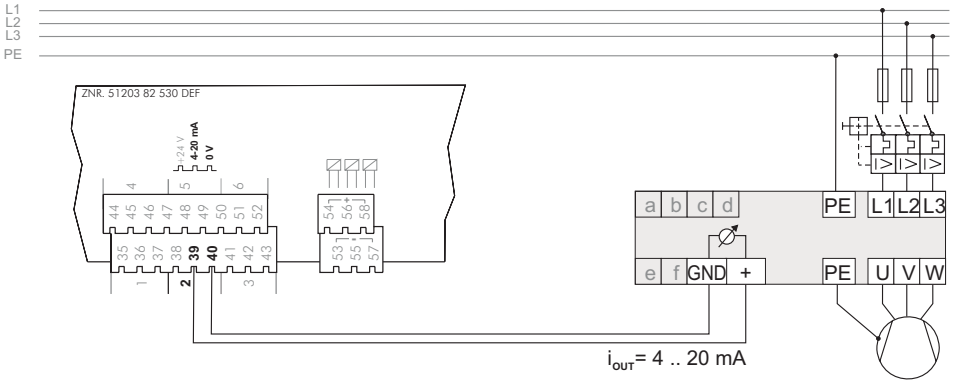
As the speed controlled compressor demonstrates the longest operating time in the combined regulation mode, a base load rotation of the speed controlled compressor is conducted in addition to the base load rotation of the fixed network compressor. To this end, compressor 1 and compressor 2 are switched alternately to the frequency converter via the parameterisable cycle time for the base load rotation.



The base load rotation of the speed controlled compressor is conducted via digital output 10 (terminals 3/4). If the contact is closed, an external circuit must be employed to ensure that compressor 2 is switched to the frequency converter and that compressor 1 is in fixed network operation. If the contact is open then compressor 1 is assigned to the frequency converter and compressor 2 to the fixed network.

6. Analog input for reading back the analog input signal of the FC/speed actuator

Modern FCs/speed actuators often provide the option for transmitting the actual speed or the motor current as an analog value. In order to do this, the analog output must be parameterised as a current output (4-20 mA). 4 mA at the analog output means minimum speed/current, 20 mA means maximum speed/current. For recording purposes, the analog output signal of the FC/speed actuator can be wired to analog input 2 (terminals 39/40) of the pack controller:



4.6 Replacing the battery

The pack controller contains a backup battery of type CR 2450 N, 3 V lithium. The pack controller must be removed from the system when the battery needs replacing, meaning that the compressor pack is not controlled and monitored during this time.

If the pack controller is connected to a higher-order controller via the CAN bus, it will then not be present on the CAN bus. Attention is therefore required to the repercussions this has on the higher-order controllers connected to the CAN bus as well as to precautions directly affecting the pack controller.

The safety regulations contained in the **Installation, General Safety and Connection Notes Manual** must be observed and complied with when changing the battery. All connectors may only be connected or disconnected when power is off. Circuit boards may only be exchanged when power is disconnected. Always hold circuit boards at the edges.

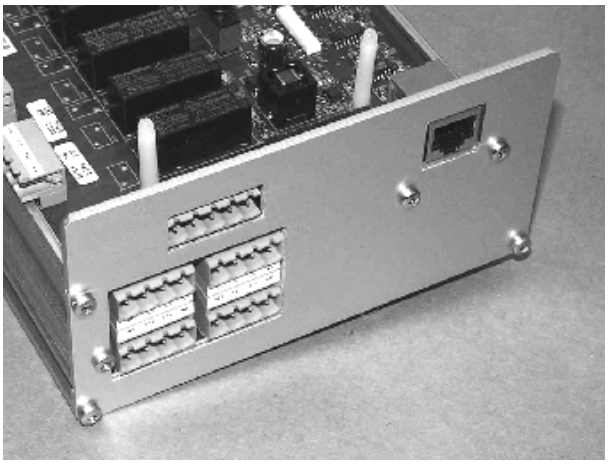
Electrostatic discharge (ESD) regulations must be observed and complied with! (See **Installation, General Safety and Connection Notes Manual**).

When the pack controller is connected to the CAN bus, removal of the controller from the CAN bus causes fault alarm on the higher-order controller (Store Computer). Make sure that service mode is activated on the CI 3000 Store Computer or that the Service Center is notified accordingly in advance.

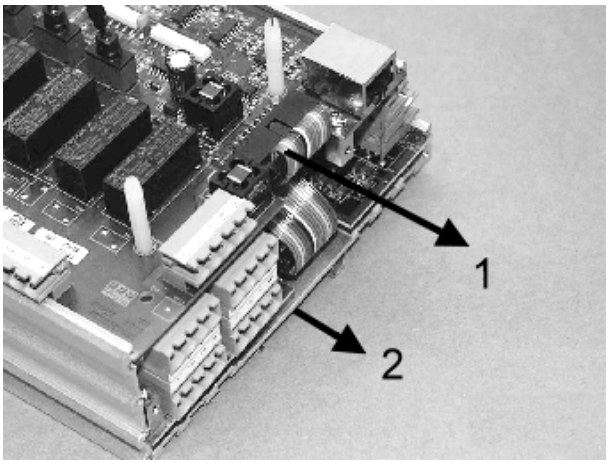
1. Disconnect the pack controller from power. Cancel alarm on Store Computer.
2. Disconnect all connectors, remove controller from support is necessary.

Some connectors carry 230 V AC power. Mark connectors as appropriate before disconnecting.

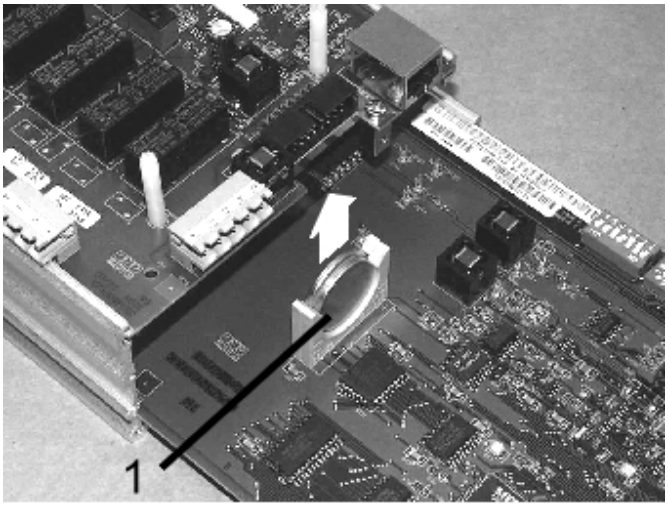
3. Undo six screws on side panel:



4. Pull connector (1) out to rear and pull out lower circuit board (2).



5. Pull battery (1) upwards out of holder and dispose of it in regulation manner:



Do not grip the new battery with metal pliers, as it might short-circuit and be destroyed.
- Wipe the new battery with a clean, dry cloth.
- Do not touch the edge contact faces.

7. Grip the new battery with a cloth and insert it in the battery holder.
8. Re-assemble in the reverse order. Reconnect all connectors.
9. Reconnect pack controller to power.
10. Provided configuration of the CI 3000 Store Computer is not changed, the pack controller will be re-detected automatically via the CAN bus. Date, time and automatic daylight saving change will be set automatically by central time synchronization.

Messages and/or alarms displayed when restarting the pack controller must be checked out on the CI 3000 Store Computer or AL 300 Operator Terminal!

First start should be performed on the pack controller after replacing the battery. All variables, except the parameters, are reset to zero. Data should be backed up with the LDSWin Software prior to performing first start.

4.7 Installing firmware update

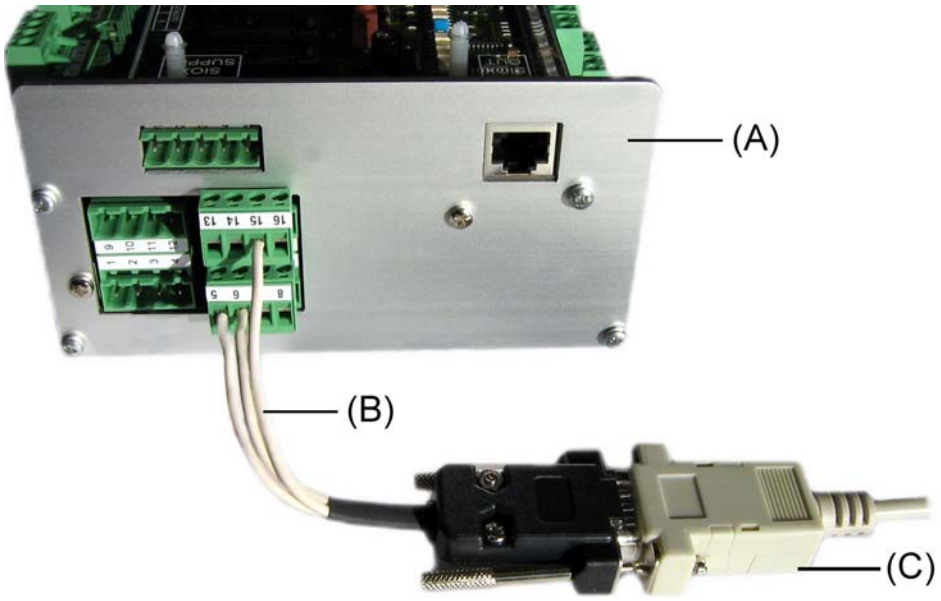
As supplied, the pack controller is operational and contains the current firmware. Future software versions can be loaded into the pack controller by firmware update when required to bring them up to date.

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)!

4.7.1 Requirements

The following conditions are required for firmware update:

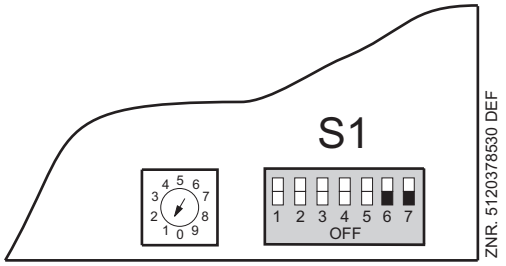
1. Pack controller (A)
2. Flash cable (B), Order no. KABLINDAD1
3. Null modem cable (C), 2 connectors female 9-pin Sub-D, Order no. PCZKABSER2
4. Update file *progvs.zip*



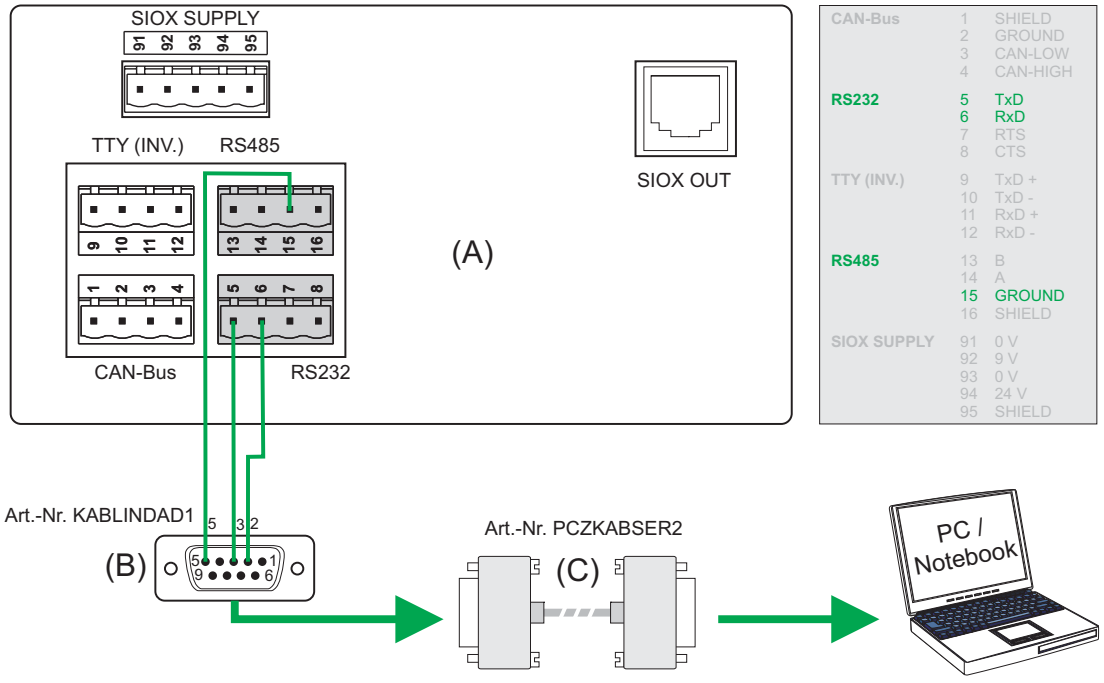
4.7.2 Updating current firmware

Firmware update is performed with the help of a PC or notebook computer connected to the pack controller via the COM port. It is **essential** to observe and carry out the steps listed below:

1. Disconnect the pack controller from the line power supply (the pack controller **must** be off-circuit).
2. Set Coding Switches 6 and 7 of DIP Switch S1 to OFF position (see chapter 4.3.1).



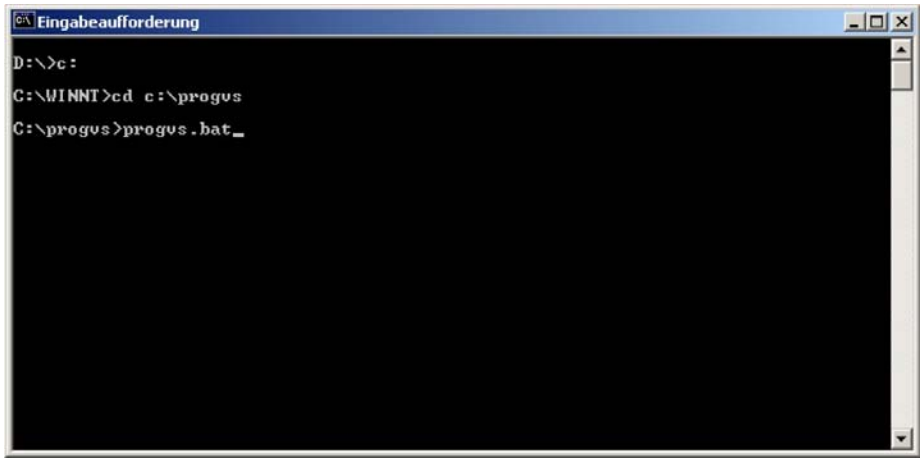
3. Connect pack controller (A) with flash cable (B)
   (connect both 4-pin connectors to the terminals 5..8 and 13..16).
4. Connect flash cable (B) with null modem cable (C).
5. Connect null modem cable with the COM 1 port of the PC.



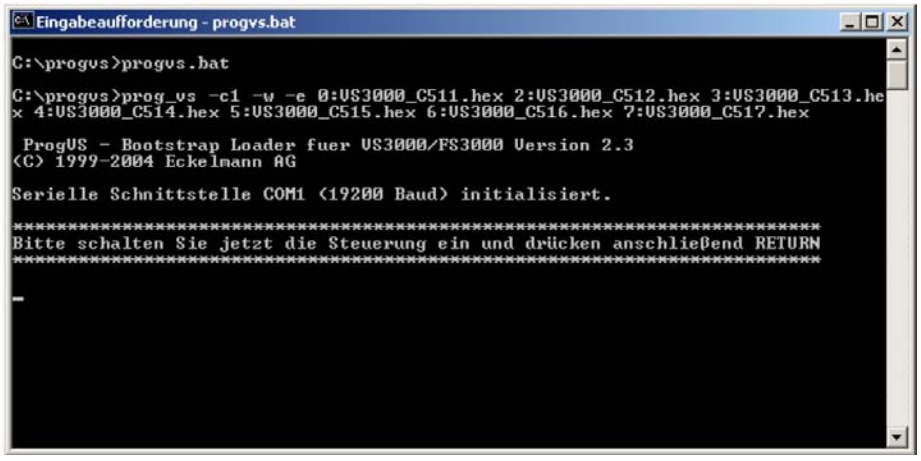
6. Extract the contents of the file "***progvs.zip"*** into the directory "***:\progvs***"
   (a different directory can also be selected if required).

7. Invoke the DOS command prompt on the PC or notebook via
   Start->All Programs->Accessories->Command Prompt.

8. At the command prompt, change to the directory where the progvs.zip file was extracted to. If not already selected, drive C is specified by entering "**C:**". The subdirectory is changed to by entering *"**cd c:\progvs**"*:

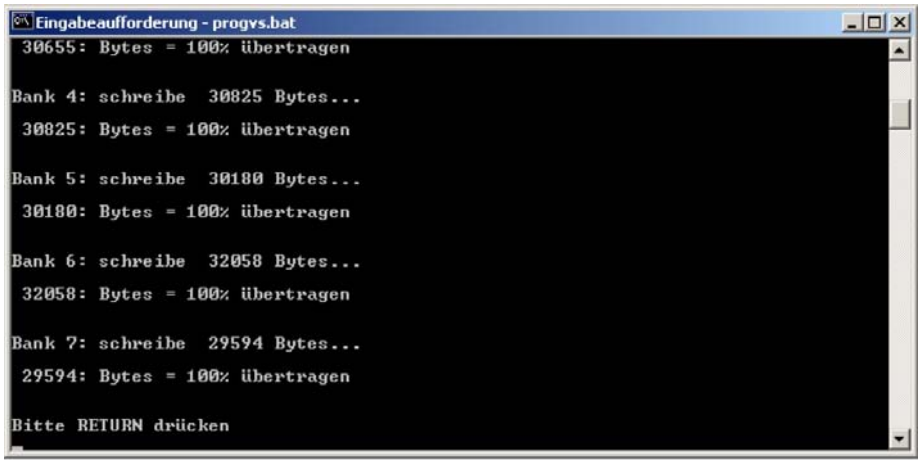


9. The update is started by inputting "***progvs.bat***" and pressing the Enter / Return key. The following screen is displayed:

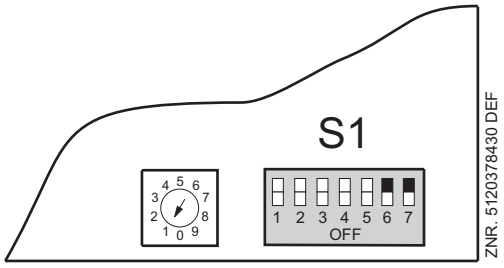


10. Comply with the message *"Bitte schalten Sie jetzt die Steuerung ein und drücken anschließend RETURN" (means "*Please switch on the controller now and then press ENTER")
    - Restart the pack controller
    - Then press the Enter key

11. The following screens opens while the firmware update is being loaded into the pack controller:



12. This screen closes automatically on pressing the Enter when the firmware has been updated..
13. Set coding switches 6 and 7 of DIP Switch S1 back to ON (see chapter 4.3.1)



14. Reconnect the pack controller to the line power supply.

In normal operation, Coding Switches 6 and 7 of DIP switch S1 are always set ON! After changing the switch positions of both S1 and S2, the pack controller must be disconnected briefly from power for the new settings to take effect!

Notice:

5 Pin and Terminal Assignments of VS 3000 BS

The following figures and tables show the terminal assignments of the VS 3000 BS Pack Controller inputs and outputs required for maximum 8 compressor and 8 fan stages.

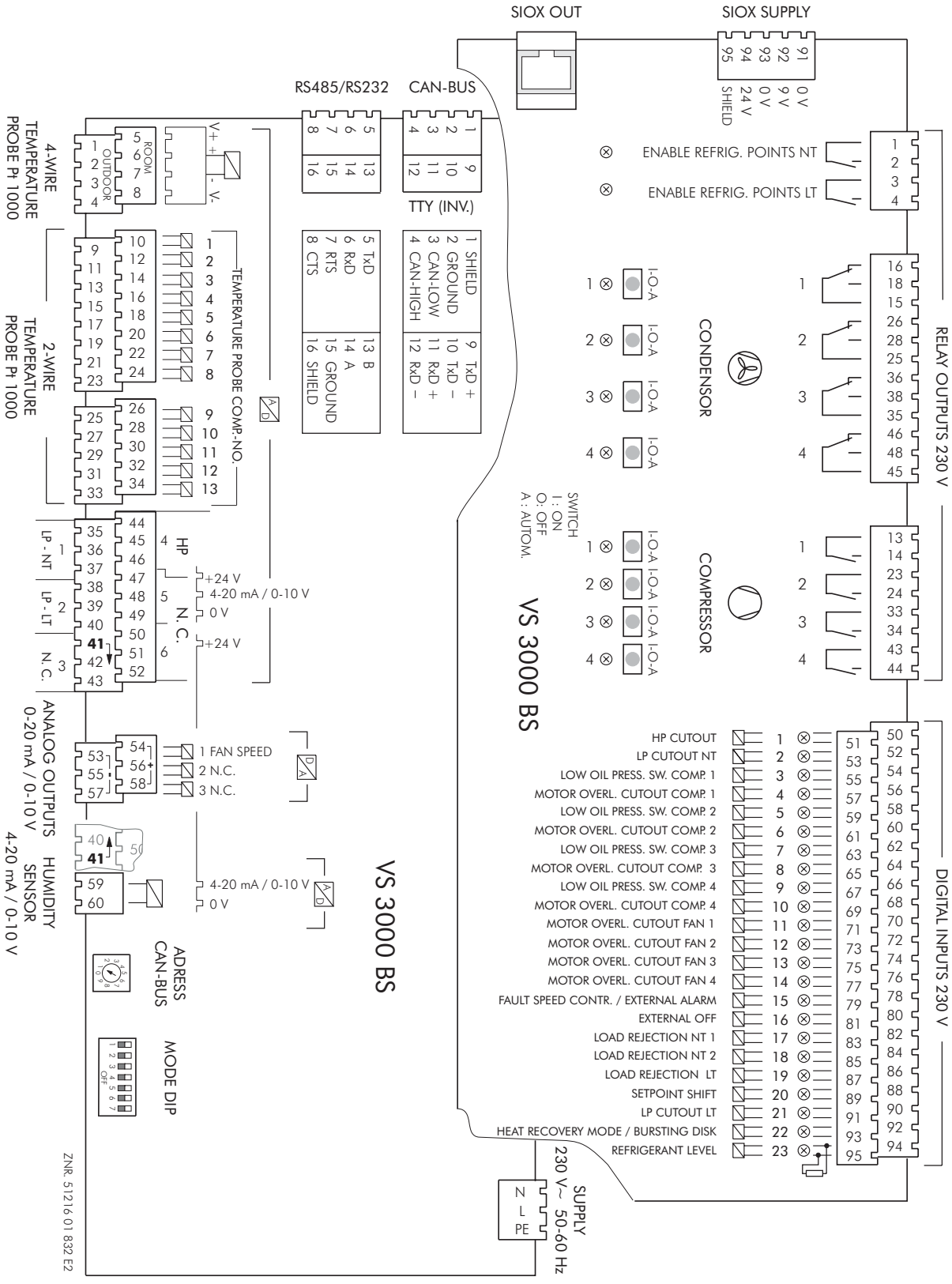
The following items MUST be observed and complied with when connecting wiring:

- All connecting leads from and to the VS 3000 BS - except digital inputs and relay outputs - must be shielded in order to prevent malfunction, e.g. faulty measurements.

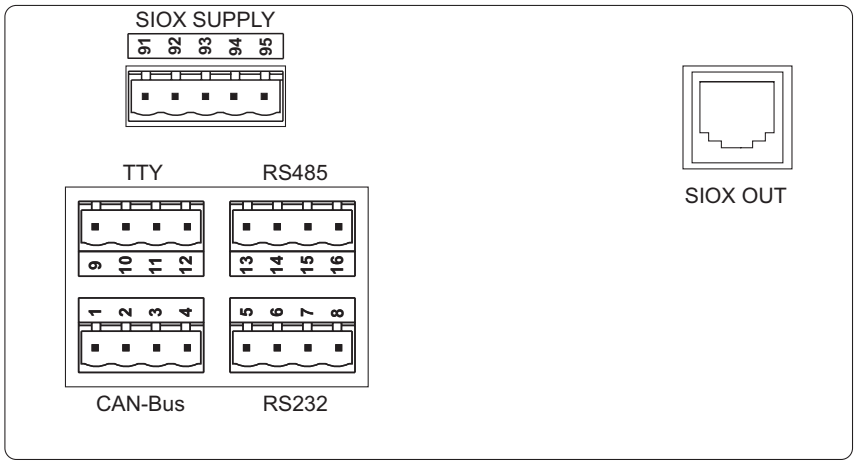
- Make sure that polarity is correct on inputs and outputs carrying current and voltage signals (0 to 10 V or 4 to 20 mA). Short circuiting or incorrect signal feed can result in impairment of function or even destruction of internal components of the VS 3000 BS. Also make sure that the inputs and outputs are correctly configured (for current or voltage signals) by the jumpers provided.

- Always disconnect the system from power before disconnecting or connecting connectors on the VS 3000 BS.

5.1 Pin assignments



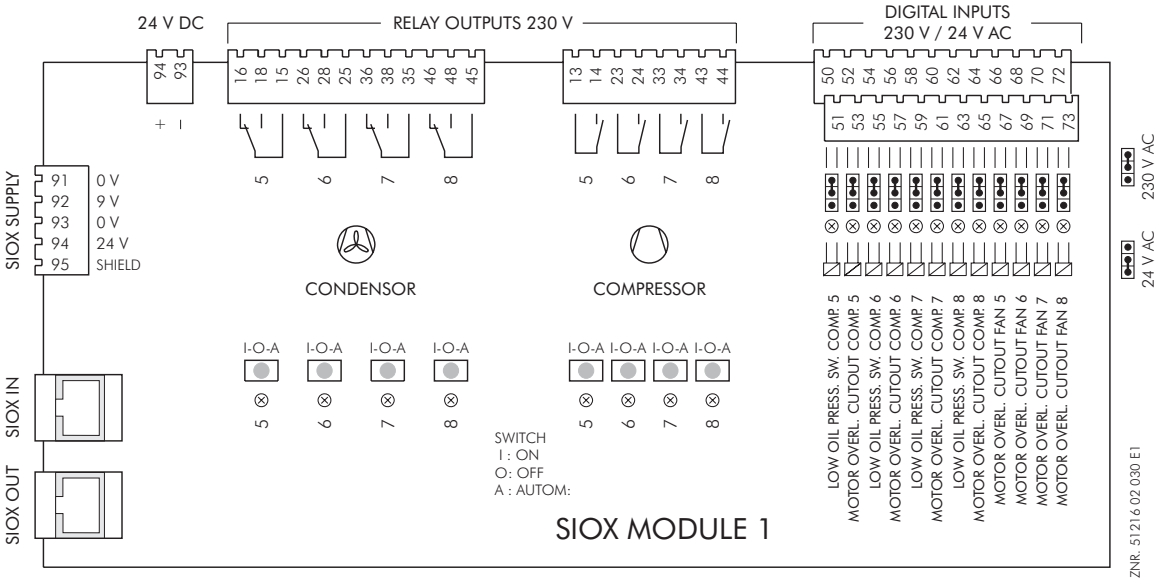
Pin assignments of VS 3000 BS basic module



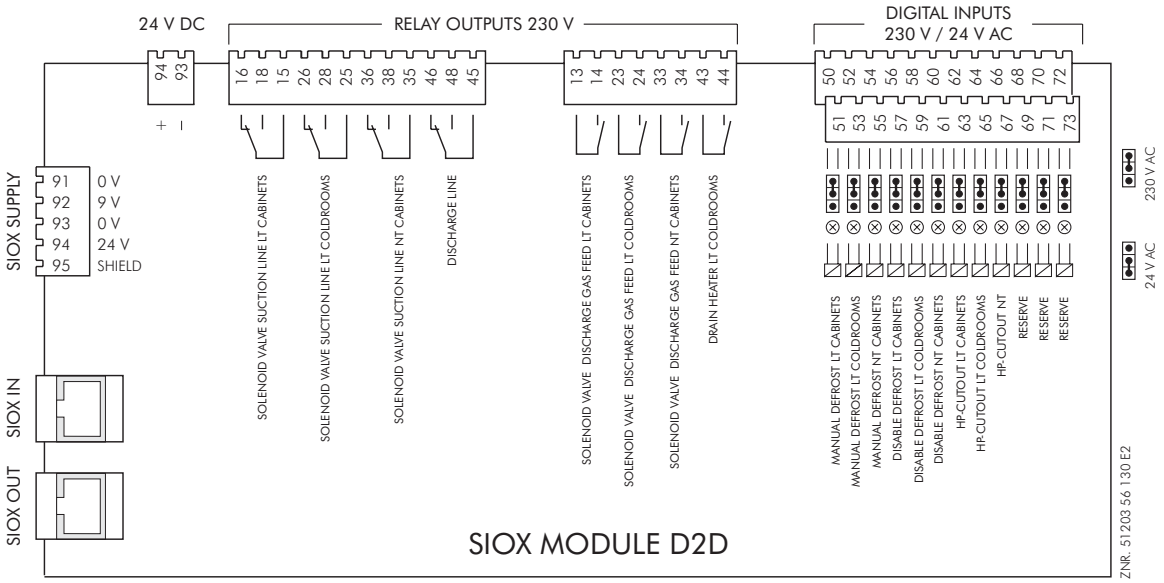
CAN-Bus	1	SHIELD
	2	GROUND
	3	CAN-LOW
	4	CAN-HIGH
RS232	5	TxD
	6	RxD
	7	RTS
	8	CTS
TTY	9	TxD +
	10	TxD -
	11	RxD +
	12	RxD -
RS485	13	B
	14	A
	15	GROUND
	16	SHIELD
SIOX SUPPLY	91	0 V
	92	9 V
	93	0 V
	94	24 V
	95	SHIELD

ZNR. 51203 55 830 D0

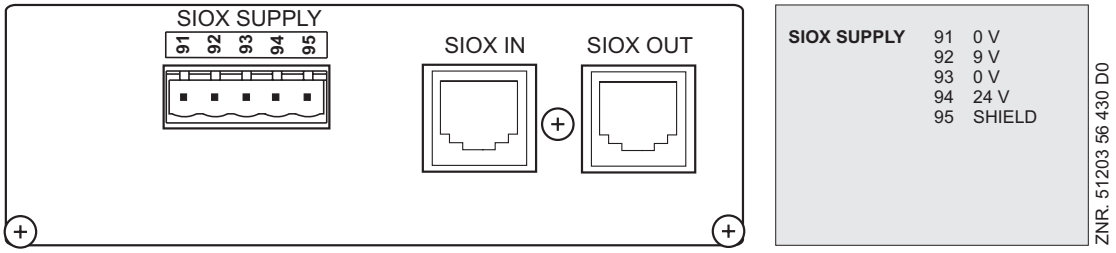
Pin assignments of VS 3000 BS basic module - side connections



Pin assignments of first SIOX extension module



Pin assignments of D2D SIOX extension module for discharge gas defrosting



Pin assignments of SIOX expansion module - side connections

5.2 Inputs/outputs for 4 compressor capacity/4 fan stages

Digital Inputs	
Function	**Basic Module Terminal No.**
High-pressure cutout	50, 51
ressure cutout Z1	52, 53
Bursting disk with HR mode activated -> HR demand	92, 93
Setpoint toggle (day/night operation)	88, 89
Fast unload/External OFF	80, 81
Motor overload cutout Condenser Fan 1	70, 71
Motor overload cutout Condenser Fan 2	72, 73
Motor overload cutout Condenser Fan 3	74, 75
Motor overload cutout Condenser Fan 4	76, 77
External alarm (speed adjuster fault with HP speed control activated)	78, 79
Low oil pressure cutout Compressor 1	54, 55
Low oil pressure cutout Compressor 2	58, 59
Low oil pressure cutout Compressor 3	62, 63
Low oil pressure cutout Compressor 4	66, 67
Motor overload cutout Compressor 1	56, 57
Motor overload cutout Compressor 2	60, 61
Motor overload cutout Compressor 3	64, 65
Motor overload cutout Compressor 4	68, 69
LP cutout Z2	90, 91
Load shedding Stage 1 Z1	82, 83
Load shedding Stage 2 Z1	84, 85
Load shedding Z2	86, 87
Level monitoring/Refrigerant low liquid level	94, 95

Digital Outputs	
Function	**Basic Module Terminal No.**
Enable refrigeration points Z1	1, 2
Enable refrigeration points Z2	3, 4
Controller Compressor 1	13, 14
Controller Compressor 2	23, 24
Controller Compressor 3	33, 34
Controller Compressor 4	43, 44
Controller Condenser Fan 1	15, 16,18
Controller Condenser Fan 2	25, 26, 28
Controller Condenser Fan 3	35, 36, 38
Controller Condenser Fan 4	45, 46, 48

Analog Inputs		
Function		**Basic Module Terminal No.**
Outdoor temperature (optional)	+ Sensor + PT1000 - PT1000 - Sensor	1 2 3 4
Room temperature (optional)	+ Sensor + PT1000 - PT1000 - Sensor	5 6 7 8
Cylinder head temperature C1	+PT1000 - PT1000	9 10
Cylinder head temperature C2	+PT1000 - PT1000	11 12
Cylinder head temperature C3	+PT1000 - PT1000	13 14
Cylinder head temperature C4	+PT1000 - PT1000	15 16
Low-pressure transducer Z1	+ 24 V 4..20 mA GND	35 36 37
Low-pressure transducer Z2	+ 24 V 4..20 mA GND	38 39 40
High-pressure transducer	+ 24 V 4..20 mA GND	44 45 46
Humidity sensor (optional)	4..20 mA GND	59 60

All leads running to and from the VS 3000 BS (except the 230 V power supply and signal leads) must be shielded! This applies especially to analog inputs (sensor leads) and CAN bus wiring.

Analog Outputs		
Function		**Basic Module Terminal No.**
Variable-speed fan control	+0..10 V GND	54 53

All leads running to and from the VS 3000 BS (except the 230 V power supply and signal leads) must be shielded! This applies especially to analog inputs (sensor leads) and CAN bus wiring.

Interfaces	
Function	**Basic Module Terminal No.**
CAN bus connection	CAN
Shield	1
Ground	2
CAN-L	3
CAN-H	4
External SIOX connection output	SIOX OUT
TTY	TTY
RS232	RS232
RS485	RS485

Power Supply	
Function	**Basic Module Terminal No.**
230 V AC	N, L
Grounding conductor	PE
SIOX power supply	
0 V	91
9 V	92
0 V	93
24 V	94
Shield	95

5.3 Inputs/outputs for 8 compressor capacity/8 fan stages

Digital Inputs		
Function	**Basic Module Terminal No.**	**1st SIOX Extension module**
High-pressure cutout	50, 51	-
Low-pressure cutout Z1	52, 53	-
Bursting disk with HR mode activated -> HR demand	92, 93	-
Setpoint toggle (day/night operation)	88, 89	-
Fast unload/External OFF	80, 81	-
Motor overload cutout Condenser Fan 1	70, 71	-
Motor overload cutout Condenser Fan 2	72, 73	-
Motor overload cutout Condenser Fan 3	74, 75	-
Motor overload cutout Condenser Fan 4	76, 77	-
Motor overload cutout Condenser Fan 5	-	66, 67
Motor overload cutout Condenser Fan 6	-	68, 69
Motor overload cutout Condenser Fan 7	-	70, 71
Motor overload cutout Condenser Fan 8	-	72, 73
External alarm (Speed adjuster fault with speed control activated)	78, 79	-
Low oil pressure cutout Compressor 1	54, 55	-
Low oil pressure cutout Compressor 2	58, 59	-
Low oil pressure cutout Compressor 3	62, 63	-
Low oil pressure cutout Compressor 4	66, 67	-
Low oil pressure cutout Compressor 5	-	50, 51
Low oil pressure cutout Compressor 6	-	54, 55
Low oil pressure cutout Compressor 7	-	58, 59
Low oil pressure cutout Compressor 8	-	62, 63
Motor overload cutout Compressor 1	56, 57	-
Motor overload cutout Compressor 2	60, 61	-
Motor overload cutout Compressor 3	64, 65	-
Motor overload cutout Compressor 4	68, 69	-
Motor overload cutout Compressor 5	-	52, 53
Motor overload cutout Compressor 6	-	56, 57
Motor overload cutout Compressor 7	-	60, 61
Motor overload cutout Compressor 8	-	64, 65
Low-pressure cutout Z2	90, 91	-
Load shedding Stage 1 Z1	82, 83	-
Load shedding Stage 2 Z1	84, 85	-
Load shedding Z2	86, 87	-
Level monitoring/Refrigerant low liquid level	94, 95	-

Digital Outputs		
Function	**Basic Module Terminal No.**	**1st SIOX Extension module**
Enable refrigeration points Z1	1, 2	-
Enable refrigeration points Z2	3, 4	-
Controller Compressor 1	13, 14	-
Controller Compressor 2	23, 24	-
Controller Compressor 3	33, 34	-
Controller Compressor 4	43, 44	-
Controller Compressor 5	-	13, 14
Controller Compressor 6	-	23, 24
Controller Compressor 7	-	33, 34
Controller Compressor 8	-	43, 44
Controller Condenser Fan 1	15,16, 18	-
Controller Condenser Fan 2	25, 26, 28	-
Controller Condenser Fan 3	35, 36, 38	-
Controller Condenser Fan 4	45, 46, 48	-
Controller Condenser Fan 5	-	15, 16, 18
Controller Condenser Fan 6	-	25, 26, 28
Controller Condenser Fan 7	-	35, 36, 38
Controller Condenser Fan 8	-	45, 46, 48

Analog Inputs			
Function		**Basic Module Terminal No.**	**1st SIOX Extension module**
Outdoor temperature	+ Sensor + PT1000 - PT1000 - Sensor	1 2 3 4	- - - -
Room temperature	+ Sensor + PT1000 - PT1000 - Sensor	5 6 7 8	- - - -
Cylinder head temperature V1	+PT1000 - PT1000	9 10	- -
Cylinder head temperature V2		11, 12	-
Cylinder head temperature V3		13, 14	-
Cylinder head temperature V4		15, 16	-
Cylinder head temperature V5		17, 18	-
Cylinder head temperature V6		19, 20	-
Cylinder head temperature V7		21, 22	-
Cylinder head temperature V8		23, 24	-
LP transducer Z1	+ 24 V 4..20 mA GND	35 36 37	- - -
LP transducer Z2	+ 24 V 4..20 mA GND	38 39 40	- - -

Analog Inputs			
Function		**Basic Module Terminal No.**	**1st SIOX Extension module**
High-pressure transducer	+ 24 V 4..20 mA GND	44 45 46	-
Humidity sensor (optional)	4..20 mA GND	59 60	- -

All leads running to and from the VS 3000 BS (except the 230 V power supply and signal leads) must be shielded! This applies especially to analog inputs (sensor leads) and CAN bus wiring.

Analog Outputs			
Function		**Basic Module Terminal No.**	**1st SIOX Extension module**
Variable-speed fan control	+0..10 V GND	54 53	-

All leads running to and from the VS 3000 BS (except the 230 V power supply and signal leads) must be shielded! This applies especially to analog inputs (sensor leads) and CAN bus wiring.

Interfaces			
Function		**Basic Module Terminal No.**	**1st SIOX Extension module**
CAN bus connection	Shield Ground CAN-L CAN-H	 1 2 3 4	-
External SIOX connection input		-	SIOX IN
External SIOX connection output		SIOX OUT	SIOX OUT
TTY		TTY	-
RS232		RS232	-
RS485		RS485	-

Power Supply			
Function		**Basic Module Terminal No.**	**1st SIOX Extension module**
230 V AC		N, L	-
Grounding conductor		PE	-
SIOX power supply	- 0 V - 9 V - 0 V - 24 V - Shield	 91 92 93 94 95	 91 92 93 94 95

5.4 Inputs/outputs of SIOX D2D expansion module for discharge gas defrosting

Digital Inputs	
Function	**D2D SIOX Extension module**
Manual defrost Z2 cases	50, 51
Manual defrost Z2 coldrooms	52, 53
Manual defrost Z2 cases	54, 55
Disable defrost Z2 cases	56, 57
Disable defrost Z2 coldrooms	58, 59
Disable defrost Z1 cases	60, 61
HP cutout Suction Z2 cases	62, 63
HP cutout Suction Z2 coldrooms	64, 65
HP cutout	66, 67
Reserved	68, 69
Reserved	70, 71
Reserved	72, 73

Digital Outputs	
Function	**D2D SIOX Extension module**
Discharge gas feed solenoid valve Z2 cases	13, 14
Discharge gas feed solenoid valve Z2 coldrooms	23, 24
Discharge gas feed solenoid valve Z1 cases	33, 34
Drain heater Z2 coldrooms	43, 44
Suction line solenoid valve Z2 cases	15, 16, 18
Suction line solenoid valve Z2 coldrooms	25, 26, 28
Suction line solenoid valve Z2 cases	35, 36, 38
Discharge line solenoid valve	45, 46, 48

Interfaces	
Function	**D2D SIOX Extension module**
External SIOX connection input	SIOX IN
External SIOX connection output	SIOX OUT

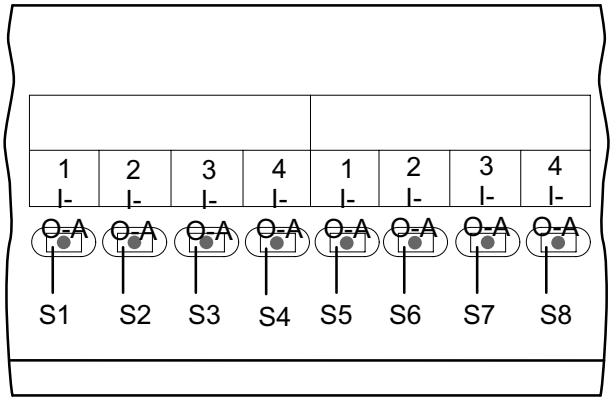
Power Supply	
Function	**D2D SIOX Extension module**
SIOX power supply	
0 V	91
9 V	92
0 V	93
24 V	94
Shield	95

Notice:

6 Operating Modes of VS 3000 BS

6.1 Emergency manual-automatic mode selection

Manual-automatic mode selection makes possible emergency manual operation of the refrigeration pack in the event of pack controller failure. Manual-automatic mode selection is implemented at a relay level subordinate to the electronic controller. Mode is selected at three positions for each compressor and condenser by switches S1 to S8 installed on the printed circuit board (see illustration below).



Manual-automatic mode selection is likewise available on the SIOX extension module.

The switch positions provided are ”A - O - I”:

- **A:** Automatic ON Compressor stage is switched on and off by controller
- **O**: Manual OFF Manual mode: Compressor stage if OFF
- **I**: Manual ON Manual mode: Compressor stage if ON

When all switches are set to the A position, the controller registers the logic state of AUTOMATIC ON. If a minimum of one switch is set to the I or O position, a message (*Manual OFF/ON CapStg x*) is entered in the log memory. The message is transmitted according to the preselected priority.

6.2 Service-Mode

When choosing *Service Mode* of (Menu 8) the VS 3000 BS Pack Controller, all compressor and condenser outputs are reset stagewise. All controller functions are subsequently inactivated, enabling each digital and analog output to be actuated manually. The controller registers Service Mode by entering a message in the log memory. The message is transmitted according to the preselected priority. In Service Mode the controller’s digital and analog inputs (motor overload cutouts, low oil pressure cutouts, pressure transducers) are disregarded. Switching commands or output of an analog voltage signal are carried out directly.

6.3 Displaying operating status

In some lines of the display, additional marks are placed before the measurement to indicate system operating status. The marks used are as follows:

- Indication of suction pressure trend:

  Shows whether compressor capacity stages are to be loaded, unloaded or not actuated at the end of the time delay intervals.

$t_{0\text{-Act}}$	X	-20 °C
$p_{0\text{-Act}}$	X	2.34b
	↓	
	+	Compressor capacity stages are loaded. $p_{o\_Act} > p_{o\_Setp} + \frac{NZ}{2}$
	=	Compressor capacity stages are not actuated. $p_{0\text{-Act}}$ in neutral zone.
	-	Compressor capacity stages are unloaded. $p_{o\_Act} < p_{o\_Setp} - \frac{NZ}{2}$

- Indication of condensing pressure trend:

  Shows whether fan capacity stages are to be loaded, unloaded or not actuated at the end of the time delay intervals.

$t_{c\text{-Act}}$	X	30 °C
$p_{c\text{-Act}}$	X	15.45b
	↓	
	+	Fan capacity stages are loaded. $p_{c\_Act} > p_{c\_Setp} + \frac{NZ}{2}$
	=	Fan capacity stages are not actuated. $p_{c\text{-Ist}}$ in neutral zone.
	-	Fan capacity stages are unloaded $p_{c\_Act} < p_{c\_Setp} - \frac{NZ}{2}$

- Indication of LP setpoint characteristic:

$t_{0\text{-Setp}}$	X	-20 °C
$p_{0\text{-Setp}}$	X	2.34b
$t_{c\text{-Setp}}$	X	30 °C
$p_{c\text{-Setp}}$	X	15.45b
	↓	
	D	Controller works with parameters for daytime operation.
	N	Controller works with parameters for nighttime operation.
	DF	Controller works with parameters for D2D discharge gas defrosting.

- Indication of HP setpoint characteristic:

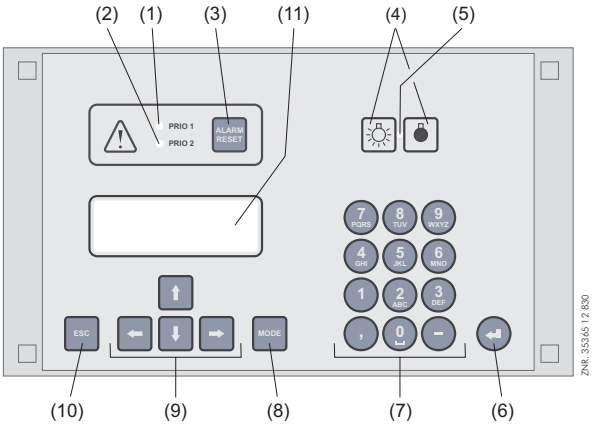
$t_{c\text{-Setp}}$	X	30 °C
$p_{c\text{-Setp}}$		15.45b
	↓	
		Controller works with setpoint for normal control mode.
	HR	Controller works with parameters for heat recovery mode.

7 Operation of VS 3000 BS

The VS 3000 BS Pack Controller can be operated via the CAN bus interface with an AL 300 Operator Terminal or CI 3000 Store Computer. No provision is made for operation on the VS 3000 BS Pack Controller itself except for manual-automatic mode selection (see Section 6 Operating Modes).

7.1 Operation with CI 3000 Store Computer or AL 300 Operator Terminal

Operation is the same whether using the CI 3000 Store Computer or the AL 300 Operator Terminal. The operator interface and the functions are the same on both devices.



(1) Priority 1 alarm indicator light

(2) Priority 2 alarm indicator light

(3) Buzzer and horn stop key and alarm reset key

(4) External lighting on/off switch (general lighting)

(5) Lighting on/off switch indicator light

(6) **ENTER** key

(7) Alphanumeric keypad

(8) **MODE** key; CAPS SHIFT function for text entry

(9) Cursor keys

(10) **ESC** key

(11) Display (4 lines of 20 characters)

7.2 Menus and screens

Differentiation is made between menus and screens for operation of the controller.

Numbering of menus and screens:

Each menu in the menu tree can be opened by entering a specific number and each operating screen in a menu can be opened by selecting it in the menu. This is achieved by distinct marking by numbers and letters in the menu tree. Numbers 1, 2, etc. identify the menu and the letters a, b, etc. identify the order of the screens in the menu.

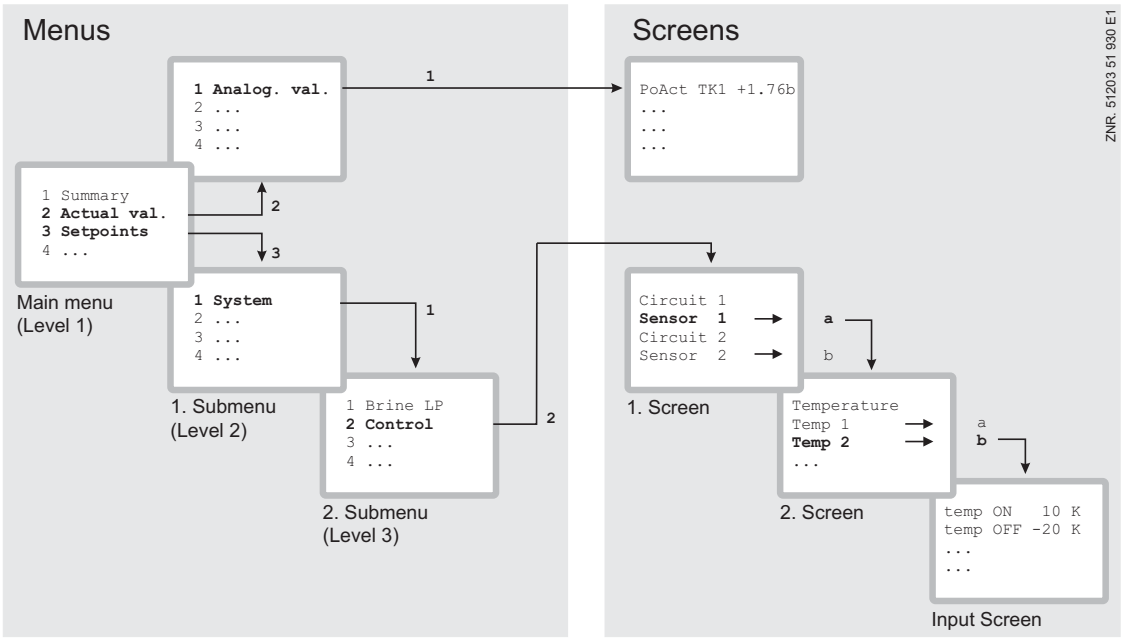
Example of screen numbering:

2 - 1 means that the 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 can be opened from the menu tree by entering the numbers 3 - 1 - 2. The letter or letters following indicate that one or more additional operating screens or selection lists can be opened in the screen by selecting them (?). The letters show their order in the screen.

Each operating screen of the VS 3000 BS can be opened by entering its respective number.



Menus

A menu contains a list of up to nine items for selection. Each item selected may contain separate submenus or operating screens.

Selecting menu items

Each line of the selection list displayed contains a number from 1 to 9 and 0 and the name of the corresponding item. The separate items can be selected directly by pressing the appropriate numeric key 1 to 9, or 0 for item 10. If the menu lists more than three items, the cursor keys can be used to scroll through the menu and view the remaining items.

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

Operating 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

Use the up and down cursor keys (↑) and (↓) to:

- Scroll line by line, for example when selecting a variable in a line from a list of predefined variables.
- Scroll block by block to view values that extend beyond the capacity of the display.

Paging

The left and right cursor keys (←) and (→) can be used to page through screens containing more than one page. If a menu contains more than three submenus, the remaining items can be viewed by scrolling with the up and down cursor keys (↑) and (↓).

Cancelling entry block

Before any values can be entered, the entry block must be deactivated as follows:

- In the Main Menu choose item 9 Parameter Setting.
- Then choose item 3 Block.
- Press ENTER (↵) to set the check mark (√). When the check mark is set, entry block is deactivated, allowing settings to be entered.
- Press ESC to exit the screen.

Blocking is activated automatically if no key is pressed for 10 minutes and when the operator terminal is switched on.

Superuser mode (granting Superuser rights)

Superuser mode is reserved exclusively for use by service personnel!

- In the Main Menu choose item 9 Parameter Setting.
- In this menu choose item 3 Block.
- Enter the current date in reverse order (not shown on display).
- Press the ENTER key (↵) to confirm, causing ”S” to be shown on the screen.
- Press the ESC key to exit the screen.

Example:

The current date is April 17, 2035, which in order of day-month-year is 17.04.35. In this instance the entry required to grant Superuser rights is 534071.

Unblocking from the main menu cancels entry block for all components of the CAN bus system. If you have moved to the operator interface of a CAN bus station but have omitted to cancel entry block, simultaneously press the **MODE** and decimal (**.**) keys to cancel entry block for the particular controller. Entry block is reactivated on exiting the operator interface for the controller.

Activating service mode

Service mode is reserved exclusively for use by service personnel!

Service mode enables the service technician to suppress the remote alarm function of the CI 3000 Store Computer for a limited time while carrying out maintenance of repair work.

- In the Main Menu, choose 9 Parameter Setting..
- From this menu item choose 3 Block.
- - Simultaneously press the **MODE** + ENTER (↵) keys to open the screen for suppressing remote alarm and enter the time required for service work (1 to 255 min.).
- - This activates service mode for the specified time.

Any alarms (Priority 1 and 2) still active when the set service mode time expires cause the audible signalling devices and alarm relays to be actuated and are forwarded by automatic fault report transmission.

Service mode can be reset/cancelled by entering a time of 0 min.

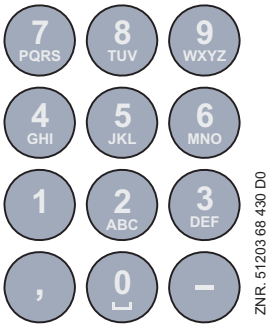
Entering values and text

Use the up and down cursor keys (↑) and (↓) to select the line wanted and press the ENTER key (↵). The cursor jumps to the entry field. The cursor keys (↑) and (↓) or numeric keys can then be used to enter or change values. Keep the cursor key (↑) or (↓) depressed to change values in fast mode.

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
1	1
2	abc2
3	def3
4	ghi4
5	jkl5
6	mno6
7	pqrs7
8	tuv8
9	wxyz9
-	. _ -
,	Insert space



Alphanumeric key assignments

Press the **MODE** key to shift between upper and lower case letters.

Deleting text entry

Simultaneously press the MODE and minus (-) keys to delete a complete line of text. Press the MODE and decimal (.) keys to delete one character.

Cancelling an entry

Press the ESC key to cancel an entry at any time. The entry will not be applied.

Exiting menus and 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.

7.3 Operation / Parameter setting of VS 3000 BS Pack Controller

The LCD display contains 4 lines of 20 characters. If a menu or screen consists of more than 4 lines, the cursor keys can be used to scroll through the remaining lines.

```
MAIN MENU
4 Messages          ↑
5 Remote Control
6 Store Computer    ↓
```

Entry block must be deactivated before parameters can be set (see chapter 8 Menu Structure).

In the Main Menu of the AL 300 Operator Terminal or CI 3000 Store Computer, open submenu *5 Remote Operation*. This displays the following screen:

```
REMOTE CONTROL    Nd.nnn
Node name           ↑
Item ID         XXXXX↓
```

Select the VS 3000 BS Pack Controller wanted with the cursor keys (↑) (↓) or by entering its Node No. *nnn* with the numeric keys. Press the ENTER key to open the case controller. This displays the following main menu for the VS 3000 BS Pack Controller:

```
VS 3000 BS                    Pos: XXXXX
1 Summary                           ↑
2 Actual Values
3 Setpoints
4 Clock
5 Messages
6 Operating data
7 Default settings
8 Service Mode                      ↓
```

Notice:

8 Menu Structure of VS 3000 BS

The VS 3000 BS Pack Controller must be connected to a setup unit to allow setting of parameters. Parameter setting is made via the CAN bus interface communicating with the VS 3000 BS.
The setup unit for operation of the VS 3000 BS may be either an AL 300 Operator Terminal or a CI 3000 Store Computer (see also Section 1 - System Design).

Working with menus and screens

See Section 7 for details.

Numbering of menus and screens

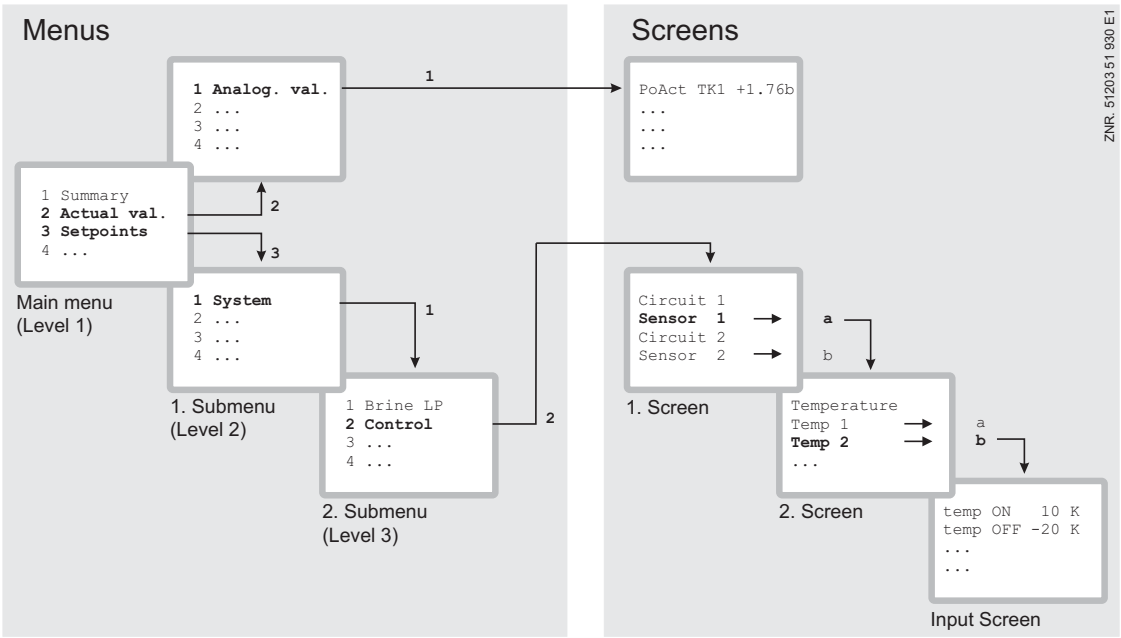
Each menu can be opened by entering a specific number and each operating screen in a menu can be opened by selecting it from the menu. This is achieved by distinct marking by numbers and letters in the menu tree. Numbers 1, 2, etc. identify the menu and the letters a, b, etc. identify the order of the screens in the menu.

Example of screen numbering:

2-1 means that the 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 can be opened from the menu tree by entering the numbers 3 - 1 - 2. The letter or letters following indicate that one or more additional operating screens or selection lists can be opened in the screen by selecting them ( ). The letters show their order in the screen.



8.1 Menu tree

Level 1	Level 2	Level 3	Screen No.	Screen name
Main Menu			-	VS3000 BS
1 Summary			1	
2 Actual Value			2	ACT. VALUES
	Analog values		2-1	ANALOG VAL.
		Cyl.temp.Z1	2-1-a	Z1 COMP
		Cyl.temp.Z2	2-1-b	Z2 COMP
	Compresor Z1		2-2	Z1 COMP
	Compressor Z2		2-3	Z2 COMP
	Condenser fan		2-4	COND FAN
	System		2-5	SYSTEM
	D2D		2-6	D2D

Level 1	Level 2	Level 3	Screen No.	Screen name
3 Setpoints			3	SETPOINTS
	System config.		3-1	CONFIG
		Sensor match	3-1-a	SENSOR
		Refrigerant	3-1-b	REFRIGT
		Booster/Sat.cont	3-1-c	CONT TYPE
		Enable Z1 comp.	3-1-d	Z1 COMP
		Enable Z2 comp.	3-1-e	Z2 COMP
		Enab. cond.stages	3-1-f	ENABLE COND
	LP control		3-2	SETPOINTS
		LP cont.day Z1	3-2-1	LP CONT D
		LP cont.night Z1	3-2-2	LP CONT N
		LP cont.day Z2	3-2-3	LP CONT D
		LP cont.night Z2	3-2-4	LP CONT N
	HP control		3-3	HP CONT
		Control	3-3-1	HP CONT
		Setpoints	3-3-2	HP CONT
	Comp. monitor		3-4	COMP MON
	Liq.level mon.		3-5	REFRIGT MON
	Ext. alarms		3-6	EXT. ALARM
	Base load		3-7	BASE LOAD
	Messages		3-8	MESSAGE
	D2D		3-9	D2D
		Defrost	3-9-a	Defrost
		Def. Z2R	3-9-b	Def. Z2R
		Def. timer	3-9-c	Def. timer
		Def.timer Z2-R	3-9-d	Def. timer Z2R
4 Clock			4	CLOCK
	Setpoint. toggle		4	CLOCK
	Current time		4-a	CLOCK
	Toggle time		4-b	CLOCK
5 Messages			5	MESSAGE
	Dispaly		5-1	MESSAGE
	Delete		5-2	MESSAGE

Level 1	Level 2	Level 3	Screen No.	Screen name
6 Operating data			6	OP DATA
	On time Z1		6-1	OP DATA
	On time Z2		6-2	OP DATA
	Fan out time		6-3	OP DATA
	Day run time Z1		6-4	HISTORY Z1
		Runt times	6-4-1	HISTORY
		Runt times D	6-4-2	HISTORY
		Runt times N	6-4-3	HISTORY
		Compr. starts	6-4-4	HISTORY
		Starts Day	6-4-5	HISTORY
		Starts Night	6-4-6	HISTORY
		Activity	6-4-7	HISTORY
		Activity D	6-4-8	HISTORY
		Activity N	6-4-9	HISTORY
	Day run time Z2		6-5	HISTORY Z2
		Runt times	6-5-1	HISTORY
		Runt times D	6-5-2	HISTORY
		Runt times N	6-5-3	HISTORY
		Compr. starts	6-5-4	HISTORY
		Starts Day	6-5-5	HISTORY
		Starts Night	6-5-6	HISTORY
		Activity	6-5-7	HISTORY
		Activity D	6-5-8	HISTORY
		Activity N	6-5-9	HISTORY
7 Defaul settings			7	VS3000 BS
8 Service Mode			8	SERVICE
	Analog values		8-1	SERVICE
	Compressor Z1		8-2	SERVICE
	Compressor Z2		8-3	SERVICE
	Condenser fan		8-4	SERVICE
	System		8-5	SERVICE
	D2D		8-6	D2D

8.1.1 Menu 0 Main Menu

VS3000 BS POS: XXX	
1 Summary	Move to Screen 1
2 Actual values	Move to Screen 2
3 Setpoints	Move to Screen 3
4 Clock	Move to Screen 4
5 Messages	Move to Screen 5
6 Operating data	Move to Screen 6
7 Default settings	Move to Screen 7
8 Service Mode	Move to Screen 8

8.1.2 Menu 1 Summary

Act. to Z1 +/-/= XXX°C	Actual value, evaporating temperature Z1
Setp. to Z1 N/D/A XXX°C	Calculated setpoint t_0, evaporating temperature Z1
Act. to Z2 +/-/= XXX°C	Actual value, evaporating temperature Z2
Setp. to Z2 N/D/A XXX°C	Calculated setpoint t_0, evaporating temperature Z2
Act. tc +/-/= XXX°C	Actual value, HP condensing temperature
Setp. tc HR XXX°C	Calculated setpoint tc, HP condensing temperature

A = Setpoint with discharge gas defrosting active

D = Daytime operation

HR = Heat recovery mode

N = Nighttime operation

8.1.3 Menu 2 Actual values

ACT. VALUES POS:xxxxx	
1 Analog values	Move to Screen 2-1
2 Compressor Z1	Move to Screen 2-2
3 Compressor Z2	Move to Screen 2-3
4 Condenser fan	Move to Screen 2-4
5 System	Move to Screen 2-5
6 D2D	Move to Screen 2-5 (Only shown when discharge gas defrosting is activated. See Section 4 - Installation and Startup)

- Menu 2-1 Analog values

ANALOG VAL POS: XXXXX	Shows refrigeration point data archived on CI 3000 Store Computer
Act. LP Z1 +/-/= X.XX b	Current evaporating pressure Z1
Setp. LP Z1 D/N/A X.XX b	Evaporating pressure setpoint for comparison Z1
Act. to Z1 +/-/= XX °C	Current evaporating temperature Z1
Setp. to Z1 D/N/A XX °C	Evaporating temperature setpoint for comparison Z1
Act. LP Z2 +/-/= X.XX b	Current evaporating temperature
Setp. LP Z2 D/N/A X.XX b	Evaporating temperature setpoint for comparison Z2
Act. to Z2 +/-/= XX °C	Current evaporating temperature Z2
Setp. to Z2 D/N/A XX °C	Evaporating temperature setpoint for comparison
Room temp. XX °C	Current room temperature (optional)
Setp. HP -/+/= X.XX b	Current condensing temperature
Setp. HP X.XX b	Condensing temperature setpoint for comparison
Setp. tc -/+/= XX °C	Current condensing temperature
Setp. tc XX °C	Condensing temperature setpoint for comparison
Outd.temp. XX °C	Current outdoor temperature (optional)
Humidity XXX%	Current humidity of air
Cyl.temp. Z1 →	Analog cylinder head temperature. Move to Screen 2-1-a.
Cyl.temp. Z2 →	Analog cylinder head temperature. Move to Screen 2-1-b.

- Screen 2-1-a Analog Values Cylinder Head Temperatures Z1

Z1 COMP POS: XXXXX		
Cyl.temp. C1	XX °C	Cylinder head temperature 1st compressor
...		Only the actual number of compressors is shown.
Cyl.temp. Cn	XX °C	Cylinder head temperature last compressor Z1

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration

No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 2-1-b Analog Values Cylinder Head Temperatures Z2

Z2 COMP POS: XXXXX		
Cyl.temp. Cn+1	XX °C	Cylinder head temperature 1st compressor Z2 (Stage n+1)
...		Only the actual number of compressors is shown.
Cyl.temp. Cmax	XX °C	Cylinder head temperature last compressor Z2

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration

No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 2-2 Compressor Z1

Z1 COMP POS: XXXXX		
Mot.cutout C 1	XXX	Digital input, motor overload cutout first compressor (only shown when defined in system configuration: Menu 3-1)
Oil press. C 1	XXX	Digital input, low oil pressure cutout first compressor (only shown when defined in system configuration: Menu 3-1)
Man.switch C 1	XXX	Manual switch ON-OFF-AUTO first compressor stage
Compressor C 1	XXX	Digital output first compressor stage 1
...		Only the actual number of compressors is shown
Mot.cutout C n	XXX	Digital input, motor overload cutout last compressor Z1 (only shown when defined in system configuration: Menu 3-1)
Oil press. C n	XXX	Digital input, low oil pressure cutout last compressor Z1 (only shown when defined in system configuration: Menu 3-1)
Man.switch C n	XXX	Manual switch ON-OFF-AUTO last compressor stage Z1
Compressor C n	XXX	Digital output last compressor stage Z1

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 2-3 Compressor Z2

Z2 COMP POS: XXXXX		
Mot.cutout Cn+1	XXX	Digital input, motor overload cutout Compressor n+1 (only shown when defined in system configuration: Menu 3-1)
Oil press. Cn+1	XXX	Digital input, low oil pressure cutout Compressor n+1 (only shown when defined in system configuration: Menu 3-1)
Man.switch Cn+1	XXX	Manual switch ON-OFF-AUTO Compressor Stage n+1
Compressor Cn+1	XXX	Digital output Compressor Stage n+1
...		Only the actual number of compressors is shown
Mot.cutout C max	XXX	Digital input, motor overload cutout max. compressor (only shown when defined in system configuration: Menu 3-1)
Oil press. Cmax	XXX	Digital input, low oil pressure cutout max. compressor (only shown when defined in system configuration: Menu 3-1)
Man.switch Cmax	XXX	Manual switch ON-OFF-AUTO max. compressor stage
Compressor Cmax	XXX	Digital output max. compressor stage

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 2-4 Condenser fan

COND FAN POS: XXXXX		
Mot.cutout F 1	XXX	Digital input, motor overload cutout Fan 1
Fan F 1	XXX	Digital output Fan 1
...		Only the actual number of fans is shown
Mot.cutout F 8	XXX	Digital input, motor overload cutout Fan 8
Fan F 8	XXX	Digital output Fan 8

VS 3000 BS basic module: Fan 1 - max. 4
With 1st SIOX extension module: Fan 1 - max. 8

- Menu 2-5 System

SYSTEM	POS: XXXXX	
HP cutout	XXX	Digital input, HP cutout
LP switch Z1	XXX	Digital input, LP cutout Z1
LP switch Z2	XXX	Digital input, LP cutout Z2
Bust disk	XXX	Digital input, bursting disk
Low liq. level	XXX	Digital input, low refrigerant level
Ext. alarm	XXX	Digital input, external alarm
Setp. toggle	XXX	Digital input, setpoint toggle
Comp/cond OFF	XXX	Digital input, external unload
Load shed Z11	XXX	Digital input, Load Shedding 1 Z1
Load shed Z12	XXX	Digital input, Load Shedding 2 Z1
Load shed Z2	XXX	Digital input, Load Shedding Z2
Enable Z1	XXX	Digital output, enable refrigeration points Z1
Enable Z2	XXX	Digital output, enable refrigeration points Z2

- Menu 2-6 D2D (Discharge Gas Defrosting)

D2D		POS: XXXXX	
Com.disch.line		XXX	Output, Solenoid Valve 1 common discharge line
Drain htr.	Z2	XXX	Output, drain heater Z2 coldrooms
Defrost	Z2	XXX	Input, manual defrost Z2 / Z2 cases
Disable def.	Z2	XXX	Input, disable defrost Z2/Z2 cases
HP switch	Z2	XXX	Input, HP cutout in Z1 suction line Z2/Z2 cases
Suct. line	Z2	XXX	Output, Solenoid Valve 2.2/1 close suction line Z2/Z2 cases
Discharge	Z2	XXX	Output, Solenoid Valve 3.2/1 feed discharge gas Z2/Z2 cases
Defrost	Z2R	XXX	Input, manual defrost Z2 coldrooms
Disabledef.	Z2R	XXX	Input, disable defrost Z2 coldrooms
HP switch	Z2R	XXX	Input, HP cutout in Z1 suction line Z2 coldrooms
Suct. line	Z2R	XXX	Output, Solenoid Valve 2.2/2 close suction line Z2 coldrooms
Discharge	Z2R	XXX	Output, Solenoid Valve 3.2/2 feed discharge gas Z2 coldrooms
Defrost	Z1	XXX	Input, manual defrost Z1
Disabledef.	Z1	XXX	Input, disable defrost Z1
HP switch	Z1	XXX	Input, HP cutout in LT suction line
Suct. line	Z1	XXX	Output, solenoid valve close suction line Z1 cases
Discharge	Z1	XXX	Output, solenoid valve feed discharge gas Z1/Z1 cases

8.1.4 Menu 3 Setpoints

SETPOINTS POS: XXXXX	
1 System config.	Move to Screen 3-1
2 LP control	Move to Screen 3-2
3 HP control	Move to Screen 3-3
4 Comp. monitor	Move to Screen 3-4
5 Liq.level mon.	Move to Screen 3-5
6 Ext. alarms	Move to Screen 3-6
7 BAse load	Move to Screen 3-7
8 Messages	Move to Screen 3-8
9 D2D	Move to Screen 3-9

- Menu 3-1 System config.

CONFIG POS: XXXXX			Entry	De-fault	Dim.
Sensor match	→	Match pressure transducers	→	Screen 3-1-a	
Refrigerant	XXXXX →	Select refrigerant	→	Screen 3-1-b	
Oil eq. line	X	Enable/disable oil equalization YES/NO	↑, ↓ (Y/N)	N	-
Booster op	XXX	Enter booster/satellite operation	↑, ↓ (ON/OFF)	OFF	-
Booster/Sat.cont	→	Booster/satellite compressor control type		Screen 3-1-c	
Case node No.	XX	CAN bus Node No. of UA300 controlling booster/satellite compressor	1..99, --	--	
Sauggas-Bypass	X	Suction gas bypass YES/NO	↑, ↓ (Y/N)	N	-
Kn.Nr.Kaskade	X	Enter CAN bus address of refrigeration point (control by refrigeration point)	1..9	--	-
No. comps. Z1	X	Enter number of compressors Z1	1..3/7	3	-
No.capstagesZ1	X	Enter number of capacity stages Z1	1..3	1	-
Enable Z1 comp.	→	Enable compressor stages Z1	→	Screen 3-1-d	
Mot.cutout C Z1	X	Enable motor overload cutout Z1 YES/NO	↑, ↓ (Y/N)	N	-
Oil pr. cut. Z1	X	Low oil pressure cutout Z1 YES/NO	↑, ↓ (Y/N)	N	-
No. comps Z2	X	Enter number of compressors Z2	1..3/7	1/2	-
No.cap.stages Z2	X	Enter number of capacity stages Z2	1..3	1	-
Enable Z2 comp.	→	Enable compressor stages Z2	→	Screen 3-1-e	
Mot.cutout C Z2	X	Enable motor overload cutout Z2 YES/NO	↑, ↓ (Y/N)	N	-
Oil pr. cut. Z2	X	Low oil pressure cutout Z2 YES/NO	↑, ↓ (Y/N)	N	-
No.cond. stages	X	Number of condenser stages Z2	0..4/8	4/8	-
Enab. cond.stages	→	Enable condenser stages Z2 ON/OFF	→	Screen 3-1-f	
HR rec. mode	X	Enable heat recovery mode YES/NO	↑, ↓ (Y/N)	N	-
Room temp.	XXX	Enable room temperature sensors ON/OFF	↑, ↓ (ON/OFF)	ON	-

CONFIG POS: XXXXX			Entry	De-fault	Dim.
Outd.temp.	XXX	Enable room temperature sensors ON/OFF	↑, ↓ (ON/OFF)	ON	-
Humidity	X	Enable outdoor temperature sensors ON/OFF	↑, ↓ (ON/OFF)	OFF	-
NodeNr. Env.dat	X	CAN bus Node No. of VS 3000 to supply ambient data	1..9, --	--	-
signal setvalue	X	Setpoint toggle signal polarity	0..1	1	-

- Screen 3-1-a Sensor match

SENSOR POS: XXXXX			Entry	De-fault	Dim.
Z1 sensor	→	Select signal interface for Z1 pressure transducer (4 to 20 mA or 0 to 10 V)	→	Screen 3-1-a-a	
Z2 sensor	XXX	Select signal interface for Z2 pressure transducer (4 to 20 mA or 0 to 10 V)	→	Screen 3-1-a-b	
HP sensor	XXX	Select signal interface for HP pressure transducer (4 to 20 mA or 0 to 10 V)	→	Screen 3-1-a-c	
po-Z1 4mA / po-Z1 0V		Pressure at 4 mA or 0 V at Z1 pressure sensor output Z1	0..2,0	0,0	bar
po-Z1 20mA / po-Z1 10V		Pressure at 20 mA or 10 V at Z1 pressure sensor output Z1	8,0..26,0	10,0	bar
po-Z2 4mA / po-Z2 0V		Pressure at 4 mA or 0 V at Z2 pressure sensor output Z2	0..2,0	0,0	bar
po-Z2 20mA / po-Z2 10V		Pressure at 20 mA or 10 V at Z2 pressure sensor output Z2	8,0..26,0	10,0	bar
pc 4mA / pc 0V		Pressure at 4 mA or 0 V at HP pressure sensor output	0..2,0	1,0	bar
pc 20mA / pc 10V		Pressure at 20 mA or 10 V at HP pressure sensor output	23,0..60,0	26,0	bar

- Screen 3-1-a-a Z1 sensor

Z1 sensor POS: XXXXX			Entry	De-fault	Dim.
4-20 mA	√	4 to 20 mA at Z1 pressure sensor output	√	√	-
0-10 V		0 to 10 V at Z1 pressure sensor output	√	-	-

- Screen 3-1-a-b Z2 sensor

Z2 sensor POS: XXXXX			Entry	De-fault	Dim.
4-20 mA	√	4 to 20 mA at Z2 pressure sensor output	√	√	-
0-10 V		0 to 10 V at Z2 pressure sensor output	√	-	-

- Screen 3-1-a-c HD sensor

HP sensor POS: XXXXX		Entry	De-fault	Dim.
4-20 mA √	4 to 20 mA at HP pressure sensor output	√	√	-
0-10 V	0 to 10 V at HP pressure sensor output	√	-	-

- Screen 3-1-b Refrigerant

REFRIGT POS: XXXXX		Entry	De-fault	Dim.
R22		√		
R502		√		
R134a		√		
R404a √		√	√	
R402a		√		
R717		√		
R1270		√		
R507		√		
R407c		√		
R410a		√		
R290		√		
R744		√		

- Screen 3-1-c Booster/Sat.cont (Control Type Booster/Satellite)

CONT. TYPE POS: XXXXX		Entry	De-fault	Dim.
Refrig. pt.		√		-
Pressure		√	√	-

- Screen 3-1-d Enable Z1 comp. (enable compressor stages Z2)

Z1 COMP POS: XXXXX		Entry	De-fault	Dim.
Comp. stage 1 XXX	Capacity Stage 1	↑, ↓ (ON/OFF)	ON	-
...	Only the available capacity stages (according to system configuration) are shown.			
Comp. stage n XXX	Capacity Stage n	↑, ↓ (ON/OFF)	ON	-

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-1-e Enable comps. Z2 (enable compressor stages Z2)

Z2 COMP POS: XXXXX			Entry	De-fault	Dim.
Comp. stage n+1	XXX	Capacity Stage n+1	↑, ↓ (ON/OFF)	ON	-
...		Only the available capacity stages (according to system configuration) are shown.			
Comp. stage max	XXX	Capacity Stage max	↑, ↓ (ON/OFF)	ON	-

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-1-f Enab. cond.stages (enable HP condenser stages)

ENABLE COND POS: XXXXX			Entry	De-fault	Dim.
Cond. stage 1	XXX	Condenser Stage 1	↑, ↓ (ON/OFF)	ON	-
...		Only the available condenser stages (according to system configuration) are shown.			
Cond. stage 8	XXX	Condenser Stage 8	↑, ↓ (ON/OFF)	ON	-

VS 3000 BS basic module: Fan 1 - max. 4
With 1st SIOX extension module: Fan 1 - max. 8

- Menu 3-2 LP control

SETPOINTS POS: XXXXX	
1 LP cont.day Z1	Move to Screen 3-2-1
2 LP cont.night Z1	Move to Screen 3-2-2
3 LP cont.day Z2	Move to Screen 3-2-3
4 LP cont.night Z2	Move to Screen 3-2-4

- Menu 3-2-1 LP cont.day Z1

LP CONT D POS: XXXXX		Entry	De-fault	Dim.
to-max. Z1 XXX °C	Max. t_0 setpoint for setpoint shift	-50..10	-12	°C
tr-min. Z1 XXX °C	min room temperature for setpoint shift	0..20	15	°C
to-min. Z1 XXX °C	min t_0 setpoint for setpoint shift	-50..10	-16	°C
tr-max. Z1 XXX °C	Max. room temperature for setpoint shift	20..35	25	°C
humid. adapt. X	Humidity shift activated Y/N	↑, ↓, (Y/N)	N	-
Basic load time C →	Show basic times t_b ON	→	Screen 3-2-1-a	
Var. load time C →	Show variable times t_v ON	→	Screen 3-2-1-b	
Bas.unload time C →	Show basic times t_b OFF	→	Screen 3-2-1-c	
Var.unload time C →	Show variable times t_v OFF	→	Screen 3-2-1-d	
Dead band XX K	Switching hysteresis	1..10	3	K
Control const. XX K	Max. control error for variable control time	1..10	5	K

- Screen 3-2-1-a Basic load time C

B. LOAD POS: XXXXX		Entry	De-fault	Dim.
BAS LOAD T C1 XXX s	Only the available capacity stages are shown.	3..250	10	sec
BAS LOAD T C2 XXX s		3..250	10	sec
...				
BAS LOAD T Cn XXX s		3..250	10	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-1-b Var. load time C

V. LOAD T POS: XXXXX			Entry	De-fault	Dim.
VAR LOAD T C 1	XXX s	Only the available capacity stages are shown.	3..250	100	sec
VAR LOAD T C 2	XXX s		3..250	100	sec
...					
VAR LOAD T C n	XXX s		3..250	100	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-1-c Bas.unload time C

B. LOAD T POS: XXXXX			Entry	De-fault	Dim.
BAS UNLO T C 1	XXX s	Only the available capacity stages are shown.	3..250	5	sec
BAS UNLO T C 2	XXX s		3..250	5	sec
...					
BAS UNLO T C n	XXX s		3..250	5	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-1-d Var.unload time C

V. UNLO T POS: XXXXX			Entry	De-fault	Dim.
VAR LOAD T C 1	XXX s	Only the available capacity stages are shown.	3..250	10	sec
VAR LOAD T C 2	XXX s		3..250	10	sec
...					
VAR LOAD T C n	XXX s		3..250	10	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 3-2-2 LP cont.night Z1

LP CONT N POS: XXXXX			Entry	De-fault	Dim.
to-max. Z1	XXX °C	Max. t_0 setpoint for setpoint shift	-50..10	-10	°C
tr-min. Z1	XXX °C	min room temperature for setpoint shift	0..20	15	°C
to-min. Z1	XXX °C	min t_0 setpoint for setpoint shift	-50..10	-14	°C
tr-max. Z1	XXX °C	Max. room temperature for setpoint shift	20..35	25	°C
humid. adapt.	X	Humidity shift activated YES/NO	↑, ↓, (Y/N)	N	-
Basic load time C	→	Show basic times t_b ON	→	Screen 3-2-2-a	
Var. load time C	→	Show variable times t_v ON	→	Screen 3-2-2-b	
Bas.unload time C	→	Show basic times t_b OFF	→	Screen 3-2-2-c	
Var.unload time C	→	Show variable times t_v OFF	→	Screen 3-2-2-d	
Dead band	XX K	Switching hysteresis	1..10	3	K
Control const.	XX K	Max. control error for variable control times	1..10	5	K

- Screen 3-2-2-a Basic load time C

B. LOAD T POS: XXXXX			Entry	De-fault	Dim.
BAS LOAD T C 1	XXX s	Only the available capacity stages are shown.	3..250	10	sec
BAS LOAD T C 2	XXX s		3..250	10	sec
...					
BAS LOAD T C n	XXX s		3..250	10	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-2-b Var. load time C

V. LOAD T POS: XXXXX			Entry	De-fault	Dim.
VAR LOAD T C 1	XXX s	Only the available capacity stages are shown.	3..250	100	sec
VAR LOAD T C 2	XXX s		3..250	100	sec
...					
VAR LOAD T C n	XXX s		3..250	100	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-2-c Bas.unload time C

B. UNLO T POS: XXXXX			Entry	De-fault	Dim.
BAS UNLO T C 1	XXX s	Only the available capacity stages are shown.	3..250	5	sec
BAS UNLO T C 2	XXX s		3..250	5	sec
...					
BAS UNLO T C n	XXX s		3..250	5	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-2-d Var.unload time C

V. UNLO T POS: XXXXX			Entry	De-fault	Dim.
VAR UNLO T C 1	XXX s	Only the available capacity stages are shown.	3..250	10	sec
VAR UNLO T C 2	XXX s		3..250	10	sec
...					
VAR UNLO T C n	XXX s		3..250	10	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 3-2-3 LP cont.day

LP CONT D POS: XXXXX			Entry	De-fault	Dim.
to-max. Z2	XXX °C	Max. t_0 setpoint for setpoint shift	-50..10	-36	°C
tr-min. Z2	XXX °C	min room temperature for setpoint shift	0..20	15	°C
to-min. Z2	XXX °C	min t_0 setpoint for setpoint shift	-50..10	-40	°C
tr-max. Z2	XXX °C	Max. Raumtemperatur für Sollwertschiebung	20..35	25	°C
humid. adapt.	X	Humidity shift activated YES/NO	↑, ↓, (Y/N)	N	-
Basic load time C	→	Show basic times t_b ON	→	Screen 3-2-3-a	
Var. load time C	→	Show variable times t_v ON	→	Screen 3-2-3-b	
Bas.unload time C	→	Show basic times t_b ON	→	Screen 3-2-3-c	
Var.unload time C	→	Screen showing variable times t_v OFF	→	Screen 3-2-3-d	
Dead band	XX K	Switching hysteresis	1..10	3	K
Control const.	XX K	Max. control error for variable control time	1..10	5	K

- Screen 3-2-3-a Basic load time C

B. LOAD T POS: XXXXX			Entry	De-fault	Dim.
BAS LOAD T Cn+1	XXX s	Only the available capacity stages are shown.	3..250	10	sec
BAS LOAD T Cn+2	XXX s		3..250	10	sec
...					
BAS LOAD T Cmax	XXX s		3..250	10	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configurationZ2
compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-3-b Var. load time C

V. LOAD T POS: XXXXX			Entry	De-fault	Dim.
VAR LOAD T Cn+1	XXX s	Only the available capacity stages are shown.	3..250	100	sec
VAR LOAD T Cn+2	XXX s		3..250	100	sec
...					
VAR LOAD T Cmax	XXX s		3..250	100	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-3-c Bas.unload time C

B. UNLO T POS: XXXXX			Entry	De-fault	Dim.
BAS UNLO T Cn+1	XXX s	Only the available capacity stages are shown.	3..250	5	sec
BAS UNLO T Cn+2	XXX s		3..250	5	sec
...					
BAS UNLO T Cmax	XXX s		3..250	5	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-3-d Var.unload time C

V. UNLO T POS: XXXXX			Entry	De-fault	Dim.
VAR UNLO T C n+1	XXX s	Only the available capacity stages are shown.	3..250	10	sec
VAR UNLO T C n+2	XXX s		3..250	10	sec
...					
VAR UNLO T C max	XXX s		3..250	10	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 3-2-4 LP cont.night Z2

LP CONT N POS: XXXXX		Entry	De-fault	Dim.
to-max. Z2 XXX °C	Max. t_0 setpoint for setpoint shift	-50..10	-32	°C
tr-min. Z2 XXX °C	min room temperature for setpoint shift	0..20	15	°C
to-min. Z2 XXX °C	min t_0 setpoint for setpoint shift	-50..10	-36	°C
tr-max. Z2 XXX °C	Max. Raumtemperatur für Sollwertschiebung	20..35	25	°C
humid. adapt. X	Humidity shift activated YES/NO	↑, ↓, (Y/N)	N	-
Basic load time C →	Show basic times tb ON	→	Screen 3-2-4-a	
Var. load time C →	Show variable times t_v ON	→	Screen 3-2-4-b	
Bas.unload time C →	Show basic times tb OFF	→	Screen 3-2-4-c	
Var.unload time C →	Show variable times t_v OFF	→	Screen 3-2-4-d	
Dead band XX K	Switching hysteresis	1..10	3	K
Control const. XX K	Max. control error for variable control times	1..10	5	K

- Screen 3-2-4-a Basic load time C

B. LOAD T POS: XXXXX		Entry	De-fault	Dim.
BAS LOAD T Cn+1 XXX s	Only the available capacity stages are shown.	3..250	10	sec
BAS LOAD T Cn+2 XXX s		3..250	10	sec
...				
BAS LOAD T Cmax XXX s		3..250	10	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-4-b Var. load time C

V. LOAD T POS: XXXXX		Entry	De-fault	Dim.
VAR LOAD T Cn+1 XXX s	Only the available capacity stages are shown.	3..250	100	sec
VAR LOAD T Cn+2 XXX s		3..250	100	sec
...				
VAR LOAD T Cmax XXX s		3..250	100	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-4-c Bas.unload time C

B. UNLO T POS: XXXXX		Entry	De-fault	Dim.
BAS UNLO T C n+1 XXX s	Only the available capacity stages are shown.	3..250	5	sec
Basisz.OFF Sn+2 XXX s		3..250	5	sec
...				
Basisz.OFF Smax XXX s		3..250	5	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Screen 3-2-4-d Var.unload time C

V. UNLO T POS: XXXXX		Entry	De-fault	Dim.
VAR UNLO T Cn+1 XXX s	Only the available capacity stages are shown.	3..250	10	sec
VAR UNLO T Cn+2 XXX s		3..250	10	sec
...				
VAR UNLO T Cmax XXX s		3..250	10	sec

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 3-3 HP control

HP CONT POS: XXXXX	
1 Control	Move to Screen 3-3-1
2 Setpoints	Move to Screen 3-3-2

• Menu 3-3-1 Control

HP CONT POS: XXXXX			Entry	De-fault	Dim.
Control type	→	Selection list for HP control type	→	Screen 3-3-1-a	
min speed	XXX%	min fan speed (Only shown when speed controller is selected as control type in Screen 3-3-1-a)	0..50	0	%
Adjust diff.	XX	HP controller adjusting speed (Only shown when speed controller is selected as control type in Screen 3-3-1-a)	-15..15	0	-
tc-max.	XX°C	Maximum tc with continuous HP control (Only shown when speed controller is selected as control type in Screen 3-3-1-a)	25..56	40	°C
Fan off w/comp	X	Stop fan with compressor YES/NO	↑, ↓, (Y/N)	N	-
Fan off by al.	X	Stop fan on actuation of motor overload cutout Y/N	↑, ↓, (Y/N)	Y	-

• Screen 3-3-1-a Control type

CONTROL POS: XXXXX			Entry	De-fault	Dim.
Step controller	√	Selection list for HP control type	√	√	-
Speed controller			√		

• Menu 3-3-2 HP Control Setpoints

HP CONT POS: XXXXX			Entry	De-fault	Dim.
tc-max	XX°C	Max. t_c setpoint for setpoint shift	0..45	25	°C
ta-min	XX°C	min outdoor temperature for setpoint shift	0..15	0	°C
tc-min	XX°C	min t_c setpoint for setpoint shift	0..35	25	°C
tod-max	XX°C	Max. outdoor temperature for setpoint shift	16..45	30	°C
Max. ht rec.	XX°C	$t_{c\text{-}Setp}$ in heat recovery mode	30..50	46	°C
Dif. ht. rec.	XX K	Switching hysteresis in heat recovery mode	1..10	4	K
tc Offset N	XX K	t_c offset in night operation	0..15	0	K
Bas. load time F	→	Set basic times t_b ON	→	Screen 3-3-2-a	
Var. load time F	→	Set variable times t_v ON	→	Screen 3-3-2-b	
Bas.unload time F	→	Set basic times t_b OFF	→	Screen 3-3-2-c	
Var.unload time F	→	Set variable times t_v OFF	→	Screen 3-3-2-d	
Dead band	XX K	Switching hysteresis	1..10	5	K
Control const.	XX K	Maximum control error for variable control times	1..10	7	K

- Screen 3-3-2-a Bas. load time F

B. LOAD POS: XXXXX		Entry	De-fault	Dim.
B. load t. F 1 XXX s	Only the available condenser capacity stages are shown.	3..250	20	sec
...				
B. load t. F 8 XXX s		3..250	20	sec

VS 3000 BS basic module: Fan 1 - max. 4
With 1st SIOX extension module: Fan 1 - max. 8

- Screen 3-3-2-b Var. load time F

V. LOAD T POS: XXXXX		Entry	De-fault	Dim.
V. load t. F 1 XXX s	Only the available condenser capacity stages are shown.	3..250	20	sec
...				
V. load t. F 8 XXX s		3..250	20	sec

VS 3000 BS basic module: Fan 1 - max. 4
With 1st SIOX extension module: Fan 1 - max. 8

- Screen 3-3-2-c Bas.unload time F

B. UNLO T POS: XXXXX		Entry	De-fault	Dim.
B. unlo t. F 1 XXX s	Only the available condenser capacity stages are shown.	3..250	30	sec
...				
B. unlo t. F 8 XXX s		3..250	30	sec

VS 3000 BS basic module: Fan 1 - max. 4
With 1st SIOX extension module: Fan 1 - max. 8

- Screen 3-3-2-d Var.unload time F

V. UNLO POS: XXXXX		Entry	De-fault	Dim.
V. unlo t. F 1 XXX s	Only the available condenser capacity stages are shown.	3..250	100	sec
...				
V. unlo t. F 8 XXX s		3..250	100	sec

VS 3000 BS basic module: Fan 1 - max. 4
With 1st SIOX extension module: Fan 1 - max. 8

- Menu 3-4 Comp. monitor (compressor monitoring)

COMP MON POS: XXXXX		Entry	De-fault	Dim.
Comp. OFF temp XXX °C	Disable one compressor at high temperature	80..145	140	°C
Comp. ON temp XXX °C	Enable compressor after high temperature	50..120	100	°C
Del.Comp.temp XX m	Delay for *Cyl.temp. Z1/Z2 Cx* alrm	0..5	1	min
tc Comp OFF XXX °C	t_c limit for compressor capacity stage disabling	20..55	52	°C
tc Comp ON XXX °C	t_c limit for compressor capacity stage enabling	15..48	45	°C
to Comp OFF Z1 XXX °C	t_0 limit for compressor disable Z1	-54..2	-25	°C
to Comp ON Z2 XXX °C	t_0 limit for compressor disable Z2	-54..2	-46	°C
Del. to OFF Z1 XXX m	Delay for *ND zu tief Z1* alram	0..60	10	min
Del. to OFF Z2 XXX m	Delay for *ND zu tief Z2* alarm	0..60	10	min
Delay tc OFF XXX m	Delay for *HD zu hoch* alarm	0..60	5	min
Starts/h XXX	Allowed hourly compressor starts	4..16	10	-

- Menu 3-5 Liq.level mon. (Refrigerant monitoring)

REFRIGT MON POS: XXXXX		Entry	De-fault	Dim.
Del.low level XXX m	Delay for *Low liq. level* (Low Refrigerant Level) alarm	-, 1..120	60	min

- Menu 3-6 Ext. alarms (External alarms monitoring)

EXT. ALARM POS: XXXXX		Entry	De-fault	Dim.
TIME dalay XXX s	Delay in seconds for *External Alarm* report	0..250	5	sec
Alarm message: XXXXXXXXXXXX.XXX.XXX.X	Message displayed in occurrence of external alarms: Defaulttext: *Ext. alarm* or *Speed adjuster*	Text		

- Menu 3-7 Base load

BASE LOAD POS: XXXXX		Entry	De-fault	Dim.
Cycle time C. XXX m	Zykluszeit für die Grundlastumschaltung Verdichter	5..720	30	min
BaseLoadRot.F J/N	Activate base load rotation for fans (Only shown when *Step Controller* is selected as HP control type in Screen 3-3-1-a)	↑, ↓, (Y/N)	N	-
On time cond. J/N	Prompt for run time equalization (Only shown when *BaseLoadRot.F.* is set to Y)	↑, ↓, (Y/N)	N	-
Cycle time F. XXX m	Cycle time for fan base load rotation (Only shown when *BaseLoadRot.F* is set to Y)	5..720	720	min

- Menu 3-8 Messages

MESSAGE	POS: XXXXX		Entry	De-fault	Dim.
Mot. cut out C Z2	X	Motor overload cutout compressor tripped Comp. Z2	-, 0..2	2	-
Mot. cut out C Z1	X	Motor overload cutout compressor tripped Comp. Z1	-, 0..2	2	-
Oil diff. pr. Z2	X	Low oil pressure cutout tripped Compressor Z2	-, 0..2	2	-
Oil diff. pr. Z1	X	Low oil pressure cutout tripped Compressor Z1	-, 0..2	2	-
Cyl. temp. Z2	X	Cylinder head temperature above limit Z2	-, 0..2	2	-
Cyl. temp. Z1	X	Cylinder head temperature above limit Z1	-, 0..2	2	-
Mot. cutout F	X	Fan motor overload cutout tripped	-, 0..2	2	-
HP cutout	X	High-pressure cutout tripped	-, 0..2	1	-
LP cutout Z2	X	Low-pressure cutout tripped Z2	-, 0..2	2	-
LP cutout Z1	X	Low-pressure cutout tripped Z1	-, 0..2	2	-
Low LP Z2	X	t_0 below lower limit Z2	-, 0..2	2	-
Low LP Z1	X	t_0 below lower limit Z21	-, 0..2	2	-
High HP	X	t_c above upper limit	-, 0..2	2	-
Meas.err.cyl. Z2	X	Cylinder head temperature measuring loop error Z2	-, 0..2	2	-
Meas.err.cyl. Z1	X	Cylinder head temperature measuring loop error Z1	-, 0..2	2	-
Meas.error HP	X	High-pressure measuring loop error	-, 0..2	2	-
Meas err. LP Z2	X	LP measuring loop error Z2	-, 0..2	2	-
Meas err. LP Z1	X	LP measuring loop error Z1	-, 0..2	2	-
Meas. error tod	X	Outdoor temperature measuring loop error	-, 0..2	2	-
Meas. error tr	X	Room temperature measuring loop error	-, 0..2	2	-
Meas.err.humid.	X	Humidity sensor measuring loop error	-, 0..2	2	-
Power failure	X	Controller start following power failure	-, 0..2	0	-
First start	X	Controller first start	-, 0..2	2	-
Busrt disk	X	Bursting disk input actuated	-, 0..2	-	-
External alarm	X	External alarm input actuated	-, 0..2	-	-
I/O module error	X	I/O module (SIOX) failure	-, 0..2	1	-
Service moode	X	Service mode activated	-, 0..2	0	-
Comp/cond unload	X	External unload deactivated	-, 0..2	0	-
Load shed Z2	X	Compressor Z2 disabled by load shedding	-, 0..2	0	-
Load shed Z1	X	Compressor Z1 disabled by load shedding	-, 0..2	0	-
Low liq. level	X	Low refrigerant level switch actuated	-, 0..2	2	-
RAM error	X	Internal data memory defective	-, 0..2	1	-
EEPROM error	X	EEPROM (parameter memory) defective	-, 0..2	2	-
RTC error	X	Real-time clock fault	-, 0..2	2	-
Setpoint changed	X	Setpoint changed	-, 0..2	0	-

MESSAGE	POS: XXXXX		Entry	De-fault	Dim.
Max. speed	X	Speed adjuster threshold exceeded	-, 0..2	0	-
Battery voltage	X	Internal battery fault	-, 0..2	2	-
Comp OFF Man	X	Compressor OFF by manual switch	-, 0..2	0	-
Comp ON Man	X	Compressor ON by manual switch	-, 0..2	0	-
HP cutout D2D Z1	X	High-pressure cutout, discharge gas defrosting Z1 cases	-, 0..2	2	-
HP cutout D2D Z2	X	High-pressure cutout, discharge gas defrosting Z2 cases	-, 0..2	2	-
HP cutout D2D Z2R	X	High-pressure cutout, discharge gas defrosting Z1 col-drooms	-, 0..2	2	-
Disable D2D Z1	X	Disable discharge gas defrosting Z1	-, 0..2	0	-
Disable D2D Z2	X	Disable discharge gas defrosting Z2	-, 0..2	0	-
Disable D2D Z2R	X	Disable discharge gas defrosting Z2 coldrooms	-, 0..2	0	-
Fault D2D Z1	X	Discharge gas defrosting fault Z1	-, 0..2	2	-
Fault D2D Z2	X	Discharge gas defrosting fault Z2	-, 0..2	2	-
Fault D2D Z2R	X	Discharge gas defrosting fault Z2 coldrooms	-, 0..2	2	-
Sens type change	X	Sensor matching changed	-, 0..2	0	-
Z1-Comp auto-dis	X	Automatic compressor disable Z1	-, 0..2	2	-
Z1-Comp auto-dis	X	Automatic compressor disable Z2	-, 0..2	2	-

- Menu 3-9 D2D (Discharge Gas Defrosting)

D2D POS: XXXXX			Entry	De-fault	Dim.
Defrost	→	Defrost type Z2 and Z1 or *Z2 Only*	→	Screen 3-9-a	
Def. Z2R	→	Defrost method Z2 coldrooms	→	Screen 3-9-b	
Def.timer	→	Enter Z2 defrost times	→	Screen 3-9-c	
Def.timer Z2-R	→	Enter Z2 coldroom defrost times with separate defrosting (Only shown when *Aux. defrost* or *Separate* is selected in Screen 3-9-b)	→	Screen 3-9-d	
tc Comp OFF	XX°C	Temperatures above which Z1 capacity stages are unloaded	30..40	35	°C
tc Comp ON	XX°C	Temperatures above which no Z1 capacity stages are loaded	20..30	25	°C
Drain htr. Z2	XXm	Drain heater start delay Z2 coldrooms	5..30	15	min
Defrost Z2	XXm	Defrost duration Z2 cases	10..30	12	min
Comp.OFF Z2	X	Disable Z2 compressors during defrosting YES/NO	↑, ↓, (Y/N)	Y	-
to Comp.ON Z2	XX°C	Z2 compressors remain disabled after Z2 defrosting until temperature t_0 *Comp.ON Z2* is obtained	-10..5	-5	°C
to-Setpt Z1	X°C	t_0 setpoint Z1 during discharge gas defrosting with joint defrosting Z2 and Z2R	-30..-5	-20	°C
BAS LOAD T Z1	XXs	Basic load time Z1 during D2D Z2	5..200	20	sec
BAS UNLO. T Z1	XXs	Basic unload time Z1 during D2D Z2	5..100	10	sec
Defrost Z2R	XXm	Defrost duration Z2 coldrooms	10..30	10	min
Verz.Z1 Abtau.	XXm	Defrost delay Z1 after Z2 defrost	0..90	5	min
Defrost Z1	XXm	Defrost duration Z1 cases	10..30	20	min
to-Setpt Z2	X°C	t_0 setpoint Z2 during discharge gas defrosting Z1	-50..-20	-38	°C
BAS LOAD T Z2	XXs	Basic load time Z2 during D2D Z1	5..200	20	sec
BAS UNLO. T Z2	XXs	Basic unload time Z2 during D2D Z1	5..100	10	sec

- Screen 3-9-a Defrost

Defrost POS: XXXXX<<			Entry	De-fault	Dim.
Z2 and Z1		Discharge gas defrosting for Z1 and Z2 cases/coldrooms	↑, ↓, √		-
Z2 only	√	Discharge gas defrosting Z2 cases/coldrooms only	↑, ↓, √	√	-

- Screen 3-9-b Def. Z2R (Defrost Z2R)

Def. Z2R POS: XXXXX<<			Entry	De-fault	Dim.
With cases	√	Jointly with Z2 cases	↑, ↓, √	√	-
Aux. defrost		Jointly with Z2 cases and auxiliary defrost	↑, ↓, √		-
Separate		Independently of Z2 cases	↑, ↓, √		-
El. UA300		Electric with UA 300	↑, ↓, √		-

- Screen 3-9-c Def.timer (Defrost timer)

Def.timer POS: XXXXX			Entry	De-fault	Dim.
Defr. 1 XXXXX hh.mm	Defrost timer for Z2 cases (and Z2 coldrooms with joint and auxiliary defrosting)	↑, ↓ Mo-Su Mo-Fr Mo-Sa Sa-Su ----- Mo, Tu, We, Th, Fr, Sa, Su, number	Mo-So 06:00	-
Defr. 2 XXXXX hh.mm	Defrost timer for Z2 cases (and Z2 coldrooms with joint and auxiliary defrosting)	↑, ↓ Mo-Su Mo-Fr Mo-Sa Sa-Su ----- Mo, Tu, We, Th, Fr, Sa, Su, number	Mo-So 18:00	-
Defr. 3 XXXXX hh.mm	Defrost timer for Z2 cases (and Z2 coldrooms with joint and auxiliary defrosting)	↑, ↓ Mo-Su Mo-Fr Mo-Sa Sa-Su ----- Mo, Tu, We, Th, Fr, Sa, Su, number	-----	-
...				
Defr. 7 XXXXX hh.mm	Defrost timer for Z2 cases (and Z2 coldrooms with joint and auxiliary defrosting)	↑, ↓ Mo-Su Mo-Fr Mo-Sa Sa-Su ----- Mo, Tu, We, Th, Fr, Sa, Su, number	-----	-

- Screen 3-9-d Def.timer Z2R (Defrost Timer Z2 Coldrooms)

DEF.Z2R POS: XXXXX				Entry	Default/Dimension		
					NT	LT	Dim.
Defr. 1	XXXXX	hh.mm	Defrost timer for Z2 coldrooms with auxiliary and separate defrosting, (Only shown when Auxiliary Defrost or Separate is selected in Screen 3-9-a)	↑, ↓ Mo-Su Mo-Fr Mo-Sa Sa-Su ----- Mo, Tu, We, Th, Fr, Sa, Su, number	-----	-----	-
...							
Defr. 7	XXXXX	hh.mm	Defrost timer for Z2 coldrooms with auxiliary and separate defrosting, (Only shown when Auxiliary Defrost or Separate is selected in Screen 3-9-a)	↑, ↓ Mo-Su Mo-Fr Mo-Sa Sa-Su ----- Mo, Tu, We, Th, Fr, Sa, Su, number	-----	-----	-

8.1.5 Menu 4 Clock

CLOCK POS: XXXXX			Entry	De-fault	Dim.
Setpoint toggle	XXX	Setpoint toggle external or by internal timer	↑, ↓ (INT/EXT)	EXT	-
Current time	→	Show current date/time	→	Screen 4-a	
Toggle time	→	Enter toggle times (Only shown when setpoint toggle is set to *INT*)	→	Screen 4-b	

- Screen 4-a Current time

CLOCK POS: XXXXX			Entry	De-fault	Dim.
Date:	xxdd.mm.yy	Current day, date		Date	-
Time:	hh.mm	Current time		Time	-
Auto dayl. savg	X	Automatically adjust clock for daylight saving changes (YES/NO)	↑, ↓ (Y/N)	Y	-

- Screen 4-b Toggle time

TOGGLE POS: XXXXX		Entry	De-fault	Dim.
dd hh:mm dd hh:mm	Enter up to 7 toggle times each for 2nd setpoint ON (Only shown when setpoint toggle is set to *INT* in Menu 4)	↑, ↓ Mo-Su Mo-Fr Mo-Sa Sa-Su ----- Mo, Tu, We, Th, Fr, Sa, Su, number	Mo 00:00 Mo 00:00	-
...				
dd hh:mm dd hh:mm		As above	-----	-

8.1.6 Menu 5 Messages

MESSAGE POS: XXXXX	
1 Display	Move to Screen 5-1
2 Delete	Move to Screen 5-2

- Menu 5-1 Display (show messages)

MESSAGE POS: XXXXX		Entry
Meldetext dd.mm.yy hh:mm ON/OFF	Message text with date and time	↑, ↓
...	Other messages	

- Menu 5-2 Delete (delete messages)

MESSAGE POS: XXXXX		Entry
Delete? Are you sure? No: ESC Yes: ↵	Prompt to confirm deletion of messages	↵

8.1.7 Menu 6 Operating data

OP DATA POS: XXXXX	
1 On time Z1	Move to Screen 6-1
2 On time Z2	Move to Screen 6-2
3 Fan on time	Move to Screen 6-3
4 Day run time Z1	Move to Screen 6-4
5 Day run time Z2	Move to Screen 6-5

- Menu 6-1 On time Z1 (Run Times Z1 Compressor Stages)

OP DATA POS: XXXXX		Entry	De-fault	Dim.
On time C 1 XXXX h	Show and enter total run times of Z1 compressors. Only available Z1 compressors are shown.	↑, ↓ 0..9999	0h	hr
...				
On time C n XXXX h		As above	0h	hr

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-2 On time Z2 (Run Times Z2 Compressor Stages)

OP DATA POS: XXXXX		Entry	De-fault	Dim.
On time C n+1 XXXX h	Show and enter total run times of Z2 compressors. Only available Z2 compressors are shown.	↑, ↓ 0..9999	0h	hr
...				
On time C max XXXX h		As above	0h	hr

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-3 Fan on time (Run Times Fan Stages)

OP DATA POS: XXXXX		Entry	De-fault	Dim.
On time F 1 XXXX h	Show and enter total run times of fans. Only available fans are shown.	↑, ↓ 0..9999	0h	hr
...				
On time F 8 XXXX h		As above	0h	hr

VS 3000 BS basic module: Fan 1 - max. 4
With 1st SIOX extension module: Fan 1 - max. 8

- Menu 6-4 Day run time Z1 (History)

HISTORY Z1 POS: XXXXX	
1 Rune times	Move to Screen 6-4-1
2 Run time D	Move to Screen 6-4-2
3 Run time N	Move to Screen 6-4-3
4 Compr. starts	Move to Screen 6-4-4
5 Starts Day	Move to Screen 6-4-5
6 Starts Night	Move to Screen 6-4-6
7 Activity	Move to Screen 6-4-7
8 Activity D	Move to Screen 6-4-8
9 Activity N	Move to Screen 6-4-9

- Menu 6-4-1 Rune times Z1

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Run time Z1 → ↓	Press → to show Z1 run times for date shown in Line 1. Press ↑↓ to select date max. 31 days past.	Screen 6-4-1-a

- Screen 6-4-1-a Run Times Z1

Run time Z1 POS: XXXXX		Default	Dim.
Comp. stage 1 hh:mm	Daily run time of Z1 compressor stages. Only the actual number of compressor stages is shown.	00:00	hr:min
...			
Comp. stage n hh:mm		00:00	hr:min

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-4-2 Run time Day Z1

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Run t. Z1 D → ↓	Press → to show daytime Z1 run times for date shown in Line 1. Press ↑↓ to select date max. 31 days past.	Screen 6-4-2-a

- Screen 6-4-2-a Run Times Z1 Day

Run t. Z1 D POS: XXXXX		Default	Dim.
Comp. stage 1 hh:mm	Daily daytime run time of Z1 compressor stages. Only the actual number of compressor stages is shown.	00:00	hr:min
...			
Comp. stage n hh:mm		00:00	hr:min

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-4-3 Run time N Z1

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Run t. Z1 N → ↓	Press → to show Z1 nighttime run times for date shown in Line 1. Press ↑↓ to select date max. 31 days past.	Screen 6-4-3-a

- Screen 6-4-3-a Run Times Z1 Night

Run t. Z1 N POS: XXXXX		Default	Dim.
Comp. stage 1 hh:mm	Daily nighttime run time of Z1 compressor stages. Only the actual number of compressor stages is shown.	00:00	hr:min
...			
Comp. stage n hh:mm		00:00	hr:min

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-4-4 Compressor starts Z1

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Starts Z1 → ↓	Press → to show Z1 compressor starts for date shown in Line 1. Press ↑↓ to select date max. 31 days past.	Screen 6-4-4-a

- Screen 6-4-4-a Compressor starts Z1

Starts Z1 POS: XXXXX		De-fault	Dim.
Comp. stage 1 X	Daily starts of Z1 compressor stages. Only the actual number of compressor stages is shown.	0	-
...			
Comp. stage n X		0	-

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-4-5 Compressor Starts Z1 Day

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Starts Z1 D → ↓	Press → to show daytime Z1 compressor starts for date shown in Line 1. Press ↑↓ to select date max. 31 days past	Screen 6-4-5-a

- Screen 6-4-5-a Compressor Starts Z1 Day

Starts Z1 D POS: XXXXX		De-fault	Dim.
Comp. stage 1 X	Daily daytime starts of Z1 compressor stages. Only the actual number of compressor stages is shown.	0	-
...			
Comp. stage n X		0	-

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-4-6 Compressor Starts Z1 Night

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Starts Z1 N → ↓	Press → to show nighttime Z1 compressor starts for date shown in Line 1. Press ↑↓ to select date max. 31 days past.	Screen 6-4-6-a

- Screen 6-4-6-a Compressor Starts Z1 Night

Starts Z1 N POS: XXXXX		De-fault	Dim.
Comp. stage 1 X	Daily nighttime starts of Z1 compressor stages. Only the actual number of compressor stages is shown.	0	-
...			
Comp. stage n X		0	-

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-4-7 Activity Z1

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Activity Z1 XXX % ↓	Activity (utilization) of Z1 in % Press ↑↓ to select date max. 31 days past.	↓, ↑, ESC

- Menu 6-4-8 Activity D Z1 (Day)

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Activ. Z1 D XXX % ↓	Daytime activity (utilization) of Z1 in % Press ↑↓to select date max. 31 days past.	↓, ↑, ESC

- Menu 6-4-9 Activity D Z1 (Night)

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Activ. Z1 N XXX % ↓	Nighttime activity (utilization) of Z1 in % Press ↑↓to select date max. 31 days past	↓, ↑, ESC

- Menu 6-5 Day run time Z2 (History)

HISTORY Z2 POS: XXXXX	
1 Rune times	Move to Screen 6-5-1
2 Run time D	Move to Screen 6-5-2
3 Run time N	Move to Screen 6-5-3
4 Compr. starts	Move to Screen 6-5-4
5 Starts Day	Move to Screen 6-5-5
6 Starts Night	Move to Screen 6-5-6
7 Activity	Move to Screen 6-5-7
8 Activity D	Move to Screen 6-5-8
9 Activity N	Move to Screen 6-5-9

- Menu 6-5-1Rune times Z2

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Run time Z2 → ↓	Press → to show Z2 run times for date shown in Line 1. Press ↑↓ to select date max. 31 days past.	Screen 6-5-1-a

- Screen 6-5-1-aRun Times Z2

Run time Z2 POS: XXXXX		Default	Dim.
Comp. stage n+1 hh:mm	Daily run time of Z2 compressor stages. Only the actual number of compressor stages is shown.	00:00	hr:min
...			
Comp. stage max hh:mm		00:00	hr:min

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-5-2 Run time Day Z2

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Run t. Z2 D → ↓	Press → to show daytime Z2 run times for date shown in Line 1. Press ↑↓ to select date max. 31 days past.	Screen 6-5-2-a

- Screen 6-5-2-a Run Times Z2 Day

Run t. Z2 D POS: XXXXX			Default	Dim.
Comp. stage n+1	hh:mm	Daily daytime run time of Z2 compressor stages. Only the actual number of compressor stages is shown.	00:00	hr:min
...				
Comp. stage max	hh:mm		00:00	hr:min

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-5-3 Run time N Z2

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	
Run t. Z2 N	→ ↓	Press → to show Z2 nighttime run times for date shown in Line 1. Press ↑↓ to select date max. 31 days past.	Screen 6-5-3-a

- Screen 6-5-3-a Run Times Z2 Night

Run t. Z2 N POS: XXXXX			Default	Dim.
Comp. stage n+1	hh:mm	Daily nighttime run time of Z2 compressor stages. Only the actual number of compressor stages is shown.	00:00	hr:min
...				
Comp. stage max	hh:mm		00:00	hr:min

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-5-4 Compressor starts Z2

HISTORY POS: XXXXX			Entry
Date:	dd.mm.yy	Date	
Starts Z2	→ ↓	Press → to show Z2 compressor starts for date shown in Line 1. Press ↑↓ to select date max. 31 days past.	Screen 6-5-4-a

- Screen 6-5-4-a Compressor starts Z2

Starts Z1 POS: XXXXX			De-fault	Dim.
Comp. stage n+1	X	Daily starts of Z2 compressor stages. Only the actual number of compressor stages is shown.	0	-
...				
Comp. stage max	X		0	-

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-5-5 Compressor Starts Z2 Day

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Starts Z2 D → ↓	Press → to show daytime Z2 compressor starts for date shown in Line 1. Press ↑↓ to select date max. 31 days past	Screen 6-5-5-a

- Screen 6-5-5-a Compressor Starts Z2 Day

Starts Z2 D POS: XXXXX			De-fault	Dim.
Comp. stage n+1	X	Daily daytime starts of Z2 compressor stages. Only the actual number of compressor stages is shown.	0	-
...				
Comp. stage max	X		0	-

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-5-6 Compressor Starts Z2 Night

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Starts Z2 N → ↓	Press → to show nighttime Z2 compressor starts for date shown in Line 1. Press ↑↓ to select date max. 31 days past.	Screen 6-4-6-a

- Screen 6-5-6-a Compressor Starts Z2 Night

Starts Z2 N POS: XXXXX		De-fault	Dim.
Comp. stage n+1 X	Daily nighttime starts of Z2 compressor stages. Only the actual number of compressor stages is shown.	0	-
...			
Comp. stage max X		0	-

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 6-5-7 Activity Z2

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Activity Z2 XXX % ↓	Activity (utilization) of Z2 in % Press ↑↓ to select date max. 31 days past.	↓, ↑, ESC

- Menu 6-5-8 Activity D Z1 (Day)

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Activ. Z2 D XXX % ↓	Daytime activity (utilization) of Z2 in % Press ↑↓to select date max. 31 days past.	↓, ↑, ESC

- Menu 6-5-9 Activity D Z1 (Night)

HISTORY POS: XXXXX		Entry
Date: dd.mm.yy	Date	
Activ. Z2 N XXX % ↓	Nighttime activity (utilization) of Z2 in % Press ↑↓to select date max. 31 days past	↓, ↑, ESC

8.1.8 Menu 7 Default settings

VS3000BS POS: XXXXX		Entry
Load default? Are ypu sure? No: ESC Yes: ↵	Prompt to confirm loading of default parameters	↵, ESC

8.1.9 Menu 8 Service Mode

SERVICE POS: XXXXX	
1 Analog values	Move to Screen 8-1
2 Compressor Z1	Move to Screen 8-2
3 Compressor Z2	Move to Screen 8-3
4 Condenser fan	Move to Screen 8-4
5 System	Move to Screen 8-5
6 D2D	Move to Screen 8-6

- Menu 8-1 Default Analog values

SERVICE POS: XXXXX		Entry	De-fault	Dim.
AnalogOut1 X.X V	Voltage at Analog Output 1 (Terminals 53, 54)	↑, ↓ 0,0..10,0	0,0	V
AnalogOut2 X.X V	Voltage at Analog Output 1 (Terminals 55, 56)	↑, ↓ 0,0..10,0	0,0	V
AnalogOut3 X.X V	Voltage at Analog Output 1 (Terminals 57, 58)	↑, ↓ 0,0..10,0	0,0	V

- Menu 8-2 Default Compressor Z1 ON/OFF

SERVICE POS: XXXXX		Entry	De-fault	Dim.
Compressor C 1 XXX	Control status of respective compressor (stage) in Z1, ON or OFF. Only the actual number or compressors is shown.	↑, ↓ (ON/OFF)	OFF	-
...				
Compressor C n XXX		↑, ↓ (ON/OFF)	OFF	-

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration

No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 8-3 Default Compressor Z2 ON/OFF

SERVICE POS: XXXXX		Entry	De-fault	Dim.
Compressor C n+1 XXX	Control status of respective compressor (stage) in Z2, ON or OFF. Only the actual number or compressors is shown.	↑, ↓ (ON/OFF)	OFF	-
...				
Compressor C max XXX		↑, ↓ (ON/OFF)	OFF	-

VS 3000 BS basic module: Max. total compressor stages: 4
With 1st SIOX extension module: Max. total compressor stages: 8
Z1 compressors: 1 to n Compressor stages: 1 to max. 3/7, depending on system configuration
Z2 compressors: n+1 to max. Compressor stages: 2 to max. 4/8, depending on system configuration
No. compressor stages Z1 + No. compressor stages Z2 = Max. 4/8 total compressor stages

- Menu 8-4 Default Condenser fan ON/OFF

SERVICE POS: XXXXX		Entry	De-fault	Dim.
Fan F 1 XXX	Control status of respective fan, ON or OFF. Only the actual number or compressors is shown.	↑, ↓ (ON/OFF)	OFF	-
...				
Fan F 8 XXX		↑, ↓ (ON/OFF)	OFF	-

VS 3000 BS basic module: Fan 1 - max. 4
With 1st SIOX extension module: Fan 1 - max. 8

- Menu 8-5 Default System

SERVICE POS: XXXXX		Entry	De-fault	Dim.
Enable Z1 XXX	Digital output *Enable Refrigeration Point* Z1 ON or OFF	↑, ↓ (ON/OFF)	OFF	-
Enable Z2 XXX	Digital output *Enable Refrigeration Point* Z2 ON or OFF	↑, ↓ (ON/OFF)	OFF	-

- Menu 8-6 Default D2D (Discharge Gas Defrosting)

D2D POS: XXXXX		Entry	De-fault	Dim.
Com.disch.line XXX	Digital output *Common Discharge Line* ON or OFF	↑, ↓ (ON/OFF)	OFF	-
Drain htr. Z2 XXX	Digital output *Drain Heater Z2* ON or OFF	↑, ↓ (ON/OFF)	OFF	-
Suct. line Z2 XXX	Digital output *Suction Line Z2* ON or OFF	↑, ↓ (ON/OFF)	OFF	-
Discharge Z2 XXX	Digital output *Discharge Gas Z2* ON or OFF	↑, ↓ (ON/OFF)	OFF	-
Suct. line Z2R XXX	Digital output *Suction Line Z2R* ON or OFF	↑, ↓ (ON/OFF)	OFF	-
Discharge Z2R XXX	Digital output *Discharge Gas Z2R* ON or OFF	↑, ↓ (ON/OFF)	OFF	-
Suct. line Z1 XXX	Digital output *Suction Line Z1* ON or OFF	↑, ↓ (ON/OFF)	OFF	-
Discharge Z1 XXX	Digital output *Discharge Gas Z*1 ON or OFF	↑, ↓ (ON/OFF)	OFF	-

9 Alarms and Messages of VS 3000 BS

9.1 Reporting system

A number of messages are recognized by the system and logged in the internal fault memory with date, time and priority. Receive/Send messages are logged in fault memory. Time resolution is 1 minute.

Messages are logged in fault memory in their order of occurrence. Capacity of the fault memory is sufficient to store 200 entries. When the memory is full, the next message received overwrites the oldest entry (ring buffer).

The fault memory is battery-backed, meaning that messages will not be lost in a power failure.

Alarms/messages can be retrieved with a setup unit (AL 300 Operator Terminal or CI 3000 Store Computer). The most recent message is displayed first in the list. Contents of the fault memory can be deleted with the setup unit. Messages are also transmitted via the CAN bus, enabling the current message to be displayed on the setup unit and a central fault memory to be built with the CI 3000 Store Computer for the complete refrigeration system.

9.2 Structure of alarms/messages

Messages are made up of the date and time of event, priority and specific message text in real language. They are presented on the display of the setup unit in three lines of 20 characters. One line is used to identify the active controller.

Line	Example	Data
1	Messages ID: xxxxx	Active controller
2	Motor overload cutout C1	Message
3	20.5.98 10:20 ON	Date and time of message
4	20.5.98 10:25 OFF	Fault corrected

Four alarm priorities may be used:

– Alarm not entered in alarm log

0 Alarm entered in alarm log but not transmitted to higher-order system components

1 Alarm entered in alarm log and transmitted to higher-order system components with Prio. 1

2 Alarm entered in alarm log and transmitted to higher-order system components with Prio. 2

In a compressor fault condition, an alarm is automatically upgraded to Priority 1 when 50% of the compressors have failed. Change of alarm priority results in automatic generation of a Priority 0 message (archived in message log only) reading as follows:

Prio M xxx: *p1* > *p2*

where xxx = Alarm/message number

p1: Previous alarm priority

p2: New alarm priority

9.3 Types of alarm

Alarms recorded by the VS 3000 BS Pack Controller and stored in fault memory are:

- Process fault alarms
- System fault alarms

9.3.1 Process fault alarms

No.	Messages text	Process fault alarm
1	Mot. cutout Z2 Cx	Motor overload cutout tripped Z2 Compressor x
2	Mot. cutout Z1 Cx	Motor overload cutout tripped Z1 Compressor x
3	Cyl. temp. Z2 Cx	Cylinder head temperature above upper limit Z2 Compressor Cx
4	Cyl. temp. Z1 Cx	Cylinder head temperature above upper limit Z1 Compressor Cx
5	Oil diff. pr. Z2 Cx	Low oil pressure cutout tripped Z2 Compressor x
6	Oil diff. pr. Z1 Cx	Low oil pressure cutout tripped Z1 Compressor x
7	Low LP Z2	t_0 below lower limit Z2 circuit
8	Low LP Z1	t_0 below lower limit Z1 circuit
9	LP cutout Z2	Low-pressure cutout tripped Z2
10	LP cutout Z1	Low-pressure cutout tripped Z1
11	Max. speed	Speed above high threshold for speed adjuster
12	Manual OFF Cx	Switched to Manual OFF
13	Manual ON Cx	Switched to Manual ON
14	Mot. cutout fan x	Motor overload cutout tripped Condenser Fan x
15	High HP	t_c above upper limit
16	HP cutout	High-pressure cutout tripped
17	Low liq. level	Low refrigerant level switch actuated
18	Service	Service mode activated
19	Comp/cond unload	External unload
20	Load shed Z2	Z2 compressor disabled by load shedding
21	Load shed Z1	Z1 compressor disabled by load shedding
22	Burst disk def.	Digital input for bursting disk actuated
23	Power failure	Controller restart after power failure
24	First start	First start of controller and loading of default parameters
25	Setpoint changed	Setpoint changed
28	Ext. alarm	Digital input for external alarm active
29	Speed adjuster	Digital input for speed adjuster/external alarm active and speed adjuster is activated

No.	Messages text	Process fault alarm
30	HP cutout. D2D Z1	Digital input for high-pressure cutout with discharge gas defrosting of Z1 cases is active (not yet implemented)
31	HP cutout. D2D Z2	Digital input for high-pressure cutout with discharge gas defrosting of Z2 cases is active
32	HP cutout. D2D Z2R	Digital input for high-pressure cutout with discharge gas defrosting of Z2 coldrooms is active
33	Disable D2D Z1	Digital input for disabling discharge gas defrosting of Z1 cases is active (not yet implemented)
34	Disable D2D Z2	Digital input for disabling discharge gas defrosting of Z2 cases is active
35	Disable D2D Z2R	Digital input for disabling discharge gas defrosting of Z2 coldrooms is active
36	Fault D2D Z1	Fault in discharge gas defrosting of Z1 cases (not yet implemented)
36	Fault D2D Z2	Fault in discharge gas defrosting of Z2 cases
36	Fault D2D Z2R	Fault in discharge gas defrosting of Z2 coldrooms
37	Sensor type change	Parameter for matching pressure transducer changed
38	Auto disable Z1 Sx	Z1 Compressor Stage x automatically disabled (high cylinder head temp. 5 times in one day)
39	Auto disable Z2 Sx	Z2 Compressor Stage x automatically disabled (high cylinder head temp. 5 times in one day)

9.3.2 System fault alarms

In occurrence of a *HP Measuring Loop Error*, condenser stages are unloaded when compressors are stationary and loaded when compressors are running. Capacity stages are likewise loaded when compressors have been started manually. Actuation takes place after the basic time has elapsed. No allowance is made for variable times.

In occurrence of an *LP Measuring Loop Error*, compressor capacity stages are loaded or unloaded until about 50% of all available compressor capacity stages are working. Actuation takes place after the basic time has elapsed. No allowance is made for variable times. In occurrence of all other *Measuring Loop Errors*, computation continues with the most recent valid value for the duration of the error.

EPROM and RAM errors are fatal errors and result in the controller going on HOLD, as correct running of the program can then no longer be expected. Output signals are reset.

No.	Message text	System fault alarm
1	Meas. error cyl. Z2 Vx	Fault in measuring loop to detect cylinder head temperature of Z2 Compressor Cx
2	Meas. error cyl. Z1 Vx	Fault in measuring loop to detect cylinder head temperature of Z1 Compressor Cx
3	Meas. error HP	Fault in measuring loop to detect high pressure
4	Meas. err. LP Z2	Fault in measuring loop to detect low pressure Z2
5	Meas. err. LP Z1	Fault in measuring loop to detect low pressure Z1
6	Meas. error tr	Fault in measuring loop to detect room temperature
7	Meas. error tod	Fault in measuring loop to detect outdoor temperature
8	Meas. err. humidity	Fault in measuring loop to detect air humidity
9	RTC error	Fault in controller real-time clock
10	EEPROM error	Internal EEPROM (parameter memory) defective
11	RAM error	Internal data memory defective
12	SIOX error x	Failure of I/O SIOX extension module No. x
13	Battery voltage	Internal battery fault

9.4 Archiving of operating data

9.4.1 Compressor/fan operating hours

Total running time of compressors/fans is measured at 30-second intervals and stored in memory backed up against data loss in power failure. Time is shown in hours. Operating hours can also be programmed for replacement of compressors/fans or the controller (Menu 6-1).

9.4.2 Daily run times

In addition to total operating hours, the daily run time, compressor starts and activity (utilization) of the compressor pack are recorded. The cycle time starts at midnight and the current status is shown in hours and minutes. This data is additionally stored in memory over a period of 32 days for use in evaluating operation of the compressor pack and can be read out via the *History Z1* and *History Z1* menu (Menu 6-2).

Compressor daily run time

Daily run times of compressors are recorded each day and stored in memory with date and time. The cycle time starts at midnight. The VS 3000 BS records daily compressor run times separately for the 1st setpoint (Menu 6-4-2 / 6-5-2) and 2nd setpoint (Menu 6-4-3 / 6-5-3).

Compressor starts

Compressor start signals are recorded daily and stored with date and time. The cycle time starts at midnight. The VS 3000 BS records daily compressor starts separately for the 1st setpoint (Menu 6-4-5 / 6-5-5) and 2nd setpoint (Menu 6-4-6 / 6-5-6).

Compressor pack activity/utilization

Activity is calculated by the following formula:

$$E - Activity = \frac{L}{[n \cdot (T_1 - T_0)]}$$

E-Activity : Activity (utilization) of compressor pack
L : Total of all compressor run times
n : Number of compressors installed
T_1 : Current time
T_0 : Day change

The current status is shown as a percentage. The VS 3000 BS records daily activity of the compressor pack separately for the 1st setpoint (Menu 6-4-8 / 6-5-8) and 2nd setpoint (Menu 6-4-9 / 6-5-9).

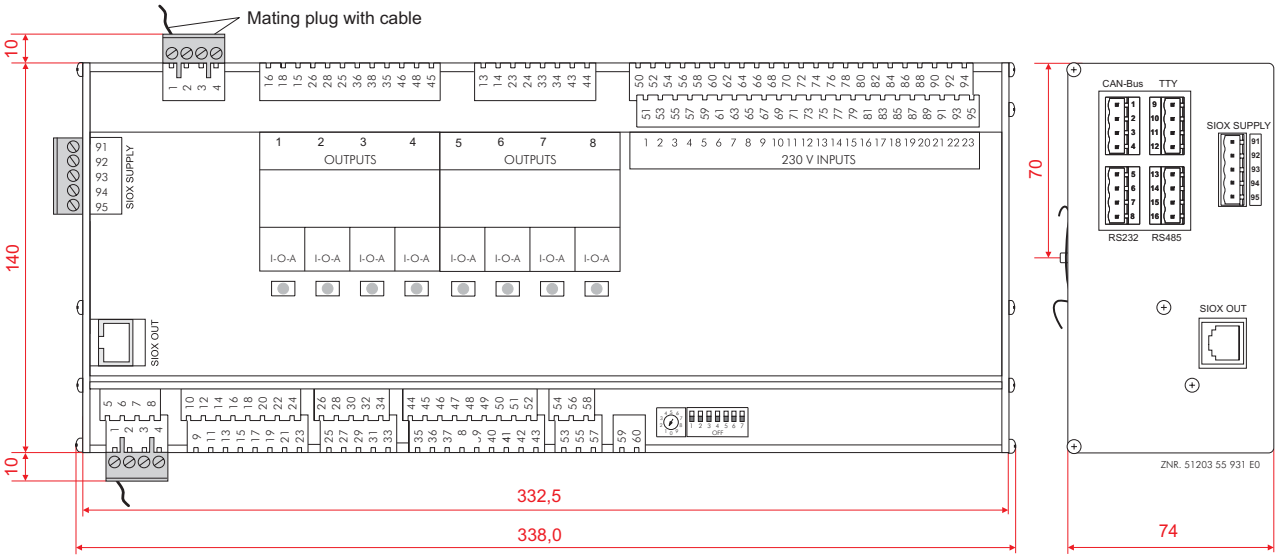
Notice:

10 Specifications of VS 3000 BS

10.1 Electrical Data

	VS 3000 BS
Power supply	U_{Nom} = 230 V AC, 200 - 265 V AC, 50/60 Hz
Rated power	6 W
Leakage current over PE	max. 1 mA
Relay outputs	10 x 250 V AC, 6 A (6 N.O., 4 changeover), floating Transverse voltage between outputs max. 400 V AC
Digital inputs	23 x 230 V AC floating Transverse voltage between inputs max. 400 V AC
Analog inputs	8 x PT1000 temperature sensors, 2-wire type 2 x PT1000 temperature sensors, 4-wire type 3 x pressure sensors 4..20 mA and 1 x humidity sensor 4..20 mA all inputs internally convertible by jumper (Leads running to analog inputs must be shielded.)
Analog outputs	1 x 0-10 V / 4-20 mA (internally convertible by jumper) 0-10 V (min. load 1 k)/4-20 mA (max. load 800Ω) (Leads running to analog inputs must be shielded.)
Fieldbus port	CAN bus, floating
Data ports	Serial RS232 / RS485 Data port for SIOX TTY (passive)
Other ports	Power supply for external SIOX extension modules
Archive memory	Compressor run times, starts, activity, fault reports
Monitoring function	Watchdog
Real-time clock	Byttery-backed Lithium cell (Typ CRC 2450 N / 3V Lithium, (10 years shelf life), 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%
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
Atmospheric pressure	Transport: 660 hPa .. 1060 hPa Operation: 860 hPa .. 1060 hPa
Weight	VS 3000: ca. 1600 g SIOX: ca. 800 g
Enclosure	IP20
CE conformity	Conforming to EC Directives 73/23/EEC (Low-Voltage Directive) 89/336/EEC (EMC Directive)

10.2 Mechanical data of VS 3000 BS



10.3 Mechanical data of SIOX extension module