Introduction to the Frigolink System

(2007-11)

Contents

1 The Frigolink System

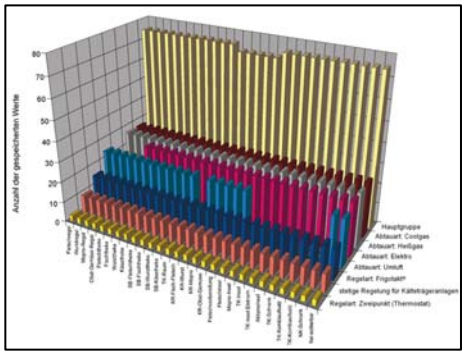
The Frigolink control system is presented in the introduction. The focus here is on the system's components, structure and control concepts.
You can look up all further information in the detailed Frigolink manual.
You can obtain it from your Wurm sales partner.

1.1 The Concept

Frigolink offers comprehensive control solutions for industry and supermarket refrigeration as well as for building equipment. It can be built up simply and quickly and is easily set up and simple to operate.
The Frigolink control system basically has two system components: Main modules and field modules.
The main module is built into the switch cabinet and takes over central control and co-ordination of the field modules. It also serves as central operating unit.
The field modules, in contrast, can be placed in electrical distribution cabinets or furniture strips and serve to record measurement values and to input and output switching signals.

1.2 The Expert Database

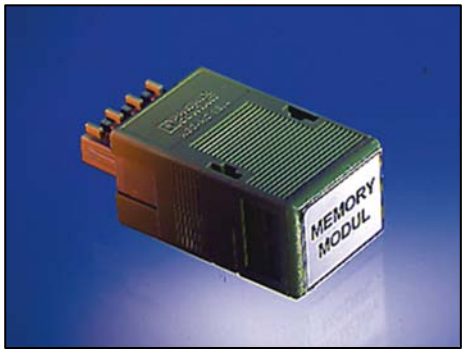
Standard settings for all applications are stored in the main module in the expert database. This expert database encompasses a multitude of parameters, which are laid out differently depending on the application.
The foundation for the expert database is many years of evaluating measurement data. They show that, for almost all system types and makes, a standard setting can be found under which the system works optimally.
Fine-tuning of the systems is then often limited to just a few parameters.



The Expert Database

1.3 The Memory Module

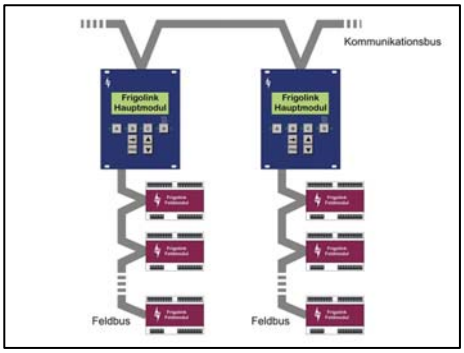
All parameter settings for the system (setpoints, individual user texts for controller, inputs and outputs) are stored in the memory module.
It is designed as a plug-in module and can be easily exchanged at any time.
This has enormous advantages for system configuration, as it can be performed in advance on the computer. If such a pre-parameterised memory module is used, all entered parameters and texts are available immediately.



The Memory Module

1.4 System Communication

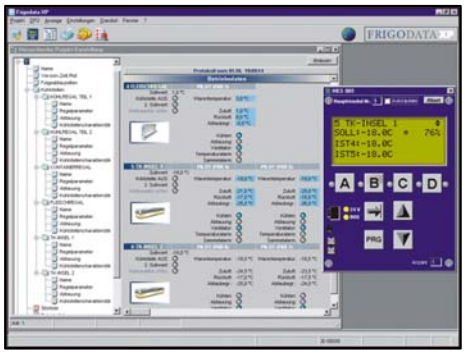
In system communication, Frigolink relies on the CAN bus, which has proved itself millions of times in automation technology.
Data exchange between main and field modules takes place via the field bus. For system communication with the gateway and between the main modules, a second CAN-bus interface is available:
Malfunction reports as well as central control and measurement signals are exchanged via the communication bus.
Both bus systems are, of course, electrically isolated from each other. This increases reliability considerably.



The Frigolink Bus System

1.5 Remote Data Transmission with FRIGODATA XP

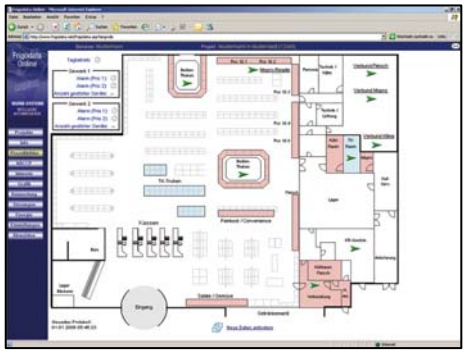
In the interplay with gateways and the FRIGODATA XP software, the Frigolink system can be completely remote controlled and monitored.
Besides receiving malfunction reports from the system, you can adjust setpoints, call up log data or observe the system remotely.



Frigodata XP

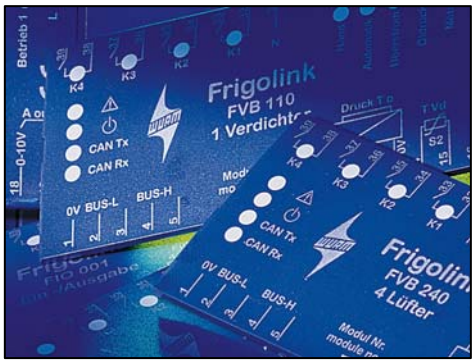
1.6 Frigodata Online

Frigodata Online permits observation of your system via the Internet without special software.
You only need a computer with Internet access, an Internet browser and enabling via your sales partner.


Frigodata Online

Frigolink main module with switch cards

Frigolink field module



Lid print on the field modules

OEM cold location field module FKD002B

2 The Components

2.1 Main Modules

The main module is built into the switch cabinet and takes over regulation as well as central control and co-ordination of the field modules. It also serves as a central display and operating unit.

Various main module types - adapted to the respective application – are available. The devices continue to be available in different language variants.

All operating elements are located on the front of the main module. They include the four-line display with plain text, eight buttons for operation, six LEDs for menu and main module status, an LED for the fault message, and a Western socket for connecting a laptop (via CAN-PC converter).

2.2 Field Modules

The field modules serve to record measurement values (temperature, pressure, etc.) as well as to input and output switching signals and are placed in electrical distribution cabinets or furniture strips.

Various field modules are available for evaluation and monitoring of cold locations, compressors, ventilators, pumps, electronic injection valves (EEV) etc. The field modules may be installed in the central switch cabinet, the subdistributor or in the base of a refrigerator.

The field modules have a number of analogue and digital inputs and outputs.
Each input or output is assigned to a specific function. These functions and their wiring are printed on the cover.

If the system communication malfunctions, the field modules ensure limited operation via emergency programs.

Besides the main and field modules, there are a multitude of additional components that complete the Frigolink system:

2.3 Gateways

There are various gateways with different performance characteristics to fit system size and application. These can be equipped with various modems (analogue, ISDN) or with coupling via Ethernet (LAN).

Gateway CMD200

2.4 Switch Cards

The system can be equipped with switch cards for switching function and status displays. These clearly show the operating and malfunction status of cold locations and drives and make manual switching of individual consumers (e.g. compressors, ventilators or cold locations) possible.

2.5 Remote Displays

Through the remote displays, the goods temperature and cold location status can be displayed on the refrigerator front or in a separate cold location switchbox outside the control or machine room.

Remote display DSP002

2.6 Sensors

Various sensors are available for the different application areas of the system equipment. Precision NTC probes are available for temperature measurement.Pressure transmitters serve to record low and high pressure. Additional sensors serve to record the air humidity in sales and cold rooms.

2.7 Driver Modules

Various driver modules are available for triggering valves without internal amplifiers (e.g.: EEVs or thermal valve drives).

2.8 Accessories

The Frigolink program is rounded out with accessories, such as module racks, power-level modules (for multiple switching of measurement signals), temperature and signal recording devices and a central display panel. As a result, information can be taken over into Frigolink from other systems or existing systems.

Determining the representative goods temperature

3 Cold location Control

3.1 Control Process for Cold locations

The cold location main module HKS001 controls and monitors up to 8 cold locations or evaporators.

This covers all applications, from simple thermostat function up to constant control, with brine or expansion valves. The required parameters are stored in the expert database and can be called down when the cold location is set up.

Frigolink controls the cold locations according to the representative goods temperature (TÜV-certified according to EN441) and helps you fulfil the requirements of the hygiene ordinance HACCP.

With intelligent additional functions, such as defrost when required, latent heat use and Frigotakt control processes, you protect the goods and achieve considerable energy and cost savings.

Special defrost functions, such as successor and group defrosting or forced cooling (necessary for hot and cool gas defrosting), ensure an optimised, higher-level defrost co-ordination beyond cold locations and main modules.

Central switching functions, such as the day/night signal or emergency switch-off in case of compound malfunction, can be achieved through the communication bus.

3.2 Thermostat Control

A two-point controller is depicted in the thermostat control. As soon as the actual value exceeds or falls below the setpoint by half the switching difference, the cold location output is switched on or off. The thermostat control can be combined with an overheating control (EEV).

3.3 Frigotakt

Frigotakt is a control process developed by Wurm GmbH. This process permits performance-dependent compressor switching, since here Frigolink knows the required cooling performance of the cold locations in the compound. The Frigotakt thermostat control can be combined with an overheating control (EEV).

3.4 PID Control

PID control is used to trigger constant actuators. A constant correcting variable, which is available at the analogue output of the field module as voltage 0...10V for triggering valves, is determined from the control difference between setpoint and goods temperature. The PID control can be combined with an overheating control (EEV).

3.5 Three-point

A three-zone thermostat with the areas cooling, heating and neutral zone is imitated for temperature control. The three-point temperature control can also be combined with an »rF« moisture control or EEV control.

3.6 Constant / AT1B

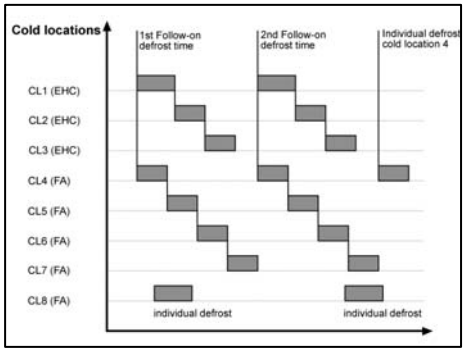
Frigolink offers the control process constant / AT1B for use in refrigerant equipment with Siemens AT1B actuators. In this control process, the actuator is triggered via a specially modulated PWM signal.

3.7 Overheating control (EEV)

The EEV control can be optionally activated for every cold location. The valve can be triggered constantly or through a PWM signal.
For the control process, you can select between overheating control (combined with thermostat function) or constant control.
With constant control, the EEV remains permanently opened; the evaporator performance, and thus the temperature, is constantly controlled via the degree of opening.
Special safety functions for the use of refrigerant R744 (CO_2) are integrated.

3.8 Defrosting

You can choose between the forced air, electric, hot or cool gas defrosting processes. Frigolink permits realisation of complex defrosting plans via the channel and follow-on defrosting.



Defrosting scheme

3.9 Overview of the Functions of HKS001B

Control process

- Thermostat
- Frigotakt
- PID
- Three-point
- Constant / AT1B
- Overheating control (EEV)
- Moisture control (rF)
- Control according to representative goods temperature
  (certified in accordance with DIN EN 441)

Defrosting

Defrosting process
- Forced air defrosting
- Electrical defrosting
- Hot gas defrosting
- Cool gas defrosting

Defrost trigger
- Individual defrost
- Follow-on defrost
- Channel defrost
- Manual defrost

Other
- Required defrost
- Recording of the defrosting duration and melting time per evaporator
- Regulated defrost heater for industry cold rooms

Defrost module FIO001B
with inputs and outputs for:
- Forced cooling for cold locations
- Forced switching off of cold locations
- Signal of “defrosting active”
- External initiation of follow-on defrost

Alarm

- High and low temperature warning
- Monitoring of defrost safety time
  (optional malfunction or operation message)
- Monitoring of door contact switch
  (optional malfunction or operation message)
- High and low humidity warning

Special functions

for refrigerators
- Monitoring of lined-up refrigerators via alarm probes
- Continuous operation monitoring
- Deep freeze double island with medium evaporator

for cold rooms
- Digital input "Cold room door open"
- Regulating actual value copy
- Regulated defrost heater for industry-cold rooms

Fault list / operating list

- Fault list (50 entries)
- Operating list (25 entries)

Higher-level bus communication

- Total breakdown of compound equipment
- Day/ night signal
- Clock synchronisation
- Temperature and rel. humidity in showroom

Other

- Automatic summer/winter time changeover
- Operating hours counter for cooling, defrosting and ventilator switch outputs
- Adjustable probe balancing for temperature probes, pressure transmitters and rF sensors
- Alarm outputs (Prio 1 + 2)
- Two separate internal log storage locations with variable time grid (Frigoplot/Dokuplot) and average value calculation (Dokuplot)

3.10 Overview of Cold Location Field Modules

Field module type	FKR002B	FKV001B	FKP001B	FKD002B
Mechanical characteristics				
Installation on DIN profile rails	X	X	X	-
Installation in refrigerator front	-	-	-	X
Voltage supply with 230V~	X	X	X	-
Voltage supply with external transformer TR9-9-4	-	-	-	X
Field bus service socket for laptop	-	-	-	X
Connection via pre-made lines	-	-	-	X
Integrated display	-	-	-	X
Remote display via DSP002 (Connection via pre-made plug-and-socket connection)	-	X	X	-
Remote display via FLAxxx	X	(X) [1]	(X) [1]	(X) [1]
Inputs/outputs				
Probe inputs				
Supply air temperature	X	X	X	X
Return air temperature	X	X	X	X
Defrost limit temperature	X	X	X	X
Suction gas temperature	-	X	X	X
Analogue input 4..20mA for pressure sensor p_0 or moisture sensor rF	-	X	X	X
Digital inputs for cold location off, 2nd setpoint and cold room door open	X	X	X	X
Digital outputs				
Cooling (relay)	X	X	-	X
Defrost (relay)	X	X	X	X
Fan (relay)	X	X	X	X
Cooling or PWM for EEV (via semiconductor relay 230V~, with internal feed)	-	-	X	-
Analogue outputs	1	2	2	1
0..10V=, for constant controls	X	X	X	-
PWM (pulse-width modulated) for EEV- via ATV230	-	X	X	X
PWM (pulse-width modulated) for thermal valves via ATV001	X	X	X	X
Control process and operating modes				
Thermostat …	X	X	X	X
Frigotakt …	X	X	X	X
PID …	X	X	(X) [2]	-
Constant AT1B …	X	X	X	X
Three-point	X	X	X	X
Thermostat with EEV	-	X	X	(X) [3]
Frigotakt with EEV	-	X	X	(X) [3]
PID with EEV	-	X	(X) [2]	(X) [3]
Three-point with EEV	-	X	(X) [4]	(X) [3]
Three-point with rF (3-Pt / constant / only rF control)	-	X	-	(X) [5]

1 = Please plan DSP002 for new systems
2 = No 2nd ventilator step present
3 = Only operation of pulse-width modulated EEVs
4 = No separate "cool" switch signal
5 = No constant humidity control possible

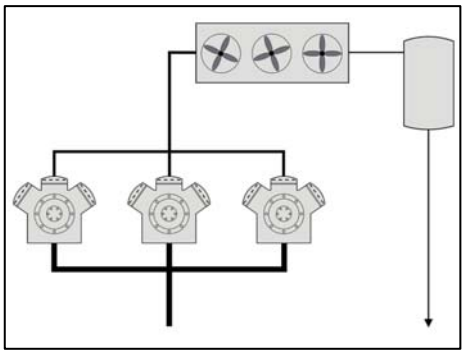
4 Compound Control

4.1 Compound Main Modules

In the Frigolink system, there are three different main modules with which the control of differentially complex equipment is possible.
Here the HVB001B and HVV001B cover the area of commercial compound control, while the HVI001B covers the area of industrial compound control.

4.2 Compound Main Module HVB001B

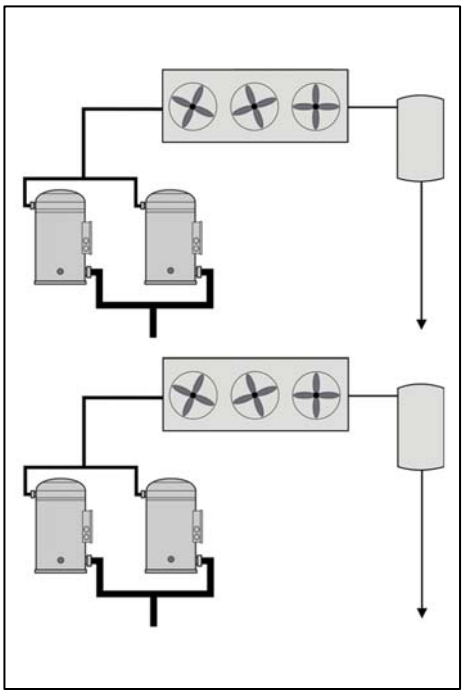
In the Frigolink system, the HVB001B is the universal control for direct-evaporating systems and refrigerant equipment.
With its scope of functions, it covers broad areas of commercial refrigeration. The HVB001B is able to control a complete compound system with sophisticated suction pressure and condenser control and to monitor additional individual compressors.



HVB diagram

4.3 Double-Compound Main Module HVV001B

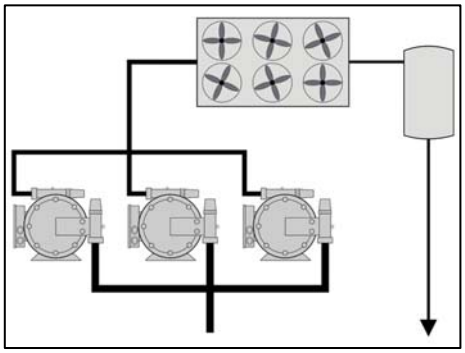
The double compound control HVV001B has a limited scope of functions compared to the HVB001B.
But it is able to control two complete compound systems for suction and condensation pressure independently of each other. This makes it the ideal controller for smaller, direct-evaporating compound systems.



HVV diagram

4.4 Industrial Compound Main Module HVI001B

The HVI001B has a special position in the area of compound controllers. It is designed as a double compound controller and simultaneously has a number of additional control circuits, processes and functions that are optimised especially for control of industry compounds. It can trigger a larger number of field modules than the HVB001B or HVV001B.



HVI diagram

4.5 Control Circuits of the Compound Control

4.5.1 Control Circuits "Suction Pressure" and "Refrigerant"

The compressors of the refrigerating equipment are regulated and monitored via the control circuits "Suction Pressure" and "Refrigerant". Various control strategies are available for triggering the compressors.

- **Multiple contact switch with base load change**
  The compressors are triggered via a multiple contact switch. The forward and return flow delays can be set independently of each other.

If necessary, there is the possibility of setting an individual delay time for the forward and return flow in each power stage of the compound. As a result, the compound can adapt better to the load profiles arising in the system.

The integrated base load change can be deactivated.

- **Master-slave for reducing switching play in industrial plants**
  This control process is especially suited for use with screw-type compressors. The master-slave switching of the compressors reduces mechanical changes and achieves a more even power adjustment of the compound. Load changes are largely run down through the master compressor. When additional compressors are switched on, the master compressor reduces its performance and thus achieves a better power adjustment between compound and cold locations.

- **Compressor control with frequency converter**
  The control process permits constant compound control with frequency converters: One or more compressors can be constantly controlled. Even a mixed operation with constant- and stepwise-controlled compressors is possible.

- **Triggering of screw-type compressors (constant, intermittent)**
  With this option, constant valve positioning can be performed especially for power regulation of screw-type compressors.
  In addition, an intermittent CR4-operation can also be implemented for earth screws.

- **Cross-compound base load change**
  With the double-compound control HVI001B, the base load change between both compounds of the main module can be co-ordinated via this function. The function is used especially in refrigerant equipment in which separate compound systems have an impact on a common refrigerant circuit (redundancy).

- **Enthalpy-controlled increase in suction pressure**
  By means of the enthalpy-controlled increase in suction pressure, the setpoint of the compound equipment can be raised dependent on the climate conditions (temperature and air humidity) in the showroom. The system follows the climactic course of the year: With favourable climactic conditions, the setpoint increase results in energy savings.

- **Dynamic forward/return flow delay**
  With this function, the delay times for the forward and return flow are dynamically adapted to the load conditions.
  With increasing deviations between setpoint and actual value, the delay times for the forward and return flow are continuously reduced.
  As a result, the compound controls strong power oscillations more quickly.

- **Frigotakt (mass flow management)**
  Compressors are controlled with the optimised mass current management of the entire refrigeration system. For this, data are exchanged constantly between compound and cold location controllers in order to achieve a co-ordinated switching of compressors and cold locations.

Besides evaluation of digital malfunction reports received, the following safety functions can be used:

- **Suction gas monitoring**
  Suction gas monitoring controls overheating of the suctioned-in refrigerant vapour. A malfunction message is triggered with a time delay when the system falls below the alarm value. As a result, slugging on the screw-type compressors can be avoided or recognised early (possible causes are, for example, defective solenoid valves or dirty injection valve nozzles).

- **Pump-Out for system start and stop**
  A pump-out can also be performed when the compound is switched on or off. Evacuation of the system when the compound is switched on and off reduces the risk of liquid slugging. In addition, leaking solenoid valves can be recognised.

- **Surge guard**
  The adjustable surge guard limits the maximum number of compressor changes per hour.

- **T_0 too high / compound overload**
  The compound controller can recognise and report an overload of the compound.
  If all available compressors are switched on and the suction pressure T_0 rises above an adjustable tolerance value, a message is generated with a time delay via a switching contact.

- **Total breakdown of compound equipment**
  If the compound controller recognises a total breakdown of the compound equipment, the solenoid valves of the related cold locations (Frigolink) are switched off. This reduces the risk of liquid slugging when the compound is started.

- **Monitoring of the compressor end temperature**
  If the end temperature on the compressor exceeds a maximum value, the compressor involved is switched off, temporarily blocked and a fault message is generated.

4.5.2 Control Circuit "Liquification"

The "Liquification" control circuit ensures control of the condensation pressure. Here, too, different control strategies can be applied:

- **Temperature recording T_C**
  For triggering of the ventilators, the condensation temperature T_C can be determined both from the condensation pressure P_C (with conversion to T_C) or by means of temperature probes on the condenser.

- **Ventilator control constant and stepwise**
  The fans are triggered by a combination of constant PI controller and multiple contact switch. As a result, the fans can be triggered both constantly and stepwise or in a constant/stepwise combination.

- **Multi-circuit condenser**
  When several T_C sensors (pressure transmitters or temperature probes) are used, a maximum selection of the temperature results automatically.

- **Outer-temperature-controlled setpoint increase**
  The condenser setpoint can be raised in dependence on the outer temperature. As a result, the condensation pressure continuously follows the outer temperature and so always works at an economical operating point (energy savings).

Besides evaluation of digital malfunction reports received, the following safety functions can be used:

- **Monitoring of max. condensation pressure**
  If the condensation temperature T_C exceeds a maximum value, the condensation pressure controller triggers a load release onto the compressor compound (to avoid high pressure malfunctions).

4.5.3 Control Circuit "Free Cold location"

The control circuit serves to regulate free cold locations. It has a release logic that, besides the temperature in the free cold location, also includes the outer and brine temperature. The ventilators of the free cold location are regulated using the free cold location temperature.

- **Ventilator control constant and stepwise**
  The fans are triggered by a combination of constant PI controller and multiple contact switch. As a result, the fans can be triggered both constantly and stepwise or in a constant/stepwise combination.

4.5.4 Control Circuit "Refrigerant Pumps"

The "Refrigerant Pumps" control circuit is used to control and monitor the twin pump. Alternatively, operation of a single pump is also possible. A completely integrated release logic, which takes into account the fault status of the pumps as well as pressure switches and flow monitors, makes external wiring largely superfluous.

- **Base load change**
  The pumps are switched in a time-controlled way. The pump interval is adjustable by pump.
  An asymmetric pump interval is set as standard to increase the operational reliability.
  Alternatively, the base load change can be triggered externally.
- **Fault switchover**
  In case of malfunction (flow monitor, pressure switch, etc.), pump switchover takes place automatically (malfunctioning pump switches off - second pump switches on).
- **Compressor switch-off (protection against freeze-up)**
  To prevent freezing of the refrigerant, the pump control brings the refrigerating equipment compressors into fast return (e.g. when both pumps break down, frost protection malfunctions, etc.).
- **Various switchover modes**
  Various modes are available for pump switchover (overlapping / with and without pauses).

4.5.5 Control Circuit "Electronic Injection Valves (EEV)"

The control circuit "EEV" can be used for overheating control of liquid subcoolers or refrigerant equipment solenoid valves. The electronic injection valves can be triggered constantly or by means of pulse-width modulated signal (PWM).

4.5.6 "Single Compressor" Control Circuit

This control circuit is used to monitor single compressors (e.g. separate satellite compressors for deep-freeze cells, or the like). Manual interventions on the compressor are possible via switch cards or the manual/off/automatic inputs of the field modules. Control does not take place.

4.6 Overview of All Compound Main Modules

Main module type	**HVB001B**	**HVV001B**	**HVI001B**
Single-compound main module	X	-	-
Double-compound main module	-	X	X
Number of triggerable field modules	8	8	12
Triggerable components			
FVB 110B, Field module for 1 compressor	X	-	X
FVB 120B, Field module for 2 compressor	X	X	X
FVB 140B, Field module for 4 compressor	X	X	X
FVB 240B, Field module for 4 condenser ventilators	X	X	X
FVB 320B, Field module for 2 pumps	X	-	X
FIO 001B, Universal input and output module	X	X	X
FKV 001B, Field module for applications with electronic injection valves	X	-	X
SLD 243, Four-way switch module for cold locations or electronic injection valve	X	-	X
SLD 342, Four-way switch module for compressors, fans, pumps	X	X	X
Control circuits			
Suction pressure	X	X	X
Refrigerant	X	-	X
Condensation	X	X	X
Refrigerant pumps	X	-	X
Electronic injection valve	X	-	X
Free cold location	-	-	X
Single machine	X	-	X
Control process and functions			
Suction pressure and refrigerant			
Standard multiple contact switch with base load change	X	X	X
Master / slave for reducing mechanical changes in industrial plants	-	-	X
Compressor control with frequency converter	-	-	X
Standard with variable delay times	-	-	X
Triggering of screw-type compressors (constant, intermittent)	-	-	X
Pump-out function with system stop	X	X	X
Pump-out functions with compressor start/stop for single-circuit / multiple-circuit facilities	-	-	X
Cross-compound base load change	-	-	X
Enthalpy-controlled increase in suction pressure	X	X	X
Dynamic forward and return flow control	X	X	X
Monitoring of single compressors	X	-	X
Mass current management with Frigotakt	X	X	-
Suction gas monitoring	X	X	X
Condensation			
Standard for ventilator steps (stepwise and/or constant)	X	X	X
Speed and steps (combined)	X	X	X
Regulation according to condensation pressure or outer temperature	X	X	X
Free cold location			
Standard for ventilator steps (stepwise and/or constant)	-	-	X
Speed and steps (combined)	-	-	X
Refrigerant pumps			
Base load switch	X	-	X
Malfunction switch-off with one pump	X	-	X
Malfunction switchover with two pumps	X	-	X
Various discharge modes for pump control	X	-	X
Electronic injection valves			
Constant or by means of pulse-width modulated Signal (PWM)	X	-	X

5 Characteristics in Overview

System and components

- Flexible system configuration of main and field modules for every size system, totally according to control requirements and system specifications.
- System communication via CAN bus
- Two separate bus systems, subdivided into field bus and communication bus for especially high security.
- Expert database for fast placement into operation and optimal operation of the system through selection of stored system types with standard control parameters.
- Individual adjustment of all control parameters is possible
- All set parameters are stored in the interchangeable memory module of the main module.
- Intelligent probe management with automatic probe recognition simplifies installation and operation of the system.

Operation

- Simple management of the system via the main module
- Simple addressing of the components

Malfunctions and operating events

- Fault list as ring memory with 50 entries per main module
- After a malfunction occurs, the system automatically branches to the fault menu if the device has not been operated in the last 5 minutes.
- All malfunctions are stored with their start and end times so the malfunction period can be read at a glance.
- Operating list as ring memory with 25 occurred events that are displayed in plain text.

Emergency operation

- Frigolink has different emergency programs available in the various main and field modules that ensure secure operation of the equipment in the most varied of malfunctions.

The exact descriptions of the various emergency programs can be found in the detailed function descriptions of the respective components in the Frigolink Manual.

6 Notice for EMC-Appropriate Layout of Frigolink Systems

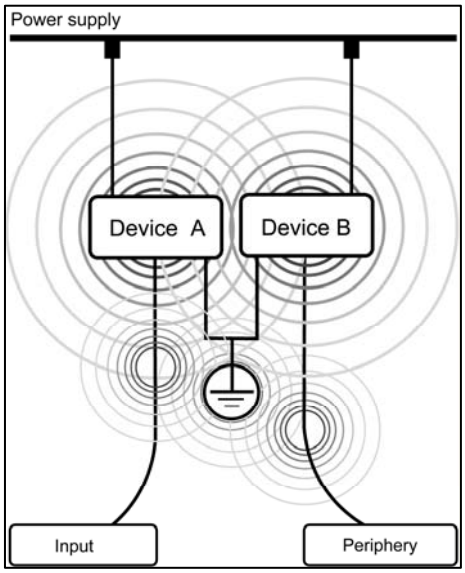
6.1 General Notes

Today, electronic devices are naturally within our area of experience. But since there are more and more application areas, the number of these devices continues to grow.
Some technical boundary conditions are needed so that these devices can function next to each other without malfunction and not disturb each other.
These boundary conditions are summarised under the term "EMC" (electromagnetic compatibility):
During operation, every electronic device and also many electrical devices produce electromagnetic waves that radiate from the device. The limit values to be maintained for interference transmission and immunity against interference are recorded in the standards of DIN EN 61000.
Radiation must lie below an established threshold so that other devices are not impaired in their function. In exactly the same way, it is established that a device must have a certain immunity against disturbance to be able to work without error.

The triggers of such disturbances are, for example:

- Switching procedures with shuttles (safety coil, switch contacts)
- Electronic power supply units for fluorescent lamps
- Phase controls
- Frequency converters, radio or television broadcasters
- High-tension wires
- Storms (lightning)
- Radios
- Mobile telephones
- Microwave devices, etc.

The disturbance signals generated by a disturbance source (e.g. frequency converters) spread preferably by cable over lines connected to the device. But since such lines seldom lie alone, such as on a cable route, the disturbances also couple on parallel lines and so are distributed further. Radiation over the device housing can also cause malfunctions to spread.



Malfunction spread graphic

6.2 Layout remarks

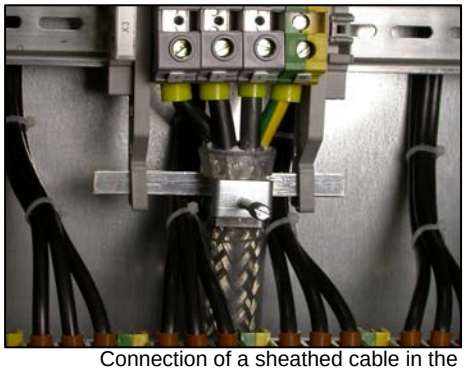
It is therefore important to take into account certain rules when installing electronic components.
The following remarks merely represent a starting point.

- A carefully performed earthing of switch boxes and systems is prescribed for touch-protection reasons (e.g. VDE 0100). This also includes extensive equipotential bonding between all system components. The way this is designed determines how efficient the disturbance suppression is from an EMC perspective. The above-described malfunctions are high-frequency disturbances that are only inadequately carried away over the touch protection earth connection. These high-frequency malfunctions have the characteristic of flowing only on the surface of an electrical conductor. Therefore, besides the required cross section, an EMC-appropriate earthing must also have a conductor surface that is as large as possible. This can best be achieved with a highly flexible earthing cable or through an earth band with the appropriate cross section.

- The installation instructions of the manufacturers of phase controls, switch power packs and frequency converters must be observed and carried out precisely. The measures specified by the manufacturers, such as sinus filters, power chokes, insulated signal lines, etc., must be present, since they are absolutely required to fulfil the EMC guideline.

- All data lines (e.g. signal, measurement or bus lines) must be designed as insulated lines and laid at a distance from power lines (e.g. supply, motor lines) that is as large as possible. Here the line insulation must be designed one-sided.
  Switch boxes with well-filled cable conduits (degree of fill > 80%) have large couple factors for malfunctions. Here, disturbances can easily spread and also influence uninvolved electronic devices. In these cases, it can make sense to wire the safety coils with RC-combinations. Every fuse manufacturer offers wiring suitable for the fuse types used. As a result, disturbance creation in the switching processes is extremely reduced at the safety coil.

EMC-appropriate earthing with a highly flexible earth band



Connection of a sheathed cable in the clamping block

Wiring of a safety coil with RC combination

7 Guideline for the use of electronic devices from Wurm GmbH & Co. KG.

7.1 Contents

Compliance with this guideline is critical for guarantee and warranty claims, repairs and goodwill adjustments. Besides this Guideline, the technical description for the specific device must be followed in all cases, since specific deviations from this Guideline are possible.
In case of lack of clarity or unanswered questions, Wurm GmbH & Co. KG or the responsible sales organisation should be contacted.
In addition, the General Terms and Conditions of Sale and Delivery of Wurm GmbH & Co. KG and/or the responsible sales organisation apply.

7.2 Unpacking at Delivery

A visual check of the devices must be made before and during unpacking to discover possible transport damage. Please note any damage to transport packaging, dents, scratches, loose parts, etc. Any damage must be reported to the transportation company immediately.

Before disposing of packaging materials, please check them for loose parts and inserts.

To help us process warranty claims, please provide an exact description of the defect (possibly with photo) as well as information about the delivery slip number, order, type designation and serial numbers of the devices

7.3 Technical Data

- The exact functions and areas of use can be taken from the respective technical description of the devices. Here, attention should be paid to the correct description regarding device, version and stage.
- Special uses must be checked with Wurm GmbH & Co. KG or the responsible sales organisation.
- Observe the special technical data as well as the instructions for installation and placement into operation of the respective device.
- Especially important are the maximum loads on the relays and connection terminals. If not complied with, there is the danger of hanging relay contacts. That, in turn, can result in improper functioning of the equipment.
- Under no conditions may you make changes or conversions to the modules on your own.
- Observe all warning signs on and in the devices. These must not be removed.
- The devices are maintenance-free.
- In case of malfunction, repairs must only be performed by trained specialists.
- Tighten connection terminals carefully; over-tightening results in damage to the controller.
- If a dongle is included, its misuse can result in damage to the goods. We expressly refer to the corresponding information in the operating instructions.
- Do not lay probes and data lines in multiple cables together with other current-carrying conductors.
- If control lines of digital inputs (low or main voltage) are laid parallel to current-carrying lines, low input current or inactive open inputs can result in capacitive coupling of voltage onto these inputs. This can trigger faulty signals. If these effects are suspected, by-pass capacitors and/or base load units can be used to avoid fault currents. Ask Wurm GmbH & Co.KG or the responsible sales organisation for possible solutions, if necessary.
- The devices are developed and produced in accordance with the EC Directive on Electromagnetic Compatibility 2004/108/EC.

7.4 Work Safety and Sources of Danger

- Caution, high voltage!
- Work on electrical systems may only be performed by trained specialists.
- The relevant local safety and accident-protection regulations must be observed.
- High power can also be present on the devices even when control voltage is shut off.
- When performing service work, shut off all electrical circuits.
- Never subject the devices to moisture and water. Danger of improper functioning and short circuit.
- Use the devices only within the permissible temperature range.
- Extreme temperature changes can result in the formation of condensation water in connection with elevated humidity.
- Never subject the device to strong heat, dust or vibrations. Avoid impact and high pressure. If the housing is damaged, there is danger of death from electrical shock.
- The devices must never be opened. If defects are suspected, the devices should be replaced or, if desired, sent in for repair with an exact description of the fault.
- Use only correct tools for all work.
- Check all cable connections before placing into operation.
- The protection and monitoring equipment required for safety must under no circumstances be made ineffective or improperly changed or altered.
- The devices should be removed from operation when they are obviously defective or function improperly or when safe operation is no longer possible.

8 Validity of the documentation

Revison	Function expansion	Page
2006-03	Basis of the documentation	
2007-10	Various changes	1,26
2007-11	Layout remarks amended	22

All software versions that are not listed are special solutions for individual projects and are not documented in this description in detail.

The general technical guideline must be observed!

The validity of this document automatically expires upon publication of a new technical description.