# µChiller

**Controller for chiller / Heat Pump**

# Controller manual

Rel.: 1.0

**22/01/2021**


Manual code:

**99980501**

EN

## Revision History

| Release | Date | Action |
|---|---|---|
| **1.0** | **22/01/2021** | **First release** |

For Technical Support, please contact the company:

| | |
|---|---|
| | |

# IMPORTANT

**The products described in this manual, in relation to its advanced level of technology, requires setup / configuration / programming / commissioning to be able to operate in the best possible way for the specific application. The failure to complete such operations, which are required/indicated in the user manual, may cause the final product to malfunction; the manufacturer accepts no liability in such cases.**

**Only qualified personnel may install or carry out technical service on the product.**

**The customer must only use the product in the manner described in the documentation relating to the product.**

- Do not attempt to open the device in any way other than described in the manual.
- Do not drop, hit or shake the device, as the internal circuits and mechanisms may be irreparably damaged.
- Do not use corrosive chemicals, solvents or aggressive detergents to clean the device.
- Do not use the product for applications other than those specified in the technical manual.

# DISPOSAL

## INFORMATION FOR USERS ON THE CORRECT HANDLING OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE).

The product is made up of metal parts and plastic parts. In reference to European Union directive 2002/96/EC issued on 27 January 2003 and related national legislation, please note that:

- WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
- the public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment;
- the equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
- the symbol (crossed- out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
- in the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

Key to the symbols:

Important: to bring critical issues to the attention of those using the product.

Note: to focus attention on important topics; in particular the practical application of the various product functions.

# Table of contents

# 1. Introduction

µChiller is the Carel solution for complete management of air/water and water/water chillers and heat pumps, and condensing units. The solution also allows the field replacement of µchiller2 and µchiller2 SE with the new product (hereinafter called the **Legacy** model).

The maximum configuration manages 2 compressors per circuit, up to a maximum of 2 circuits (using an expansion card for circuit 2). The distinctive element of µChiller is complete control of high-efficiency units through integrated management of electronic expansion valves (ExV), thus ensuring greater compressor protection and reliability and a high-efficiency unit. The user terminal allows wireless connectivity with mobile devices and is built- in on the panel mounted models, or sold separately on DIN rail mounted models. CAREL's "APPLICA" app, available on Google Play for the Android operating system, makes it easier to configure parameters and commission the unit in the field.

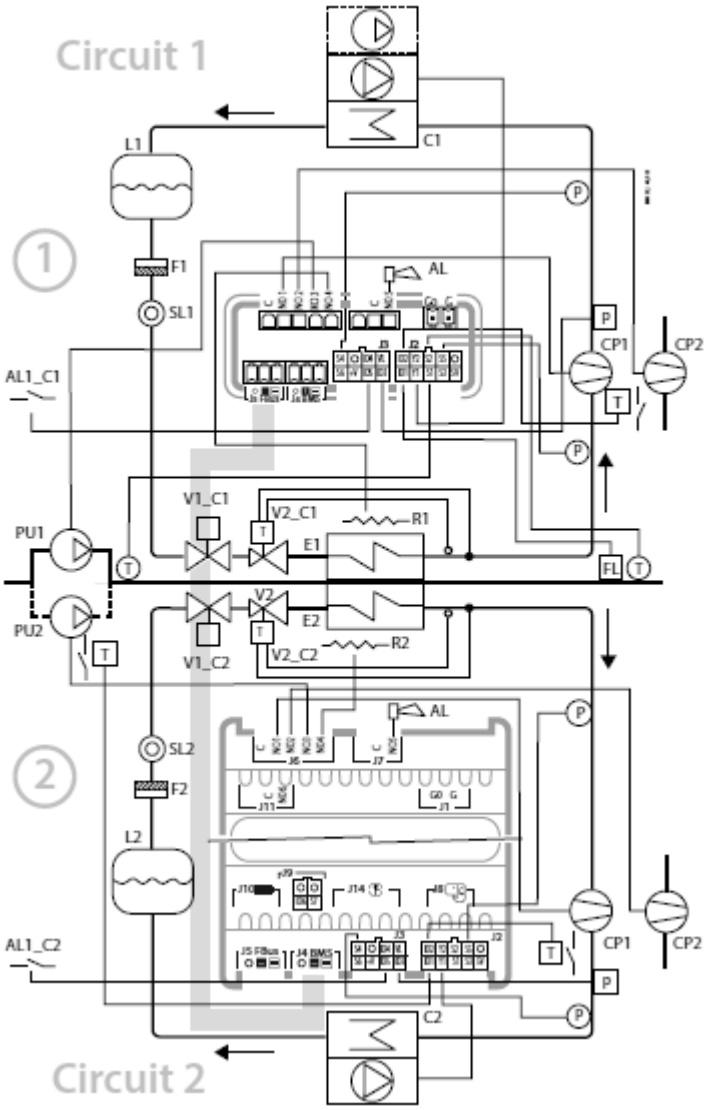
## 1.1 Models

| Models P/N | Assembly | Connectivity | Compressor management | Notes | Electronic expansion valve management |
|---|---|---|---|---|---|
| UCHBP00000190 | panel | NFC | On/Off | Standard version | bipolar: with EVD Evolution driver |
| UCHBP00000200 | panel | NFC, Bluetooth (BLE) | On/Off | Standard version | bipolar: with EVD Evolution driver |
| UCHBD00001230 | DIN rail | - | On/Off | Standard version | bipolar: with EVD Evolution driver |
| UCHBDE0001150 | DIN rail | - | On/Off | Enhanced version | unipolar: built-in; bipolar with external EVD Evolution driver |
| UCHBDH0001150 | DIN rail | - | On/Off and BLDC | - | bipolar: with external EVD Evolution driver |
| UCHBE00001230 2nd circuit expansion | DIN rail | - | On/Off and BLDC | | unipolar: built-in; bipolar with external EVD Evolution driver |
| UCHBE00001150 2nd circuit expansion | DIN rail | - | On/Off and BLDC | - | unipolar: built-in; bipolar: with external EVD Evolution driver |
| UCHBP000X0190 | panel | NFC | On/Off | Legacy version | bipolar: with EVD Evolution driver |
| UCHBP000X0200 | NFC, Bluetooth | NFC, Bluetooth | On/Off | Legacy version | bipolar: with EVD Evolution driver |
| UCHBP000X0230 | DIN rail | - | On/Off | Legacy version | bipolar: with EVD Evolution driver |

# 2. Functional diagrams

## 2.1 Chillers, On/Off compressors and thermostatic expansion valve

**Important:** The black lines refer to the electrical connections, the grey lines the serial connections between controller and options (I/O expansion for the second circuit, EVD and EVO ).




| Ref. | Description | Ref. | Description | Ref. | Description |
|---|---|---|---|---|---|
| C1/C2 | Condenser 1/2 | PU1/2 | User pump 1/2 | AL1_C1/2 | Remote alarm circuit 1/2 |
| E1/E2 | Evaporator 1/2 | L1/2 | Liquid receiver 1/2 | CP1/2 | Compressor 1/2 |
| V1_C1 | Solenoid valve circuit 1 | SL1/2 | Liquid sight glass 1/2 | R1/2 | Frost protection heater 1/2 |
| V1_C2 | Solenoid valve circuit 2 | F1/2 | Filter-drier 1/2 | P | Pressure probe/pressure switch |
| V2_C1 | Thermostatic expansion valve circuit 1 | FL | Flow switch | T | Temperature probe / thermostat |
| V2_C2 | Thermostatic expansion valve circuit 2 | AL | Alarm | | |

Analogue inputs – Master Circuit 1

| Ref. | Description | Type | Configuration parameters |
|---|---|---|---|
| S1 | Return temperature from user | NTC | Hc31 |
| S2 | Delivery temperature to user | NTC | Hc32 |
| S3 | Not present | - | Hc00 |
| S4 | Condensing pressure | 0-5V | Hc34; C040; C041; C042 |
| S5 | Evaporation pressure | 0-5V | Hc35; C037; C038; C039 |
| S6 | Not present | - | Hc03; U025; U026; U027 |

Analogue inputs – Slave Circuit 2

| Ref. | Description | Type | Configuration parameters |
|---|---|---|---|
| S1 | Not present | - | Hc41 |
| S2 | Not present | - | Hc42 |
| S3 | Not present | - | Hc43 |
| S4 | Condensing pressure | 0-5V | Hc44; C040; C041; C042 |
| S5 | Evaporation pressure | 0-5V | Hc45; C037; C038; C039 |
| S6 | Not present | - | Hc05; U025; U026; U027 |

**Notice**: the discharge temperature probe is automatically assigned type NTC-HT

Digital inputs – Master Circuit 1

| Ref. | Description | Configuration parameters |
|---|---|---|
| ID1 | User pump flow switch | Hc14; U060 |
| ID2 | Compressor 1 overload | Hc15; C035 |
| ID3 | High pressure switch | C034 |
| ID4 | Not present | Hc06; C035; U059; U058; U062; U057; U061 |
| ID5 | Remote alarm | Hc07; C035; U059; U058; U062; U057; U061 |

Digital inputs – Slave Circuit 2

| Ref. | Description | Configuration parameters |
|---|---|---|
| ID1 | Pump 2 overload | Hc16; U061 |
| ID2 | Compressor 1 overload | Hc17; C035 |
| ID3 | High pressure switch | C034 |
| ID4 | Not present | Hc09; C035; U059; U058; U062; U057; U061 |
| ID5 | Not present | Hc10; |
| ID6 | Not present | Hc11 |

Digital outputs – Master Circuit 1

| Ref. | Description | Configuration parameters |
|---|---|---|
| C-NO1 | Compressor 1 | Hc51; C036 |
| C-NO2 | Compressor 2 | Hc52; C036 |
| C-NO3 | User pump 1 | Hc53; U063 |
| C-NO4 | Frost protection heater (*) | Hc54; U066; S063; U065 |
| C5-NO5 | Alarm | Hc55; U064 |

Digital outputs – Slave Circuit 2

| Ref. | Description | Configuration parameters |
|---|---|---|
| C-NO1 | Compressor 1 | Hc61; C036 |
| C-NO2 | Compressor 2 | Hc62; C036 |
| C-NO3 | User pump 1 | Hc63; U063 |
| C-NO4 | Frost protection heater (*) | Hc64; U066; S063; U065 |
| C5-NO5 | Not used | Hc65; U064 |
| C6-NO6 | Not used | Hc66 |

**Notice:** (*) the configuration of the output depends on the type of unit: heat pump (reverse-cycle) => reversing valve; Chiller with free cooling (master only) => FC valve; otherwise => Frost protection heater.

Analogue outputs – Master Circuit 1

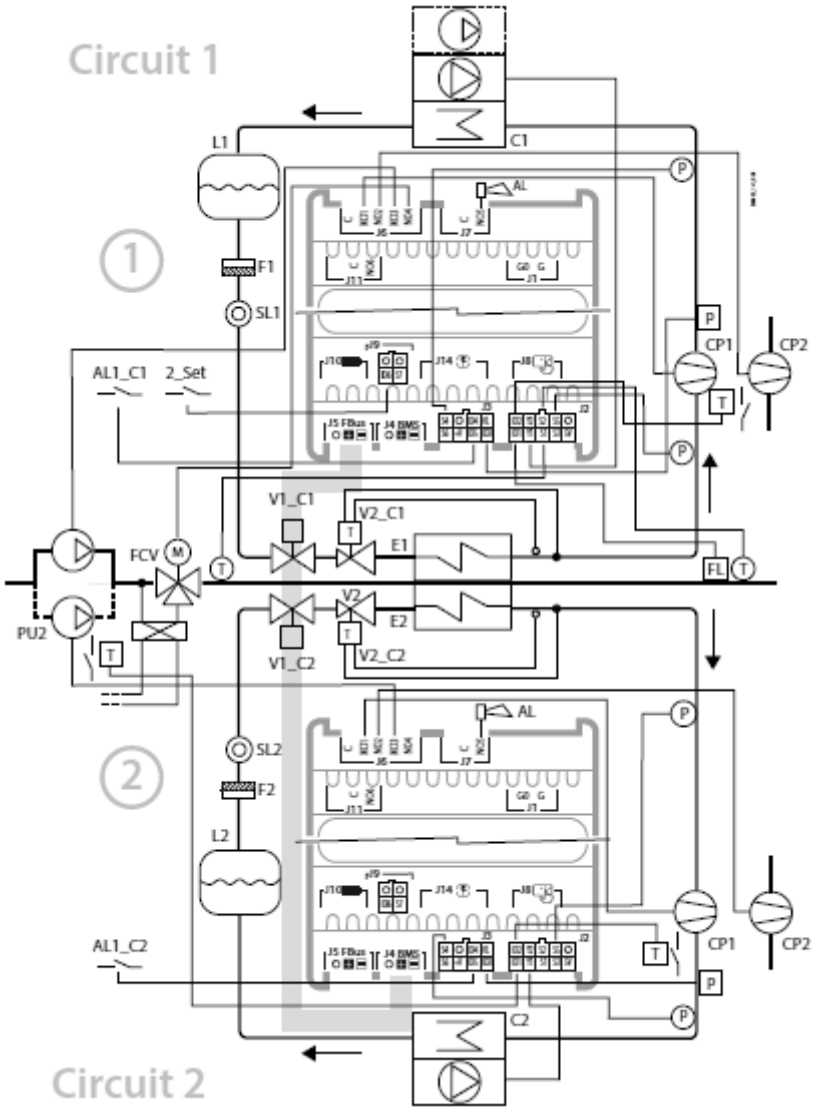
| Ref. | Description | Type | Configuration parameters | Notes |
|---|---|---|---|---|
| Y1 | Modulating/On-Off fan | 0-10V | Hc71 | FCS1*0/CONVONOFF |
| Y2 | Not used | 0-10V | Hc72 | |

Analogue outputs – Slave Circuit 2

| Ref. | Description | Type | Configuration parameters | Notes |
|---|---|---|---|---|
| Y1 | Modulating/On-Off fan | 0-10V | Hc81 | FCS1*0/CONVONOFF |
| Y2 | Not used | 0-10V | Hc82 | |

## 2.2 Chillers, On/Off compressors with free cooling and thermostatic expansion valve

**Important:** The black lines refer to the electrical connections, the grey lines the serial connections between controller and options (I/O expansion for the second circuit, EVD and EVO ).




| Ref. | Description | Ref. | Description | Ref. | Description |
|---|---|---|---|---|---|
| C1/C2 | Condenser 1/2 | FCV | Free cooling valve | P | Pressure probe/pressure switch |
| E1/E2 | Evaporator 1/2 | SL1/2 | Liquid sight glass 1/2 | T | Temperature probe / thermostat |
| V1_C1 | Solenoid valve circuit 1 | F1/2 | Filter-drier 1/2 | AL | Alarm |
| V1_C2 | Solenoid valve circuit 2 | FL | Flow switch | AL1_C1/2 | Remote alarm circuit 1/2 |
| V2_C1 | Thermostatic expansion valve circuit 1 | CP1/2 | Compressor 1/2 | 2_Set | 2nd set point |
| V2_C2 | Thermostatic expansion valve circuit 2 | PU1/2 | User pump 1/2 | L1/2 | Liquid receiver 1/2 |

Analogue inputs – Master Circuit 1

| Ref. | Description | Type | Configuration parameters |
|---|---|---|---|
| S1 | Return temperature from user | NTC | Hc31 |
| S2 | Delivery temperature to user | NTC | Hc32 |
| S3 | Not present | - | Hc00 |
| S4 | Condensing pressure | 0-5V | Hc34; C040; C041; C042 |
| S5 | Evaporation pressure | 0-5V | Hc35; C037; C038; C039 |
| S6 | Not present | - | Hc03; U025; U026; U027 |

Analogue inputs – Slave Circuit 1

| Ref. | Description | Type | Configuration parameters |
|---|---|---|---|
| S1 | Not present | - | Hc41 |
| S2 | Not present | - | Hc42 |
| S3 | Not present | - | Hc43 |
| S4 | Condensing pressure | 0-5V | Hc44; C040; C041; C042 |
| S5 | Evaporation pressure | 0-5V | Hc45; C037; C038; C039 |
| S6 | Not present | - | Hc05; U025; U026; U027 |

**Notice:** the discharge temperature probe is automatically assigned type NTC-HT

Digital inputs – Master Circuit 1

| Ref. | Description | Configuration parameters |
|---|---|---|
| ID1 | User pump flow switch | Hc14; U060 |
| ID2 | Compressor 1 overload | Hc15; C035 |
| ID3 | High pressure switch | C034 |
| ID4 | Not present | Hc06; C035; U059; U058; U062; U057; U061 |
| ID5 | Not present | Hc07; C035; U059; U058; U062; U057; U061 |
| ID6 | Not present | HC08; C035; U059; U058; U062; U057; U061 |

Digital inputs – Slave Circuit 2

| Ref. | Description | Configuration parameters |
|---|---|---|
| ID1 | Pump 2 overload | Hc16; U061 |
| ID2 | Compressor 1 overload | Hc17; C035 |
| ID3 | High pressure switch | C034 |
| ID4 | Not present | Hc09; C035; U059; U058; U062; U057; U061 |
| ID5 | Remote alarm | Hc10 |
| ID6 | Not present | Hc11 |

Digital outputs – Master Circuit 1

| Ref. | Description | Configuration param.s |
|---|---|---|
| C-NO1 | Compressor 1 | Hc51; C036 |
| C-NO2 | Compressor 2 | Hc52; C036 |
| C-NO3 | User pump 1 | Hc53; U063 |
| C-NO4 | Free cooling valve (*) | Hc54; U066; S063; U065 |
| C5-NO5 | Alarm | Hc55; U064 |
| C6-NO6 | Not used | Hc56 |

Digital outputs – Slave Circuit 2

| Ref. | Description | Configuration param.s |
|---|---|---|
| C-NO1 | Compressor 1 | Hc61; C036 |
| C-NO2 | Compressor 2 | Hc62; C036 |
| C-NO3 | User pump 1 | Hc63; U063 |
| C-NO4 | Not used | Hc64 |
| C5-NO5 | Alarm | Hc65 |
| C6-NO6 | Not used | Hc66 |

**Notice:** (*) the configuration of the output depends on the type of unit: heat pump (reverse-cycle) => reversing valve; Chiller with free cooling (master only) => FC valve; otherwise => Frost protection heater.

Analogue outputs – Master Circuit 1

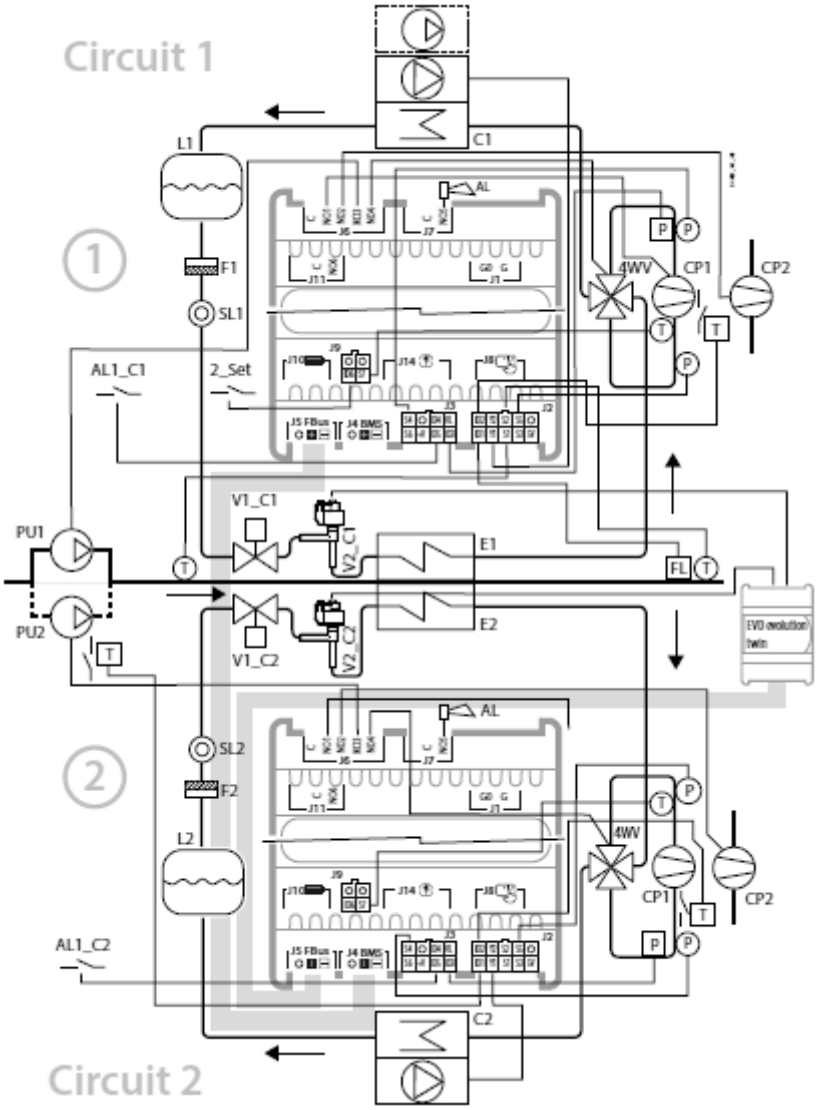
| Ref. | Description | Type | Configuration parameters | Notes |
|---|---|---|---|---|
| Y1 | Modulating/On-Off fan | 0-10V | Hc71 | FCS1*0/CONVONOFF |
| Y2 | Not used | 0-10V | Hc72 | |

Analogue outputs – Slave Circuit 2

| Ref. | Description | Type | Configuration parameters | Notes |
|---|---|---|---|---|
| Y1 | Modulating/On-Off fan | 0-10V | Hc81 | FCS1*0/CONVONOFF |
| Y2 | Not used | 0-10V | Hc82 | |

## 2.3 Chillers/ heat pumps, On/Off compressors and bipolar ExV expansion valve

**Important:** The black lines refer to the electrical connections, the grey lines the serial connections between controller and options (I/O expansion for the second circuit, EVD and EVO ).




| Ref. | Description | Ref. | Description | Ref. | Description |
|---|---|---|---|---|---|
| C1/C2 | Condenser 1/2 | SL1/2 | Liquid sight glass 1/2 | 4WV | Reversing valve |
| E1/E2 | Evaporator 1/2 | F1/2 | Filter-drier 1/2 | P | Pressure probe/pressure switch |
| V1_C1 | Solenoid valve circuit 1 | FL | Flow switch | T | Temperature probe / thermostat |
| V1_C2 | Solenoid valve circuit 2 | CP1/2 | Compressor 1/2 | PU1/2 | User pump 1/2 |
| V2_C1 | Electronic expansion valve circuit 1 | L1/2 | Liquid receiver 1/2 | AL | Alarm |
| V2_C2 | Electronic expansion valve circuit 2 | AL1_C1/2 | Remote alarm circuit 1/2 | 2_Set | 2nd set point |

Analogue inputs – Master Circuit 1

| Ref. | Description | Type | Configuration parameters |
|---|---|---|---|
| S1 | Return temperature from user | NTC | Hc31 |
| S2 | Delivery temperature to user | NTC | Hc32 |
| S3 | Not present | - | Hc00 |
| S4 | Condensing pressure | 0-5V | Hc34; C040; C041; C042 |
| S5 | Evaporation pressure | 0-5V | Hc35; C037; C038; C039 |
| S6 | Not present | - | Hc03; U025; U026; U027 |
| S7 | Suction temperature | NTC | Hc04 |

Analogue inputs – Slave Circuit 2

| Ref. | Description | Type | Configuration parameters |
|---|---|---|---|
| S1 | Not present | - | Hc41 |
| S2 | Not present | - | Hc42 |
| S3 | Not present | - | Hc43 |
| S4 | Condensing pressure | 0-5V | Hc44; C040; C041; C042 |
| S5 | Evaporation pressure | 0-5V | Hc45; C037; C038; C039 |
| S6 | Not present | - | Hc05; U025; U026; U027 |
| S7 | Suction temperature | NTC | Hc47 |

**Notice:** the discharge temperature probe is automatically assigned type NTC-HT

Digital inputs – Master Circuit 1

| Ref. | Description | Configuration parameters |
|---|---|---|
| ID1 | User pump flow switch | Hc14; U060 |
| ID2 | Compressor 1 overload | Hc15; C035 |
| ID3 | High pressure switch | C034 |
| ID4 | Not present | Hc06; C035; U059; U058; U062; U057; U061 |
| ID5 | Remote alarm | Hc07; C035; U059; U058; U062; U057; U061 |
| ID6 | 2nd set point | HC08; C035; U059; U058; U062; U057; U061 |

Digital inputs – Slave Circuit 2

| Ref. | Description | Configuration parameters |
|---|---|---|
| ID1 | Pump 2 overload | Hc16; U061 |
| ID2 | Compressor 1 overload | Hc17; C035 |
| ID3 | High pressure switch | C034 |
| ID4 | Not used | Hc09; C035; U059; U058; U062; U057; U061 |
| ID5 | Not used | Hc10; C035; U059; U058; U062; U057; U061 |
| ID6 | Not used | Hc11 |

Digital outputs – Master Circuit 1

| Ref. | Description | Configuration paramet. |
|---|---|---|
| C-NO1 | Compressor 1 | Hc51; C036 |
| C-NO2 | Compressor 2 | Hc52; C036 |
| C-NO3 | User pump 1 | Hc53; U063 |
| C-NO4 | Reversing valve | Hc54; U066; S063; U065 |
| C5-NO5 | Alarm | Hc55; U064 |
| C6-NO6 | Not used | Hc56 |

Digital outputs – Slave Circuit 2

| Ref. | Description | Configuration paramet. |
|---|---|---|
| C-NO1 | Compressor 1 | Hc61; C036 |
| C-NO2 | Compressor 2 | Hc62; C036 |
| C-NO3 | User pump 2 | Hc63; U063 |
| C-NO4 | Reversing valve | Hc64; U66; S063; U065 |
| C5-NO5 | Alarm | Hc65 |
| C6-NO6 | Not used | Hc66 |

**Notice:** (*) the configuration of the output depends on the type of unit: heat pump (reverse-cycle) => reversing valve; Chiller with free cooling (master only) => FC valve; otherwise => Frost protection heater.

Analogue outputs – Master Circuit 1

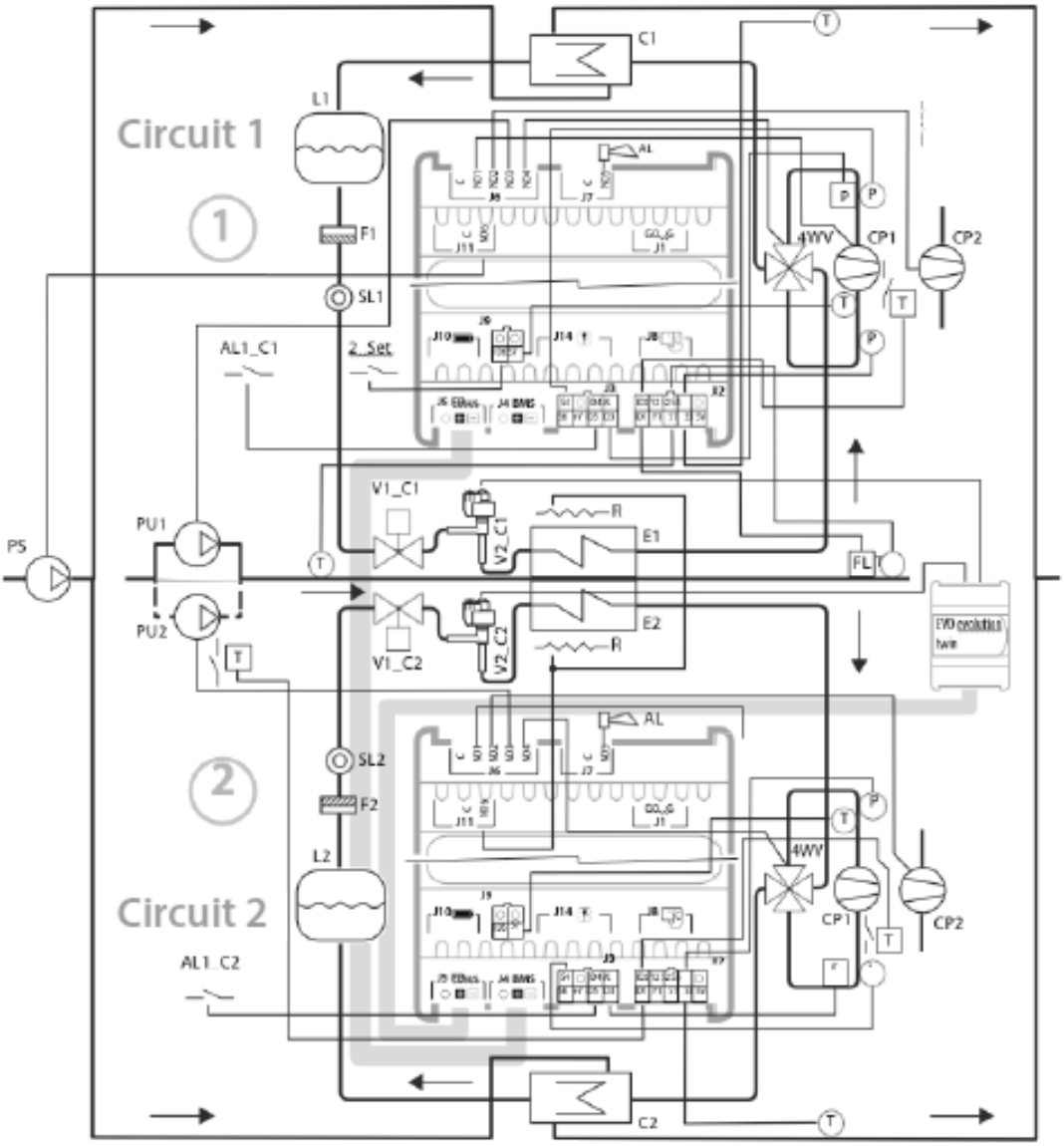
| Ref. | Description | Type | Configuration parameters | Notes |
|---|---|---|---|---|
| Y1 | Modulating/On-Off fan | 0-10V | Hc71 | FCS1*0/CONVONOFF |
| Y2 | Not used | 0-10V | Hc72 | |

Analogue outputs – Slave Circuit 2

| Ref. | Description | Type | Configuration parameters | Notes |
|---|---|---|---|---|
| Y1 | Modulating/On-Off fan | 0-10V | Hc81 | FCS1*0/CONVONOFF |
| Y2 | Not used | 0-10V | Hc82 | |

## 2.4 Chillers/water to water heat pumps, On/Off compressors and bipolar ExV expansion valve

**Important:** The black lines refer to the electrical connections, the grey lines the serial connections between controller and options (I/O expansion for the second circuit, EVD and EVO ).




| Ref. | Description | Ref. | Description | Ref. | Description |
|---|---|---|---|---|---|
| C1/C2 | Condenser 1/2 | SL1/2 | Liquid sight glass 1/2 | 4WV | Reversing valve |
| E1/E2 | Evaporator 1/2 | F1/2 | Filter-drier 1/2 | P | Pressure probe/pressure switch |
| V1_C1 | Solenoid valve circuit 1 | FL | Flow switch | AL | Alarm |
| V1_C2 | Solenoid valve circuit 2 | CP1/2 | Compressor 1/2 | T | Temperature probe / thermostat |
| V2_C1 | Electronic expansion valve circuit 1 | PU1/2 | User pump 1/2 | L1/2 | Liquid receiver 1/2 |
| V2_C2 | Electronic expansion valve circuit 2 | PS | Source pump | AL1_C1/2 | Remote alarm circuit 1/2 |
| R1/2 | Frost protection heater | 2_Set | 2nd set point | | |

Analogue inputs – Master Circuit 1

| Ref. | Description | Type | Configuration parameters |
|---|---|---|---|
| S1 | Return temperature from user | NTC | Hc31 |
| S2 | Delivery temperature to user | NTC | Hc32 |
| S3 | Source water delivery temperature | NTC | Hc00 |
| S4 | Condensing pressure | 0-5V | Hc34; C040; C041; C042 |
| S5 | Evaporation pressure | 0-5V | Hc35; C037; C038; C039 |
| S6 | Not present | - | Hc03; U025; U026; U027 |
| S7 | Suction temperature | NTC | Hc04 |

Analogue inputs – Slave Circuit 2

| Ref. | Description | Type | Configuration parameters |
|---|---|---|---|
| S1 | Not present | - | Hc41 |
| S2 | Not present | - | Hc42 |
| S3 | Source water delivery temperature | NTC | Hc00 |
| S4 | Condensing pressure | 0-5V | Hc44; C040; C041; C042 |
| S5 | Evaporation pressure | 0-5V | Hc45; C037; C038; C039 |
| S6 | Not present | - | Hc05; U025; U026; U027 |
| S7 | Suction temperature | NTC | Hc47 |

**Notice:** the discharge temperature probe is automatically assigned type NTC-HT

Digital inputs – Master Circuit 1

| Ref. | Description | Configuration parameters |
|---|---|---|
| ID1 | User pump flow switch | Hc14; U060 |
| ID2 | Compressor 1 overload | Hc15; C035 |
| ID3 | High pressure switch | C034 |
| ID4 | Not present | Hc06; C035; U059; U058; U062; U057; U061 |
| ID5 | Remote alarm | Hc07; C035; U059; U058; U062; U057; U061 |
| ID6 | 2nd set point | HC08; C035; U059; U058; U062; U057; U061 |

Digital inputs – Slave Circuit 2

| Ref. | Description | Configuration parameters |
|---|---|---|
| ID1 | Pump 2 overload | Hc16; U061 |
| ID2 | Compressor 1 overload | Hc17; C035 |
| ID3 | High pressure switch | C034 |
| ID4 | Not present | Hc09; C035; U059; U058; U062; U057; U061 |
| ID5 | Not present | Hc10; C035; U059; U058; U062; U057; U061 |
| ID6 | Not present | Hc11 |

Digital outputs – Master Circuit 1

| Ref. | Description | Configuration param.s |
|---|---|---|
| C-NO1 | Compressor 1 | Hc51; C036 |
| C-NO2 | Compressor 2 | Hc52; C036 |
| C-NO3 | User pump 1 | Hc53; U063 |
| C-NO4 | Reversing valve | Hc54; U066; S063; U065 |
| C5-NO5 | Alarm | Hc55; U064 |
| C6-NO6 | Source water pump | Hc56; Hc12 |

Digital outputs – Slave Circuit 2

| Ref. | Description | Configuration param.s |
|---|---|---|
| C-NO1 | Compressor 1 | Hc61; C036 |
| C-NO2 | Compressor 2 | Hc62; C036 |
| C-NO3 | User pump 2 | Hc63; U063 |
| C-NO4 | Reversing valve | Hc64; U66; S063; U065 |
| C5-NO5 | Alarm | Hc65 |
| C6-NO6 | Frosts protection heater | Hc66 |

**Notice:** (*) the configuration of the output depends on the type of unit: heat pump (reverse-cycle) => reversing valve; Chiller with free cooling (master only) => FC valve; otherwise => Frost protection heater.

Analogue outputs – Master Circuit 1

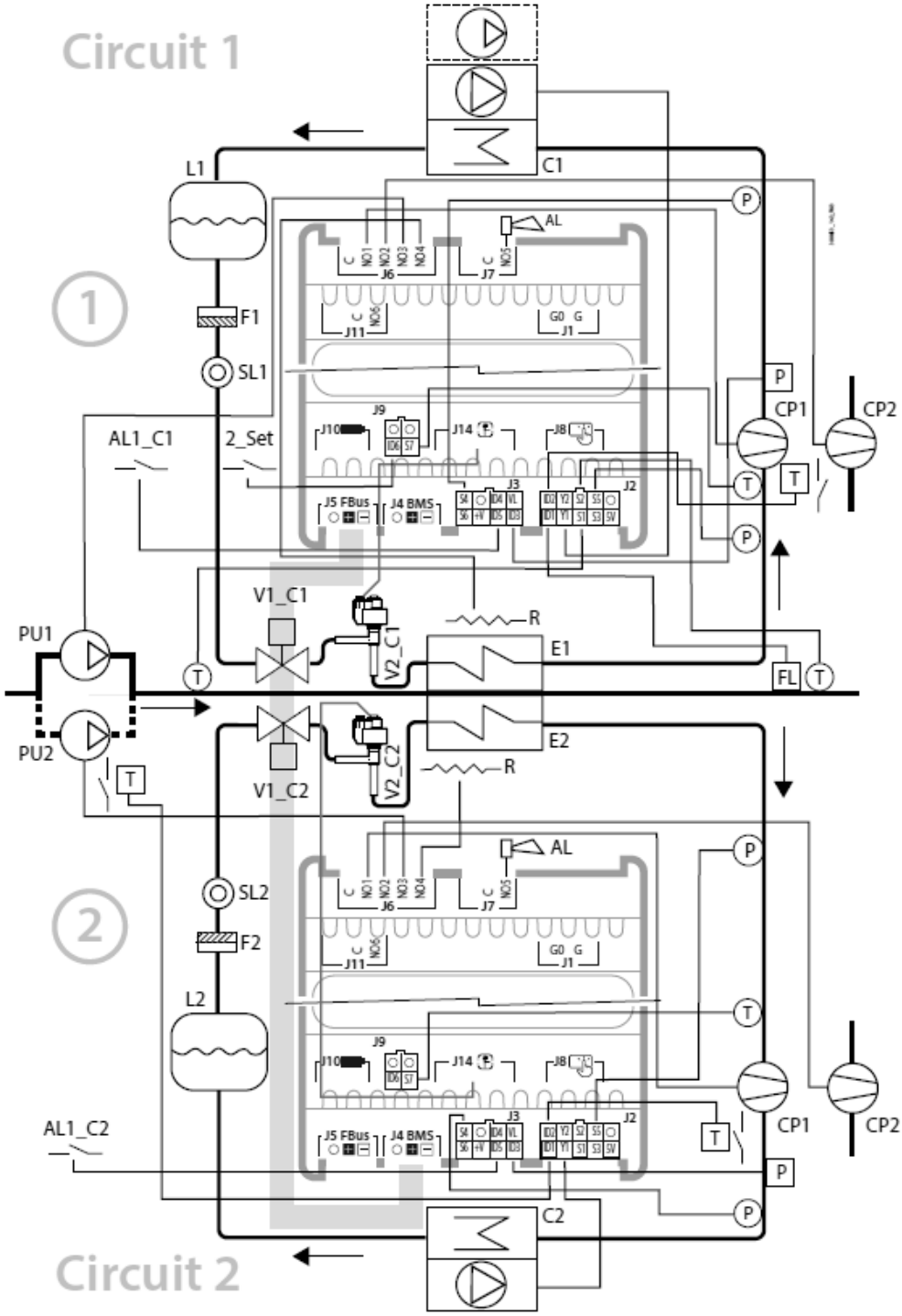
| Ref. | Description | Type | Configuration parameters | Notes |
|---|---|---|---|---|
| Y1 | On-Off source pump (panel model) | 0-10V | Hc71 | CONVONOFF |
| Y2 | Not used | 0-10V | Hc72 | |

Analogue outputs – Slave Circuit 2

| Ref. | Description | Type | Configuration parameters | Notes |
|---|---|---|---|---|
| Y1 | Not used | 0-10V | Hc81 | - |
| Y2 | Not used | 0-10V | Hc82 | |

## 2.5 Chillers, On/Off compressors and unipolar ExV expansion valve

**Important:** The black lines refer to the electrical connections, the grey lines the serial connections between controller and options (I/O expansion for the second circuit, EVD and EVO ).




| Ref. | Description | Ref. | Description | Ref. | Description |
|---|---|---|---|---|---|
| C1/C2 | Condenser 1/2 | SL1/2 | Liquid sightglass 1/2 | R1/2 | Frost protection heater |
| E1/E2 | Evaporator 1/2 | F1/2 | Filter-drier 1/2 | P | Pressure probe/pressure switch |
| V1_C1 | Solenoid valve circuit 1 | FL | Flow switch | T | Temperature probe / thermostat |
| V1_C2 | Solenoid valve circuit 2 | PU1/2 | User pump 1/2 | CP1/2 | Compressor 1/2 |
| V2_C1 | Electronic expansion valve circuit 1 | L1/2 | Liquid receiver 1/2 | AL | Alarm |
| V2_C2 | Electronic expansion valve circuit 2 | 2_Set | 2nd set point | AL1_C1/2 | Remote alarm circuit 1/2 |

Analogue inputs – Master Circuit 1

| Ref. | Description | Type | Configuration parameters |
|---|---|---|---|
| S1 | Return temperature from user | NTC | Hc31 |
| S2 | Delivery temperature to user | NTC | Hc32 |
| S3 | Not present | - | Hc00 |
| S4 | Condensing pressure | 0-5V | Hc34; C040; C041; C042 |
| S5 | Evaporation pressure | 0-5V | Hc35; C037; C038; C039 |
| S6 | Not present | - | Hc03; U025; U026; U027 |
| S7 | Suction temperature | NTC | Hc04 |

Analogue inputs – Slave Circuit 2

| Ref. | Description | Type | Configuration parameters |
|---|---|---|---|
| S1 | Not present | - | Hc41 |
| S2 | Not present | - | Hc42 |
| S3 | Not present | - | Hc00 |
| S4 | Condensing pressure | 0-5V | Hc44; C040; C041; C042 |
| S5 | Evaporation pressure | 0-5V | Hc45; C037; C038; C039 |
| S6 | Not present | - | Hc05; U025; U026; U027 |
| S7 | Suction temperature | NTC | Hc47 |

**Notice:** the discharge temperature probe is automatically assigned type NTC-HT

Digital inputs – Master Circuit 1

| Ref. | Description | Configuration parameters |
|---|---|---|
| ID1 | User pump flow switch | Hc14; U060 |
| ID2 | Compressor 1 overload | Hc15; C035 |
| ID3 | High pressure switch | C034 |
| ID4 | Not present | Hc06; C035; U059; U058; U062; U057; U061 |
| ID5 | Remote alarm | Hc07; C035; U059; U058; U062; U057; U061 |
| ID6 | 2nd set point | HC08; C035; U059; U058; U062; U057; U061 |

Digital inputs – Slave Circuit 2

| Ref. | Description | Configuration parameters |
|---|---|---|
| ID1 | Pump 2 overload | Hc16; U061 |
| ID2 | Compressor 1 overload | Hc17; C035 |
| ID3 | High pressure switch | C034 |
| ID4 | Not present | Hc09; C035; U059; U058; U062; U057; U061 |
| ID5 | Not present | Hc10; C035; U059; U058; U062; U057; U061 |
| ID6 | Not present | Hc11 |

Digital outputs – Master Circuit 1

| Ref. | Description | Configuration param.s |
|---|---|---|
| C-NO1 | Compressor 1 | Hc51; C036 |
| C-NO2 | Compressor 2 | Hc52; C036 |
| C-NO3 | User pump 1 | Hc53; U063 |
| C-NO4 | Reversing valve | Hc54; U066; S063; U065 |
| C5-NO5 | Alarm | Hc55; U064 |
| C6-NO6 | Not used | Hc56; |

Digital outputs – Slave Circuit 2

| Ref. | Description | Configuration param.s |
|---|---|---|
| C-NO1 | Compressor 1 | Hc61; C036 |
| C-NO2 | Compressor 2 | Hc62; C036 |
| C-NO3 | User pump 2 | Hc63; U063 |
| C-NO4 | Reversing valve | Hc64; U66; S063; U065 |
| C5-NO5 | Alarm | Hc65 |
| C6-NO6 | Not used | Hc66 |

**Notice:** (*) the configuration of the output depends on the type of unit: heat pump (reverse-cycle) => reversing valve; Chiller with free cooling (master only) => FC valve; otherwise => Frost protection heater.

Analogue outputs – Master Circuit 1

| Ref. | Description | Type | Configuration parameters | Notes |
|---|---|---|---|---|
| Y1 | Modulating/On-off fan | 0-10V | Hc71 | FCS1*0/CONVONOFF |
| Y2 | Not used | 0-10V | Hc72 | |

Analogue outputs – Slave Circuit 2

| Ref. | Description | Type | Configuration parameters | Notes |
|---|---|---|---|---|
| Y1 | Modulating/On-off fan | 0-10V | Hc81 | FCS1*0/CONVONOFF |
| Y2 | Not used | 0-10V | Hc82 | |

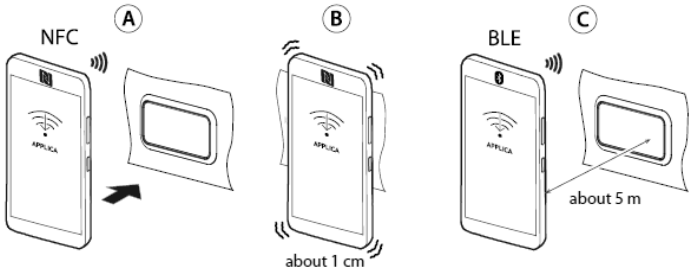
# 3. Initial Configuration

## 3.1 APPLICA App

The “Applica” app can be used to configure the controller from a mobile device (smartphone, tablet), via NFC (Near Field Communication) and Bluetooth (BLE). Users can both configure the commissioning parameters and set groups of preset parameters according to specific needs (recipes).

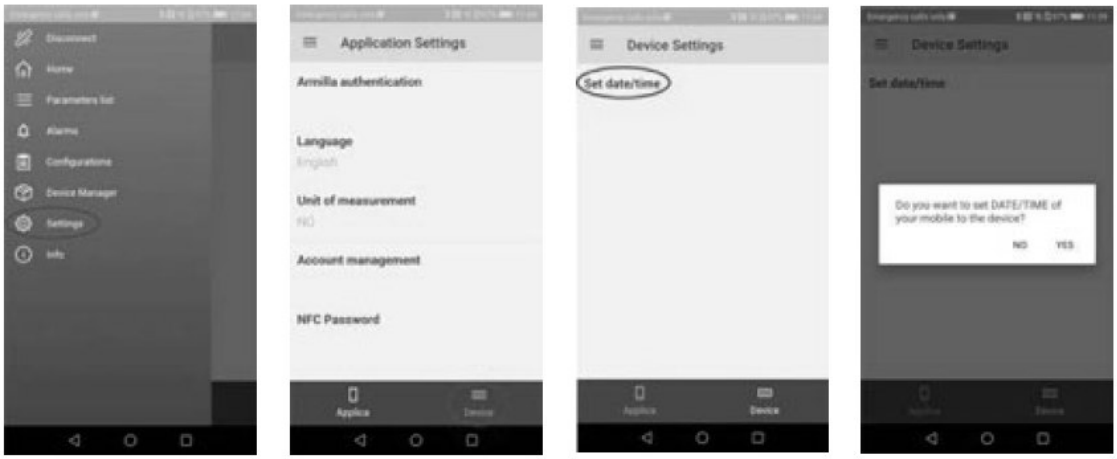
Once the Carel “Applica” app has been installed and opened (see the paragraph “Mobile device”, proceed as follows:

1. For NFC devices, move (A) the mobile device near to the µChiller user terminal (the position of the NFC antenna on the mobile device must be identified in order to place it over the display): wait for the signal that the device has been read (B).
2. For Bluetooth devices (C), select the “SCAN BLUETOOTH” option, then choose the device from the list.




### 3.1.1 Applica: Date & hour settings

Applica includes a feature for setting the date and time on µChiller in just one simple step, copying the values from the mobile device.




Procedure:

1. open Applica on the mobile device;
2. access the controller via NFC or Bluetooth, entering your profile credentials;
3. access the menu on the command bar at the top left;
4. select “set date/time”:
5. confirm;
6. with an NFC connection, move the device near to the user terminal to write the copied values

**Notice:** with a Bluetooth connection, the values are copied on confirmation.

### 3.1.2 Unit set-up parameter list

**Notice:** follow the order shown in the table to configure the Unit set-up parameters.

| Par. | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|
| U077 | Type of unit | 0 | 0 | 0 | |
| | 0=CH; | | | | |
| | 1=HP; | | | | |
| | 2=CH/HP | | | | |
| | 3=Cooling-only condensing unit; | | | | |
| | 4=Reverse-cycle condensing unit; | | | | |
| | 5=Cooling-only air/air | | | | |
| | 6=Reverse cycle air/air/air | | | | |
| S068 | Source type (0=Air; 1=Water) | 0 | 0 | 1 | - |
| U076 | Number of system pumps | 1 | 1 | 2 | - |
| C046 | No. of unit circuits | 1 | 1 | 2 | - |
| C047 | Type of compressors used (0=1 On/Off; 1=2 On/Off; 2= 1 BLDC; 3= 1 BLDC+On/Off | 0 | 0 | 1/3 | - |
| S065 | Type of source fan (0/1=Modulating/On-OFF) | 0 | 0 | 1 | - |
| S064 | Type of source air circuit (0=Independent; 1=Common) | 0 | 0 | 1 | - |
| S072 | Source pump activation | 0 | 0 | 1 | - |
| | 0=Always on | | | | |
| | 1=On with compressors on | | | | |
| | 2=control on condensing temperature | | | | |
| E047 | ExV driver (0=Disabled; 1=Built-in;2=EVD Evolution) | 0 | 0 | 2 | - |
| E046 | EVD Evolution: valve (1=VAREL ExV,…) (*)<br>(*) see EVD Evolution manual for the complete list of selectable valves | 1 | 1 | 24 | - |
| E020 | MOP in cooling: threshold | 30.0 | -60.0 | 200.0 | °C |
| E022 | MOP in heating: threshold | 20.0 | -60.0 | 200.0 | °C |
| C017 | Max high pressure threshold (HP) | 65.0 | 0.0 | 999.9 | °C |
| C018 | Min low pressure threshold (LP) | 0.2 | -99.9 | 99.9 | bar |
| U068 | Free cooling: enable (0/1=no/yes) | 0 | 0 | 1 | - |
| U074 | Free cooling type (0=Air; 1=Remote coil; 2=Water) | 0 | 0 | 2 | - |
| U071 | Design free cooling delta T | 8.0 | 0.0 | 99.9 | K |
| U061 | System pump overload: input logic (0/1=NC/NO) | 0 | 0 | 1 | - |
| U065 | Free-cooling valve: output logic (0/1=NO/NC) | 0 | 0 | 1 | - |
| S063 | Reversing valve: output logic (0/1=NO/NC) | 0 | 0 | 1 | - |
| S054 | 4-way valve: pressure differential for reversing | 3.0 | 0.0 | 999.9 | bar |
| C049 | Low pressure switch alarm delay on compressor activation | 90 | 0 | 999 | - |
| C050 | Low pressure switch alarm delay with compressor on | 15 | 0 | 999 | - |
| C051 | Low pressure switch input logic (0=NC; 1=NA) | 0 | 0 | 1 | - |
| S053 | Defrost synchronisation (0=Independent, 1=Separate, 2=Simultaneous) | 0 | 0 | 2 | - |
| U006 | Cooling set point: minimum limit | 5.0 | -99.9 | 999.9 | °C |
| U007 | Cooling set point: maximum limit | 20.0 | -99.9 | 999.9 | °C |
| U008 | Heating set point: minimum limit | 30.0 | 0.0 | 999.9 | °C |
| U009 | Heating set point: maximum limit | 45.0 | 0.0 | 999.9 | °C |
| Hc13 | Buzzer (0/1=No/Yes) | 1 | 0 | 1 | - |
| U081 | High/low pressure and frost alarm reset configuration | 7 | 0 | 7 | - |
| | 0= HP1-2/LP1-2/A1-2/Manual frost protection | | | | |
| | 1= HP1-2/LP1-2/A1-2/Automatic frost protection | | | | |
| | 2= HP1-2/A1-2 Manual frost protection LP1-2 automatic | | | | |
| | 3= HP1-2 manual LP1-2/A1-2 Automatic frost protection | | | | |
| | 4= HP1-2/LP1-2 manual A1-2/Automatic frost protection | | | | |
| | 5= HP1-2/LP1-2 (3 times in an hour) manual; A1-2/Automatic frost protection | | | | |
| | 6= HP1-2/LP1-2 (3 times in an hour) manual; A1-2/Manual frost protection | | | | |
| | 7=HP1-2 manual/LP1-2 (3 times in an hour)/Manual frost protection | | | | |

### 3.1.3 mCH2 parameters

| Par. | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|
| F027 | Compressors at part load (0=NO, 1=YES) | 0 | 0 | 1 | - |
| F003 | Number of evaporators (0=1; 1=2) | 0 | 0 | 1 | - |
| F007 | Sensor S4 installed on the source heat exchanger (0=No, 1=Yes: in CH mode reads condensing temp., in HP mode reads evap. temp.) | 0 | 0 | 1 | - |
| F008 | Frost protection alarm delay | 10 | 0 | 999 | - |
| F009 | Supply air temperature limit threshold | 14.0 | 0.0 | 99.9 | °C |
| F010 | Supply air temperature limit diff. | 4.0 | 0.0 | 20.0 | °K |
| F011 | Heater dig. output logic (0=NO; 1=NC) | 0 | 0 | 1 | - |
| F012 | Offset on set point in cooling operation for the heaters | 1.0 | 0.0 | 99.9 | °K |
| F013 | Differential on set point in cooling mode for the heaters | 0.5 | 0.2 | 99.9 | °K |
| F014 | Offset on set point in heating mode for the heaters | 3.0 | 0.0 | 99.9 | °K |
| F015 | Differential on set point in heating mode for the heaters | 1.0 | 0.2 | 99.9 | °K |
| F016 | Heaters active during defrost (0=No, 1=Yes) | 0 | 0 | 1 | - |
| F017 | Supply fan operating mode (0=Always ON; 1=ON by temp. control) | 0 | 0 | 1 | - |
| F018 | Hot-start set point | 40.0 | 0.0 | 99.9 | °C |
| F019 | Hot-keep differential | 5.0 | 0.0 | 99.9 | °K |
| F020 | Compressor request logic from digital input (0=NC; 1=NO) | 1 | 0 | 1 | - |
| F021 | Mixed water outlet temperature probe calibration (S1 expansion) | 0.0 | -99.9 | 99.9 | °K |
| F022 | Evaporator 2 water outlet temperature probe calibration (S2 expansion) | 0.0 | -99.9 | 99.9 | °K |
| F023 | Direct relationship between digital inputs and digital outputs for condensing unit (0=No, 1=Yes) | 0 | 0 | 1 | - |
| F024 | Manual heater 1 management (0=AUTO; 1= OFF; 2=ON) | 0 | 0 | 2 | - |
| F025 | Manual heater 2 management (0=AUTO; 1= OFF; 2=ON) | 0 | 0 | 2 | - |
| F026 | Compressors off at low outside temperature (air/air) | -40.0 | -40.0 | 99.9 | °C |

## 3.2 APPLICA Desktop

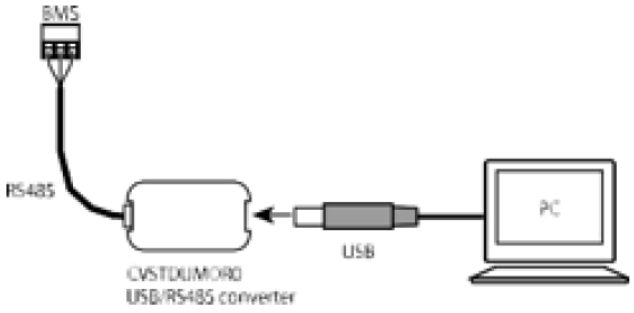
Applica Desktop is a program intended for manufacturers and installers of units fitted with the µChiller controller. It can be downloaded from ksa.carel.com.

The Applica Desktop offers the possibility to:

- access the controller using the assigned profile;
- create configurations;
- apply configurations;
- clone a unit configuration, i.e. copy all of the unit's parameter values;
- complete the commissioning procedure;
- troubleshoot any problems on the unit.

Notice:

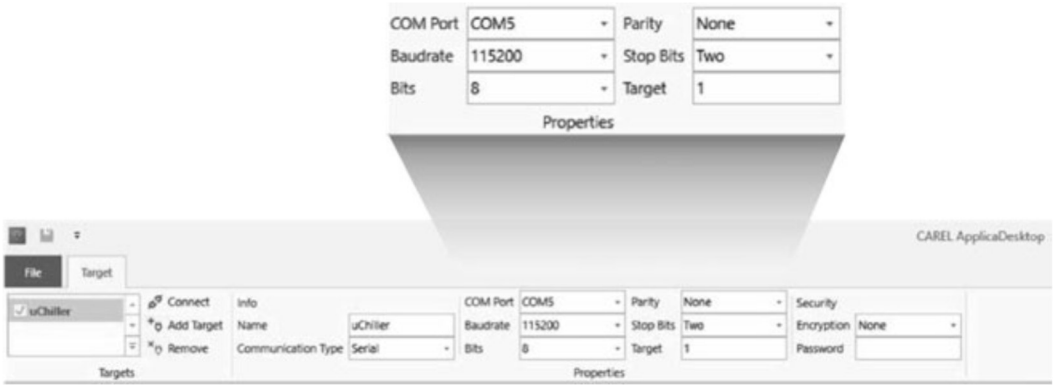
- Applica Desktop can be used as an alternative to the Applica app, and requires an internet connection;
- For the physical connection to the BMS port on µChiller, use the USB/RS485 converter P/N CVSTDUMOR0




### 3.2.1 Preparing for operation

1. Access KSA, "Software & Support", "µChiller" section.
2. Select the "Configurations" folder.
3. For µChiller Standard, Enhanced and Legacy models (with On/Off compressor), select the "Refrigerants" section and then the refrigerant charged on the unit.
4. Connect to the BMS port on the µChiller controller;
5. Open Applica Desktop; a window will be opened with the right part of the top bar as shown below:

6. Select “Add target” and assign it a meaningful name (e.g.
7. In the “COM Port” fi eld, enter the COM port used for the USB connection to the USB/RS485 converter;
8. Configure the connection parameters (Baudrate=115200, Bits=8, Parity=None, Stop Bits=Two, Serial Node=1) as shown in the figure (the data are saved automatically);
9. Use “Connect” to connect to the µChiller (which must be powered on).

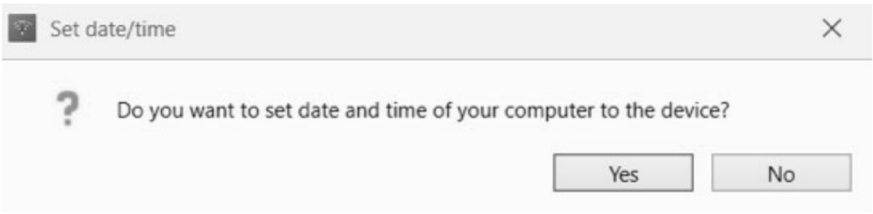



## 3.2.2 Applica Desktop: date and time setting

Applica Desktop can set the date and time on µChiller in just one simple step, copying the values from the PC to the controller


Procedure:

1. Once connected, select “Set date & time”;
2. In the pop-up window, confirm synchronisation of the time and date on µChiller with the PC



# 4. User Interface

## 4.1 Introduction

µChiller uses the user terminal to display the alarms, the main variables and to set the unit set points (User level) and manual functions (Service level). The terminal has a 7- segment LED display with two rows: the top row is 3-digit plus sign and decimal point; the bottom row is 4-digit plus sign (this can also display the hour format -hh:mm and date - MM:DD). There is a buzzer, 14 operating icons and 4 buttons for scrolling and setting the parameters. The terminal has NFC (Near Field Communication) and Bluetooth (depending on the model) connectivity for interaction with mobile devices (on which the Carel "Applica" app has been installed, available on Google Play for the Android operating system).

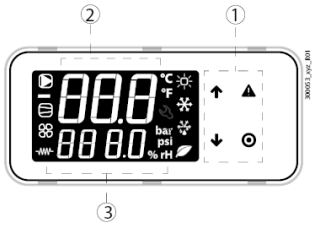
**Notice:** access levels: U=User; S=Service; M=Manufacturer. See the parameter table.

The unit of measure on the display can be changed via parameter UoM, accessed at a Service level, including in the direct access functions menu.

| Code | Description | Def. | UoM | Min. | Max. | Lev. |
|---|---|---|---|---|---|---|
| UoM | Unit of measure 0=°C/barg – 1=°F/psig | 0 | - | 0 | 1 | S |

The information and parameters accessible from the terminal and from the Applica app depend on the access level and the unit configuration parameters.

## 4.2 User Terminal




| Key | |
|---|---|
| 1 | Keypad |
| 2 | Main field |
| 3 | Device status and operating mode icons |

**Note:** the user terminal only allows access to certain parameters at the User and Service levels: to access all of the Service and Manufacturer parameters, use the Carel Applica app or the configuration and commissioning tool.

### 4.2.1 Keypad

| Button | Description | Function |
|---|---|---|
|  | UP | • When scrolling: go to the previous parameter<br>• In programming mode: increase the value |
|  | DOWN | • When scrolling: go to the next parameter<br>• In programming mode: decrease in value<br>Main menu:<br>• pressed briefly: unit dashboard display<br>• pressed and held (3 s): access User parameters (set point, unit on-off , ...) |
|  | Alarm | • Pressed briefly: display active alarms and mute buzzer<br>• Pressed and held (3 s): reset alarms. |
|  | PRG | • When scrolling: access parameter programming mode<br>In programming mode:<br>• pressed briefly: confirm value<br>• pressed and held (3 s): return to the main menu |

### 4.2.2 Icons

| Icon | Function | On | Flashing |
|---|---|---|---|
|  | System pump | Active | In manual operation |
|  | Source device status (pump/fan) | Active | In manual operation |
|  | Compressor status | Active | In manual operation (with ExV) |
|  | Frost protection heater | Active | - |
|  | Operating mode | Heating | - |
|  | Operating mode | Cooling | High water temperature |
|  | Operating mode | Defrost | Dripping after defrosting |
|  | Operating mode | Free cooling | - |
|  | Service | Service request on exceeding operating hours | Service request on exceeding operating hours |

## 4.3 Standard display

At start- up, the user terminal briefly shows "NFC", indicating that the NFC interface is available on the user terminal for communication with mobile devices, and then the standard display is shown. The standard display shows:

• on the top row: the delivery water temperature;
• on the bottom row, when the unit is on, the return water temperature; when the unit is off, it shows "OFF".

**Note:** "bLE" flashes on the display during "Bluetooth" communication.

### 4.3.1 Dashboard

From the main menu, press DOWN to access information on the status of the devices and the temperatures, superheat values, etc. for the two circuits:

• unit "OFF" and the reason for shutdown:

– "diSP" from keypad;

– "dI" from remote contact (via digital input);

– "Schd" from time band (scheduler);

– "bMS" from BMS;

– "ChnG" from operating mode changeover (heating/cooling);

– "AlrM" from alarm.

• "CMP" compressors;

• "AFC1" source water delivery temperature circuit 1;

• "AFC2" source water delivery temperature circuit 2;

• "EuP1" evaporation temperature circuit 1;

• "SSH1" superheat circuit 1;

• "Cnd1" condensing temperature circuit 1;

• "dSt1" BLDC compressor discharge temperature circuit 1;

• "EuP2" evaporation temperature circuit 2;

• "SSH2" superheat circuit 2;

• "Cnd2" condensing temperature circuit 2;

• "dSt2" BLDC compressor discharge temperature circuit 2; and if the access level is "Service":

• "Hd00" supervisor address (BMS);

and if the access level is "Service":

• "Hd01" BMS baud rate;

• "Hd02" BMS communication parameters;

• "ESC" to exit the dashboard.

#### Example


Go to the standard display.


Press DOWN: CMP indicates that compressor 1 is on (o) and compressor 2 is off (_).


Press DOWN: EuP1 indicates the evaporation temperature in circuit 1 (3.8°C).


Press DOWN: Cnd1 indicates the condensing temperature in circuit 1 (40.8°C).


To return to the standard display, press PRG (corresponding to ESC).

### 4.3.2 Direct access functions

The user terminal only provides access to the basic configuration parameters, such as direct functions and active alarms without password protection, or, with password protection, to the parameters used to configure and optimise the unit.

Press DOWN for 3 s to access the direct access functions:

- set point;
- switching unit on and off;
- change operating mode (cooling/heating, only on reverse-cycle units);
- select unit of measure.

In programming mode, the bottom row shows the parameter code, and the top row shows the value.

**Procedure**

Press:

- DOWN for 3 s to access the parameters (User level, no password required);
- UP and DOWN to scroll and set the parameters;
- PRG to change the parameter value and save the changes;
- PRG (3 s) or ESC to return to the standard display.


1. Go to the standard display


2. Press DOWN for 3 s: the current set point (SEtA) is shown - read- only


3. Press DOWN: the cooling set point (SEtC) is shown


4. Press PRG: the value flashes; press UP/DOWN to change the value; PRG to confirm.

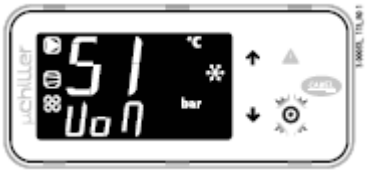

5. Press DOWN: the heating set point (SEtH) is shown - for heat pump units only.


6. Press DOWN: the unit ON/OFF function (UnSt) is shown.


7. Press DOWN: the function for switching from cooling (C) to heating (H) mode (ModE) is shown – for heat pump units only.


8. Press DOWN: the manual defrost function (dFr) is shown – Service level and reverse-cycle A/W units only.


9. Press DOWN: the function to delete the alarm log (ClrH) is shown – Service level only.




10. Press DOWN: the unit of measure selection (UoM) is shown


11. After having completed the settings, to exit either:
– from the categories press ESC and then PRG;
– press PRG for 3 s

### 4.3.3 Programming mode

Go to the standard display and press PRG to enter programming mode.

**Procedure**

Press:

- PRG to access the parameters with password protection;
- UP and DOWN to scroll and set the parameters;
- PRG to change the parameter value and save the changes;
- PRG (3 s) or ESC to return to the standard display.


1. Go to the standard display


2. Press PRG: the password prompt (PSd) is shown


3. Press PRG: the first digit of the password flashes; set the value, press PRG. The second digit now flashes; enter the other digits to complete the password.


4. Press PRG: if the password is correct, the first parameter category is shown:
PLt (= system)


5. Press PRG: the first parameter is shown: U002 (Pump 1 manual control)


6. Press PRG: the value flashes; press UP/DOWN to change the value; PRG to confirm.


7. Press UP/DOWN to display the other parameters.


**Note**: User password: 1000; See the parameter table.

### 4.3.4 Programming menu


Category PLt (system): identified by code Uxxx, these parameters all relate to control and management of the system units.


Category EEV (ExV valve): identified by code Exxx, these parameters all relate to control and management of the electronic expansion valve (s).


Category CMP (compressors): identified by code Cxxx, these parameters all relate to control and management of the compressors and refrigerant circuits.


Category Src (source): identified by code Sxx, these parameters all relate to control and management of the condenser / source.


Category Clc (Clock): identified by code Haxx, these are the parameter for setting the date/time.


Category Hst (Alarm log): access the alarm log. Each event is described with the date (in the format DD MM) and time (in the format hh:mm) alternating.


Use Log- Out to exit the category.


Use ESC to return to the standard display.

**Notes:**

- the Service password also accesses the User parameters;
- if no button is pressed, after around 3 minutes the terminal will automatically return to the standard display.

# 5. Functions

## 5.1 Temperature control

µChiller can control either the unit's return or delivery water temperature. The return (from user) and delivery (to user) water temperature probes can be installed on any of the channels. See the Installation chapter.

### 5.1.1 PID Control

Two types of PID control are available:

• PID control at start-up;

• PID control in operation.

For each type of PID control, the following parameters can be set:

• Control probe (return or delivery);

• Proportional gain (Kp);

• Integral time (action disabled when time set to 0);

• Derivative time (action disabled when time set to 0).

The control set point and the operating mode (heating / cooling) are the same for both control types:

• control at start-up is aimed at preventing excess capacity being called. Indeed, as when starting the exact status of the units (loads) is not known, but rather only the temperature, capacity needs to be delivered gradually, awaiting the reaction from the system. Control can be applied to the water return temperature, using a low gain and a sufficiently high integral time, greater than the system time constant (120- 180 s, considering a system time constant of at least 60 s, corresponding to a minimum water content of 2.5 l/kW).

• control in operation needs to be more reactive, so as to respond quickly to any variations in load and keep the delivery water temperature as close as possible to the set point. In this case, the time constant depends on the response of the compressor-evaporator system, and is in the order of a few tens of seconds (slower with tube bundle evaporators, faster with plate evaporators).

The following table shows the recommended values (to be calibrated if necessary during system commissioning), according to the type of evaporator used

| | | Evaporator | |
|---|---|---|---|
| Code | Description | Tube bundle | Plate |
| U036 | Control probe at start-up - 0=Return 1=Delivery | Return | Return |
| U039 | PID at start-up: Kp | 6.0 | 6.0 |
| U040 | PID at start-up: Ti - 0: integral action disabled | 180 s | 180 s |
| U041 | PID at start-up: Td - 0: derivative action disabled | 0 s | 0 s |
| U038 | Control probe in operation - 0=Return 1=Delivery | Delivery | Delivery |
| U042 | PID in operation: Kp | 10.0 | 10.0 |
| U043 | PID in operation: Ti - 0: integral action disabled | 120 s | 120 s |
| U044 | PID in operation: Td - 0: derivative action disabled | 3 s | 3 s |

The control sequence is as follows:

1. when the unit is Off, both PID controls are disabled;

2. when the unit starts, following the set user pump – compressor delay, the PID at start-up is enabled and generates a capacity request (percentage) that is then processed so as to activate the compressors;

3. if this request is sufficient, one compressor will be started;

4. once the compressor has started, after a set time, control switches from PID at start- up to PID in operation;

5. when the controller requests deactivation of the compressors, these are enabled to stop;

6. after the last compressor has been stopped, restart is managed using the PID at start-up.

If the delay between PID at start-up/in operation is set to 0, PID control in operation will always be active.

| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| S | U047 | Compressor activation delay after user pump | 30 | 0 | 999 | s |
| S | U037 | PID control delay at start-up/operation | 180 | 0 | 999 | s |

### 5.1.2 Proportional control

If the desired control is only proportional to the water outlet or return temperature, consider the relationship:

$$K_p = 100/BP$$

For example, to have a proportional band of 2K, set the value of Kp to 50.

The following are the parameter settings required to control the return temperature:

| User | Cod. | Description | Setting | UoM | Note |
|---|---|---|---|---|---|
| S | U036 | Control probe at start-up - 0=Return 1=Delivery | 0 | - | - |
| S | U037 | PID control delay at start-up/operation | 180 | s | Not significant |
| | U038 | Control probe in operation - 0=Return 1=Delivery | 0 | - | |
| | U039 | PID at start-up: Kp | 50.0 | - | => Proportional band = 2K |
| | | | 34.0 | | => Proportional band = 3K |
| | | | 25.0 | | => Proportional band = 4K |
| | | | 20.0 | | => Proportional band = 5K |
| | U040 | PID at start-up: Ti - 0: integral action disabled | 0 | s | |
| | U041 | PID at start-up: Td - 0: derivative action disabled | 0 | s | |
| | U042 | PID in operation: Kp | =U039 | s | Same as Kp at start-up |
| | U043 | PID in operation: Ti - 0: integral action disabled | 0 | s | |
| | U044 | PID in operation: Td - 0: derivative action disabled | 0 | s | |

## 5.1.3 Set point compensation

µChiller adjusts the set point based on the outside temperature.

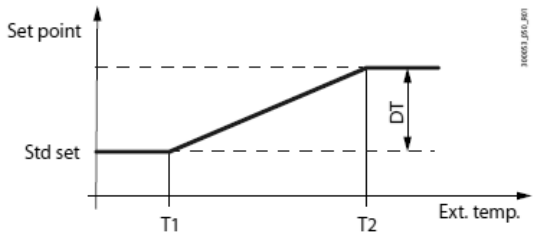
**Notice:** this function can only be enabled if the outside temperature probe is fitted.

The compensation (positive or negative) is determined by:

1. start compensation start (in cooling/heating);
2. end compensation threshold (in cooling/heating);
3. maximum compensation value (in cooling/heating).

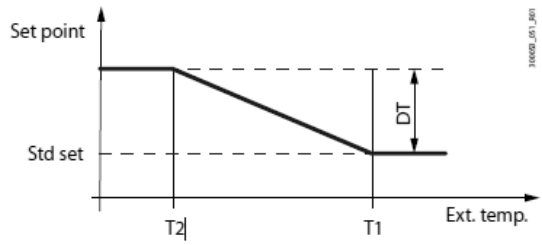
| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| S | U010 | Enable set point compensation: 0/1=no/yes | 0 | 0 | 1 | - |
| U | SEtC | Cooling set point | 7.0 | U006 | U007 | °C/°F |
| S | U011 | Cooling compensation: start | 25.0 | -99.9 | 999.9 | °C |
| S | U012 | Cooling compensation: end | 35.0 | -99.9 | 999.9 | °C |
| S | U013 | Cooling compensation: maximum value | 5.0 | -99.9 | 999.9 | K |
| U | SEtH | Heating set point | 40.0 | U008 | U009 | °C/°F |
| S | U014 | Heating compensation: start | 5.0 | -99.9 | 999.9 | °C |
| S | U015 | Heating compensation: end | -10 | -99.9 | 999.9 | °C |
| S | U016 | Heating compensation: maximum value | 5.0 | -99.9 | 999.9 | K |

**Compensation in cooling:**




| Key | |
|---|---|
| Ext. Temp. | Outside temperature |
| Std set | Control set point |
| T1 | Outside temperature to start compensation in cooling mode |
| T2 | Outside temperature to end compensation in cooling mode |
| DT | Maximum compensation value in cooling mode |

**Compensation in heating:**




| Key | |
|---|---|
| Ext. Temp. | Outside temperature |
| Std set | Control set point |
| T1 | Outside temperature to start compensation in heating mode |
| T2 | Outside temperature to end compensation in heating mode |
| DT | Maximum compensation value in cooling mode |

### 5.1.4 Request from BMS

The request can be managed directly from a BMS, bypassing normal temperature control and enabling the external request signal (0-100.0%) via the specific Modbus serial variable (BMS_PwrReq, HR 331). This operation is enabled via another serial variable (En_BMS_PwrReq, CS 22).

**Note:** if the supervisor is offline, the unit continues to operate in stand-alone mode, regardless of the request from the BMS.

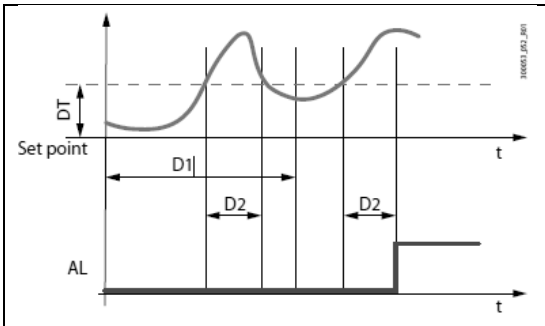
### 5.1.5 High evaporator outlet temperature alarm

µChiller activates an alarm when the evaporator outlet temperature exceeds the threshold set by the user (via the offset relative to the control set point). When the outlet temperature exceeds the threshold, a counter starts and after a delay (settable), the alarm is activated. An initial delay disables the alarm in the transient period when the unit is starting.

**Notes:**

- the alarm is only available on chiller units.
- the high temperature alarm can be used to activate a backup unit in critical applications.

| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| U | SetA | Current set point | - | -999.9 | 999.9 | °C |
| S | U031 | High water temperature alarm: offset | 10.0 | 0.0 | 99.9 | K |
| S | U032 | High water temperature alarm: delay at start-up | 15 | 0 | 99 | Min |
| S | U033 | High water temperature alarm: delay in operation | 180 | 0 | 999 | s |

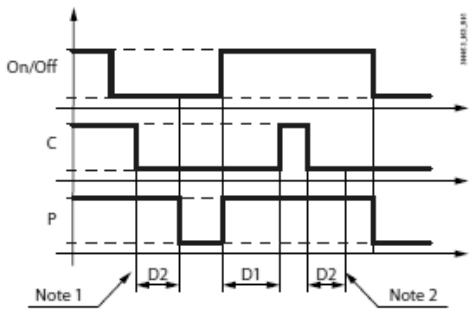



| Key | |
|---|---|
| Set point | Current set point |
| DT | Offset |
| D1 | Delay at start-up |
| D2 | Delay in steady operation |
| AL | Alarm |

## 5.2 User pump

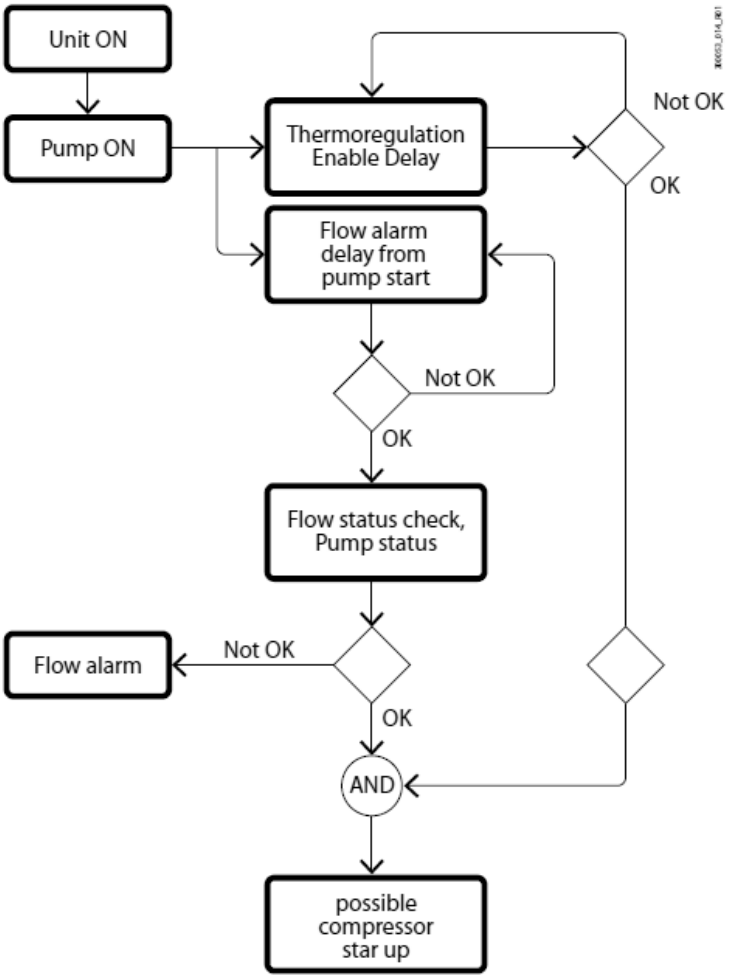
µChiller can manage up to two user- side pumps (depending on the hardware used and the required configuration). A delay can be set between pump and compressor activation (= temperature control enabled). A delay can also be set between the deactivation of the last compressor and the pump. If when the unit shuts down the compressors have been shut down for at least the “user pump shutdown delay after compressor”, then the pump is stopped immediately.

| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| S | U047 | Compressor activation delay after user pump | 30 | 0 | 999 | s |
| S | U048 | User pump shutdown delay after compressor | 180 | 0 | 999 | s |




| Key | |
|---|---|
| Unit | Unit On-Off (local or remote control) |
| C | Compressor |
| P | User pump |
| D1 | Compressor activation delay after user pump |
| D2 | User pump shutdown delay after compressor |
| Note 1 | Control is not active: the compressors are stopped based on their own safety times |
| Note 2 | In this case, the pump can stop immediately |

Below is a diagram that represents operation for the configuration with one pump only:




Temperature control is enabled only after the flow alarm delay from pump on, so as to prevent the compressors from starting if there is no fluid flow.

Temperature control is enabled only after the flow alarm delay from pump on, so as to prevent the compressors from starting if there is no fluid flow.

Depending on the configuration, up to two user pumps can be enabled. µChiller includes the following features:

• with two pumps, automatic rotation to ensure fluid circulation and equalisation of operating hours. Rotation is performed:

– at the end of a period that can be set, in hours;

– when there is an overload alarm on the active pump.

• management of the pump overload alarm (if available, depending on the controller and configuration). Fault signal and immediate pump deactivation.

• Management of a flow switch that monitors fluid circulation in the system.

• frost protection with unit off: the pump is started so as to activate fluid circulation (when the unit is on, the function is disabled).

• pump anti-blocking: if the pump is off for more than a week, it is activated for 3 seconds.

| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| S | U049 | User pump rotation time | 12 | 0 | 999 | h |

## 5.2.1 Cyclical pump activation during standby

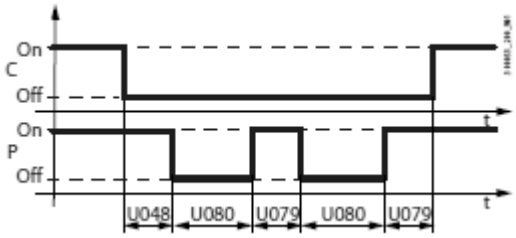
When the chiller serves a chilled water tank (for example, in winemaking applications), the pump does not need to keep running, consequently energy can be saved by stopping the pump when the cooling demand is met.

A function can be activated to:

• switch the pump off after the compressors are stopped by the temperature controller;

• activate the pump periodically, in order to reactivate the compressors and satisfy demand from the units.

| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| S | U078 | Unit pump in standby: enable On-Off cycles | 0 | 0 | 1 | - |
| S | U079 | Unit pump in standby: On time | 3 | 1 | 15 | min |
| S | U080 | Unit pump in standby: Off time | 15 | 3 | 99 | min |



## 5.3 Frost protection control

Frost protection control can be managed using the evaporation pressure probe, which directly monitors the conditions of the evaporator, or using the water temperature probe. In the latter case, the delivery water temperature or the source water temperature in the water/water unit is used in heating mode).

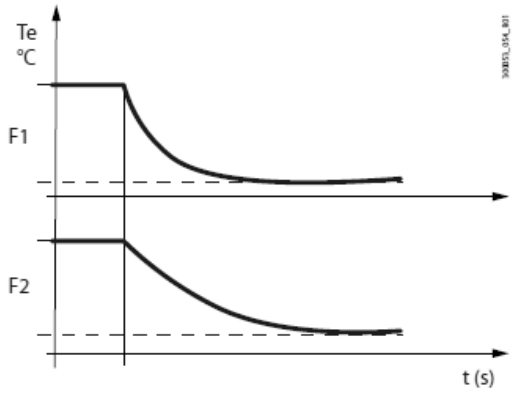
| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| S | U082 | Frost protection control type 0=Evaporation temperature 1=Water temperature | 0 | 0 | 1 | - |

### 5.3.1 Frost protection alarm

When there is a frost alarm on the evaporator, the corresponding circuit is shut down. Each circuit manages its own evaporation pressure probe, and consequently also the frost protection alarm. The evaporation temperature value is filtered based on an exponential distribution formula that takes into consideration the thermal mass of the evaporator so as to avoid false alarms at start- up. A specific algorithm uses this filtered value and activates the alarm if the frost protection threshold is exceeded.

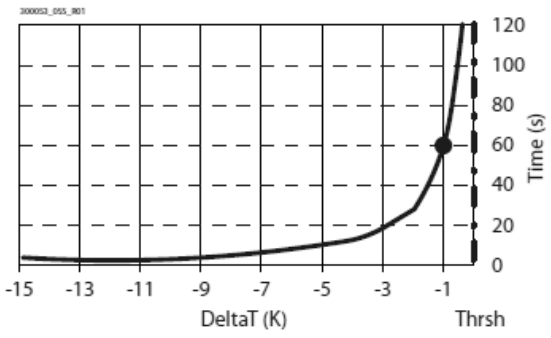
| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| S | U050 | User side frost protection: alarm threshold | -0.8 | -99.9 | 999.9 | °C |
| S | U051 | User side frost protection: differential | 30.0 | 0.0 | 999.9 | K |
| S | U052 | User-side frost protection: delay time at 1K | 30 | 0 | 999 | s |

The figure shows the action of the filter on the evaporation temperature, according to the exponential distribution formula.



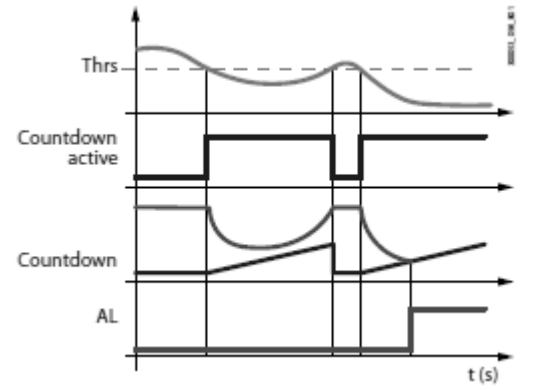

| | |
|---|---|
| | |
| | |
| **Key** | |
| Te | Filtered evaporation temperature |
| F1 | Filter with low delay |
| F2 | Filter with high delay |
| | |
| | |

When the filtered evaporation temperature falls below the alarm threshold, a counter is activated, and the counter time-out is either increased or decreased based on the deviation of the evaporation temperature from the frost protection threshold, until reaching zero when the deviation from the threshold it is greater than the differential, following a hyperbolic trend. This trend imitates the actual behaviour of ice formation and ensures better protection. The following diagram shows the trend in the alarm delay time according to the deviation from the alarm threshold, using the following values: delay time at 1K=60s; differential=30K. At the threshold the delay is equal to 10 times the set value (600s in the example).




| | |
|---|---|
| | |
| | |
| **Key** | |
| Time [s] | Frost protection alarm delay |
| Thrsh | Frost protection alarm threshold |
| DeltaT [K] | Deviation from the frost protection alarm threshold |
| | |
| | |

Frost protection alarm operation:




| | |
|---|---|
| | |
| | |
| **Key** | |
| t [s] | Time [s] |
| Thrsh | Frost protection alarm threshold |
| AL | Frost protection alarm |
| | |
| | |

The value of the delay (at 1K) in the previous example refers to a plate evaporator; if a tube bundle evaporator is used, which has greater thermal inertia, the delay time (at 1K) can be increased to a suitable value. The following table shows the recommended values for the alarm threshold (with pure water), differential and delay, according to the type of evaporator used.

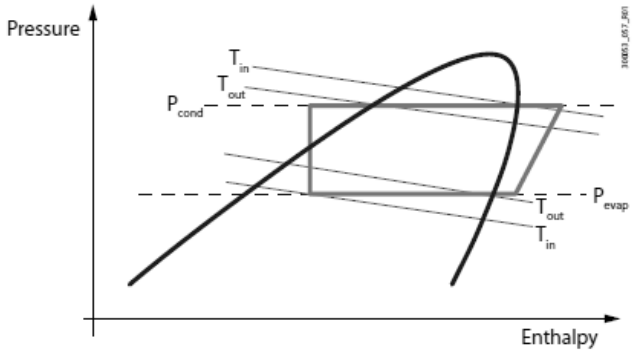
| | | Recommended values based on the heat exchanger | |
|---|---|---|---|
| **Code** | **Description** | **Tube bundle** | **Plate** |
| U050 | User side frost protection: alarm threshold | -0.3°C | -1.2°C |
| U051 | User side frost protection: differential | 30.0°C | 30.0°C |
| U052 | User-side frost protection: delay time at 1K | 90 s | 60 s |

With pure water, the frost protection threshold must be set just below zero (from - 0.8°C to - 1.5°C) to account for the heat transfer temperature gradient across the metal between the refrigerant and the water. For tube bundle heat exchangers, values close to zero (above - 0.5°C) should be considered, to guarantee better protection due to their specific mechanical construction.

## 5.3.2 Frost protection threshold with glide (R407C)

A correct frost protection threshold also needs to consider the minimum temperature reached inside the evaporator. When using refrigerants without glide or with minimum glide (e.g. R410A, R134a), the value coincides with the pressure-temperature conversion (dew) of the transducer fitted on the suction pipe, while for refrigerants with glide (e.g. R407C), the value to be used is lower than the pressure- temperature conversion (in the case of R407C it is 5- 6°C). The following diagram clearly shows the difference between the two temperature values (Tin and Tout) at the evaporation pressure (P evap.) due to the "glide" effect of the refrigerant.

**P-H Diagram – Zeotropic Blend**




| Key | |
|---|---|
| Tin (Pevap) | Evaporator refrigerant inlet temperature |
| Tout (Pevap) | Saturated evaporation temperature “dew” |
| Pcond | Condensing pressure |
| Pevap | Evaporation pressure |
| | |

**Note:** as a consequence of the above, the suggested frost protection set point with pure water and R407C refrigerant is 4-4.5°C.

## 5.3.3 Frost protection alarm with water temperature

The frost protection alarm uses the water delivery probe (user) in cooling mode, while in heating mode, on water/water units, it uses the water temperature. When there is a frost alarm, the corresponding circuits are shut down. When the temperature is below the alarm threshold, the alarm is activated, and it is reset when it rises back above the threshold plus a differential.

| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| S | U050 | User side frost protection: alarm threshold | -0.8 | -99.9 | 999.9 | °C |
| S | U051 | User side frost protection: differential | 30.0 | 0.0 | 999.9 | K |

## 5.3.4 Frost prevention

The frost protection threshold on the evaporation temperature is used as the minimum evaporation temperature threshold for frost prevention. Prevention is applied by limiting circuit capacity when the threshold is exceeded.

### 5.3.5 Frost prevention with the unit OFF

When the unit switched off, µChiller provides frost protection: the water is prevented from freezing by activating a pump and/or frost protection heater. When the water temperature in the heat exchangers reaches the frost protection set point, the selected device is activated.

The probe used is the one located on the user heat exchanger outlet and source heat exchanger inlet. The following devices can be activated:

- heater;
- pump;
- heater and pump.

| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| S | U053 | Unit OFF: frost protection set point | 4.0 | -99.9 | 999.9 | °C |
| S | U054 | Unit OFF: frost protection differential | 2.0 | 0.0 | 999.9 | K |
| S | U055 | Frost protection type: 0=Heater 1=Pump 2=Heater/Pump | 2 | 0 | 2 | - |

## 5.4 Compressor rotation

If there is just one compressor, the temperature control request will be exactly the same as the request that the compressor needs to satisfy. On units with two compressors, µChiller manages rotation in order to balance compressor operating hours and starts, so as to best deliver the required capacity.

### 5.4.1 Frost prevention with the unit OFF

µChiller starts and stops the compressors based on:

- FIFO rotation (**F**irst **I**n **F**irst **O**ut), meaning the first compressor to start will also be the first to stop;
- activation time: the first compressor to start will be the one with the lowest number of operating hours.

If the circuit is equipped with a variable-speed (BLDC) compressor, this will always be the first to start and the last to stop.

| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| M | C048 | Compressor rotation type - 1=FIFO, 2=Time | 1 | 1 | 2 | - |

### 5.4.2 Capacity distribution

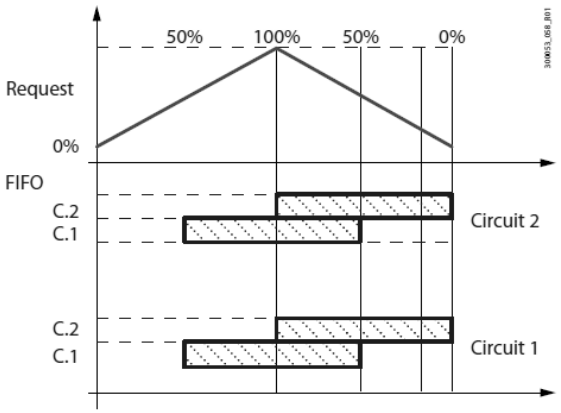
µChiller manages the most suitable capacity distribution between the circuits so as to increase overall unit efficiency. The behaviour of capacity distribution varies based on:

- whether there are 1 or 2 circuits;
- the type of compressor(s) used: modulating (BLDC) or fixed speed;
- the ratio between compressor capacities.

To avoid simultaneous starts or stops of several compressors, there are two fixed minimum delays: one between starts (30 s) and the other (10 s) between stops.

Compressor capacity distribution in steps

Below is an example of capacity distribution with two circuits in the tandem configuration with two fixed-speed compressors (scroll), each with the same capacity, and FIFO rotation.




| | |
|---|---|
| | |
| | |
| **Key** | |
| Request | Capacity request (temperature control) |
| C1 | Compressor 1 |
| C.2 | Compressor 2 |
| | |
| | |

## 5.4.3 Rotation due to alarm

In the event of a compressor alarm, the next compressor available will be switched on as a replacement if the temperature control request is sufficiently high as to warrant starting another compressor.

## 5.4.4 Force rotation (destabilisation)

Some compressor manufacturers specify that on units with multiple compressors, the compressors need to be rotated after a certain period of inactivity, even if control is stable.

The destabilisation function, which meets this requirement:

- can be enabled by parameter;
- avoids refrigerant migration during long periods of inactivity;
- can also be used to keep all the compressors at operating temperature.

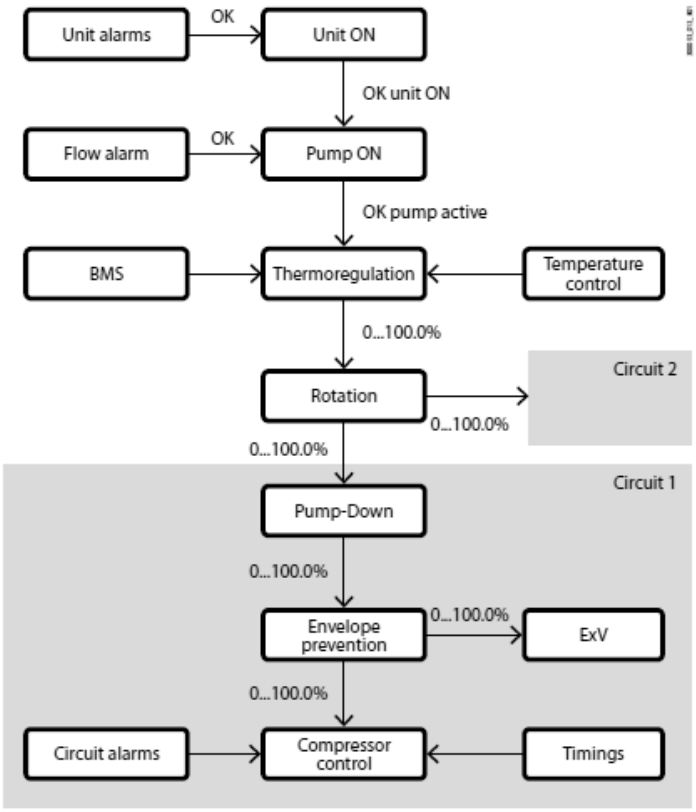
| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| M | C020 | Maximum circuit destabilisation time | 240 | 5 | 999 | min |
| M | C044 | Enable destabilisation – 0/1= No/Yes | 1 | 0 | 1 | - |

## 5.5 Compressor management

µChiller manages scroll compressors with direct starting or modulating BLDC compressors (scroll and rotary).

A maximum of 4 scroll compressors are available in tandem configuration on two circuits; in the High Efficiency models, with BLDC compressors, the maximum is 1BLDC+1On-Off per circuit.

The flow chart below shows the process for calculating the request to the compressors:




**Note:** for the sake of simplicity, the parameters are shown for just one compressor and one circuit, therefore all the compressors and circuits on the unit will have the same settings.

### 5.5.1 Compressors with capacity control (Legacy model only)

For Legacy models, compressors can be capacity-controlled in the compressor plus valve configuration, on a maximum of two circuits. For compressors with capacity control, the FIFO or timed rotation logic will refer to the circuit and not to the compressor valves.

Example: if circuit 1 starts when power returns, compressor 1 starts at part capacity, then the valve is managed as the second step, so that the compressor works at the highest efficiency. If less capacity is needed, first the valve that manages compressor capacity will be deactivated and then the compressor itself. There is no rotation between compressor and valve. When capacity is needed again, the second circuit with compressor 2 will be activated and, subsequently, if required, the corresponding valve. On deactivation, the valve will be managed first, and only then the compressor.

| User | Code | Description | Def. | Min. | Max. | Uom |
|---|---|---|---|---|---|---|
| M | F027 | Enable capacity-controlled compressor 0/1=No/Yes | 0 | 0 | 1 | - |

## 5.6 Compressor alarms

If abnormal conditions occur and the prevention actions are not effective, the compressor will be shut down so as to avoid damage to the compressor itself or other unit components, i.e. the control algorithm stops the compressors and closes the expansion valve.

### Compressor shutdown

The compressors will be available again after the:

• minimum compressor off time (par. C013);

• minimum time between consecutive compressor starts (par. C014).

### Compressor delay at start-up/in operation

Compressor start-up is a critical phase. µChiller thus manages certain alarms differently, in order to switch smoothly from startup to normal, steady operation. These alarms are:

• low differential pressure;

• out of envelope alarm.

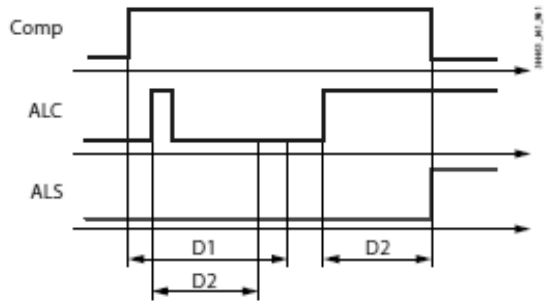
There are thus two delays for these alarms:

• delay at start-up;

• delay in operation.

The alarm condition is ignored when the compressor is off and during the start-up phase. When the unit reaches steady operation, the condition causes the corresponding alarm once the delay has elapsed.

Behaviour will thus be as follows




| Key | |
|---|---|
| Comp | Compressor status |
| ALC | Status of the alarm condition |
| ALS | Alarm signal |
| D1 | Alarm disabling from compressor start-up |
| D2 | Alarm delay in operation |
| t | Time |
| | |

## 5.7 Expansion valve driver

The driver to manage the electronic expansion valve is a fundamental device for the µChiller controller. This is used to safely manage the compressor and thus the circuit, constantly controlling the discharge temperature and the position of the working point inside the compressor envelope. The solution provided manages unipolar valves up to a certain cooling capacity (Carel E3V - cooling capacity up to 90- 100 kW) with the built- in driver (DIN model only) and bipolar valves with higher capacities, using the external EVD Evolution driver. This must be connected to the FBus serial port on µChiller via the Modbus circuit 1 protocol

with a baud rate of 19200 bps. Use a specific cable for RS485 (AWG20- 22 with 1½ twisted pair plus shield).

**Note:**

- EVD Evolution is only used as an expansion valve positioner;
- if the ExV electronic expansion valve is used, the suction temperature probe is connected to input S3 (panel model) or S7(DIN rail model). See the functional diagrams. For the connection see wiring diagram attached to this manual.

## 5.8 Control of the expansion valve

The control logic manages various functions:

- communication with the EVD Evolution driver, if used (read/write parameters via FBus serial port);
- control of suction superheat (SSH);
- low superheat control and alarm (Low SH);
- minimum evaporation temperature control and alarm (LOP);
- maximum evaporation temperature control and alarm (MOP);
- control of cooling capacity, so as to position the valve correctly in the transient stages according to circuit control status;
- control algorithm that calculates the valve opening steps;
- valve opening value sent to the valve driver.

  If the EVD Evolution driver is offline, all the compressors are stopped immediately.

Dedicated electronic expansion valve parameters

- Certain parameters relating to the electronic expansion valve vary according to the operating mode:
- chiller;
- heat pump. These are:
- superheat parameters (set point and PID);
- alarm thresholds and integral actions for protection functions: LOP, MOP and Low SH

## 5.9 Source pump

µChiller manages one source-side pump (water/water units only). In the same way as for the user pumps, the source pump is activated when the unit is switched on, and a shutdown delay after the last compressor stops can be set.

The source pump can be activated:

- when the unit is switched on, and after a set delay for switching off after the unit has been switched off;
- when the first compressor starts, and after a set delay for switching off after the last compressor stops;
- via temperature control. Below is a table summarising the probes used for controlling the pump in each configuration:

| Circuit | Probes used for control | |
|---|---|---|
| | Chiller | Heat pump |
| 1 | Condensing press./temp.circuit1 | Evaporation press./temp. circuit1 |
| 2 | Condensing press./temp. circuit 2 | Evaporation press./temp. circuit 2 |

µChiller manages:

- frost protection with the unit off: the pump is started so as to activate fluid circulation (when the unit is on the function is disabled).
- pump anti-blocking: if the pump is off for more than a week, it is activated for 3 seconds

| Use | Cod | Description | Def | Min | Max | U |
|---|---|---|---|---|---|---|
| S | S072 | Source pump activation - 0=Always on - 1= On with compressor on - 2 = Control on condensing press./temp. | 0 | 0 | 2 | - |
| S | S028 | Source pump in cooling: set point | 30.0 | -999.9 | 999.9 | °C |
| S | S029 | Source pump in heating: set point | 10.0 | 0.0 | 99.9 | °C |
| S | S034 | Source pump: differential in cooling | 15.0 | 0.0 | 99.9 | K |
| S | S035 | Source pump: differential in heating | 5.0 | 0.0 | 99.9 | K |

## 5.10 Source fans

On units with two circuits, µChiller manages the source (condenser) either separately (independent air circuits) or with one common air circuit, by setting a parameter: when there is a common air circuit, fan 1 works based on the higher request between circuit 1 and 2.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S064 | Type of source air circuit - 0 = Independent 1 = Common | 0 | 0 | 1 | - |

Below is a table summarising the probes used for controlling the fans in each configuration:

| Circuit | Probes used for control | |
|---|---|---|
| | Chiller | Heat pump |
| 1 | Condensing press./temp. circuit 1 | Evaporation press./temp. circuit 1 |
| 2 | Condensing press./temp. circuit 2 | Evaporation press./temp. circuit 2 |

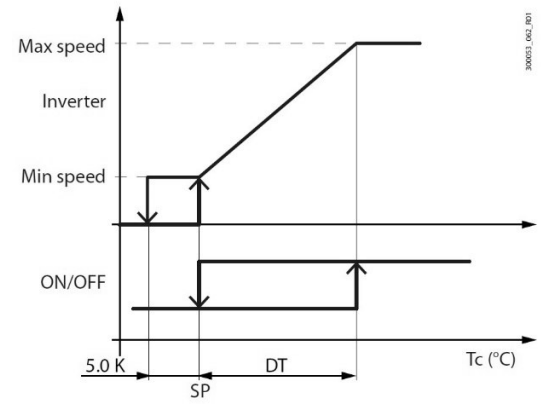
The control mode changes based on the operating mode (chiller or heat pump).

### 5.10.1 Modulating / On-Off fans

On the µChiller panel version, analogue output Y1 is the only output available: consequently, to control an on-off fan, a CONV-ON OFF module (Carel) is needed to convert the 0-10 V analogue output into a relay control. On the versions for DIN rail mounting, relay NO6 is available and can be configured as a fan output. On-Off fans then need to be configured.

| Use | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| M | Hc12 | NO6 configuration - 0=Frost protection 1=Source fan/pump | 0 | 0 | 1 | - |
| S | S065 | Type of source fan 0/1=Modulating/ON-OFF | 0 | 0 | 1 | - |
| S | S028 | Source fan in cooling: set point | 30.0 | -999.9 | 999.9 | °C |
| S | S029 | Source fan in heating: set point | 10.0 | 0.0 | 99.9 | °C |
| S | S031 | Source fan in cooling: set point at start-up | 45.0 | 0.0 | 999.9 | °C |
| S | S032 | Source fan: delay at start-up in cooling | 240 | 0 | 999 | s |
| S | S034 | Source fan: differential in cooling | 15.0 | 0.0 | 99.9 | K |
| S | S035 | Source fan: differential in heating | 5.0 | 0.0 | 99.9 | K |
| S | S036 | Modulating source fan: min speed value | 20.0 | 0.0 | 100.0 | % |
| S | S037 | Modulating source fan: max speed value | 80.0 | 0.0 | 100.0 | % |

The following diagram shows the two control modes (modulating or on-off) in chiller operation (cooling):



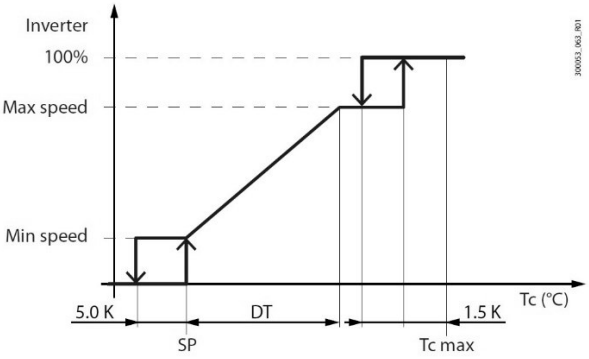

| Key | |
|---|---|
| Max speed | Modulating source fan: max speed value |
| Min speed | Modulating source fan: min speed value |
| SP | Control set point |
| DT | Control differential |
| Tc | Condensing temperature |
| | |
| | |

## 5.10.2 Control in chiller mode

Fan control may be modulating or ON-OFF and is based on the saturated temperature value, equivalent to the condensing pressure, limited by Tc max.

| Use | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | C017 | Max high pressure threshold (HP) | 65.0 | 0.0 | 999.9 | °C |
| S | S028 | Source fan in cooling: set point | 30.0 | -999.9 | 999.9 | °C |
| S | S034 | Source fan: differential in cooling | 15.0 | 0.0 | 99.9 | K |
| S | S036 | Modulating source fan: min speed value | 20.0 | 0.0 | 100.0 | % |
| S | S037 | Modulating source fan: max speed value | 80.0 | 0.0 | 100.0 | % |

The control diagram is shown below:




| Key | |
|---|---|
| Max speed | Modulating source fan: max speed value |
| Min speed | Modulating source fan: min speed value |
| SP | Control set point |
| DT | Control differential |
| Tc max | Maximum condensing temperature |
| Tc | Condensing temperature |
| | |

Fig.5.r

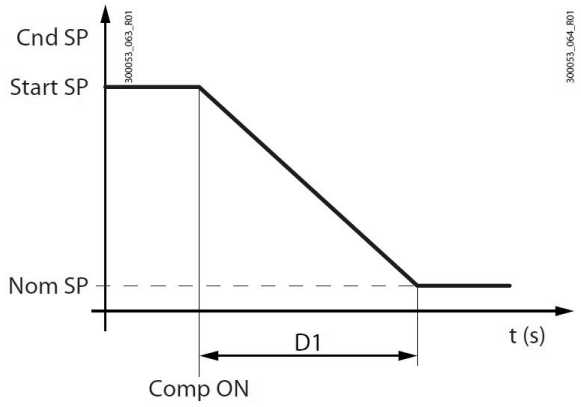
In the graph, some offsets are expressed with a numerical value, indicating that they are not modifiable but rather are fixed parameters. The current calculated set point value is displayed on the dashboard.

### Set point control

In chiller mode, a specific condensing temperature set point for starting the compressor can be set to a value that is higher than the nominal set point, so that the compressor can reach steady operation more quickly.

The transition to the nominal set point is made gradually over a time equal to the delay at start-up.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S031 | Source fan in cooling: set point at start-up | 45.0 | 0.0 | 999.9 | °C |
| S | S032 | Source fan: delay at start-up in cooling | 240.0 | 0 | 999 | °C |



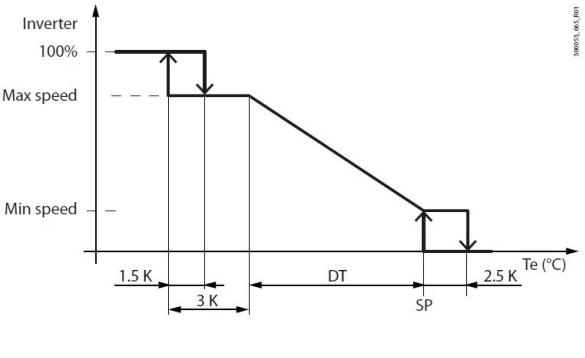

| Key | |
|---|---|
| | |
| Cnd SP | Condensing temperature set point |
| Start SP | Set point at start-up |
| Nom SP | Nominal set point |
| Cmp ON | Compressor activation |
| D1 | Delay at start-up |
| | |

## 5.10.3 Control in heat pump mode

Fan control may be modulating or ON-OFF and is based on the saturated temperature value, equivalent to the evaporation pressure.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | C017 | Max high pressure threshold (HP) | 65.0 | 0.0 | 999.9 | °C |
| S | S029 | Source fan in heating: set point | 10.0 | -999.9 | 999.9 | °C |
| S | S035 | Source fan: differential in heating | 5.0 | 0.0 | 99.9 | K |
| S | S036 | Modulating source fan: min speed value | 20.0 | 0.0 | 100.0 | % |
| S | S037 | Modulating source fan: max speed value | 80.0 | 0.0 | 100.0 | % |

The control diagram is shown below:




| Key | |
|---|---|
| Max speed | Modulating source fan: max speed value |
| Min speed | Modulating source fan: min speed value |
| SP | Control set point |
| DT | Control differential |
| Tc max | Maximum condensing temperature |
| Te | Evaporation temperature |
| | |

In the graph, some off sets are expressed with a numerical value, indicating that they are not modifiable on the display but rather are fixed parameters. The current calculated set point value is displayed on the dashboard.

### 5.10.4 “Low noise” function

This function reduces the noise emitted by modulating fans by increasing the set point at night.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S020 | Enable noise reduction 0/1=No/Yes | 0 | 0 | 1 | - |
| S | S021 | Noise reduction time band: start hours | 22 | 0 | 23 | h |
| S | S022 | Noise reduction time band: start minutes | 30 | 0 | 59 | min |
| S | S023 | Noise reduction time band: end hours | 8 | 0 | 23 | h |
| S | S024 | Noise reduction time band: end minutes | 30 | 0 | 59 | min |
| S | S025 | Source fan: noise reduction set point | 45. | 0.0 | 999.9 | °C |

### 5.10.5 Fan anti-blocking function

For systems intended to operate in cold climates, µChiller modulates fan speed to prevent the unit from shutting down due to frost formation. The function is activated when the outdoor temperature falls below a threshold and, instead of turning off the fans, keeps then on at a minimum speed. If the outside temperature is reached when the fans are off, these are activated at start-up speed for a certain time, and then switch to the minimum speed.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S016 | Source fan: cold climate temperature threshold | -0.5 | -999.9 | 999.9 | °C |
| S | S017 | Source fan: min cold climate speed | 10.0 | 0.0 | 100.0 | % |
| S | S018 | Source fan: cold climate speed at start-up | 50.0 | 0.0 | 100.0 | % |
| S | S019 | Source fan: cold climate speed at start-up time | 5 | 0 | 300 | s |

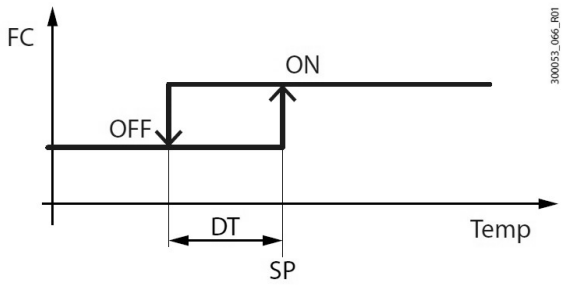
## 5.11 Free cooling

The free cooling (FC) function can be enabled only on chiller units. The type of free cooling is configured by parameter, and may be:

- air free cooling, on air/water units equipped with air- water heat exchanger coils upstream of the condenser coils and with modulating fan control;
- remote air free cooling (see the specific paragraph);
- water free cooling, on water/water units with mixing of the source water or via water- water heat exchanger upstream of the evaporator and a 3-way modulating valve on the free cooling circuit.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | U068 | Free cooling: enable 0/1=no/yes | 0 | 0 | 1 | - |
| S | U069 | Free cooling: activation differential | 3.0 | 0.0 | 99.9 | K |
| S | U070 | Free cooling: hysteresis | 1.5 | 0.0 | 99.9 | K |
| S | U071 | Design free cooling delta T | 8.0 | 0.0 | 99.9 | K |
| S | U072 | Water free cooling: valve closing threshold | 5.0 | -999.9 | 999.9 | °C |
| S | U073 | Water free cooling: valve closing differential | 3.0 | 0.0 | 99.9 | K |
| M | U074 | Free cooling type: 0=Air 1=Remote coil 2=Water | 0 | 0 | 2 | - |

Free cooling is enabled when the outside source temperature is sufficiently lower than the temperature of the water entering the unit, as shown in the following figure:




| Key | |
|---|---|
| FC | Free cooling |
| DT | Control differential |
| SP | Activation differential |
| Temp | User return temperature – outside source temp. |
| | |
| | |
| | |

On air/water units, the fans are controlled based on the condensing temperature as long as the circuit's compressor is on; as soon as the compressor stops, the free cooling fan is controlled to maintain the desired water temperature set point.

## 5.12 Types of free cooling

### 5.12.1 Condensing unit with common air circuit

Free cooling is enabled based on the comparison between the user return water temperature and the outside air temperature; this directly controls switching of the three-way valve, which allows the water returning from the user terminals to flow through the free cooling coil before entering the evaporator. Free cooling capacity is controlled by modulating the fan speed (with the compressors off); in combined operation (free cooling + mechanical cooling), fan speed is controlled to correctly manage the condensing stage.
Inputs used:
To enable free cooling:

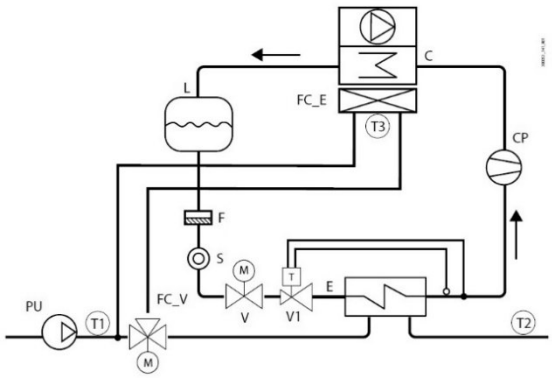
- User return temperature;
- Outside air temperature;

To manage capacity in free cooling mode:

- (according to the control probe used) Return/delivery water temperature.

Outputs used:

- 0-10 V to manage the common fan between free cooling and condenser;
- Free cooling valve On-Off control




| Ref. | Description |
|---|---|
| FC_E | Free cooling heat exchanger |
| C | Condenser |
| E | Evaporator |
| F | Filter-drier |
| L | Liquid receiver |
| CP | Compressor |
| S | Liquid sightglass |
| FC_V | Free cooling valve |
| PU | User pump |
| T1 | User return probe |
| T2 | User delivery probe |
| T3 | Outside temperature probe |
| V1 | Thermostatic expansion valve |
| V | Solenoid valve |

## 5.12.2 Air-cooled condensing unit with separate air circuit

Free cooling is enabled based on the comparison between the user return water temperature and the outside air temperature; this directly controls switching of the three-way valve, which allows the water returning from the user terminals to flow through the free cooling coil before entering the evaporator. Free cooling capacity is controlled by modulating the specific fan speed; in combined operation (free cooling + mechanical cooling), free cooling fan speed is always 100%.

Inputs used:

To enable free cooling:

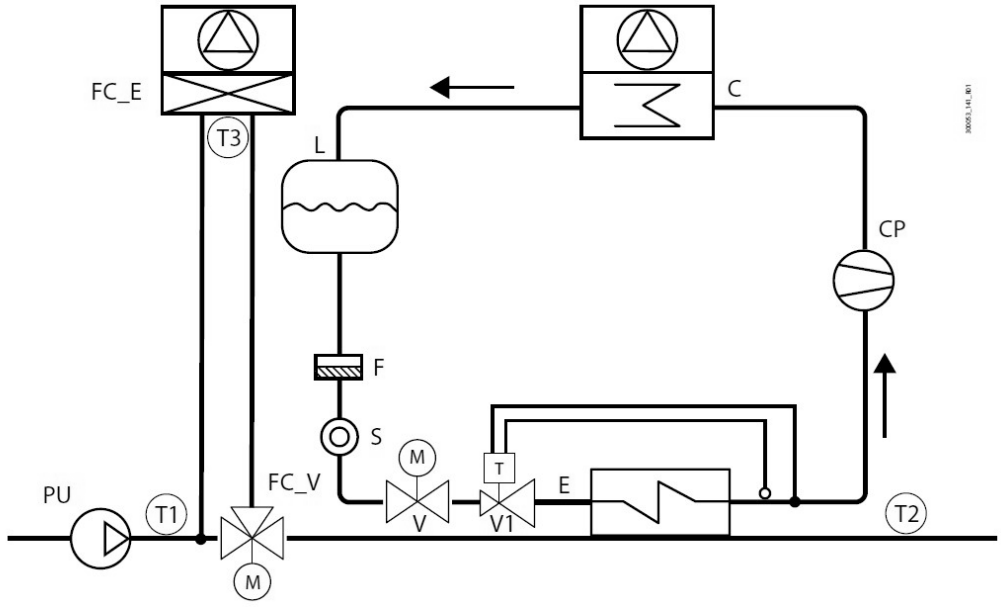
- User return temperature;
- Outside air temperature;

To manage capacity in free cooling mode:

- (according to the control probe used) Return/delivery water temp.

Outputs used:

- 0-10 V to manage the condenser fan (Y1: Circuit 1 and Circuit 2)
- 0-10 V to manage the free cooling fan (Y2: Circuit 1);
- Free cooling valve On-Off control.




| Ref. | Description |
|---|---|
| FC_E | Free cooling heat exchanger |
| C | Condenser |
| E | Evaporator |
| F | Filter-drier |
| L | Liquid receiver |
| CP | Compressor |
| S | Liquid sight glass |

| Ref. | Description |
|---|---|
| FC_V | Free cooling valve |
| PU | User pump |
| T1 | User return probe |
| T2 | User delivery probe |
| T3 | Outside temperature probe |
| V1 | Thermostatic expansion valve |
| V | Solenoid valve |

## 5.12.3 Water-cooled condensing unit

Free cooling is enabled based on the comparison between the user return water temperature and the source water temperature (Temp. IN source); this controls modulation of the three-way valve that mixes the source water with the water returning from the user terminals through the free cooling coil before entering the evaporator.

Free cooling capacity is controlled by modulating the three-way free cooling valve; in combined operation (free cooling + mechanical cooling), the three-way free cooling valve is always open at 100%.

Inputs used:

To enable free cooling:

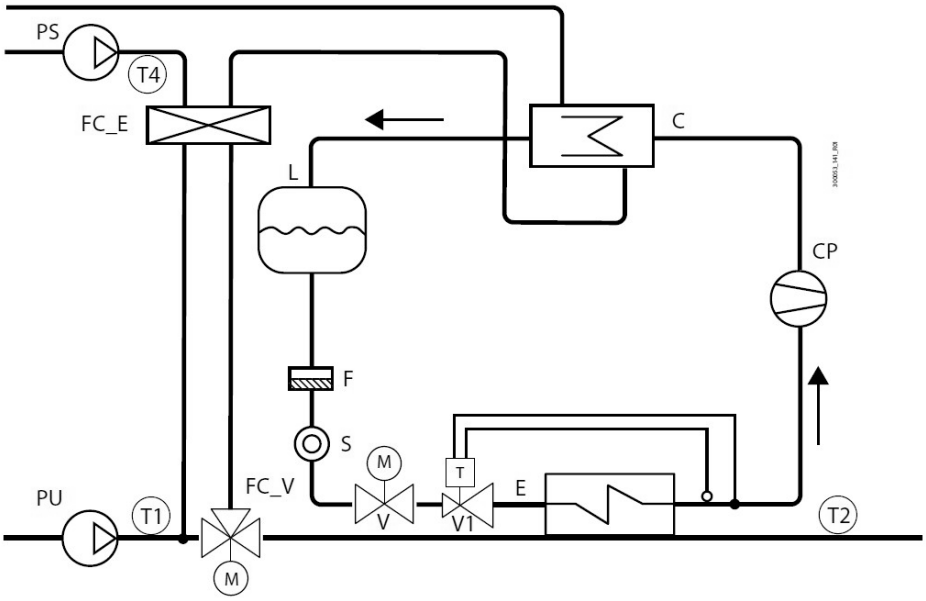
- User return temperature;
- Source inlet temperature;

To manage capacity in free cooling mode:

- (according to the control probe used) Return/delivery water temp.

Outputs used:

- 0-10 V to manage the condenser fan
- 0-10 V to manage the free cooling valve




| Ref. | Description |
|---|---|
| FC_E | Free cooling heat exchanger |
| C | Condenser |
| E | Evaporator |
| F | Filter-drier |
| L | Liquid receiver |
| CP | Compressor |
| FC_E | Free cooling heat exchanger |
| S | Liquid sightglass |

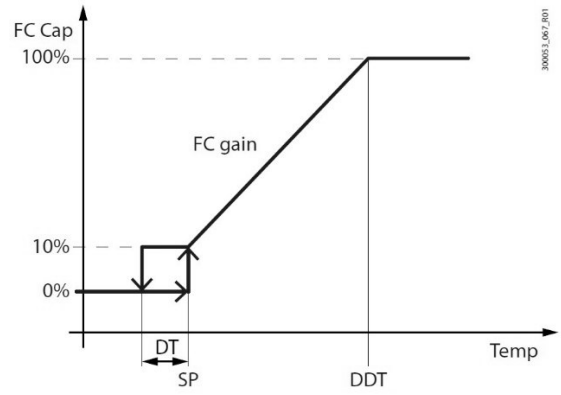
| Ref. | Description |
|---|---|
| V | Solenoid valve |
| FC_V | Free cooling valve |
| PU | User pump |
| PS | Source pump |
| T1 | User return probe |
| T2 | User delivery probe |
| T4 | Source return probe |
| V1 | Thermostatic expansion valve |

## 5.13 Free cooling functions

### 5.13.1 Dynamic control gain

This special function manages the balancing of capacity between the free cooling coil and the evaporator: this optimises control stability and fluidity.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | U070 | Free cooling: hysteresis | 1.5 | 0.0 | 99.9 | K |
| S | U069 | Free cooling: activation differential | 3.0 | 0.0 | 99.9 | K |
| S | U071 | Free cooling delta T | 8.0 | 0.0 | 99.9 | K |

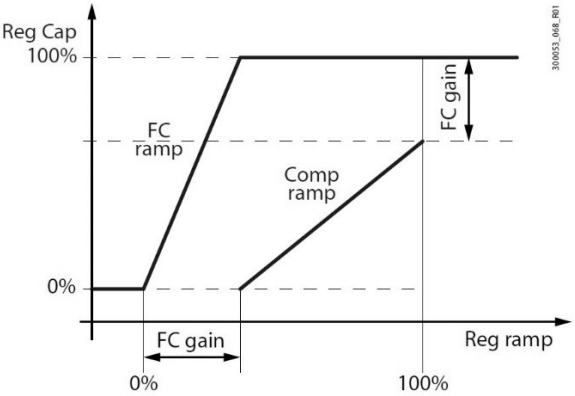



| Key | |
|---|---|
| FC Cap | Free cooling capacity |
| DT | Hysteresis |
| SP | Activation differential |
| DDT | Design free cooling delta T |
| Temp | User return temperature – source temp. |
| | |
| | |

Fig.5.y

The diagram shows the ideal behaviour of free cooling control (FC) in relation proportionally to its capacity; "Design free cooling delta T" is the temperature difference (water inlet - source) needed to cover the rated unit capacity using the free cooling coil only.

The value obtained - "FC gain" - is used to adapt the control ramp to the various cooling sources, as shown in the figure.




| Key | |
|---|---|
| Reg Cap | Control capacity |
| FC ramp | Free cooling control ramp |
| FC gain | Dynamic gain of free cooling control |
| Comp ramp | Compressor control ramp |
| Reg ramp | Control ramp |
| | |
| | |

Fig.5.z

The result is a perfect balance between the cooling capacities of the free cooling coil and the evaporator, in order to maintain the same proportionality in all load conditions. In other words, the same percentage of capacity is obtained for the same temperature variation in any load condition.

### 5.13.2 Effectiveness control

µChiller uses this function to start the compressors when the free cooling coil alone cannot bring the water to the set point, despite the fact that the source conditions theoretically allow for free cooling operation only. When this occurs, there may be a malfunction on the devices activated during free cooling; the compressors thus need to be started and free cooling disabled in order to ensure unit operation.

This situation is signalled by the "Free cooling warning".

### 5.13.3 Valve anti-block management

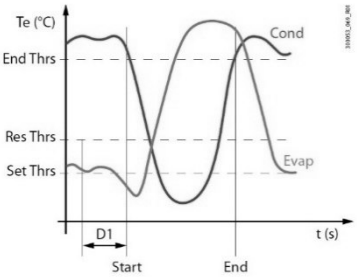
To avoid mechanical blocking of the valve, when a position (closed or open) is kept for more than a week, the valve is moved for 30 seconds to the opposite position.

## 5.14 Defrost

During heat pump operation on air/water units, the outdoor coil works as an evaporator. If the outside temperature is low, frost may form on the coil, resulting in reduced unit efficiency. To free the coil from frost and restore maximum efficiency, µChiller activates the defrost function. Activation depends on the value read by the reference probe (pressure transducer, low pressure side -> evaporation temperature in the graph), on the activation threshold being exceeded, and a possible delay.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S039 | Defrost: start temperature | -1.0 | -99.9 | 99.0 | °C |
| S | S040 | Defrost: reset start defrost delay threshold | 1.0 | S039 | 99.9 | °C |
| S | S041 | Defrost: delay at start-up | 30 | 0 | 999 | min |
| S | S042 | Defrost: end temperature | 52.0 | -999.9 | 999.9 | °C |
| S | S046 | Defrost: min duration | 1 | 0 | 99 | min |
| S | S047 | Defrost: max duration | 5 | 0 | 99 | min |

Example of defrost activation:




| Key | |
|---|---|
| T | Temperature |
| End Thrs | End defrost temperature |
| Res Thrs | Reset start defrost delay threshold |
| Set Thrs | Start defrost temperature |
| D1 | Defrost start delay |
| Start | Start defrost |
| End | End defrost |
| T_Cond | Condensing temperature |
| T_Evap | Evaporation temperature |

Fig.5.aa

If the defrost temperature does not exceed the reset threshold during the defrost start delay, then the defrost starts. It ends when the reference probe (pressure transducer, high pressure side -> condensing temperature in the graph) exceeds the end defrost temperature or the maximum defrost duration has elapsed.

**Note:** for optimal defrost management, it is recommended to set the start defrost temperature to the evaporation temperature value at which ice starts forming on the coil (-1.0°C / -1.5°C); the defrost start delay expresses the time needed to accumulate a layer of ice that requires defrosting (30- 60 minutes). Also see the paragraph “Sliding defrost”.

### 5.14.1 Defrost procedure

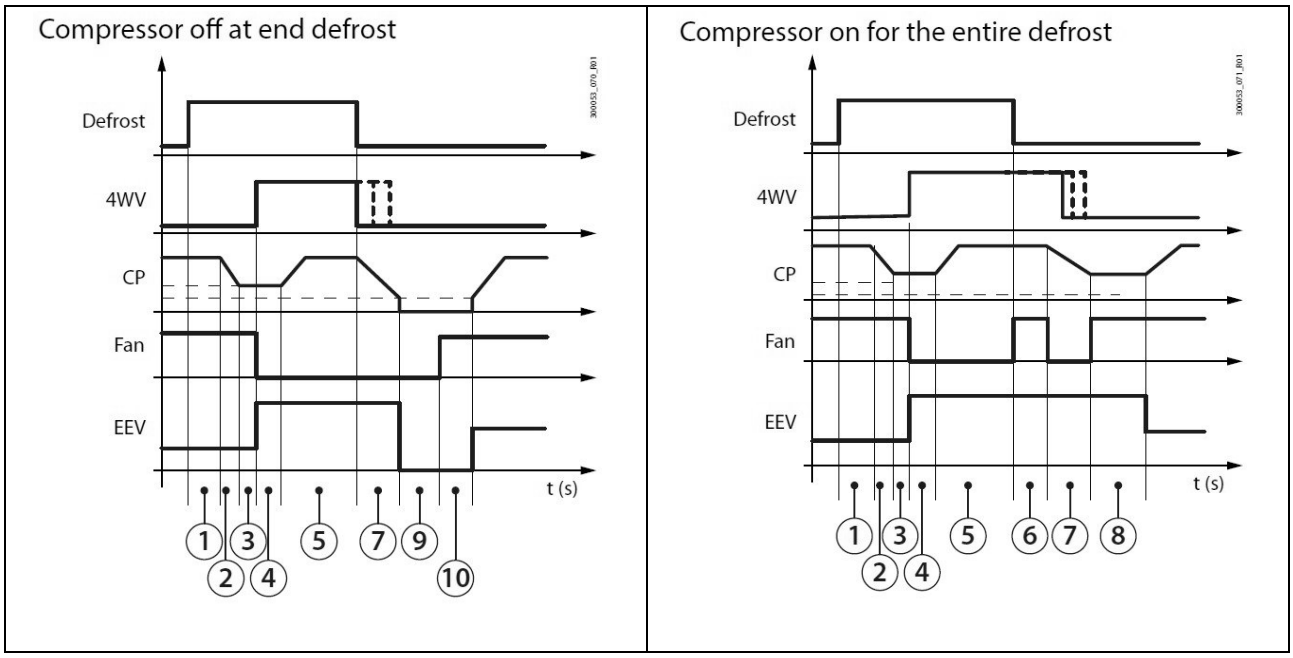
**Note:** in the following description:

- "case with compressor ON" indicates that the phase is only featured if defrost is set with the compressor On;
- "case with compressor off " indicates that the phase is only featured if defrost is set with the compressor Off;

End defrost can be managed in two ways:

- with the compressor off: the thermal inertia of the condenser is used to end the defrost;
- with the compressor on: to make the defrost as fast as possible.

| Use | Cod | Description | De | Mi | M | UO |
|---|---|---|---|---|---|---|
| M | S055 | Compressor after defrost 0/1=On/Off | 0 | 0 | 1 | - |




| Key | |
|---|---|
| Defrost | Defrost request |
| 4WV | Cycle reversal (4-way valve) |
| CP | Compressor capacity |
| Fan | Enable fans |
| EEV | Electronic expansion valve |

The control phases are described below.

### Synchronisation (1)

Once the defrost start condition is true, there is a fixed delay of 10 s to check whether the other circuit requires defrosting, to carry out a simultaneous defrost if needed.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S053 | Defrost synchronisation: 0=Independent 1=Separate 2=Simultaneous | 40.0 | 0.0 | 999.9 | rps |

### Decrease capacity to start defrosting (2)

Capacity at start defrost can be managed in two ways:

- stopping the compressors
- compressor running at minimum power. For circuits with on-off compressors, a single compressor kept on, while the compressor is kept at minimum capacity for circuits with BLDC compressor.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| M | S073 | Compressor status at start defrost 0/1=On/Off | 0 | 0 | 1 | - |
| S | S052 | BLDC compressor speed for cycle reversing in defrost | 40.0 | 0.0 | 999.9 | rps |

### Waiting time before reversing the cycle (3)

The 4-way valve is positioned in chiller mode to run the defrost, the fans are stopped and the compressor remains at the cycle-reversal speed for 5 seconds. Normally during this phase the electronic expansion valve tends to close, due to low superheat. As a result it is forced to the maximum opening so as to guarantee a constant fl ow of refrigerant and maximum defrost capacity.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S044 | Operation time at min capacity before cycle reversing | 20 | 0 | 999 | s |

### Cycle reversal and waiting time after reversal (4)

The 4-way valve is positioned in chiller mode to perform defrost, the fans switch off and the compressor remains at the cycle inversion speed for 5 seconds. Normally during this phase the electronic expansion valve tends to close due to low superheat. For this reason it is forced to the maximum opening to guarantee the constant flow of refrigerant and the maximum defrost power.

### Defrosting (5)

The actual defrosting procedure starts: the compressor delivers full capacity so as to defrost the outdoor coil. In this phase, the BLDC compressor goes to the speed set by the corresponding parameter, the electronic expansion valve remains at the maxi-mum opening and the fans remain off. The minimum/maximum defrost time and minimum time between two consecutive defrosts start counting in this phase.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S046 | Defrost: min duration | 1 | 0 | 99 | min |
| S | S047 | Defrost: max duration | 5 | 0 | 99 | min |
| S | S050 | Minimum delay between consecutive defrosts | 20 | 0 | 999 | min |
| S | S051 | BDLC compressor speed in defrost | 80.0 | 0.0 | 999.9 | rps |

The minimum defrost time protects compressors and circuit components from transients with high dynamics that are too close together. The maximum defrost time is a safety feature that avoids any abnormal conditions (end defrost threshold not reached - e.g. due to strong winds) that would stop the production of hot water required by the user terminals. The minimum time between consecutive defrosts is needed to prevent the unit from defrosting too frequently and thus only partly meeting demand. The actual defrosting procedure therefore ends after a maximum time or when the set condensing temperature is reached. If the compressor stops during this phase, the counters are reset.

### Dripping (case with compressor on) (6)

In this phase, the compressor remains on at the defrost speed, the electronic valve is opened to the maximum and the fans are started at maximum speed, and remain at this speed for the entire dripping phase. The duration of the dripping phase can be set.

| Use | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S048 | Dripping: duration | 90 | 0 | 999 | s |

### Decreased compressor capacity to end defrost (7)

Circuit capacity is reduced to the minimum and the cycle is reversed. In this phase, the fans are stopped (they are only activated if necessary for high pressure prevention) and the cycle reversing valve is moved to the heat pump position, controlled based on the difference between condensation and evaporation pressure: as soon as this pressure difference falls below the minimum differential for valve activation + 1 bar, the cycle is reversed (return to heat pump mode). If the reversing threshold is not reached, the cycle is reversed after a fixed time (60 s). The electronic expansion valve is opened to the maximum position.

| Use | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S054 | 4-way valve: pressure differential for reversing | 3.0 | 0.0 | 999.9 | bar |

### Waiting after cycle reversal (case with comp. ON) (8)

After reversing the cycle, there is a waiting time to ensure the correct flow of refrigerant; in this phase too, the ExV remains in the 100% open position.

| Use | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S045 | Operation time at min capacity after cycle reversing | 30 | 0.0 | 999.9 | s |

### Dripping (case with comp. OFF) (9)

In this phase, the compressors, the electronic expansion valve and the fans are stopped, waiting for the coil to complete defrosting due to thermal inertia and stop dripping. The duration of the dripping phase can be set.

| Use | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S0478 | Dripping: duration - 0=Dripping not performed | 90 | 0 | 999 | s |

### Post-dripping phase (case with comp. OFF) (10)

During this phase, the fans are started at 100% speed to completely expel any water still on the coil. The duration of the post- dripping phase can be set. At the end of the post- dripping phase, the circuit is reactivated in normal heat pump operation.

| Use | Code | Description | De | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S049 | Post-dripping: duration - 0=Post-dripping not performed | 30.0 | 0 | 999 | s |

### Quick start phase (case with comp. OFF) (11)

The compressor restarts based on the control request and the unit returns to normal operation. The start- up time is reduced so as to quickly bring compressor speed in line with the request.

| Use | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S056 | BLDC smart start: duration (*) | 30.0 | 0 | 999 | s |

(*) Shortened compressor start-up after defrost

This action assumes that the compressor has been off for a very short time, and therefore does not require complete pre-heating as is the case during normal start-up.

During the defrost phase (when the unit is in chiller mode), the fans are started if the condensing pressure exceeds the high condensing pressure alarm threshold - 5K.

| Use | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| M | C017 | Max high pressure threshold (HP) | 30.0 | 0 | 999 | s |

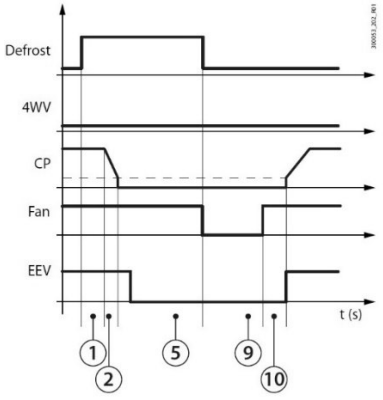
### 5.14.2 Defrost with fans

When the outside temperature allows (outside temperature > 6-7°C), the fans alone can be used to defrost the coil, without operating the compressors, so as to improve system energy efficiency. When the outside temperature is greater than or equal to the value of S069, the function is activated: in this condition, the waiting time S041 before the defrost request is halved (to facilitate defrosting with fans only).

**Note:** if parameter S069 is set to 0.0°C (32°F), the function is disabled.

| User | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S069 | Defrost with fans: outside temperature threshold<br>0.0=Function disabled | 0.0 | 0.0 | 99.9 | °C |

The defrost phases are as follows.




#### Synchronisation (1):

See the previous defrosts.

#### Compressor stopped to start defrosting (2)

The circuit with the BLDC compressor decreases its capacity to the minimum set value, and then switches off; on-off compressors are all switched off.

#### Defrosting (5)

The actual defrosting phase starts: the fans are started at 100% speed to heat the coil and melt the ice that has formed on the fins. Defrosting ends, once the minimum time has elapsed, when the evaporation temperature reaches 2°C, or after the maximum time. The minimum/maximum defrost time and minimum time between two consecutive defrosts start counting in this phase.

### Dripping (9)

The fans are stopped, waiting for the coil to complete defrosting due to thermal inertia and stop dripping. The dripping time can be set.

### Post-dripping (10)

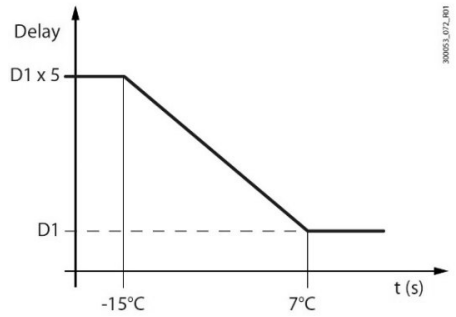
The fans are started at 100% speed to completely expel any water still on the coil. The post- dripping time can be set. At the end of the post-dripping phase, the circuit is reactivated in normal heat pump operation.

## 5.14.3 Sliding defrost

As the water vapour content in the air decreases as the outside temperature decreases, the time needed for a layer of ice to form that requires defrosting increases proportionally as the outside temperature decreases. Consequently, a function has been added, enabled when the outside air probe is available, which extends the defrost delay time, as shown in the following figure.

**Note:** the outside probe can be connected to inputs S3/S6 (setting: external temperature)

| User | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| M | Hc00 | S3 configuration<br>0=Not used<br>1=External temp.<br>2=Discharge temp.<br>3=Suction temp.<br>4=Source water delivery temperature | 0 | 0 | 3/4 | - |
| M | Hc03 | S6 configuration<br>0=Not used<br>1=Remote set point<br>2=External temperature | 0 | 0 | 2 | - |
| S | S041 | Defrost: delay at start-up | 30 | 0 | 999 | min |
| S | S043 | Enable sliding defrost: 0/1=No/Yes | 0 | 0 | 1 | - |




| Key | |
|---|---|
| Delay | Calculated defrost start delay |
| D1 | Defrost start delay |
| D1 x 5 | Maximum defrost delay (5 x D1) |
| Temp | Outside air temperature |
| | |
| | |
| | |
| | |

## 5.14.4 Defrost synchronisation

On two-circuit units, the defrosting procedures can be synchronised.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | S053 | Defrost synchronisation<br>0=Independent<br>1=Separate<br>2=Simultaneous | 0 | 0 | 2 | - |

### Independent

The two circuits start defrosting when the conditions are right, independently of each other. In other words, there is no synchronization and the circuits can defrost at the same time.

### Separate

When the first circuit requires defrosting:

- it start the defrost procedure;
- the other continues to work in heat pump mode;

When the first circuit has finished defrosting, the other is free to start.

### Simultaneous

This procedure is used if the air fl ow cooling the condenser coils on one circuit affects the other: during the defrost phase this would mean a considerable waste of energy to recover the heat lost in the air flow on the other circuit. The first circuit that requires defrosting thus puts the entire unit into defrost mode. If only one circuit starts defrosting, it completes all the defrost phases while the other remains off. If the other circuit one requires defrosting but is waiting until the defrost start delay elapses, the delay is ignored and the circuit also starts defrosting. When one of the circuits reaches the end defrost condition, it remains in the dripping phase until the other circuit ends the procedure. In this way, the dripping phase is performed by both circuits, preventing the air fl ow to the condenser coils from affecting the defrost procedure. During this phase, the compressor is stopped instead of operating at end defrost capacity, to prevent the waiting phase of the other compressor from bringing the user terminals to excessively low temperatures.

**Note:** if there is a common air circuit for the condensers, simultaneous defrosting is enabled automatically.

## 5.15 4-way valve management

A special function has been included to ensure correct control of the 4- way valve that reverses the refrigerating cycle. When there is a request to reverse the valve, the controller checks whether the pressure difference is higher than a threshold before activating the valve: if the difference is lower, the application waits until the compressor starts and then activates the valve when the pressure difference is reached.

| Use | Cod | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| M | S054 | 4-way valve: pressure differential for reversing | 3.0 | 0.0 | 999.9 | bar |

In the event of a power failure, the controller realigns the 4-way valve with the physical position of the valve at next start-up, considering the status of the circuit at the time of the power failure.

## 5.16 Condensing unit management

µChiller can manage condensing units with one or two circuits, air- or water-cooled, in cooling-only mode or reverse cycle with defrost. The mode is set using parameter U077.

Compared to a chiller unit, the condensing unit does not manage circulation of the primary fluid (pump, flow switch, etc.).

The control signal can be sent to the condensing unit in two ways:

- via BMS;
- via digital inputs

### Request via BMS

The request is written by an external device to register HR 331. If the unit is offline, the request is overridden to 0% and the devices are turned off.

### Request via digital inputs

There is a digital input for each compressor. Activation of the digital input corresponds to a control step request. The µChiller application manages rotation between steps, stop due to alarms, and timings.

For Legacy models only, the direct relationship between request digital inputs and compressor digital outputs can be set using parameter F023. In this case, rotation of the steps must be managed externally.

| Use | Code | Description | Def | Min | Max | UOM |
|---|---|---|---|---|---|---|
| S | F023 | Direct relationship DI - compressor DO (MC only) 0=No, 1=Yes | 0 | 0 | 1 | - |

# 6. PARAMETER TABLE

Notes:

- Levels: U=User; S=Service; M=Manufacturer; Display: the x indicates that the parameter can be accessed from the display terminal;
- R/W=read/write parameters; R=read-only parameters.

## 6.1 System

| User | Display | Code | Description | Def | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| Plt = System | | | | | | | | | |
| S | | U000 | User pump 1: maintenance hour threshold (x100) | 99 | 0 | 999 | h | R/W | HR002 |
| S | | U001 | User pump 1: reset hour counter | 0 | 0 | 1 | - | R/W | CS000 |
| S | x | U002 | User pump 1: operating mode 0=AUTO - 1=OFF - 2=ON | 0 | 0 | 2 | - | R/W | HR003 |
| S | | U003 | User pump 2: maintenance hour threshold (x100) | 99 | 0 | 999 | h | R/W | HR004 |
| S | | U004 | User pump 2: reset hour counter | 0 | 0 | 1 | - | R/W | CS001 |
| S | x | U005 | User pump 2: operating mode 0=AUTO - 1=OFF - 2=ON | 0 | 0 | 2 | - | R/W | HR005 |
| S | | U006 | Cooling set point: minimum limit | 5.0 | -99.9 | 999.9 | °C/°F | R/W | HR007 (2R) |
| S | | U007 | Cooling set point: maximum limit | 20.0 | -99.9 | 999.9 | °C/°F | R/W | HR009 (2R) |
| S | | U008 | Heating set point: minimum limit | 30.0 | 0.0 | 999.9 | °C/°F | R/W | HR01 (2R) |
| S | | U009 | Heating set point: maximum limit | 45.0 | 0.0 | 999.9 | °C/°F | R/W | HR011 (2R) |
| S | | U010 | Enable set point compensation - 0/1=no/yes | 0 | 0 | 1 | - | R/W | CS002 |
| S | | U011 | Cooling compensation: start | 25.0 | -99.9 | 999.9 | °C/°F | R/W | HR015 (2R) |
| S | | U012 | Cooling compensation: end | 35.0 | -99.9 | 999.9 | °C/°F | R/W | HR017 (2R) |
| S | | U013 | Cooling compensation: maximum value | 5.0 | -99.9 | 999.9 | K/R | R/W | HR019 (2R) |
| S | | U014 | Heating compensation: start | 5.0 | -99.9 | 999.9 | °C/°F | R/W | HR021 (2R) |
| S | | U015 | Heating compensation: end | -10 | -99.9 | 999.9 | °C/°F | R/W | HR023 (2R) |
| S | | U016 | Heating compensation: maximum value | 5.0 | -99.9 | 999.9 | K/R | R/W | HR025 (2R) |
| S | | U017 | Enable time band - 0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS003 |
| S | | U018 | Time band: start hours | 17 | 0 | 23 | h | R/W | HR027 |
| S | | U019 | Time band: start minutes | 30 | 0 | 59 | min | R/W | HR028 |
| S | | U020 | Time band: end hours | 7 | 0 | 23 | h | R/W | HR029 |
| S | | U021 | Time band: end minutes | 0 | 0 | 59 | min | R/W | HR030 |
| S | | U022 | Type of changeover in time band 0=Off - 1=2nd set point | 0 | 0 | 1 | - | R/W | CS004 |
| U | x | U023 | 2nd cooling set point | 10.0 | U006 | U007 | °C/°F | R/W | HR031(2R) |
| U | x | U024 | 2nd heating set point | 35.0 | U008 | U009 | °C/°F | R/W | HR033(2R) |
| S | | U025 | Remote set point: analogue input 0=0-5V - 1=0-10V - 2=4-20 mV | 0 | 0 | 2 | - | R/W | HR035 |
| S | | U026 | Remote set point: min value | 5.0 | -99.9 | 999.9 | °C/°F | R/W | HR037(2R) |
| S | | U027 | Remote set point: max value | 35.0 | -99.9 | 99.9 | °C/°F | R/W | HR039(2R) |
| S | | U028 | Remote set point: offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR043(2R) |
| S | x | U031 | High water temp. alarm: offset | 10.0 | 0.0 | 99.9 | K/R | R/W | HR049(2R) |
| S | x | U032 | High water temp. alarm: delay at start-up | 15 | 0 | 99 | min | R/W | HR051 |
| S | x | U033 | High water temp. alarm: delay in operation | 180 | 0 | 999 | s | R/W | HR052 |
| S | | U034 | Operating mode changeover 0=Keypad - 1=Digital input | 0 | 0 | 1 | - | R/W | CS005 |
| S | | U035 | Cooling/heating changeover: delay | 15 | 0 | 999 | min | R/W | HR053 |
| S | | U036 | Control probe at start-up 0=Return - 1=Delivery | 0 | 0 | 1 | - | R/W | CS006 |
| S | | U037 | PID control delay at start-up/operation | 180 | 0 | 999 | s | R/W | HR054 |
| S | | U038 | Control probe in operation 0=Return - 1=Delivery | 1 | 0 | 1 | - | R/W | CS007 |
| S | | U039 | PID at start-up: Kp | 6.0 | 0.0 | 999.9 | - | R/W | HR055(2R) |
| S | | U040 | PID at start-up: Ti 0: integral action disabled | 180 | 0 | 999 | s | R/W | HR057 |
| S | | U041 | PID at start-up: Td 0: derivative action disabled | 0 | 0 | 99 | s | R/W | HR058 |
| S | | U042 | PID in operation: Kp | 10.0 | 0.0 | 999.9 | - | R/W | HR059(2R) |
| S | | U043 | PID in operation: Ti 0: integral action disabled | 120 | 0 | 999 | s | R/W | HR061 |
| S | | U044 | PID in operation: Td 0: derivative action disabled | 3 | 0 | 99 | s | R/W | HR062 |
| S | | U045 | User pump flow alarm: delay at start-up | 10 | 0 | 999 | s | R/W | HR063 |
| S | | U046 | User pump flow alarm: delay in operation | 3 | 0 | 99 | s | R/W | HR064 |
| S | | U047 | Compressor activation delay after user pump | 30 | 0 | 999 | s | R/W | HR065 |
| S | | U048 | User pump shutdown delay after compressor | 180 | 0 | 999 | s | R/W | HR066 |
| S | | U049 | User pump rotation time | 12 | 0 | 999 | h | R/W | HR067 |
| S | | U050 | User side frost protection: alarm threshold | -0.8 | -99.9 | 999.9 | °C/°F | R/W | HR068 (2R) |
| S | | U051 | User side frost protection: differential | 30.0 | 0.0 | 999.9 | K/R | R/W | HR070 (2R) |

| User | Disp. | Code | Description | Def | Min. | Max. | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| S | | U052 | User-side frost protection: delay time at 1K | 30 | 0 | 999 | s | R/W | HR072 |
| S | | U053 | Unit OFF: frost protection set point | 4.0 | -99.9 | 999.9 | °C/°F | R/W | HR073 (2R) |
| S | | U054 | Unit OFF: frost protection differential | 2.0 | 0.0 | 99.9 | K/R | R/W | HR075 (2R) |
| S | | U055 | User side return temp. probe: offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR079 (2R) |
| S | | U056 | User side delivery temp. probe: offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR083 (2R) |
| S | | U057 | Remote alarm: input logic - 0/1=NC/NO | 0 | 0 | 1 | - | R/W | CS008 |
| S | | U058 | Cooling/heating input: logic - 0/1=NO/NC | 1 | 0 | 1 | - | R/W | CS009 |
| S | x | U059 | Remote ON/OFF: input logic - 0/1=NO/NC | 1 | 0 | 1 | - | R/W | CS010 |
| S | | U060 | User pump flow switch: input logic - 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS011 |
| S | | U061 | User pump overload protector: input logic 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS012 |
| S | | U062 | 2nd set point: input logic - 0/1=NO/NC | 1 | 0 | 1 | - | R/W | CS013 |
| M | | U063 | User pump: output logic - 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS014 |
| S | | U064 | Global alarm relay: output logic - 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS015 |
| S | | U065 | Free cooling valve: output logic - 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS016 |
| M | | U066 | Frost protection heater: output logic - 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS017 |
| S | | U067 | Alarm relay configuration - 0/1=Control alarms/All | 0 | 0 | 1 | - | R/W | CS018 |
| S | | U068 | Free cooling: enable - 0/1=no/yes | 0 | 0 | 1 | - | R/W | CS019 |
| S | | U069 | Free cooling: activation differential | 3.0 | 0.0 | 99.9 | K/R | R/W | HR085 (2R) |
| S | | U070 | Free cooling: hysteresis | 1.5 | 0.0 | 99.9 | K/R | R/W | HR087 (2R) |
| S | | U071 | Design free cooling delta T | 8.0 | 0.0 | 99.9 | K/R | R/W | HR089 (2R) |
| S | | U072 | Water free cooling: valve closing threshold | 5.0 | -999.9 | 999.9 | °C/°F | R/W | HR091 (2R) |
| S | | U073 | Water free cooling: valve closing differential | 3.0 | 0.0 | 99.9 | K/R | R/W | HR093 (2R) |
| M | | U074 | Free cooling type<br>0=Air - 1=Remote coil - 2=Water | 0 | 0 | 2 | - | R/W | HR095 |
| S | | U075 | Frost protection type<br>0=Heater - 1=Pump - 2=Heater/Pump | 2 | 0 | 2 | - | R/W | HR096 |
| M | | U076 | Number of user pumps | 1 | 1 | 2 | - | R/W | HR097 |
| M | | U077 | Type of unit<br>0= CH; 1= HP; 2= CH/HP<br>3= Condensing unit CH<br>4= Condensing unit CH/HP | 0 | 0 | 4 | - | R/W | HR098 |
| S | | U078 | Unit pump in standby: enable On-Off cycles<br>0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS080 |
| S | | U079 | Unit pump in standby: On time | 3 | 1 | 15 | min | R/W | HR709 |
| S | | U080 | Unit pump in standby: Off time | 15 | 3 | 99 | min | R/W | HR710 |
| S | | U081 | Pressure alarm reset configuration | 7 | 0 | 7 | - | R/W | HR239 |
| M | | U082 | Frost protection type<br>0 = Evaporation temperature<br>1 = Water delivery temperature | 0 | 0 | 1 | - | R/W | CS093 |

## 6.2 Compressor

| User | Displ. | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| CMP=Compressor | | | | | | | | | |
| S | | C000 | Comp. 1 circuit 1: maintenance hour threshold(x100) | 99 | 0 | 999 | h | R/W | HR153 |
| S | | C001 | Comp. 1 circuit 1: reset hour counter | 0 | 0 | 1 | - | R/W | CS023 |
| S | x | C002 | Comp. 1 circuit 1: operating mode<br>-0=AUTO - 1=OFF - 2=ON | 0 | 0 | 2 | - | R/W | HR154 |
| S | | C003 | Comp. 2 circuit 1: maintenance hour threshold(x100) | 99 | 0 | 999 | h | R/W | HR155 |
| S | | C004 | Comp. 2 circuit 1: reset hour counter | 0 | 0 | 1 | - | R/W | CS024 |
| S | x | C005 | Comp. 1 circuit 2: operating mode<br>0=AUTO - 1=OFF - 2=ON | 0 | 0 | 2 | - | R/W | HR156 |
| S | | C006 | Comp. 1 circuit 2: maintenance hour threshold(x100) | 99 | 0 | 999 | h | R/W | HR157 |
| S | | C007 | Comp. 2 circuit 1: reset hour counter | 0 | 0 | 1 | - | R/W | CS025 |
| S | x | C008 | Comp. 2 circuit 1: operating mode<br>0=AUTO - 1=OFF - 2=ON | 0 | 0 | 2 | - | R/W | HR158 |
| S | | C009 | Comp. 2 circuit 2: maintenance hour threshold(x100) | 99 | 0 | 999 | h | R/W | HR159 |
| S | | C010 | Comp. 2 circuit 2: reset hour counter | 0 | 0 | 1 | - | R/W | CS026 |
| S | x | C011 | Comp. 2 circuit 2: operating mode<br>0=AUTO - 1=OFF - 2=ON | 0 | 0 | 2 | - | R/W | HR160 |
| M | | C012 | Min compressor on time | 180 | 30 | 999 | s | R/W | HR162 |
| M | | C013 | Min compressor off time | 60 | 30 | 999 | s | R/W | HR163 |
| M | | C014 | Min time between consecutive compressor starts | 360 | 300 | 999 | s | R/W | HR164 |
| M | | C017 | Max high pressure threshold (HP) | 65.0 | 0.0 | 999.9 | °C/°F | R/W | HR324 (2R) |
| M | | C018 | Min low pressure threshold (LP) | 0.2 | -99.9 | 99.9 | bar | R/W | HR326 (2R) |
| M | | C020 | Maximum circuit destabilisation time | 240 | 5 | 999 | min | R/W | HR168 |
| S | | C022 | Circuit 1: discharge temp. offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR170 (2R) |
| S | | C023 | Circuit 1: suction temp. offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR172 (2R) |
| S | | C024 | Circuit 2: discharge temp. offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR174 (2R) |
| S | | C025 | Circuit 2: suction temp. offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR176 (2R) |

| User | Disp | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| S | | C026 | Circuit 1: condensation pressure offset | 0.0 | -99.9 | 99.9 | bar | R/W | HR178 (2R) |
| S | | C027 | Circuit 1: evaporation pressure offset | 0.0 | -99.9 | 99.9 | bar | R/W | HR180 (2R) |
| S | | C028 | Circuit 1: condensing temp. offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR182 (2R) |
| S | | C029 | Circuit 1: evaporation temp. offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR184 (2R) |
| S | | C030 | Circuit 2: condensation pressure offset | 0.0 | -99.9 | 99.9 | bar | R/W | HR186 (2R) |
| S | | C031 | Circuit 2: evaporation pressure offset | 0.0 | -99.9 | 99.9 | bar | R/W | HR188 (2R) |
| S | | C032 | Circuit 2: condensing temp. offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR190 (2R) |
| S | | C033 | Circuit 2: evaporation temp. offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR192 (2R) |
| M | | C034 | HP pressure switch: input logic - 0/1=NC/NO | 0 | 0 | 1 | - | R/W | CS027 |
| M | | C035 | Compressor overload protector: input logic 0/1=NC/NO | 0 | 0 | 1 | - | R/W | CS028 |
| M | | C036 | Compressor: output logic - 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS029 |
| M | | C037 | Evaporation pressure: probe type - 0=0-5V - 1=4-20mA | 0 | 0 | 1 | - | R/W | HR194 |
| M | | C038 | Evaporation pressure probe: min value | 0.0 | -1.0 | 99.9 | bar | R/W | HR195 (2R) |
| M | | C039 | Evaporation pressure probe: max value | 17.3 | 0.0 | 99.9 | bar | R/W | HR197 (2R) |
| M | | C040 | Condensation pressure: probe type - 0=0-5V 1=4- 20mA | 0 | 0 | 1 | - | R/W | HR199 |
| M | | C041 | Condensation pressure probe: min value | 0.0 | -1.0 | 99.9 | bar | R/W | HR200 (2R) |
| M | | C042 | Condensation pressure probe: max value | 45.0 | 0.0 | 99.9 | bar | R/W | HR202 (2R) |
| M | | C044 | Enable destabilisation - 0/1=No/Yes | 1 | 0 | 1 | - | R/W | CS030 |
| S | | C045 | Refrigerant 3=R407C - 4=R410a - 6=R290 - 10=R744 - 22=R32 | 4 | 0 | 99 | - | R | IR038 |
| M | | C046 | No. of unit circuits | 1 | 1 | 2 | - | R/W | HR206 |
| M | | C047 | Type of compressors used 0=1 On/Off - 1=2 On/Off - 2=1 BLDC - 3= 1 BLDC+On/Off | 0 | 0 | 3 | - | R/W | HR207 |
| M | | C049 | LP pressure switch: alarm delay from compressor start | 90 | 0 | 999 | - | R/W | HR269 |
| M | | C050 | LP pressure switch: alarm delay in steady operation | 15 | 0 | 999 | - | R/W | HR269 |
| M | | C051 | HP pressure switch: input logic 0=NC 1=NO | 0 | 0 | 1 | - | R/W | CS76 |

### 6.2.1 Inverter compressor

| User | Dis | Code | Description | Def | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| S | | P000 | Min evaporation temp.: custom limit | -25.0 | -99.9 | 999.9 | °C/°F | R/W | HR335 (2R) |
| S | | P001 | Max condensing temp.: custom limit | 70.0 | -99.9 | 999.9 | °C/°F | R/W | HR337 (2R) |
| M | | P003 | Out of envelope alarm delay | 120 | 0 | 999 | s | R/W | HR340 |
| M | | P004 | Low pressure differential alarm delay | 60 | 0 | 999 | s | R/W | HR341 |
| M | | P006 | Oil recovery: min request for activation | 35.0 | 0.0 | 100.0 | % | R/W | HR344 (2R) |
| M | | P007 | Oil recovery: min speed for activation | 35.0 | 0.0 | 999.9 | rps | R/W | HR346 (2R) |
| M | | P008 | Oil recovery: comp. operating time at low speed | 15 | 0 | 999 | min | R/W | HR348 |
| M | | P009 | Oil recovery: force comp. speed time | 3 | 0 | 999 | min | R/W | HR349 |
| M | | P010 | Oil recovery: force comp. speed value | 50.0 | 0.0 | 999.9 | rps | R/W | HR350 (2R) |
| M | | P011 | Oil equalisation: solenoid valve opening time at start-up | 30 | 0 | 999 | s | R/W | HR352 |
| M | | P012 | Oil equalisation: solenoid valve opening time | 3 | 0 | 999 | s | R/W | HR353 |
| M | | P013 | Oil equalisation: min solenoid valve closed time | 1 | 0 | 999 | min | R/W | HR354 |
| M | | P014 | Oil equalisation: max solenoid valve closed time | 15 | 0 | 999 | min | R/W | HR355 |
| M | | P015 | Oil equalisation: solenoid valve closed time increment | 20 | 0 | 999 | min | R/W | HR356 |
| S | | P016 | Oil equalisation valve: output logic - 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS66 |
| M | | P017 | Enable oil equalisation valve - 0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS67 |
| M | | P018 | Enable oil recovery - 0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS68 |
| S | x | P019 | BLDC compressor circ.1: operating mode 0=AUTO; 1=0%, …101=100% | 0 | 010 1- | R/W | HR357 | | |
| S | x | P020 | BLDC compressor circ.2: operating mode 0=AUTO; 1=0%, …101=100% | 0 | 0 | 101 | - | R/W | HR358 |
| M | | P021 | Max. deltaP at start-up | 900.0 | 0.0 | 2000.0 | kPa | R/W | HR359 (2R) |
| M | | P022 | EVD: max pre-opening time for pressureequalisation | 10 | 0 | 999 | s | R/W | HR361 |
| M | | P023 | EVD: pre-opening value for pressure equalisation | 50.0 | 0.0 | 100.0 | % | R/W | HR362 (2R) |
| M | | P024 | Start-up speed | 50.0 | 20.0 | 120.0 | rps | R/W | HR363 (2R) |
| M | | P025 | Custom speed: max value | 120.0 | 0.0 | 999.9 | rps | R/W | HR365 (2R) |
| M | | P026 | Custom speed: min value | 20.0 | 0.0 | 999.9 | rps | R/W | HR367 (2R) |
| S | | P030 | Skip frequency: centre point [010] | 0.0 | 0.0 | 999.9 | Hz | R/W | HR375 (2R) |
| S | | P031 | Skip frequency: band [011] | 0.0 | 0.0 | 999.9 | Hz | R/W | HR377 (2R) |
| M | | P032 | Enable motor over-temperature alarm (PTC) [027] - 0/1=No/Yes | 0 | 0 | 1 | | R/W | HR379 |
| M | | P033 | Motor over-temperature delay delay (PTC) [028] | 0 | 0 | 999 | s | R/W | HR380 |
| M | | P034 | Enable crankcase heater function - 0/1=No/Yes | 0 | 0 | 1 | | R/W | CS69 |

## 6.3 Electronic valve

| User | Disp. | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| EEU =Valve | | | | | | | | | |
| S | | E000 | ExV circuit 1: manual mode - 0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS020 |
| S | | E001 | ExV circuit 1: steps in manual mode | 0 | 0 | 65535 | steps | R/W | HR099 |
| S | | E002 | ExV circuit 2: manual mode - 0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS021 |
| S | | E003 | ExV circuit 2: steps in manual mode | 0 | 0 | 65535 | steps | R/W | HR100 |
| S | x | E004 | SH in cooling: set point | 6.0 | -40.0 | 180.0 | K/R | R/W | HR101 (2R) |
| S | | E005 | SH in cooling: Kp | 15.0 | 0.0 | 800.0 | - | R/W | HR103 (2R) |
| S | | E006 | SH in cooling: Ti | 150 | 0.0 | 1000.0 | s | R/W | HR105 (2R) |
| S | | E007 | SH in cooling: Td | 1.0 | 0.0 | 800.0 | s | R/W | HR107 (2R) |
| S | x | E008 | SH in heating: set point | 6.0 | -40.0 | 180.0 | K/R | R/W | HR109 (2R) |
| S | | E009 | SH in heating: Kp | 15.0 | 0.0 | 800.0 | - | R/W | HR111 (2R) |
| S | | E010 | SH in heating: Ti | 150 | 0.0 | 1000.0 | s | R/W | HR113 (2R) |
| S | | E011 | SH in heating: Td | 1.0 | 0.0 | 800.0 | s | R/W | HR115 (2R) |
| S | | E012 | LowSH in cooling: threshold | 1.0 | -40.0 | 180.0 | K/R | R/W | HR117 (2R) |
| S | | E013 | LowSH in cooling: Ti | 10.0 | 0.0 | 800.0 | s | R/W | HR119 (2R) |
| S | | E014 | LowSH in heating: threshold | 1.0 | -40.0 | 180.0 | K/R | R/W | HR121 (2R) |
| S | | E015 | LowSH in heating: Ti | 10.0 | 0.0 | 800.0 | s | R/W | HR123 (2R) |
| S | | E016 | LOP in cooling: threshold | -5.0 | -60.0 | 200.0 | °C/°F | R/W | HR125 (2R) |
| S | | E017 | LOP in cooling: Ti | 5.0 | 0.0 | 800.0 | s | R/W | HR127 (2R) |
| S | | E018 | LOP in heating: threshold | -50.0 | -60.0 | 200.0 | °C/°F | R/W | HR129 (2R) |
| S | | E019 | LOP in heating: Ti | 5.0 | 0.0 | 800.0 | s | R/W | HR131 (2R) |
| M | | E020 | MOP in cooling: threshold | 30.0 | -60.0 | 200.0 | °C/°F | R/W | HR133 (2R) |
| M | | E021 | MOP in cooling: Ti | 15.0 | 0.0 | 800.0 | s | R/W | HR135 (2R) |
| M | | E022 | MOP in heating: threshold | 20.0 | -60.0 | 200.0 | °C | R/W | HR137 (2R) |
| M | | E023 | MOP in heating: Ti | 15.0 | 0.0 | 800.0 | s | R/W | HR139 (2R) |
| M | | E024 | LowSH: alarm delay time | 300 | 0 | 18000 | s | R/W | HR141 |
| M | | E025 | LOP: alarm delay time | 300 | 0 | 18000 | s | R/W | HR142 |
| M | | E026 | MOP: alarm delay time | 300 | 0 | 18000 | s | R/W | HR143 |
| M | | E032 | Valve opening % at start-up (EVAP/EEV capacity ratio) in cooling | 100 | 0 | 100 | % | R/W | HR144 |
| M | | E033 | Valve opening % at start-up (EVAP/EEV capacity ratio) in heating | 100 | 0 | 100 | % | R/W | HR145 |
| M | | E034 | Control delay after pre-positioning | 6 | 3 | 18000 | s | R/W | HR146 |
| M | | E046 | EVD Evolution: valve (1=CAREL EXV, ...) (*) | 1 | 1 | 35 | - | R/W | HR048 |
| S | | E047 | ExV driver (0=Disabled, 1=Built-in, 2=EVD Evolution) | 0 | 0 | 2 | - | R/W | HR328 |

## 6.4 Source

| User | Display | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| Src = Source | | | | | | | | | |
| S | | S000 | Source pump 1: maintenance hour threshold (x100) | 99 | 0 | 999 | h | R/W | HR209 |
| S | | S001 | Source pump 1: reset hour counter | 0 | 0 | 1 | - | R/W | CS031 |
| S | x | S002 | Source pump 1: operating mode 0=AUTO - 1=OFF - 2=ON | 0 | 0 | 2 | - | R/W | HR210 |
| S | | S008 | Source fan 1 circuit 1: maintenance hour threshold (X100) | 99 | 0 | 999 | h | R/W | HR214 |
| S | | S009 | Source fan 1 circuit 1: reset hour counter | 0 | 0 | 1 | - | R/W | CS033 |
| S | x | S010 | Source ON/OFF fan 1 circuit 1: operating mode - 0=AUTO - 1=OFF - 2=ON | 0 | 0 | 2 | - | R/W | HR215 |
| S | x | S011 | Source modulating fan circuit 1: operating mode - 0=AUTO - 1=0% - 2=1%, ..101=100% | 0 | 0 | 101 | - | R/W | HR216 |
| S | | S012 | Source fan 1 circuit 2: maintenance hour threshold (X100) | 99 | 0 | 999 | h | R/W | HR217 |
| S | | S013 | Source fan 1 circuit 2: reset hour counter | 0 | 0 | 1 | - | R/W | CS034 |
| S | x | S014 | Source ON/OFF fan circuit 2: operating mode 0=AUTO - 1=OFF - 2=ON | 0 | 0 | 2 | - | R/W | HR218 |
| S | x | S015 | Source modulating fan circuit 2: operating mode 0=AUTO - 1=0% - 2=1%, ..101=100% | 0 | 0 | 101 | - | R/W | HR219 |
| S | | S016 | Source fan: cold climate temperature threshold | -0.5 | -999.9 | 999.9 | °C/°F | R/W | HR220 (2R) |
| S | | S017 | Source fan: min cold climate speed | 10.0 | 0.0 | 100.0 | % | R/W | HR222 (2R) |
| S | | S018 | Source fan: cold climate speed at start-up | 50.0 | 0.0 | 100.0 | % | R/W | HR224 (2R) |
| S | | S019 | Source fan: cold climate speed at start-up time | 5 | 0 | 300 | s | R/W | HR226 |
| S | x | S020 | Enable noise reduction - 0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS035 |
| S | | S021 | Noise reduction time band: start hours | 22 | 0 | 23 | h | R/W | HR167 |
| S | | S022 | Noise reduction time band: start minutes | 30 | 0 | 59 | min | R/W | HR212 |
| S | | S023 | Noise reduction time band: end hours | 8 | 0 | 23 | h | R/W | HR041 |
| S | | S024 | Noise reduction time band: end minutes | 30 | 0 | 59 | min | R/W | HR042 |
| S | | S025 | Source fan: noise reduction set point | 45.0 | 0.0 | 999.9 | °C/°F | R/W | HR231 (2R) |
| S | | S026 | Compressor start delay after pump start | 30 | 0 | 999 | s | R/W | HR233 |

| User | Displ. | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| S | | S027 | Pump shutdown delay after compressor off | 10 | 0 | 999 | s | R/W | HR234 |
| S | | S028 | Source fan in cooling: set point | 30.0 | -999.9 | 999.9 | °C/°F | R/W | HR235 (2R) |
| S | | S029 | Source fan in heating: set point | 10.0 | 0.0 | 99.9 | °C/°F | R/W | HR237 (2R) |
| S | | S031 | Source fan in cooling: set point at start-up | 45.0 | 0.0 | 999.9 | °C/°F | R/W | HR241 (2R) |
| S | | S032 | Source fan: delay at start-up in cooling | 240 | 0 | 999 | s | R/W | HR243 |
| S | | S034 | Source fan: differential in cooling | 15.0 | 0.0 | 99.9 | K | R/W | HR246 (2R) |
| S | | S035 | Source fan: differential in heating | 5.0 | 0.0 | 99.9 | K | R/W | HR248 (2R) |
| S | | S036 | Modulating source fan: min speed value | 20.0 | 0.0 | 100.0 | % | R/W | HR250 (2R) |
| S | | S037 | Modulating source fan: max speed value | 80.0 | 0.0 | 100.0 | % | R/W | HR252 (2R) |
| S | | S039 | Defrost: start temperature | -1.0 | -99.9 | 99.0 | °C/°F | R/W | HR254 (2R) |
| S | | S040 | Defrost: reset start defrost delay threshold | 1.0 | S039 | 99.9 | °C/°F | R/W | HR256 (2R) |
| S | | S041 | Defrost: delay at start-up | 30 | 0 | 999 | min | R/W | HR258 |
| S | | S042 | Defrost: end temperature | 52.0 | -999.9 | 999.9 | °C/°F | R/W | HR259 (2R) |
| S | | S043 | Enable sliding defrost - 0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS037 |
| S | | S044 | Operation time at min capacity before cycle reversing | 20 | 0 | 999 | s | R/W | HR261 |
| S | | S045 | Operation time at min capacity after cycle reversing | 30 | 0 | 999 | s | R/W | HR262 |
| S | | S046 | Defrost: min duration | 1 | 0 | 99 | min | R/W | HR263 |
| S | | S047 | Defrost: max duration | 5 | 0 | 99 | min | R/W | HR264 |
| S | | S048 | Dripping: duration - 0=Dripping not performed | 90 | 0 | 999 | s | R/W | HR265 |
| S | | S049 | Post-dripping: duration - 0=Post-dripping not performed | 30 | 0 | 999 | s | R/W | HR266 |
| S | | S050 | Minimum delay between consecutive defrosts | 20 | 0 | 999 | min | R/W | HR267 |
| S | | S051 | BDLC compressor speed in defrost | 80.0 | 0.0 | 999.9 | rps | R/W | HR382 (2R) |
| S | | S052 | BLDC compressor speed for cycle reversing in defrost | 40.0 | 0.0 | 999.9 | rps | R/W | HR384 (2R) |
| S | | S053 | Defrost synchronisation - 0=Independent - 1=Separate - 2=Simultaneous | 0 | 0 | 2 | - | R/W | HR272 |
| M | | S054 | 4-way valve: pressure differential for reversing | 3.0 | 0.0 | 999.9 | bar | R/W | HR274 (2R) |
| M | | S055 | Compressor after defrost - 0/1=On/Off | 0 | 0 | 1 | - | R/W | CS038 |
| S | | S056 | BLDC smart start: duration (*) | 20 | 0 | 999 | s | R/W | HR278 |
| S | | S057 | Source frost protection: alarm threshold | -0.8 | -999.9 | 999.9 | K/R | R/W | HR279 (2R) |
| S | | S058 | Source frost protection: alarm differential | 30.0 | 0.0 | 999.9 | K/R | R/W | HR281 (2R) |
| S | | S059 | Frost protection alarm delay at threshold -1K | 30 | 0 | 999 | s | R/W | HR283 |
| S | | S060 | Source: outside air temperature probe offset | 0.0 | -99.9 | 99.9 | K/R | R/W | HR284 (2R) |
| M | | S061 | Source fan: output logic - 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS039 |
| M | | S062 | Source pump: output logic - 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS040 |
| S | | S063 | Reversing valve: output logic - 0/1=NO/NC | 0 | 0 | 1 | - | R/W | CS041 |
| S | | S064 | Type of source air circuit 0=Independent - 1=Common | 0 | 0 | 1 | - | R/W | CS042 |
| S | | S065 | Type of source fan - 0/1=Modulating/ON-OFF | 0 | 0 | 1 | - | R/W | CS044 |
| S | | S068 | Unit type - 0=Air - 1=Water | 0 | 0 | 1 | - | R/W | CS046 |
| S | | S069 | Defrost with fans: outside temperature threshold 0.0°C/32.0°F=Function disabled | 0.0 | 0.0 | 99.9 | - | R/W | HR736 |
| S | | S072 | Source pump activation 0=on with unit on 1=on with compressor on 2=modulating on/off with condensing temperature | 0 | 0 | 2 | - | R/W | HR213 |
| S | | S073 | Compressor status at start defrost 0=On minimum speed - 1=Off | 0 | 0 | 1 | - | R/W | CS92 |

## 6.5 Input /output configuration

| User | Disp. | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| S | | Hc31 | S1configuration | 7 | 0 | 8 | - | R/W | HR752 |
| S | | Hc32 | S2configuration | 8 | 0 | 8 | - | R/W | HR753 |
| S | | Hc00 | S3configuration | 0 | 0 | 8 | - | R/W | HR286 |
| | | S008 | Source fan 1 circuit 1 maintenance hour threshold (x100) | 99 | 0 | 999 | h | R/W | HR214 |
| M | | Hc01 | S4 and S5 configuration 0=Pressure - 1=Temperature | 0 | 0 | 1 | - | R/W | HR287 |
| M | | Hc02 | Enable S4 0/1=No/Yes | 1 | 0 | 1 | - | R/W | CS048 |
| S | | Hc34 | S4 configuration | 7 | 0 | 10 | - | R/W | HR754 |
| S | | Hc35 | S5 configuration | 8 | 0 | 10 | - | R/W | HR755 |
| S | | Hc03 | S6 configuration | 0 | 0 | 11 | - | R/W | HR288 |
| S | | Hc04 | S7 configuration (DIN) | 6 | 0 | 8 | - | R/W | HR289 |
| S | | Hc41 | S1 configuration (Circuit 2) | 0 | 0 | 8 | - | R/W | HR756 |
| S | | Hc42 | S2 configuration (Circuit 2) | 0 | 0 | 8 | - | R/W | HR757 |
| S | | Hc43 | S3 configuration (Circuit 2) | 0 | 0 | 8 | - | R/W | HR758 |
| S | | Hc44 | S4 configuration (Circuit 2) | 7 | 0 | 10 | - | R/W | HR759 |
| S | | Hc45 | S5 configuration (Circuit 2) | 8 | 0 | 10 | - | R/W | HR760 |
| S | | Hc05 | S6 configuration (Circuit 2) | 0 | 0 | 11 | - | R/W | HR290 |
| S | | Hc47 | S7 configuration (Circuit 2) | 6 | 0 | 8 | - | R/W | HR761 |
| S | | Hc14 | ID1 configuration | 1 | 0 | 10 | - | R/W | HR297 |

| User | Disp. | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| S | | Hc15 | ID2 configuration | 2 | 0 | 10 | - | R/W | HR298 |
| S | | Hc06 | ID4 configuration | 0 | 0 | 10 | - | R/W | HR291 |
| S | | Hc07 | ID5 configuration | 7 | 0 | 10 | - | R/W | HR292 |
| S | | Hc08 | ID6 configuration | 6 | 0 | 10 | - | R/W | HR293 |
| S | | Hc16 | ID1 configuration (Circuit 2) | 10 | 0 | 10 | - | R/W | HR299 |
| S | | Hc17 | ID2 configuration (Circuit 2) | 2 | 0 | 10 | - | R/W | HR300 |
| S | | Hc09 | ID4 configuration (Circuit 2) | 0 | 0 | 10 | - | R/W | HR294 |
| S | | Hc10 | ID5 configuration (Circuit 2) | 7 | 0 | 10 | - | R/W | HR295 |
| S | | Hc11 | ID6 configuration (Circuit 2) | 0 | 0 | 10 | - | R/W | HR296 |
| S | | Hc51 | NO1 configuration | 1 | 0 | 11 | - | R/W | HR740 |
| S | | Hc52 | NO2 configuration | 2 | 0 | 11 | - | R/W | HR741 |
| S | | Hc53 | NO3 configuration | 4 | 0 | 11 | - | R/W | HR742 |
| S | | Hc54 | NO4 configuration | 7 | 0 | 11 | - | R/W | HR743 |
| S | | Hc55 | NO5 configuration | 10 | 0 | 11 | - | R/W | HR744 |
| S | | Hc56 | NO6 configuration | 0 | 0 | 11 | - | R/W | HR745 |
| S | | Hc61 | NO1 configuration (Circuit 2) | 1 | 0 | 8 | - | R/W | HR746 |
| S | | Hc62 | NO2 configuration (Circuit 2) | 2 | 0 | 8 | - | R/W | HR747 |
| S | | Hc63 | NO3 configuration (Circuit 2) | 4 | 0 | 8 | - | R/W | HR748 |
| S | | Hc64 | NO4 configuration (Circuit 2) | 7 | 0 | 8 | - | R/W | HR749 |
| S | | Hc65 | NO5 configuration (Circuit 2) | 0 | 0 | 8 | - | R/W | HR750 |
| S | | Hc66 | NO6 configuration (Circuit 2) | 0 | 0 | 8 | - | R/W | HR751 |
| S | | Hc71 | Y1 configuration | 1 | 0 | 3 | - | R/W | HR240 |
| S | | Hc72 | Y2 configuration | 3 | 0 | 3 | - | R/W | HR245 |
| S | | Hc81 | Y1 configuration (Circuit 2) | 1 | 0 | 2 | - | R/W | HR244 |
| S | | Hc82 | Y2 configuration (Circuit 2) | 0 | 0 | 2 | - | R/W | HR276 |
| S | | Hc13 | Buzzer<br>0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS050 |

Notes: (1) Max = 3 with Panel model, Max = 2 with DIN model.

## 6.6 mCH2 Parameters (Legacy model only)

| User | Disp. | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| M | x | F027 | Capacity stepped compressors (0= NO, 1= YES) | 0 | 0 | 1 | - | - | - |
| M | x | F003 | Number of evaporators (0=1; 1=YES) | 0 | 0 | 1 | - | - | - |
| M | x | F007 | S4 sensor installed on source exchanger (0= No, 1=Yes: in CH read condensation, in HP read evaporation) | 0 | 0 | 1 | - | - | - |
| M | x | F008 | Antifreeze alarm delay | 10 | 0.0 | 999 | - | - | - |
| M | x | F009 | Supply air temperature limit threshold | 14.0 | 0.0 | 99.9 | °C | - | - |
| M | x | F010 | Supply air differential limit temperature | 4.0 | 0.0 | 20.0 | °K | - | - |
| M | x | F011 | Resistance digital output logic (0=N.O.; 1=N.C.) | 0 | 0 | 1 | °K | - | - |
| M | x | F012 | Setpoint offset in summer operating mode for heaters | 1.0 | 0.0 | 99.9 | °K | - | - |
| M | x | F013 | Differential for summer setpoint operating mode for heat resistance | 0.5 | 0.2 | 99.9 | °K | - | - |
| M | x | F014 | Offset on setpoint in winter operating mode for heaters | 3.0 | 0.0 | 99.9 | °K | - | - |
| M | x | F015 | Differential on set point in winter operating mode for heaters | 1.0 | 0.2 | 99.9 | °K | - | - |
| M | x | F016 | Active resistance during defrost v (0= No, 1=Yes) | 0 | 0 | 1 | - | - | - |
| M | x | F017 | Supply fan operating mode (0=Always ON; 1=ON by thermoregulation) | 0 | 0 | 1 | - | - | - |
| M | x | F018 | Hot start setpoint | 40.0 | 0.0 | 99.9 | °C | - | - |
| M | x | F019 | Hot-keep differential | 5.0 | 0.0 | 99.9 | °K | - | - |
| M | x | F020 | Compressor request logic from digital input (0=N.C.; 1=N.O.) | 1 | 0 | 1 | - | - | - |
| M | x | F021 | Mix outlet water temperature probe calibration (S1 expansion) | 0.0 | -99.9 | 99.9 | °K | - | - |
| M | x | F022 | Evaporator 2 water outlet temperature probe calibration (S2 expansion) | 0.0 | -99.9 | 99.9 | °K | - | - |
| M | x | F023 | Direct relationship between digital inputs and digital outputs for condensing unit (0=No; 1=Yes) | 0 | 0 | 1 | - | - | - |

## 6.7 BMS port

| User | Disp. | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| S | x | Hd00 | BMS: serial address | 1 | 1 | 247 | - | - | HR147 |
| S | x | Hd01 | BMS: baud rate<br>3=9600; 4=19200; 5=38400; 6=57600; 7=115200 | 7 | 3 | 7 | - | - | HR148 |
| S | x | Hd02 | BMS: settings<br>0= 8-NONE-1 - 1= 8-NONE-2 - 2= 8-EVEN-1<br>3= 8-EVEN-2 - 4= 8-ODD-1 - 5= 8-ODD-2 | 1 | 0 | 5 | - | - | HR149 |
| S | x | Hd07 | BMS: supervisor database 0= 32bit 1= 16bit | 0 | 0 | 1 | - | - | CS48 |

## 6.8 Password

| User | Disp. | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| U | | He00 | User password | 1000 | 0000 | 9999 | - | - | - |
| S | | He01 | Service password | 2000 | 0000 | 9999 | - | - | - |
| M | | He02 | Manufacturer password | 1234 | 0000 | 9999 | - | - | - |
| M | | He03 | Password for profile 1 | 0001 | 0000 | 9999 | - | - | - |
| M | | He04 | Password for profile 2 | 0002 | 0000 | 9999 | - | - | - |
| M | | He05 | Password for profile 3 | 0003 | 0000 | 9999 | - | - | - |
| M | | He06 | Password for profile 4 | 0004 | 0000 | 9999 | - | - | - |
| M | | He07 | Password for profile 5 | 0005 | 0000 | 9999 | - | - | - |
| M | | He08 | Password for profile 6 | 0006 | 0000 | 9999 | - | - | - |
| M | | He09 | Password for profile 7 | 0007 | 0000 | 9999 | - | - | - |

## 6.9 Dashboard values

| User | Disp. | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| U | x | AFC1 | Circuit 1: source water delivery temperature | - | -999.9 | 999.9 | °C/°F | R | IR217 (2R) |
| U | x | AFC2 | Circuit 2: source water delivery temperature | - | -999.9 | 999.9 | °C/°F | R | IR213 (2R) |
| U | x | EuP1 | Circuit 1: evaporation temperature (or converted value) | - | -999.9 | 999.9 | °C/°F | R | IR026 (2R) |
| U | x | EuP2 | Circuit 2: evaporation temperature (or converted value) | - | -999.9 | 999.9 | °C/°F | R | IR034 (2R) |
| U | | dSP1 | Circuit 1: condensation pressure | - | -999.9 | 999.9 | bar/psi | R | IR020 (2R) |
| U | | dSP2 | Circuit 2: condensation pressure | - | -999.9 | 999.9 | bar/psi | R | IR028 (2R) |
| U | x | dSt1 | Circuit 1: discharge temperature | - | -999.9 | 999.9 | °C/°F | R | IR012 (2R) |
| U | x | dSt2 | Circuit 2: discharge temperature | - | -999.9 | 999.9 | °C/°F | R | IR016 (2R) |
| U | x | rUSr | User: return water temperature | - | -999.9 | 999.9 | °C/°F | R | IR054 (2R) |
| U | x | dUSr | User: delivery water temperature | - | -999.9 | 999.9 | °C/°F | R | IR056 (2R) |
| U | x | Cnd1 | Circuit 1: condensing temperature (or converted value) | - | -999.9 | 999.9 | °C/°F | R | IR024 (2R) |
| U | x | Cnd2 | Circuit 2: condensing temperature (or converted value) | - | -999.9 | 999.9 | °C/°F | R | IR032 (2R) |
| U | | Sprb | Source: outside air temperature | | -999.9 | 999.9 | °C/°F | R | HR229 |
| U | | ScP1 | Circuit 1: suction pressure | - | -999.9 | 999.9 | bar/psi | R | IR022 (2R) |
| U | | ScP2 | Circuit 2: suction pressure | - | -999.9 | 999.9 | bar/psi | R | IR030 (2R) |
| U | | Sct1 | Circuit 1: suction temperature | - | -999.9 | 999.9 | °C/°F | R | IR014 (2R) |
| U | | Sct2 | Circuit 2: suction temperature | - | -999.9 | 999.9 | °C/°F | R | IR018 (2R) |
| U | x | SetA | Current set point | - | -999.9 | 999.9 | °C/°F | R | IR046 (2R) |
| U | | rSPt | Remote set point | | -999.9 | 999.9 | °C/°F | | IR090 (2R) |
| U | | Opn1 | ExV circuit 1: position | - | 0 | 9999 | % | R | IR050 |
| U | | Opn2 | ExV circuit 2: position | - | 0 | 9999 | % | R | IR053 |
| U | x | SSH1 | Circuit 1: suction superheat | - | -999.9 | 999.9 | °C/°F | R | IR048 (2R) |
| U | x | SSH2 | Circuit 2: suction superheat | - | -999.9 | 999.9 | °C/°F | R | IR051 (2R) |
| S | x | Hd00 | BMS: serial address | 1 | 1 | 245 | - | R | HR147 |
| S | x | Hd01 | BMS: baud rate<br>3=9600 - 4=19200 - 5=38400 - 6=57600 - 7=115200 | 7 | 3 | 7 | - | R | HR148 |
| S | x | Hd02 | BMS: settings<br>0=8-NONE-1 2=8-EVEN-1 4=8-ODD-1<br>1=8-NONE-2 3=8-EVEN-2 5=8-ODD-2 | 0 | 0 | 5 | - | R | HR149 |
| S | | H1C1 | Comp. 1 circuit 1: hour counter | - | 0 | 99999 | h | R | IR004 (2R) |
| S | | H1C2 | Comp. 2 circuit 1: hour counter | - | 0 | 99999 | h | R | IR006 (2R) |
| S | | H2C1 | Comp. 2 circuit 1: hour counter | - | 0 | 99999 | h | R | IR008 (2R) |
| S | | H2C2 | Comp. 2 circuit 2: hour counter | - | 0 | 99999 | h | R | IR010 (2R) |
| S | | HSP1 | Source pump: hour counter | - | 0 | 99999 | h | R | IR036 (2R) |
| S | | HuP1 | User pump 1: hour counter | - | 0 | 99999 | h | R | IR000 (2R) |
| S | | HuP2 | User pump 2: hour counter | - | 0 | 99999 | h | R | IR002 (2R) |
| S | | HFn1 | Fan circuit 1: hour counter | - | 0 | 99999 | h | R | IR040 (2R) |
| S | | HFn2 | Fan circuit 2: hour counter | - | 0 | 99999 | h | R | IR042 (2R) |
| S | x | rps1 | BLDC 1speed | - | 0 | 999.9 | rps | R | IR100 (2R) |
| S | x | rps2 | BLDC 2 speed | - | 0 | 999.9 | rps | R | IR181 (2R) |
| S | x | Mc1 | BLDC 1 current | - | 0 | 99.9 | A | R | IR102 (2R) |
| S | x | Mc2 | BLDC 2 current | - | 0 | 99.9 | A | R | IR183 (2R) |
| S | | MP1 | BLDC 1 power | - | 0 | 99.9 | kW | R | IR104 (2R) |
| S | | MP2 | BLDC 2 power | - | 0 | 99.9 | kW | R | IR185 (2R) |
| S | | Drt1 | Current speed drive 1 temperature | - | 0 | 999.9 | °C/°F | R | IR106 (2R) |
| S | | Drt2 | Current speed drive 2 temperature | - | 0 | 999.9 | °C/°F | R | IR187 (2R) |
| S | | AlHs1_1 | Speed drive 1 alarm log: last | - | 0 | 99 | | R | IR108 |
| S | | AlHs2_1 | Speed drive 1 alarm log: second-to-last | - | 0 | 99 | | R | IR109 |
| S | | AlHs3_1 | Speed drive 1 alarm log: third-to-last | - | 0 | 99 | | R | IR110 |
| S | | AlHs4_1 | Speed drive 1 alarm log: fourth-to-last | - | 0 | 99 | | R | IR111 |
| S | | AlHs1_2 | Speed drive 2 alarm log: last | - | 0 | 99 | | R | IR189 |
| S | | AlHs2_2 | Speed drive 2 alarm log: second-to-last | - | 0 | 99 | | R | IR190 |
| S | | AlHs3_2 | Speed drive 2 alarm log: third-to-last | - | 0 | 99 | | R | IR191 |
| S | | AlHs4_2 | Speed drive 2 alarm log: fourth-to-last | - | 0 | 99 | | R | IR192 |

## 6.10 Settings

| User | Display | Code | Description | Def. | Min | Max | UOM | R/W | Modbus |
|---|---|---|---|---|---|---|---|---|---|
| U | x | SEtC | Cooling set point | 7.0 | U006 | U007 | °C/°F | R/W | HR307 (2R) |
| U | x | SEtH | Heating set point | 40.0 | U008 | U009 | °C/°F | R/W | HR309 (2R) |
| U | x | 0-1 | Unit On-Off from keypad 0=OFF 1=ON | 0 | 0 | 1 | - | R/W | CS54 |
| U | x | ModE | Cooling/heating from keypad 0=Cooling 1=Heating | 0 | 0 | 1 | - | R/W | CS55 |
| - | | RES | Reset alarms from BMS 0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS56 |
| S | x | DFr | Force defrost<br>0=No 1=Circuit 1 2=Circuit 2 3=Circuit 1 and 2 | 0 | 0 | 3 | - | R/W | HR78 |
| S | x | ClrH | Reset alarm log 0/1=No/Yes | 0 | 0 | 1 | - | R/W | CS59 |
| S | x | UoM | Unit of measure 0=°C/barg 1=°F/psig | 0 | 0 | 1 | - | R/W | CS47 |
| S | x | rStr | Reset factory parameters | 0 | 0 | 1 | - | R/W | CS45 |

# 7. Supervisor table

µChiller provides a database of supervisor variables via Modbus RTU protocol over RS485 (BMS port on the µChiller controller). The BMS port has the following default settings:

- baud rate 115,200;
- data bits 8;
- no parity;
- stop bits 1.

See "Parameter table: BMS port" to set different values.

"Index" is the address specified in the Modbus® frame.

## 7.1 Coil Status

| Index | Size | Ref. | Type | Min/Max | R/W | UoM | Description |
|---|---|---|---|---|---|---|---|
| 0 | 1 | U001 | BOOL | | R/W | | U001 - User pump 1 reset hour counters |
| 1 | 1 | U004 | BOOL | | R/W | | U004 - User pump 2 reset hour counters |
| 2 | 1 | U010 | BOOL | | R/W | | U010 - Enable setpoint compensation (0=Disabled, 1=Enabled) |
| 3 | 1 | U017 | BOOL | | R/W | | U017 - Enable scheduler (0=Disabled, 1=Enabled) |
| 4 | 1 | U022 | BOOL | | R/W | | U022 - Type of scheduling (0=Switch OFF, 1=Change setpoint) |
| 5 | 1 | U034 | BOOL | | R/W | | U034 - Changeover type cold/heat (0=Keyboard, 1=DIn) |
| 6 | 1 | U036 | BOOL | | R/W | | U036 - Startup regulation probe (0=Return, 1=Delivery) |
| 7 | 1 | U038 | BOOL | | R/W | | U038 - Run regulation probe (0=Return, 1=Delivery) |
| 8 | 1 | U057 | BOOL | | R/W | | U057 - Remote alarm input logic (0=N.C., 1=N.O.) |
| 9 | 1 | U058 | BOOL | | R/W | | U058 - Cool/Heat input logic (0=N.O., 1=N.C.) |
| 10 | 1 | U059 | BOOL | | R/W | | U059 - Remote unit ON/OFF input logic (0=N.O., 1=N.C.) |
| 11 | 1 | U060 | BOOL | | R/W | | U060 - User pump flow input logic (0=N.C., 1=N.O.) |
| 12 | 1 | U061 | BOOL | | R/W | | U061 - User pump overload input logic (0=N.C., 1=N.O.) |
| 13 | 1 | U062 | BOOL | | R/W | | U062 - 2nd setpoint input logic (0=N.O., 1=N.C.) |
| 14 | 1 | U063 | BOOL | | R/W | | U063 - User pump output logic (0=N.O., 1=N.C.) |
| 15 | 1 | U064 | BOOL | | R/W | | U064 - Global alarm relay output logic (0=N.C., 1=N.O.) |
| 16 | 1 | U065 | BOOL | | R/W | | U065 - Free-Cooling valve output logic (0=N.O., 1=N.C.) |
| 17 | 1 | U066 | BOOL | | R/W | | U066 - Antifreeze heater output logic (0=N.O., 1=N.C.) |
| 18 | 1 | U067 | BOOL | | R/W | | U067 - Alarm relay configuration (0=Regulation alarms, 1=All alarms) |
| 19 | 1 | U068 | BOOL | | R/W | | U068 - Enable Free-Cooling (0=Disabled, 1=Enabled) |
| 20 | 1 | E000 | BOOL | | R/W | | E000 - ExV circ.1 enable manual mode |
| 21 | 1 | E002 | BOOL | | R/W | | E002 - ExV circ.2 enable manual mode |
| 22 | 1 | Hd06 | BOOL | | R/W | | Hd06 - Enable power request from BMS (0=Disabled, 1=Enabled) |
| 23 | 1 | C001 | BOOL | | R/W | | C001 - Compr.1 circ.1 reset hour counters |
| 24 | 1 | C004 | BOOL | | R/W | | C004 - Compr.2 circ.1 reset hour counters |
| 25 | 1 | C007 | BOOL | | R/W | | C007 - Compr.1 circ.2 reset hour counters |
| 26 | 1 | C010 | BOOL | | R/W | | C010 - Compr.2 circ.2 reset hour counters |
| 27 | 1 | C034 | BOOL | | R/W | | C034 - High press. pressostat input logic (0=N.C., 1=N.O.) |
| 28 | 1 | C035 | BOOL | | R/W | | C035 - Compr. overload input logic (0=N.C., 1=N.O.) |
| 29 | 1 | C036 | BOOL | | R/W | | C036 - Compr. output logic (0=N.O., 1=N.C.) |
| 30 | 1 | C044 | BOOL | | R/W | | C044 - Enable circuit destabilization (0=Disabled, 1=Enabled) |
| 31 | 1 | S001 | BOOL | | R/W | | S001 - Source pump 1 reset hour counters |
| 33 | 1 | S009 | BOOL | | R/W | | S009 - Source fan 1 circ.1 reset hour counters |
| 34 | 1 | S013 | BOOL | | R/W | | S013 - Source fan 1 circ.2 reset hour counters |
| 35 | 1 | S020 | BOOL | | R/W | | S020 - Enable low noise (0=Disabled, 1=Enabled) |
| 37 | 1 | S043 | BOOL | | R/W | | S043 - Enable sliding defrost (0=Disabled, 1=Enabled) |
| 38 | 1 | S055 | BOOL | | R/W | | S055 - Compr. behavior in post-defrost phase (0=Compr. is OFF, 1=Compr. is turned ON) |
| 39 | 1 | S061 | BOOL | | R/W | | S061 - Source fan output logic (0=N.O., 1=N.C.) |
| 40 | 1 | S062 | BOOL | | R/W | | S062 - Source pump output logic (0=N.O., 1=N.C.) |
| 41 | 1 | S063 | BOOL | | R/W | | S063 - Reverse valve output logic (0=N.O., 1=N.C.) |
| 42 | 1 | S064 | BOOL | | R/W | | S064 - Source flow type (0=Independent, 1=Common) |
| 44 | 1 | S065 | BOOL | | R/W | | S065 - Source fan type (0=Inverter, 1=ON/OFF) |
| 46 | 1 | S068 | BOOL | | R/W | | S068 - Source type (0=Air, 1=Water) |
| 47 | 1 | UoM | BOOL | | R/W | | UoM - Unit of measure used for Display 2-Row and BMS, not for Applica (0=°C/bar, 1=°F/PSI) |
| 48 | 1 | Hc02 | BOOL | | R/W | | Hc02 - Analog channel 4 enabling (0=Disabled, 1=Enabled) |
| 49 | 1 | Hc12 | BOOL | | R/W | | Hc12 - Digital output 6 config. (0=Antifreeze, 1=Source fan / Source pump) |
| 50 | 1 | Hc13 | BOOL | | R/W | | Hc13 - Enable buzzer (0=Disabled, 1=Enabled) |
| 52 | 1 | Ha02 | BOOL | | R/W | | Ha02 - Sets controller internal clock (0=No set, 1=Set) |
| 53 | 1 | Hd03 | BOOL | | R/W | | Hd03 - Enable NFC (0=Disabled, 1=Enabled) |
| 54 | 1 | UnSt | BOOL | | R/W | | UnSt - Unit ON/OFF command by keyboard (0=OFF 1=ON) |

| Index | Size | Ref. | Type | Min/Max | R/W | UoM | Description |
|---|---|---|---|---|---|---|---|
| 55 | 1 | ModE | BOOL | | R/W | | ModE - Cool/Heat mode by Keyboard (0=Cool, 1=Heat) |
| 56 | 1 | RES | BOOL | | R/W | | RES - Reset active alarms by BMS net (0=NO, 1=Reset) |
| 59 | 1 | ClrH | BOOL | | R/W | | ClrH - Delete alarms log (0=No, 1=Yes) |
| 63 | 1 | Hd05 | BOOL | | R/W | | Hd05 - Enable unit ON/OFF command by BMS net (0=Disabled, 1=Enabled) |
| 64 | 1 | | BOOL | | R/W | | Unit ON/OFF command by BMS |
| 66 | 1 | P016 | BOOL | | R/W | | P016 - Oil equalization solenoid valve circ.1 output logic (0=NC, 1=NO) |
| 67 | 1 | P017 | BOOL | | R/W | | P017 - Enable oil equalization function (0=OFF, 1=ON) |
| 68 | 1 | P018 | BOOL | | R/W | | P018 - Enable oil recovery function (0=OFF, 1=ON) |
| 69 | 1 | P034 | BOOL | | R/W | | P034 - Enable cranckcase heater (0=OFF, 1=ON) |
| 80 | 1 | U078 | BOOL | | R/W | | U078 - Burst function enabling (0=Disabled, 1=Enabled) |

## 7.2 Input Status

| Index | Size | Ref. | Type | Min/Max | R/W | UoM | Description |
|---|---|---|---|---|---|---|---|
| 0 | 1 | A01 | BOOL | | R | | Unit - Error in the number of retain memory writings |
| 1 | 1 | A02 | BOOL | | R | | Unit - Error in retain memory writings |
| 2 | 1 | A03 | BOOL | | R | | Unit - Remote alarm by digital input |
| 3 | 1 | A04 | BOOL | | R | | Unit - Alarm remote set point out of range |
| 4 | 1 | A05 | BOOL | | R | | Unit - Alarm user return water temperature probe broken or disconnected |
| 5 | 1 | A06 | BOOL | | R | | Unit - Alarm user delivery water temperature probe broken or disconnected |
| 7 | 1 | A08 | BOOL | | R | | Unit - User pump 1 overload |
| 8 | 1 | A09 | BOOL | | R | | Unit - User pump 2 overload |
| 9 | 1 | A10 | BOOL | | R | | Unit - Flow switch alarm, no flow present with user pump 1 active |
| 10 | 1 | A11 | BOOL | | R | | Unit - Flow switch alarm, no flow present with user pump 2 active |
| 11 | 1 | A12 | BOOL | | R | | Unit - User pumps group alarm |
| 12 | 1 | A13 | BOOL | | R | | Unit - User 1 pump maintenance |
| 13 | 1 | A14 | BOOL | | R | | Unit - User 2 pump maintenance |
| 14 | 1 | A15 | BOOL | | R | | Unit - High chilled water temperature |
| 15 | 1 | A16 | BOOL | | R | | Unit - Alarm source return water/air temperature probe broken or disconnected |
| 16 | 1 | A17 | BOOL | | R | | Unit - Source 1 pump maintenance |
| 17 | 1 | A18 | BOOL | | R | | Unit - Free-cooling anomaly |
| 18 | 1 | A19 | BOOL | | R | | Circuit 1 - Alarm discharge pressure probe broken or disconnected |
| 19 | 1 | A20 | BOOL | | R | | Circuit 1 - Alarm condensing temperature probe broken or disconnected |
| 20 | 1 | A21 | BOOL | | R | | Circuit 1 - Alarm suction pressure probe broken or disconnected |
| 21 | 1 | A22 | BOOL | | R | | Circuit 1 - Alarm evaporating temperature probe broken or disconnected |
| 22 | 1 | A23 | BOOL | | R | | Circuit 1 - Alarm discharge temperature probe broken or disconnected |
| 23 | 1 | A24 | BOOL | | R | | Circuit 1 - Alarm suction temperature probe broken or disconnected |
| 24 | 1 | A25 | BOOL | | R | | Circuit 1 - High pressure alarm by pressure switch |
| 25 | 1 | A26 | BOOL | | R | | Circuit 1 - High pressure alarm by transducer |
| 26 | 1 | A27 | BOOL | | R | | Circuit 1 - Low pressure alarm by transducer |
| 27 | 1 | A28 | BOOL | | R | | Circuit 1 - Alarm freeze evaporation temperature |
| 29 | 1 | A30 | BOOL | | R | | Circuit 1 - Overload compressor 1 |
| 30 | 1 | A31 | BOOL | | R | | Circuit 1 - Overload compressor 2 |
| 31 | 1 | A32 | BOOL | | R | | Circuit 1 - Compressor 1 maintenance |
| 32 | 1 | A33 | BOOL | | R | | Circuit 1 - Compressor 2 maintenance |
| 33 | 1 | A34 | BOOL | | R | | Circuit 1 - Source fan 1 maintenance |
| 34 | 1 | A35 | BOOL | | R | | Circuit 1 EVD - Low superheating (SH) |
| 35 | 1 | A36 | BOOL | | R | | Circuit 1 EVD - Low evaporation pressure (LOP) |
| 36 | 1 | A37 | BOOL | | R | | Circuit 1 EVD - Maximum evaporating pressure (MOP) |
| 37 | 1 | A38 | BOOL | | R | | Circuit 1 EVD - Valve motor error |
| 38 | 1 | A39 | BOOL | | R | | Circuit 1 EVD - Emergency closing |
| 39 | 1 | A40 | BOOL | | R | | Circuit 1 EVD - Incomplete valve closing |
| 40 | 1 | A41 | BOOL | | R | | Circuit 1 EVD - Offline |
| 41 | 1 | A42 | BOOL | | R | | Circuit 1 Envelope - General alarm + Alarm zone |
| 42 | 1 | A43 | BOOL | | R | | Circuit 1 BLDC - Delta pressure greater than the allowable at startup |
| 43 | 1 | A44 | BOOL | | R | | Circuit 1 BLDC - Starting failure |
| 44 | 1 | A45 | BOOL | | R | | Circuit 1 BLDC - Low differential pressure |
| 45 | 1 | A46 | BOOL | | R | | Circuit 1 BLDC - High discharge gas temperature |
| 46 | 1 | A47 | BOOL | | R | | Circuit 1 Inverter - Offline |
| 47 | 1 | A48 | BOOL | | R | | Circuit 1 Inverter - General alarm + Error code |
| 48 | 1 | A49 | BOOL | | R | | Unit - Circuit 2 board is offline |
| 49 | 1 | A50 | BOOL | | R | | Unit - Error in the number of retain memory writings of Circuit 2 board |
| 50 | 1 | A51 | BOOL | | R | | Unit - Error in retain memory writings of Circuit 2 board |
| 51 | 1 | A52 | BOOL | | R | | Circuit 2 - Alarm discharge pressure probe broken or disconnected |
| 52 | 1 | A53 | BOOL | | R | | Circuit 2 - Alarm condensing temperature probe broken or disconnected |
| 53 | 1 | A54 | BOOL | | R | | Circuit 2 - Alarm suction pressure probe broken or disconnected |

| Index | Size | Ref. | Type | Min/Max | R/W | UoM | Description |
|---|---|---|---|---|---|---|---|
| 54 | 1 | A55 | BOOL | | R | | Circuit 2 - Alarm evaporating temperature probe broken or disconnected |
| 55 | 1 | A56 | BOOL | | R | | Circuit 2 - Alarm discharge temperature probe broken or disconnected |
| 56 | 1 | A57 | BOOL | | R | | Circuit 2 - Alarm suction temperature probe broken or disconnected |
| 57 | 1 | A58 | BOOL | | R | | Circuit 2 - High pressure alarm by pressure switch |
| 58 | 1 | A59 | BOOL | | R | | Circuit 2 - High pressure alarm by transducer |
| 59 | 1 | A60 | BOOL | | R | | Circuit 2 - Low pressure alarm by transducer |
| 60 | 1 | A61 | BOOL | | R | | Circuit 2 - Alarm freeze evaporation temperature |
| 62 | 1 | A63 | BOOL | | R | | Circuit 2 - Overload compressor 1 |
| 63 | 1 | A64 | BOOL | | R | | Circuit 2 - Overload compressor 2 |
| 64 | 1 | A65 | BOOL | | R | | Circuit 2 - Compressor 1 maintenance |
| 65 | 1 | A66 | BOOL | | R | | Circuit 2 - Compressor 2 maintenance |
| 66 | 1 | A67 | BOOL | | R | | Circuit 2 - Source fan 1 maintenance |
| 67 | 1 | A68 | BOOL | | R | | Circuit 2 EVD - Low superheating (SH) |
| 68 | 1 | A69 | BOOL | | R | | Circuit 2 EVD - Low evaporation pressure (LOP) |
| 69 | 1 | A70 | BOOL | | R | | Circuit 2 EVD - Maximum evaporating pressure (MOP) |
| 70 | 1 | A71 | BOOL | | R | | Circuit 2 EVD - Valve motor error |
| 71 | 1 | A72 | BOOL | | R | | Circuit 2 EVD - Emergency closing |
| 72 | 1 | A73 | BOOL | | R | | Circuit 2 EVD - Incomplete valve closing |
| 73 | 1 | A74 | BOOL | | R | | Circuit 2 EVD - Offline |
| 74 | 1 | A75 | BOOL | | R | | Circuit 2 Envelope - General alarm + Alarm zone |
| 75 | 1 | A76 | BOOL | | R | | Circuit 2 BLDC - Delta pressure greater than the allowable at startup |
| 76 | 1 | A77 | BOOL | | R | | Circuit 2 BLDC - Starting failure |
| 77 | 1 | A78 | BOOL | | R | | Circuit 2 BLDC - Low differential pressure |
| 78 | 1 | A79 | BOOL | | R | | Circuit 2 BLDC - High discharge gas temperature |
| 79 | 1 | A80 | BOOL | | R | | Circuit 2 Inverter - Offline |
| 80 | 1 | A81 | BOOL | | R | | Circuit 2 Inverter - General alarm + Error code |
| 81 | 1 | | BOOL | | R | | PrevAFreeze_C1 - Prevent request for antifreeze condition active inside |
| 82 | 1 | | BOOL | | R | | PrevHP_C1 - Prevent request for high pressure condition active inside |
| 83 | 1 | | BOOL | | R | | PrevAFreeze_C2 - Prevent request for antifreeze condition active inside |
| 84 | 1 | | BOOL | | R | | PrevHP_C2 - Prevent request for high pressure condition active inside circ.2 |
| 102 | 1 | | BOOL | | R | | Comp1Circ1_On - Compr.1 circ.1 status (0=OFF 1=ON) |
| 103 | 1 | | BOOL | | R | | Comp2Circ1_On - Compr.2 circ.1 status (0=OFF, 1=ON) |
| 104 | 1 | | BOOL | | R | | Comp1Circ2_On - Compr.1 circ.2 status (0=OFF, 1=ON) |
| 105 | 1 | | BOOL | | R | | Comp2Circ2_On - Compr.2 circ.2 status (0=OFF, 1=ON) |
| 106 | 1 | | BOOL | | R | | RelayAlrm - Global alarm relay |
| 107 | 1 | | BOOL | | R | | CoolHeat - Unit in heating mode (0=Cooling, 1=Heating) |
| 108 | 1 | | BOOL | | R | | FC_Status - Free cooling valve status (0=OFF, 1=ON) |
| 109 | 1 | | BOOL | | R | | Antifreeze heater status |
| 110 | 1 | | BOOL | | R | | Unit scheduler status |
| 119 | 1 | A87 | BOOL | | R | | EVD - Alarm Hw incompatible |
| 120 | 1 | | BOOL | | R | | SrcFanCirc1_On - Source fan circ.1 status (0=OFF, 1=ON) |
| 121 | 1 | | BOOL | | R | | SrcPmp1_On - Source pump 1 status (0=OFF, 1=ON) |
| 122 | 1 | | BOOL | | R | | UsrPmp1_On - User pump 1 status |
| 123 | 1 | | BOOL | | R | | RevVlv_Circ1 - Reverse valve for circ.1 (0=Cooling, 1=Heating) |
| 124 | 1 | | BOOL | | R | | Oil equalization valve circuit 1 status |
| 125 | 1 | | BOOL | | R | | SrcFanCirc2_On - Source fan circ.2 status (0=OFF, 1=ON) |
| 127 | 1 | | BOOL | | R | | UsrPmp2_On - User pump 2 status |
| 128 | 1 | | BOOL | | R | | RevVlv_Circ2 - Reverse valve for circ.2 (0=Cooling, 1=Heating) |
| 129 | 1 | | BOOL | | R | | Oil equalization valve circuit 2 status |
| 131 | 1 | | BOOL | | R | | Defrost running on circuit 1 |
| 132 | 1 | | BOOL | | R | | Defrost running on circuit 2 |
| 134 | 1 | | BOOL | | R | | Unit status |
| 143 | 1 | | BOOL | | R | | Compr.1 circuit 1 forced on by oil migration management |
| 144 | 1 | | BOOL | | R | | Compr.2 circuit 1 forced on by oil migration management |
| 145 | 1 | | BOOL | | R | | Compr.1 circuit 2 forced on by oil migration management |
| 146 | 1 | | BOOL | | R | | Compr.2 circuit 2 forced on by oil migration management |
| 148 | 1 | | BOOL | | R | | UsrFlw_Absent - User pump flow absent (0=Flow OK, 1=Flow absent) |

## 7.3 Holding Registers

| Index | Size | Ref. | Type | Min/Max | R/W | UoM | Description |
|---|---|---|---|---|---|---|---|
| 2 | 1 | U000 | INT | 0..999 | R/W | h | U000 - User pump 1 maintenance hour threshold (x100) |
| 3 | 1 | U002 | INT | 0..2 | R/W | | U002 - User pump 1/fan manual mode (0=AUTO, 1=OFF, 2=ON) |
| 4 | 1 | U003 | INT | 0..999 | R/W | h | U003 - User pump 2 maintenance hour threshold (x100) |
| 5 | 1 | U005 | INT | 0..2 | R/W | | U005 - User pump 2 manual mode (0=AUTO, 1=OFF, 2=ON) |
| 7 | 2 | U006 | REAL | -99.9..999.9 | R/W | °C/°F | U006 - Cool setpoint low limit |
| 9 | 2 | U007 | REAL | -99.9..999.9 | R/W | °C/°F | U007 - Cool setpoint high limit |
| 11 | 2 | U008 | REAL | 0..999.9 | R/W | °C/°F | U008 - Heat setpoint low limit |
| 13 | 2 | U009 | REAL | 0..999.9 | R/W | °C/°F | U009 - Heat setpoint high limit |
| 15 | 2 | U011 | REAL | | R/W | °C/°F | U011 - Starting temp. point for cool setpoint compensation |
| 17 | 2 | U012 | REAL | -99.9..99.9 | R/W | °C/°F | U012 - Ending temp. point for cool setpoint compensation |
| 19 | 2 | U013 | REAL | -99.9..99.9 | R/W | K/R | U013 - Max compensation for cool setpoint |
| 21 | 2 | U014 | REAL | -999.9..999.9 | R/W | °C/°F | U014 - Starting temp. point for heat setpoint compensation |
| 23 | 2 | U015 | REAL | -99.9..99.9 | R/W | °C/°F | U015 - Ext. temp. diff. point for heat setpoint compensation |
| 25 | 2 | U016 | REAL | -99.9..99.9 | R/W | K/R | U016 - Max compensation for heat setpoint |
| 27 | 1 | U018 | INT | 0..23 | R/W | h | Time band hour |
| 28 | 1 | U019 | INT | 0..59 | R/W | min | Time band minute |
| 29 | 1 | U020 | INT | 0..23 | R/W | h | Time band hour |
| 30 | 1 | U021 | INT | 0..59 | R/W | min | Time band minute |
| 31 | 2 | U023 | REAL | U006..U007 | R/W | °C/°F | U023 - 2nd cool setpoint |
| 33 | 2 | U024 | REAL | U008..U009 | R/W | °C/°F | U024 - 2nd heat setpoint |
| 35 | 1 | U025 | INT | 0..2 | R/W | | U025 - Analog setpoint input type (0=0-5V, 1=0-10V, 2=4-20mA) |
| 37 | 2 | U026 | REAL | -99.9..99.9 | R/W | °C/°F | U026 - Remote setpoint min value |
| 39 | 2 | U027 | REAL | -99.9..99.9 | R/W | °C/°F | U027 - Remote setpoint max value |
| 41 | 1 | S023 | INT | 0..23 | R/W | h | Time band hour |
| 42 | 1 | S024 | INT | 0..59 | R/W | min | Time band minute |
| 43 | 2 | U028 | REAL | -99.9..99.9 | R/W | K/R | U028 - Remote setpoint offset |
| 48 | 1 | E046 | INT | 1..24 | R/W | | E046 - ExV valve type for EVD EVO (1=CAREL EXV, ...) |
| 49 | 2 | U031 | REAL | 0..99.9 | R/W | K/R | U031 - High water temp. setpoint offset |
| 51 | 1 | U032 | INT | 0..99 | R/W | min | U032 - High water temp. startup delay |
| 52 | 1 | U033 | INT | 0..999 | R/W | s | U033 - High water temp.run delay |
| 53 | 1 | U035 | INT | 0..999 | R/W | min | U035 - Changeover delay time |
| 54 | 1 | U037 | INT | 0..999 | R/W | s | U037 - Delay time between Startup PID and Run PID |
| 55 | 2 | U039 | REAL | 0..999.9 | R/W | | U039 - Startup PID Kp |
| 57 | 1 | U040 | INT | 0..999 | R/W | s | U040 - Startup PID Ti |
| 58 | 1 | U041 | INT | 0..99 | R/W | s | U041 - Startup PID Td |
| 59 | 2 | U042 | REAL | 0..999.9 | R/W | | U042 - Run PID Kp |
| 61 | 1 | U043 | INT | 0..999 | R/W | s | U043 - Run PID Ti |
| 62 | 1 | U044 | INT | 0..99 | R/W | s | U044 - Run PID Td |
| 63 | 1 | U045 | INT | 0..999 | R/W | s | U045 - User pump flow alarm startup delay |
| 64 | 1 | U046 | INT | 0..99 | R/W | s | U046 - User pump flow alarm run delay |
| 65 | 1 | U047 | INT | 0..999 | R/W | s | U047 - Compr. delay ON since the user pump ON |
| 66 | 1 | U048 | INT | 0..999 | R/W | s | U048 - User pump delay OFF since the compr. OFF |
| 67 | 1 | U049 | INT | 0..999 | R/W | h | U049 - User pump rotation time |
| 68 | 2 | U050 | REAL | -999.9..999.9 | R/W | °C/°F | U050 - Antifreeze user alarm threshold |
| 70 | 2 | U051 | REAL | 0..999.9 | R/W | K/R | U051 - Antifreeze user alarm differential |
| 72 | 1 | U052 | INT | 0..999 | R/W | s | U052 - Antifreeze user alarm delay time at 1K below threshold |
| 73 | 2 | U053 | REAL | -999.9..999.9 | R/W | °C/°F | U053 - Antifreeze (with unit OFF) setpoint |
| 75 | 2 | U054 | REAL | 0..99.9 | R/W | K/R | U054 - Antifreeze (with unit OFF) differential |
| 78 | 1 | DFr | INT | 0..3 | R/W | | DFr - Force manual defrost (0=None, 1=Force defrost on circ. 1, 2=Force defrost on circ. 2, 3= Force defrost on all circuits) |
| 79 | 2 | U055 | REAL | -99.9..99.9 | R/W | K/R | U055 - Probe offset of return water temp. from user |
| 83 | 2 | U056 | REAL | -99.9..99.9 | R/W | K/R | U056 - Probe offset of delivery water temp. to user |
| 85 | 2 | U069 | REAL | 0..99.9 | R/W | K/R | U069 - Delta temp. to activate Free-Cooling |
| 87 | 2 | U070 | REAL | 0..99.9 | R/W | K/R | U070 - Free-Cooling ON/OFF hysteresis |
| 89 | 2 | U071 | REAL | 0..99.9 | R/W | K/R | U071 - Delta temp. Free-Cooling design (to reach unit nominal capacity) |
| 91 | 2 | U072 | REAL | -999.9..999.9 | R/W | °C/°F | U072 - Free-Cooling limit threshold (used to close FC valve: because FC gives water with temp. very low) |
| 93 | 2 | U073 | REAL | 0..99.9 | R/W | K/R | U073 - Free-Cooling limit differential |
| 95 | 1 | U074 | INT | 0..2 | R/W | | U074 - Free-Cooling type (0=Air, 1=Remote air coil, 2=Water) |
| 96 | 1 | U075 | INT | 0..2 | R/W | | U075 - Antifreeze type (0=Heater, 1=Pump, 2=Heater-Pump) |
| 97 | 1 | U076 | INT | 1..2 | R/W | | U076 - User pump number |
| 98 | 1 | U077 | INT | 0..2 | R/W | | U077 - Unit type (0=CH, 1=HP, 2=CH/HP) |
| 99 | 1 | E001 | INT | 0..65535 | R/W | Steps | E001 - ExV circ.1 manual mode steps |
| 100 | 1 | E003 | INT | 0..65535 | R/W | Steps | E003 - ExV circ.2 manual mode steps |

| Index | Size | Ref. | Type | Min/Max | R/W | UoM | Description |
|---|---|---|---|---|---|---|---|
| 101 | 2 | E004 | REAL | -40..180 | R/W | K/R | E004 - ExV SH setpoint in cool |
| 103 | 2 | E005 | REAL | 0..800 | R/W | | E005 - ExV SH regulation Kp in cool |
| 105 | 2 | E006 | REAL | 0..1000 | R/W | s | E006 - ExV SH regulation Ti in cool |
| 107 | 2 | E007 | REAL | 0..800 | R/W | s | E007 - ExV SH regulation Td in cool |
| 109 | 2 | E008 | REAL | -40..180 | R/W | K/R | E008 - ExV SH setpoint in heat |
| 111 | 2 | E009 | REAL | 0..800 | R/W | | E009 - ExV SH regulation Kp in heat |
| 113 | 2 | E010 | REAL | 0..1000 | R/W | s | E010 - ExV SH regulation Ti in heat |
| 115 | 2 | E011 | REAL | 0..800 | R/W | s | E011 - ExV SH regulation Td in heat |
| 117 | 2 | E012 | REAL | -40..180 | R/W | K/R | E012 - ExV low SH threshold in cool |
| 119 | 2 | E013 | REAL | 0..800 | R/W | s | E013 - ExV low SH Ti in cool |
| 121 | 2 | E014 | REAL | -40..180 | R/W | K/R | E014 - ExV low SH threshold in heat |
| 123 | 2 | E015 | REAL | 0..800 | R/W | s | E015 - ExV low SH Ti in heat |
| 125 | 2 | E016 | REAL | -60..200 | R/W | °C/°F | E016 - ExV LOP regulation threshold in cool |
| 127 | 2 | E017 | REAL | 0..800 | R/W | s | E017 - ExV LOP regulation Ti in cool |
| 129 | 2 | E018 | REAL | -60..200 | R/W | °C/°F | E018 - ExV LOP regulation threshold in heat |
| 131 | 2 | E019 | REAL | 0..800 | R/W | s | E019 - EEV LOP regulation Ti in heat |
| 133 | 2 | E020 | REAL | -60..200 | R/W | °C/°F | E020 - ExV MOP regulation threshold in cool |
| 135 | 2 | E021 | REAL | 0..800 | R/W | s | E021 - ExV MOP regulation Ti in cool |
| 137 | 2 | E022 | REAL | -60..200 | R/W | °C/°F | E022 - ExV MOP regulation threshold in heat |
| 139 | 2 | E023 | REAL | 0..800 | R/W | s | E023 - ExV MOP regulation Ti in heat |
| 141 | 1 | E024 | INT | 0..18000 | R/W | s | E024 - ExV low SH alarm delay time |
| 142 | 1 | E025 | INT | 0..18000 | R/W | s | E025 - ExV LOP alarm delay time |
| 143 | 1 | E026 | INT | 0..18000 | R/W | s | E026 - ExV MOP alarm delay time |
| 144 | 1 | E032 | INT | 0..100 | R/W | % | E032 - ExV startup valve opening % (capacity ratio EVAP / EEV) in cool |
| 145 | 1 | E033 | INT | 0..100 | R/W | % | E033 - ExV startup valve opening % (capacity ratio EVAP / EEV) in heat |
| 146 | 1 | E034 | INT | 0..18000 | R/W | s | E034 - ExV regulation delay after pre-positioning |
| 147 | 1 | Hd00 | INT | 1..247 | R/W | | Hd00 - BMS port serial address |
| 148 | 1 | Hd01 | INT | 3..7 | R/W | | Hd01 - BMS port baud rate (3=9600, 4=19200, 5=38400, 6=57600, 7=115200) |
| 149 | 1 | Hd02 | INT | 0..5 | R/W | | Hd02 - BMS port network settings (0=8- NONE- 1, 1=8- NONE- 2, 2=8- EVEN- 1, 3=8-EVEN-2, 4=8-ODD-1, 5=8-ODD-2) |
| 153 | 1 | C000 | INT | 0..999 | R/W | h | C000 - Compr.1 circ.1 maintenance hour threshold (x100) |
| 154 | 1 | C002 | INT | 0..2 | R/W | | C002 - Compr.1 circ.1 manual mode (0=AUTO, 1=OFF, 2=ON) |
| 155 | 1 | C003 | INT | 0..999 | R/W | h | C003 - Compr.2 circ.1 maintenance hour threshold (x100) |
| 156 | 1 | C005 | INT | 0..2 | R/W | | C005 - Compr.2 circ.1 manual mode (0=AUTO, 1=OFF, 2=ON) |
| 157 | 1 | C006 | INT | 0..999 | R/W | h | C006 - Compr.1 circ.2 maintenance hour threshold (x100) |
| 158 | 1 | C008 | INT | 0..2 | R/W | | C008 - Compr.1 circ.2 manual mode (0=AUTO, 1=OFF, 2=ON) |
| 159 | 1 | C009 | INT | 0..999 | R/W | h | C009 - Compr.2 circ.2 maintenance hour threshold (x100) |
| 160 | 1 | C011 | INT | 0..2 | R/W | | C011 - Compr.2 circ.2 manual mode (0=AUTO, 1=OFF, 2=ON) |
| 162 | 1 | C012 | INT | 30..999 | R/W | s | C012 - Compr. min On time |
| 163 | 1 | C013 | INT | 30..999 | R/W | s | C013 - Compr. min Off time |
| 164 | 1 | C014 | INT | 300..999 | R/W | s | C014 - Min time between On of same compr. |
| 165 | 1 | C015 | INT | 10..999 | R/W | s | C015 - Compr. load up time |
| 166 | 1 | C016 | INT | 5..999 | R/W | s | C016 - Compr. load down time |
| 167 | 1 | S021 | INT | 0..23 | R/W | h | Time band hour |
| 168 | 1 | C020 | INT | 5..999 | R/W | min | C020 - Circuit destabilization max time with one or more compr. OFF |
| 169 | 1 | C021 | INT | 0..1 | R/W | | C021 - Circuit power distribution (0=Equalized, 1=Grouped) |
| 170 | 2 | C022 | REAL | -99.9..99.9 | R/W | K/R | C022 - Discharge temp. probe offset for circ.1 |
| 172 | 2 | C023 | REAL | -99.9..99.9 | R/W | K/R | C023 - Suction temp. probe offset for circ.1 |
| 174 | 2 | C024 | REAL | -99.9..99.9 | R/W | K/R | C024 - Discharge temp. probe offset for circ.2 |
| 176 | 2 | C025 | REAL | -99.9..99.9 | R/W | K/R | C025 - Suction temp. probe offset for circ.2 |
| 178 | 2 | C026 | REAL | -99.9..99.9 | R/W | bar | C026 - Discharge press. probe offset for circ.1 |
| 180 | 2 | C027 | REAL | -99.9..99.9 | R/W | bar | C027 - Suction press. probe offset for circ.1 |
| 182 | 2 | C028 | REAL | -99.9..99.9 | R/W | K/R | C028 - Cond. temp. probe offset for circ.1 |
| 184 | 2 | C029 | REAL | -99.9..99.9 | R/W | K/R | C029 - Evap. temp. probe offset for circ.1 |
| 186 | 2 | C030 | REAL | -99.9..99.9 | R/W | bar | C030 - Discharge press. probe offset for circ.2 |
| 188 | 2 | C031 | REAL | -99.9..99.9 | R/W | bar | C031 - Suction press. probe offset for circ.2 |
| 190 | 2 | C032 | REAL | -99.9..99.9 | R/W | K/R | C032 - Cond. temp. probe offset for circ.2 |
| 192 | 2 | C033 | REAL | -99.9..99.9 | R/W | K/R | C033 - Evap. temp. probe offset for circ.2 |
| 194 | 1 | C037 | INT | 0..1 | R/W | | C037 - Suction press. probe type (0=0..5V, 1=4..20mA) |
| 195 | 2 | C038 | REAL | -1.0..99.9 | R/W | bar | C038 - Suction press. probe min value |
| 197 | 2 | C039 | REAL | 0.0..99.9 | R/W | bar | C039 - Suction press. probe max value |
| 199 | 1 | C040 | INT | 0..1 | R/W | | C040 - Discharge press. probe type (0=0..5V, 1=4..20mA) |
| 200 | 2 | C041 | REAL | -1.0..99.9 | R/W | bar | C041 - Discharge press. probe min value |

| Index | Size | Ref. | Type | Min/Max | R/W | UoM | Description |
|---|---|---|---|---|---|---|---|
| 202 | 2 | C042 | REAL | 0.0..99.9 | R/W | bar | C042 - Discharge press. probe max value |
| 204 | 1 | C043 | INT | 0..1 | R/W | | C043 - Discharge temp. probe type (0=NTC, 1=NTC-HT) |
| 206 | 1 | C046 | INT | 1..2 | R/W | | C046 - Number of circuit in the unit |
| 207 | 1 | C047 | INT | 0..1/3 | R/W | | C047 - Type of compressors used (0=1 ON/OFF, 1=2 ON/OFF, 2=BLDC, 3=BLDC + ON/OFF) |
| 208 | 1 | C048 | INT | 1..2 | R/W | | C048 - Compressor rotation type (1=FIFO, 2=TIME) |
| 209 | 1 | S000 | INT | 0..999 | R/W | h | S000 - Source pump 1 maintenance hour threshold (x100) |
| 210 | 1 | S002 | INT | 0..2 | R/W | | S002 - Source pump 1 manual mode (0=AUTO, 1=OFF, 2=ON) |
| 212 | 1 | S022 | INT | 0..59 | R/W | min | Time band minute |
| 214 | 1 | S008 | INT | 0..999 | R/W | h | S008 - Source fan 1 circ.1 maintenance hour threshold (x100) |
| 215 | 1 | S010 | INT | 0..2 | R/W | | S010 - Source fan ON/OFFcirc.1 manual mode (0=AUTO, 1=OFF, 2=ON) |
| 216 | 1 | S011 | INT | 0..101 | R/W | % | S011 - Source fan inverter circ.1 manual mode(0=AUTO, 1=0%, 2=1%, .. 101=100%) |
| 217 | 1 | S012 | INT | 0..999 | R/W | h | S012 - Source fan 1 circ.2 maintenance hour threshold (x100) |
| 218 | 1 | S014 | INT | 0..2 | R/W | | S014 - Source fan ON/OFF circ.2 manual mode (0=AUTO, 1=OFF, 2=ON) |
| 219 | 1 | S015 | INT | 0..101 | R/W | % | S015 - Source fan inverter circ.2 manual mode (0=AUTO, 1=0%, 2=1%, .. 101=100%) |
| 220 | 2 | S016 | REAL | -999.9..999.9 | R/W | °C/°F | S016 - Source fan temp. threshold for cold climates |
| 222 | 2 | S017 | REAL | 0..100 | R/W | % | S017 - Source fan min speed for cold climates |
| 224 | 2 | S018 | REAL | 0..100 | R/W | % | S018 - Source fan speed up speed for cold climates |
| 226 | 1 | S019 | INT | 0..300 | R/W | s | S019 - Source fan speed up time for cold climates |
| 227 | 2 | | REAL | | R/W | % | FC_PrwReq - Free-Cooling regulation ramp |
| 229 | 2 | Sprb | REAL | | R | °C/°F | SPrb - Source external air temperature |
| 231 | 2 | S025 | REAL | 0..999.9 | R/W | °C/°F | S025 - Low noise source fan setpoint in cooling |
| 233 | 1 | S026 | INT | 0..999 | R/W | s | S026 - Compr. delay ON since the source pump ON |
| 234 | 1 | S027 | INT | 0..999 | R/W | s | S027 - Source pump delay OFF since the compr. OFF |
| 235 | 2 | S028 | REAL | -999.9..999.9 | R/W | °C/°F | S028 - Source fan cool setpoint |
| 237 | 2 | S029 | REAL | 0..99.9 | R/W | °C/°F | S029 - Source fan heat setpoint |
| 241 | 2 | S031 | REAL | 0..999.9 | R/W | °C/°F | S031 - Source fan cool setpoint at startup |
| 243 | 1 | S032 | INT | 0..999 | R/W | s | S032 - Source fan cool startup delay |
| 246 | 2 | S034 | REAL | 0..99.9 | R/W | K/R | S034 - Source fan cool differential |
| 248 | 2 | S035 | REAL | 0..99.9 | R/W | K/R | S035 - Source fan heat differential |
| 250 | 2 | S036 | REAL | 0..100 | R/W | % | S036 - Source fan inverter min speed |
| 252 | 2 | S037 | REAL | 0..100 | R/W | % | S037 - Source fan inverter max speed |
| 254 | 2 | S039 | REAL | -99.9..99.9 | R/W | °C/°F | S039 - Defrost start threshold |
| 256 | 2 | S040 | REAL | S039..99.9 | R/W | °C/°F | S040 - Defrost start threshold reset |
| 258 | 1 | S041 | INT | 0..999 | R/W | min | S041 - Defrost start delay |
| 259 | 2 | S042 | REAL | -999.9..999.9 | R/W | °C/°F | S042 - Defrost end threshold |
| 261 | 1 | S044 | INT | 0..999 | R/W | s | S044 - Defrost begin delay before actuating the 4 way valve |
| 262 | 1 | S045 | INT | 0..999 | R/W | s | S045 - Defrost ending delay after actuating the 4 way valve |
| 263 | 1 | S046 | INT | 0..99 | R/W | min | S046 - Defrost min duration |
| 264 | 1 | S047 | INT | 0..99 | R/W | min | S047 - Defrost max duration |
| 265 | 1 | S048 | INT | 0..999 | R/W | s | S048 - Dripping duration |
| 266 | 1 | S049 | INT | 0..999 | R/W | s | S049 - Post dripping duration |
| 267 | 1 | S050 | INT | 0..999 | R/W | min | S050 - Delay between defrosts |
| 272 | 1 | S053 | INT | 0..2 | R/W | | S053 - Defrost synchronization type (0=Independent, 1=Separated, 2=Simultaneous) |
| 274 | 2 | S054 | REAL | 0..999.9 | R/W | bar | S054 - Delta press. to reverse the 4 way valve |
| 278 | 1 | S056 | INT | 20..999 | R/W | s | S056 - Duration of smart start function |
| 279 | 2 | S057 | REAL | -999.9..999.9 | R/W | °C/°F | S057 - Antifreeze source alarm threshold |
| 281 | 2 | S058 | REAL | 0..999 | R/W | K/R | S058 - Antifreeze source alarm differential |
| 283 | 1 | S059 | INT | 0..999 | R/W | s | S059 - Antifreeze source alarm delay time at 1K below threshold |
| 284 | 2 | S060 | REAL | -99.9..99.9 | R/W | K/R | S060 - Source external air temperature offset |
| 286 | 1 | Hc00 | INT | 0..3/4 | R/W | | Hc00 - Analog input 3 config. (0=Not used, 1=Source temp., 2=Discharge temp., 3=Suction temp., 4=Source water delivery temp.) |
| 287 | 1 | Hc01 | INT | 0..1 | R/W | | Hc01 - Analog input 4 and 5 config. (0=Pressure, 1=Temp.) |
| 288 | 1 | Hc03 | INT | 0..2 | R/W | | Hc03 - Analog input 6 config. (0=Not used, 1=Remote setpoint, 2=Source temp.) |
| 289 | 1 | Hc04 | INT | 0..1 | R/W | | Hc04 - Analog input 7 config. (0=Not used, 1=Suction temp.) |
| 290 | 1 | Hc05 | INT | 0..1 | R/W | | Hc05 - Analog input 6 config. of Circuit 2 board (0=Not used, 1=Remote setpoint) |
| 291 | 1 | Hc06 | INT | 0..6 | R/W | | Hc06 - Digital input 4 config. (0=Not used, 1=Compr.2 circ.1 overload, 2=Remote ON/OFF, 3=Cool/Heat, 4=2nd SetPoint, 5=Remote alarm , 6=User pump 1 overload) |
| 292 | 1 | Hc07 | INT | 0..6 | R/W | | Hc07 - Digital input 5 config. (0=Not used, 1=Compr.2 circ.1 overload, 2=Remote ON/OFF, 3=Cool/Heat, 4=2nd SetPoint, 5=Remote alarm, 6=User pump 1 overload) |
| 293 | 1 | Hc08 | INT | 0..6 | R/W | | Hc08 - Digital input 6 config. (0=Not used, 1=Compr.2 circ.1 overload, 2=Remote ON/OFF, 3=Cool/Heat, 4=2nd SetPoint, 5=Remote alarm, 6=User pump 1 overload) |

| Index | Size | Ref. | Type | Min/Max | R/W | UoM | Description |
|---|---|---|---|---|---|---|---|
| 294 | 1 | Hc09 | INT | 0..5 | R/W | | Hc09 - Digital input 4 config. of Circuit 2 board (0=Not used, 1=Compr.2 circ.2 overload, 2=Remote ON/OFF, 3=Cool/Heat, 4=2nd SetPoint, 5=User pump 1 overload) |
| 295 | 1 | Hc10 | INT | 0..5 | R/W | | Hc10 - Digital input 5 config. of Circuit 2 board (0=Not used, 1=Compr.2 circ.2 overload, 2=Remote ON/OFF, 3=Cool/Heat, 4=2nd SetPoint, 5=User pump 1 overload) |
| 296 | 1 | Hc11 | INT | 0..5 | R/W | | Hc11 - Digital input 6 config. of Circuit 2 board (0=Not used, 1=Compr.2 circ.2 overload, 2=Remote ON/OFF, 3=Cool/Heat 4=2nd SetPoint, 5=User pump 1 overload) |
| 307 | 2 | SEtC | REAL | U006..U007 | R/W | °C/°F | SEtC - Cool setpoint |
| 309 | 2 | SEtH | REAL | U008..U009 | R/W | °C/°F | SEtH - Heat setpoint |
| 324 | 2 | C017 | REAL | 0..999.9 | R/W | °C/°F | C017 - Threshold of max high pressure (HP) |
| 326 | 2 | C018 | REAL | -99.9..99.9 | R/W | bar | C018 - Threshold of min low pressure (LP) |
| 328 | 1 | E047 | INT | 0..2 | R/W | | E047 - Type of ExV driver (0= Disabled, 1= EVD embedded, 2=EVD EVO) |
| 335 | 2 | P000 | REAL | -999.9..999.9 | R/W | °C/°F | P000 - Evaporating min temp. custom envelop limit |
| 337 | 2 | P001 | REAL | -999.9..999.9 | R/W | °C/°F | P001 - Condensing max temp. custom envelop limit |
| 339 | 1 | P002 | INT | 0..999 | R/W | s | P002 - Prevent min duration |
| 340 | 1 | P003 | INT | 0..999 | R/W | s | P003 - Out of envelop alarm delay time |
| 341 | 1 | P004 | INT | 0..999 | R/W | s | P004 - Low pressure difference alarm delay |
| 342 | 2 | P005 | REAL | 0..999.9 | R/W | rps | P005 - Circuit destabilization min BLDC speed threshold |
| 344 | 2 | P006 | REAL | 0..100 | R/W | % | P006 - Oil recovery min request for activation |
| 346 | 2 | P007 | REAL | 0..999.9 | R/W | rps | P007 - Oil recovery min compr. speed for activation |
| 348 | 1 | P008 | INT | 0..999 | R/W | min | P008 - Oil recovery time before activation in which the compressor can run at min speed |
| 349 | 1 | P009 | INT | 0..999 | R/W | min | P009 - Oil recovery duration in which the compr. speed is forced |
| 350 | 2 | P010 | REAL | 0..999.9 | R/W | rps | P010 - Oil recovery compr. speed in which the compr. is forced |
| 352 | 1 | P011 | INT | 0..999 | R/W | s | P011- Oil equalization startup time of solenoid valve on compr. starts |
| 353 | 1 | P012 | INT | 0..999 | R/W | s | P012 - Oil equalization solenoid valve open time |
| 354 | 1 | P013 | INT | 0..999 | R/W | min | P013 - Oil equalization solenoid valve min off time |
| 355 | 1 | P014 | INT | 0..999 | R/W | min | P014 - Oil equalization solenoid valve max off time |
| 356 | 1 | P015 | INT | 0..999 | R/W | min | P015 - Oil equalization max time for the management |
| 357 | 1 | P019 | INT | 0..101 | R/W | % | P019 - Compressor 1 circuit 1 manual mode (0=AUTO, 1=0%, ... 101=100%) |
| 358 | 1 | P020 | INT | 0..101 | R/W | % | P020 - Compressor 1 circuit 2 manual mode (0=AUTO, 1=0%, ... 101=100%) |
| 359 | 2 | P021 | REAL | | R/W | kPa | P021 - Max permitted Delta P to start up |
| 361 | 1 | P022 | INT | | R/W | s | P022 - Max time of EVD propening to equalize pressure |
| 362 | 1 | P023 | INT | | R/W | % | P023 - Preopening of EVD in case of prestart to equalize pressure |
| 363 | 2 | P024 | REAL | | R/W | rps | P024 - Start up speed |
| 365 | 2 | P025 | REAL | | R/W | rps | P025 - Max speed custom (rps) |
| 367 | 2 | P026 | REAL | | R/W | rps | P026 - Min speed custom (rps) |
| 369 | 2 | P027 | REAL | 0..100 | R/W | % | P027 - BLDC speed request threshold % to call on it |
| 371 | 2 | P028 | REAL | 20..100 | R/W | % | P028 - BLDC speed threshold to call on fixed speed compressor |
| 373 | 2 | P029 | REAL | 20..100 | R/W | % | P029 - BLDC speed threshold to switch off fixed speed compressor |
| 375 | 2 | P030 | REAL | | R/W | | P030 - Skip frequency: set 1 [010] |
| 377 | 2 | P031 | REAL | | R/W | | P031 - Skip frequency: band 1 [011] |
| 379 | 1 | P032 | INT | | R/W | | P032 - Enable motor over temperature alarm (PTC) (0=OFF, 1=ON) [027] |
| 380 | 1 | P033 | INT | | R/W | | P033 - Motor overtemperature alarm delay [028] |
| 382 | 2 | S051 | REAL | 0..999.9 | R/W | rps | S051 - BLDC defrost speed |
| 384 | 2 | S052 | REAL | 0..999.9 | R/W | rps | S052 - BLDC cycle reverse speed in defrost |
| 703 | 1 | | INT | | R/W | | MotTyp - BLDC Carel Database ID |
| 704 | 1 | | INT | | R/W | | Poles - Number of motor poles |
| 709 | 1 | U079 | INT | 1..15 | R/W | min | U079 - Burst funct. time of user pump on |
| 710 | 1 | U080 | INT | 3..99 | R/W | min | U080 - Burst funct. time of user pump off |
| 732 | 2 | S070 | REAL | -99.9..99.9 | R/W | K/R | S070 - Cond.1 antifreeze temp. probe offset (S3) |
| 734 | 2 | S071 | REAL | 99.9..99.9 | R/W | K/R | S071 - Cond.2 antifreeze temp. probe offset (S3 exp.) |
| 736 | 2 | S069 | REAL | 0..99.9 | R/W | °C/°F | S069 - Temperature set point of Fan-Defrost function (0=Function di |

## 7.4 Input register

| Index | Size | Ref. | Type | Min/Max | R/W | UoM | Description |
|---|---|---|---|---|---|---|---|
| 0 | 2 | HuP1 | INT | | R | h | HuP1 - User pump 1 working hours |
| 2 | 2 | HuP2 | INT | | R | h | HuP2 - User pump 2 working hours |
| 4 | 2 | H1C1 | INT | | R | h | H1C1 - Compr.1 circ.1 working hour |
| 6 | 2 | H1C2 | INT | | R | h | H1C2 - Compr.2 circ.1 working hour |
| 8 | 2 | H2C1 | INT | | R | h | H2C1 - Compr.1 circ.2 working hour |
| 10 | 2 | H2C2 | INT | | R | h | H2C2 - Compr.2 circ.2 working hour |
| 12 | 2 | dSt1 | REAL | | R | °C/°F | dSt1 - Discharge temp. probe of circ.1 |
| 14 | 2 | Sct1 | REAL | | R | °C/°F | Sct1 - Suction temp. of circ.1 |
| 16 | 2 | dSt2 | REAL | | R | °C/°F | dSt2- Discharge temp. probe of circ.2 |
| 18 | 2 | Sct2 | REAL | | R | °C/°F | Sct2 - Suction temp. of circ.2 |
| 20 | 2 | dSP1 | REAL | | R | bar/psi | dSP1 - Discharge press. probe of circ.1 |
| 22 | 2 | ScP1 | REAL | | R | bar/psi | ScP1 - Suction press. of circ.1 |
| 24 | 2 | Cnd1 | REAL | | R | °C/°F | Cnd1 - Cond. temp. probe (or press. probe converted value) of circ.1 |
| 26 | 2 | EuP1 | REAL | | R | °C/°F | EuP1 - Evap. temp. probe (or press. probe converted value) of circ.1 |
| 28 | 2 | dSP2 | REAL | | R | bar/psi | dSP2 - Discharge press. probe of circ.2 |
| 30 | 2 | ScP2 | REAL | | R | bar/psi | ScP2 - Suction press. of circ.2 |
| 32 | 2 | Cnd2 | REAL | | R | °C/°F | Cnd2 - Cond. temp. probe (or press. probe converted value) of circ.2 |
| 34 | 2 | EuP2 | REAL | | R | °C/°F | EuP2 - Evap. temp. probe (or press. probe converted value) of circ.2 |
| 36 | 2 | HSP1 | INT | | R | h | HSP1 - Source pump 1 working hours |
| 38 | 1 | C045 | INT | | R | | C045 - Refrigerant type (3=R407C, 4=R410a, 6=R290, 10=R744, 22=R32) |
| 40 | 2 | HFn1 | INT | | R | h | HFn1 - Source fan 1 circ.1 working hour |
| 42 | 2 | HFn2 | INT | | R | h | HFn2 - Source fan 1 circ.2 working hour |
| 46 | 2 | SEtA | REAL | | R | °C/°F | SEtA - Actual setpoint used by thermoregulation |
| 48 | 2 | SSH1 | REAL | | R | K/R | SSH1 - Suction Superheat of circ.1 |
| 50 | 1 | Opn1 | INT | | R | % | Opn1 - EEV position of circ.1 |
| 51 | 2 | SSH2 | REAL | | R | K/R | SSH2 - Suction Superheat of circ.2 |
| 53 | 1 | Opn2 | INT | | R | % | Opn2 - EEV position of circ.2 |
| 54 | 2 | rUSr | REAL | | R | °C/°F | rUSr - Return water temp. from user |
| 56 | 2 | dUSr | REAL | | R | °C/°F | dUSr - Delivery water temperature to user |
| 65 | 2 | | REAL | | R | % | Fan1Req - Inverter request source fan circ.1 |
| 67 | 2 | | REAL | | R | % | Fan2Req - Inverter request source fan circ.2 |
| 71 | 1 | | INT | | R | | UnitStatus - Unit status (0=OFF by remote DI, 1=OFF by keyboard, 2=OFF by scheduler, 3=OFF by BMS, 4=OFF by changeover mode Ch/HP, 5=OFF by alarm, 6=Unit in defrosting, 7=Unit ON, 8=Manual mode) |
| 90 | 2 | rSPt | REAL | | R | °C/°F | rSPt - Remote set point |
| 92 | 2 | | REAL | | R | % | PwrReq - Power request |
| 96 | 2 | | REAL | | R | °C/°F | SrcSetP_Circ1 - Source fan circ.1 set point |
| 98 | 2 | | REAL | | R | °C/°F | SrcSetP_Circ2 - Source fan circ.2 set point |
| 100 | 2 | rps1 | REAL | | R | rps | PSD circuit 1: Actual rotor speed coming from inverter |
| 102 | 2 | Mc1 | REAL | | R | A | PSD circuit 1: Current motor current [A] |
| 104 | 2 | MP1 | REAL | | R | kW | PSD circuit 1: Current motor consumption [kW] |
| 106 | 2 | Drt1 | REAL | | R | °C/°F | PSD circuit 1: Current drive temperature[°C] |
| 108 | 1 | AlHs1_1 | INT | | R | | PSD circuit 1: the last alarm log |
| 109 | 1 | AlHs2_1 | INT | | R | | PSD circuit 1: the last-but-1st alarm log |
| 110 | 1 | AlHs3_1 | INT | | R | | PSD circuit 1: the last-but-2nd alarm log |
| 111 | 1 | AlHs4_1 | INT | | R | | PSD circuit 1: the last-but-3rd alarm log |
| 114 | 1 | | INT | | R | | MotTyp - BLDC circ.1 Carel Database ID |
| 115 | 1 | | INT | | R | | Envelope zone circ.1 |
| 116 | 2 | | REAL | | R | °C/°F | EnvPnt_X1 - Envelope point |
| 118 | 2 | | REAL | | R | °C/°F | EnvPnt_Y1 - Envelope point |
| 120 | 2 | | REAL | | R | °C/°F | EnvPnt_X2 - Envelope point |
| 122 | 2 | | REAL | | R | °C/°F | EnvPnt_Y2 - Envelope point |
| 124 | 2 | | REAL | | R | °C/°F | EnvPnt_X3 - Envelope point |
| 126 | 2 | | REAL | | R | °C/°F | EnvPnt_Y3 - Envelope point |
| 128 | 2 | | REAL | | R | °C/°F | EnvPnt_X4 - Envelope point |
| 130 | 2 | | REAL | | R | °C/°F | EnvPnt_Y4 - Envelope point |
| 132 | 2 | | REAL | | R | °C/°F | EnvPnt_X5 - Envelope point |
| 134 | 2 | | REAL | | R | °C/°F | EnvPnt_Y5 - Envelope point |
| 136 | 2 | | REAL | | R | °C/°F | EnvPnt_X6 - Envelope point |
| 138 | 2 | | REAL | | R | °C/°F | EnvPnt_Y6 - Envelope point |
| 140 | 2 | | REAL | | R | °C/°F | EnvPnt_X7 - Envelope point |
| 142 | 2 | | REAL | | R | °C/°F | EnvPnt_Y7 - Envelope point |
| 144 | 2 | | REAL | | R | °C/°F | EnvPnt_X8 - Envelope point |

| Index | Size | Ref. | Type | Min/Max | R/W | UoM | Description |
|---|---|---|---|---|---|---|---|
| 146 | 2 | | REAL | | R | °C/°F | EnvPnt_Y8 - Envelope point |
| 148 | 1 | | INT | | R | | Envelope zone circ.2 |
| 149 | 2 | | REAL | | R | °C/°F | EnvPnt2_X1 - Envelope point |
| 151 | 2 | | REAL | | R | °C/°F | EnvPnt2_Y1 - Envelope point |
| 153 | 2 | | REAL | | R | °C/°F | EnvPnt2_X2 - Envelope point |
| 155 | 2 | | REAL | | R | °C/°F | EnvPnt2_Y2 - Envelope point |
| 157 | 2 | | REAL | | R | °C/°F | EnvPnt2_X3 - Envelope point |
| 159 | 2 | | REAL | | R | °C/°F | EnvPnt2_Y3 - Envelope point |
| 161 | 2 | | REAL | | R | °C/°F | EnvPnt2_X4- Envelope point |
| 163 | 2 | | REAL | | R | °C/°F | EnvPnt2_Y4 - Envelope point |
| 165 | 2 | | REAL | | R | °C/°F | EnvPnt2_X5 - Envelope point |
| 167 | 2 | | REAL | | R | °C/°F | EnvPnt2_Y5 - Envelope point |
| 169 | 2 | | REAL | | R | °C/°F | EnvPnt2_X6 - Envelope point |
| 171 | 2 | | REAL | | R | °C/°F | EnvPnt2_Y6 - Envelope point |
| 173 | 2 | | REAL | | R | °C/°F | EnvPnt2_X7 - Envelope point |
| 175 | 2 | | REAL | | R | °C/°F | EnvPnt2_Y7 - Envelope point |
| 177 | 2 | | REAL | | R | °C/°F | EnvPnt2_X8 - Envelope point |
| 179 | 2 | | REAL | | R | °C/°F | EnvPnt2_Y8 - Envelope point |
| 181 | 2 | rps2 | REAL | | R | rps | PSD circuit 2: Actual rotor speed coming from inverter |
| 183 | 2 | Mc2 | REAL | | R | A | PSD circuit 2: Current motor current [A] |
| 185 | 2 | MP2 | REAL | | R | kW | PSD circuit 2: Current motor consumption [kW] |
| 187 | 2 | Drt2 | REAL | | R | °C/°F | PSD circuit 2: Current drive temperature[°C] |
| 189 | 1 | AlHs1_2 | INT | | R | | PSD circuit 2: the last alarm log |
| 190 | 1 | AlHs2_2 | INT | | R | | PSD circuit 2: the last-but-1st alarm log |
| 191 | 1 | AlHs3_2 | INT | | R | | PSD circuit 2: the last-but-2nd alarm log |
| 192 | 1 | AlHs4_2 | INT | | R | | PSD circuit 2: the last-but-3rd alarm log |
| 193 | 1 | | INT | | R | | MotTyp2 - BLDC circ.2 Carel Database ID |
| 213 | 2 | AFC2 | REAL | | R | °C/°F | AFC2 - Cond.2 antifreeze temp (S3 exp.) |
| 217 | 2 | AFC1 | REAL | | R | °C/°F | AFC1 - Cond.1 antifreeze temp (S3) |

# 8. Alarms and signals

The controller manages three types of alarms, depending on the reset mode:

- **A - automatic**: the alarm is reset and the device restarts automatically when the alarm condition is no longer present;
- **R - semi-automatic**: if the alarm occurs several times, reset becomes manual and an operator needs to physically restart the device.
- **M - manual**: an operator an operator needs to physically restart the device.

Alarms that require technical service are shown on the display with the flashing spanner icon.
If the spanner icon is on, it means that a device has reached the programmed operating hour threshold, and maintenance is required (the alarm code indicates which device is affected).

For some alarms, the reset mode can be configured by parameter. The configurable alarms are:

- High pressure switch
- Low pressure switch
- Frost protection alarm

| Use | Cod | Description | De | Mi | M | UO |
|---|---|---|---|---|---|---|
| M | U081 | Pressure-frost alarm reset configuration<br>0 = high pressure switch, low pressure switch, frost all with manual reset<br>1 = high pressure switch, low pressure switch, frost all with automatic reset<br>2 = high pressure and switch and frost with manual reset, low pressure switch with automatic reset<br>3 = high pressure switch with manual reset, low pressure switch, and frost with automatic reset<br>4 = high pressure switch and low pressure switch with manual reset, frost with automatic reset<br>5 = high pressure switch and low pressure switch with semi-automatic reset, frost with automatic reset<br>6 = high pressure switch and low pressure switch with semi-automatic reset, frost with manual reset<br>7 = high pressure and switch and frost with manual reset, low pressure switch with semi-automatic reset | 7 | 0 | 7 | - |

## 8.1 Active alarms

Note: the user terminal can only access the active alarms without password protection, or, with password protection, to the alarms relating to unit initialization and optimization.

Active alarms are signalled by buzzer and the Alarm button lighting up. Pressing Alarm mutes the buzzer and displays the alarm code (on the top row) and any additional information (on the bottom row). Alarm activation is recorded in the alarm log.
If the alarm is reset automatically, the Alarm button goes off, the alarm code is cleared from the list and the alarm reset event is recorded in the alarm log.

Procedure (alarm acknowledgement):

1. press Alarm: the buzzer is muted, the alarm code is shown on the display;
2. press UP/DOWN to scroll through the list of alarms;
3. when finished, press Esc and then PRG to exit.

Procedure


When an alarm is active, the buzzer sounds and the Alarm button lights up


Pressing Alarm mutes the buzzer and displays the alarm code; pressing UP/ DOWN scrolls the list of any other alarms.


When reaching the end of the alarm list, "ESC" is shown: press PRG to exit the alarm list.


Pressing the Alarm button for more than 3 s resets the alarms: noAL indicates that there are no more active alarms. Press PRG to exit the alarm list

A single alarm can be reset by pressing Alarm for more than 3 s. If the condition that generated the alarm is still present, the alarm will be reactivated. The alarm log can be deleted using parameter ClrH, accessible via the Service level on the terminal or APPLICA via smartphone, with BLE connection, using the specific function on the alarm page ("Service" level access). The same operations can be performed with APPLICA via smartphone, using the specific function on the alarm page (a BLE connection and "Service" level access are required).

**Note:**

- deletion of the alarm log is irreversible;
- see chapter “Functions” for the alarm parameters: evaporator outlet temperature, frost protection, compressor;
- the buzzer is activated for all alarms

## 8.2 Active alarms list

| Code | Description | Reset | Effect | Priority | Delay | No. of attempt | Evaluation p. |
|---|---|---|---|---|---|---|---|
| A01 | Unit: no. of permanent memory writes | M | - | Fault | No | - | - |
| A02 | Unit: permanent memory writes | M | - | Fault | No | - | - |
| A03 | Unit: remote alarm from digital input | M | Unit shutdown | Serious, unit | No | - | - |
| A04 | Unit: remote set point probe | A | Use standard set point | Fault | 10s | - | - |
| A05 | Unit: user return water temperature probe | A | Unit shutdown | Fault | 10s | - | - |
| A06 | Unit: user delivery water temperature probe | A | Unit shutdown | Serious, unit | 10s | - | - |
| A08 | Unit: user pump 1 overload | M | - | Fault | No | - | - |
| A09 | Unit: user pump 2 overload | M | - | Fault | No | - | - |
| A10 | Unit: flow switch (with user pump 1 active) | M | Unit shutdown | Serious, unit | Param. U045/U046 | - | - |
| A11 | Unit: flow switch (with user pump 2 active) | M | Unit shutdown | Serious, unit | Param. U045/U046 | - | - |
| A12 | Unit: user pump group | M | Unit shutdown | Serious, unit | No | - | - |
| A13 | Unit: user pump 1 maintenance | A | Fault | Param. | U000 | - | - |
| A14 | Unit: user pump 2 maintenance | A | - | Fault | Param. U003 | - | - |
| A15 | Unit: high chilled water temperature | A | - | Fault | Param. U032/U033 | - | - |
| A16 | Unit: source return water/air temperature probe | A | Disable FC and Compensation (A/W units) | Fault | 10s | - | - |
| A17 | Unit: source pump 1 maintenance | A | - | Fault | Param. S000 | - | - |
| A18 | Unit: free cooling warning | M | Disable FC | Fault | Param. U032/180s | - | - |
| A19 | Circuit 1: condensation pressure probe | A | Circuit 1 shutdown | Serious, circuit 1 | 10s | - | - |
| A20 | Circuit 1: condensing temperature probe | A | Circuit 1 shutdown | Serious, circuit 1 | 10s | - | - |
| A21 | Circuit 1: evaporation pressure probe | A | Circuit 1 shutdown | Serious, circuit 1 | 10s | - | - |
| A22 | Circuit 1: evaporation temperature probe | A | Circuit 1 shutdown | Serious, circuit 1 | 10s | - | - |
| A23 | Circuit 1: discharge temperature probe | A | Circuit 1 shutdown | Serious, circuit 1 | 10s | - | - |
| A24 | Circuit 1: suction temperature probe | A | Circuit 1 shutdown | Serious, circuit 1 | 10s | - | - |
| A25 | Circuit 1: high pressure switch | Param U081. | Circuit 1 shutdown | Serious, circuit 1 | No | - | - |
| A26 | Circuit 1: high condensing pressure/temperature transducer | M | Circuit 1 shutdown | Serious, circuit 1 | No | - | - |
| A27 | Circuit 1: low pressure transducer | A (R) | Circuit 1 shutdown | Serious, circuit 1 | No | 3 | 3600 |
| A28 | Circuit 1: frost protection evaporation temperature | Param. U081 | Circuit 1 shutdown | Serious, circuit 1 | Param. U052 | - | - |
| A29 | Circuit 1: compressor 1 overload | Param. U081 | Circuit 1 shutdown | Serious, circuit 1 | Param. C049, C050 | 3 | 3600 |
| A30 | Circuit 1: compressor 2 overload | M | Comp. 1 circ. 1 shutdown | Fault, circuit 1 | No | - | - |
| A31 | Circuit 1: compressor 1 maintenance | M | Comp. 2 circ. 1 shutdown | Fault, circuit 1 | No | - | - |
| A32 | Circuit 1: compressor 2 maintenance | A | - | Fault, circuit 1 | Param. C000 | - | - |
| A33 | Circuit 1: source fan maintenance | A | - | Fault, circuit 1 | Param. C003 | - | - |
| A34 | EVD circuit 1: LowSH | A | - | Fault, circuit 1 | Param. S008 | - | - |
| A35 | EVD circuito 1: LowSH | M | Circuit 1 shutdown | Fault, circuit 1 | Param. E024 | - | - |
| A36 | EVD circuit 1: LOP | A | - | Fault, circuit 1 | Param. E025 | - | - |
| A37 | EVD circuit 1: MOP | A | Circuit 1 shutdown | Fault, circuit 1 | Param. E026 | - | - |
| A38 | EVD circuit 1: motor error | M | Circuit 1 shutdown | Fault, circuit 1 | No | - | - |
| A39 | EVD circuit 1: emergency closing | A | - | Fault, circuit 1 | No | - | - |
| A40 | EVD circuit 1: incomplete valve closing | A | - | Fault, circuit 1 | No | - | - |
| A41 | EVD circuit 1: offline | A | Circuit 1 & 2 shut-down | Serious, circuit 1 & 2 | 30s | - | - |
| A42 | Circuit 1: envelope alarm + zone alarm | A (R) | Circuit 1 shutdown | Serious, circuit 1 | Param. P003 | 3 | 3600 |
| A43 | BLDC circuit 1: high pressure differential at start-up | A | BLDC 1 not enabled to start | Serious, circuit 1 | 5min | - | - |
| A44 | BLDC circuit 1: failed start-up | A (R) | - | Serious, circuit 1 | 45s | 5 | 3600 |
| A45 | BLDC circuit 1: low pressure differential | A | Circuit 1 shutdown | Serious, circuit 1 | Param. P004 | - | - |
| A46 | BLDC circuit 1: high gas discharge temp. | M | Circuit 1 shutdown | Serious, circuit 1 | No | - | - |
| A47 | Speed drive 1: offline | A | Circuit 1 shutdown / BLDC 1 | Serious, circuit 1 | 30s | - | - |
| A48 | Speed drive 1: alarm + error code | A (R) | Circuit 1 shutdown / BLDC 1 | Serious, circuit 1 | No | 3 | 3600 |
| A49 | Unit: circuit 2 offline | A | - | Serious, circuit 2 | 30s | - | - |
| A50 | Circuit 2 unit: no. permanent memory writes | M | - | Fault | No | - | - |

| Code | Description | Reset | Effect | Priority | Delay | No. of attempt | Evaluation p. |
|---|---|---|---|---|---|---|---|
| A51 | Circuit 2 unit: permanent memory writes | M | - | Fault | No | - | - |
| A52 | Circuit 2: condensation pressure probe | A | Circuit 2 shutdown | Serious, circuit 2 | 10s | - | - |
| A53 | Circuit 2: condensing temperature probe | A | Circuit 2 shutdown | Serious, circuit 2 | 10s | - | - |
| A54 | Circuit 2: evaporation pressure probe | A | Circuit 2 shutdown | Serious, circuit 2 | 10s | - | - |
| A55 | Circuit 2: evaporation temperature probe | A | Circuit 2 shutdown | Serious, circuit 2 | 10s | - | - |
| A56 | Circuit 2: discharge temperature probe | A | Circuit 2 shutdown | Serious, circuit 2 | 10s | - | - |
| A57 | Circuit 2: suction temperature probe | A | Circuit 2 shutdown | Serious, circuit 2 | 10s | - | - |
| A58 | Circuit 2: high pressure switch | Param. U081 | Circuit 2 shutdown | Serious, circuit 2 | No | - | - |
| A59 | Circuit 2: high condensing pressure/temperature transducer | M | Circuit 2 shutdown | Serious, circuit 2 | No | - | - |
| A60 | Circuit 2: low pressure transducer | A (R) | Circuit 2 shutdown | Serious, circuit 2 | No | 3 | 3600 |
| A61 | Circuit 2: frost protection evaporation temperature | Param. U081 | Circuit 2 shutdown | Serious, circuit 2 | Param. U052 | - | - |
| A62 | Circuit 2: low pressure switch | Param. U081 | Circuit 2 shutdown | Serious, circuit 2 | Param. C049, C050 | 3 | 3600 |
| A63 | Circuit 2: compressor 1 overload | M | Comp. 1 circ. 2 shutdown | Fault, circuit 2 | No | - | - |
| A64 | Circuit 2: compressor 2 overload | M | Comp. 2 circ. 2 shutdown | Fault, circuit 2 | No | - | - |
| A65 | Circuit 2: compressor 1 maintenance | A | - | Fault | Param. C006 | - | - |
| A66 | Circuit 2: compressor 2 maintenance | A | - | Fault | Param. C003 | - | - |
| A67 | Circuit 2: source fan maintenance | A | - | Fault | Param. S012 | - | - |
| A68 | EVD circuit 2: LowSH | M | Circuit 2 shutdown | Serious, circuit 2 | Param. E024 | - | - |
| A69 | EVD circuit 2: LOP | A | Circuit 2 shutdown | Serious, circuit 2 | Param. E025 | - | - |
| A70 | EVD circuit 2: MOP | A | Circuit 2 shutdown | Serious, circuit 2 | Param. E026 | - | - |
| A71 | EVD circuit 2: motor error | M | Circuit 2 shutdown | Serious, circuit 2 | No | - | - |
| A72 | EVD circuit 2: emergency closing | A | Circuit 2 shutdown | Serious, circuit 2 | No | - | - |
| A73 | EVD circuit 2: incomplete valve closing | A | Circuit 2 shutdown | Serious, circuit 2 | No | - | - |
| A74 | EVD circuit 2: offline | A | Circuit 2 shutdown | Serious, circuit 2 | 30s | - | - |
| A75 | Circuit 2: envelope alarm + zone alarm | A (R) | Circuit 2 shutdown | Serious, circuit 2 | Param. P003 | 3 | 3600 |
| A76 | BLDC circuit 2: high pressure differential at start-up | A | BLDC 2 not enabled to start | Serious, circuit 2 | 5min | - | - |
| A77 | BLDC circuit 2: failed start-up | A (R) | - | Serious, circuit 2 | 45 | 5 | 3600 |
| A78 | BLDC circuit 2: low pressure differential | A | Circuit 2 shutdown | Serious, circuit 2 | P004 | - | - |
| A79 | BLDC circuit 2: high gas discharge temp. | M | Circuit 2 shutdown | Serious, circuit 2 | No | - | - |
| A80 | Speeddrive circuit 2: offline | A | Comp. 1 circ. 2 shutdown | Serious, circuit 2 | 30s | - | - |
| A81 | Speed drive circuit 2: alarm +code error | A (R) | Comp. 1 circ. 2 shutdown | Serious, circuit 2 | No | 3 | 3600 |
| A87 | Unit: EVD Evolution not compatible | A | Unit shutdown | Serious, unit | No | - | - |

# 9. Technical specifications

| Model | UCHBP* (panel models) | UCHBD* (DIN rail models) |
|---|---|---|
| **Phisical specifications** | | |
| Dimensions | See figures | See figures |
| Case | Polycarbonate | Polycarbonate |
| Assembly | panel | DIN rail |
| Ball pressure test temperature | 125°C | 125°C |
| Ingress protection | IP20 (rear) - IP65 (front) | IP00 |
| Front cleaning | Use soft, non-abrasive cloth and neutral detergent or water | - |
| **Environmental conditions** | | |
| Storage conditions | -40T85°C, <90 % RH non-condensing | -40T85°C, <90 % RH non-condensing |
| Operating conditions | -20T60°C, <90 % RH non-condensing | -20T60°C, <90 % RH non-condensing |
| **Electrical specifications** | | |
| Rated power supply | 24 Vac/dc (SELV or PELV power supply, Class 2) | 24 Vac/dc (SELV or PELV power supply, Class 2) |
| Operating power supply voltage | 24 Vac/dc, +10% -15% | 24 Vac/dc, +10% -15% |
| Input frequency (AC) | 50/60 Hz | 50/60 Hz |
| Maximum current draw | 600 mA rms | DIN without ExV valve driver: 600 mArms<br>DIN with ExV valve driver: 1.25 Arms |
| Absorbed power for transformer sizing | 15 VA | Models without valve driver: 15 VA Models with valve driver: 30 VA |
| Clock | precision: ± 50 ppm; min time maintenance after power off: 72 h | precision: ± 50 ppm; min time maintenance after power off: 72 h |
| Software class and structure | A | A |
| Pollution degree | 3 | 3 |
| Class of protection against electric shock | To be incorporated in class I or II appliances | To be incorporated in class I or II appliances |
| Type of action and disconnection | 1.C | 1.C |
| Rated impulse voltage | relay outputs: 4 kV; 24 V input: 0.5 kV | relay outputs: 4 kV; 24 V input: 0.5 kV |
| Surge immunity category | relay outputs: III; input 24V: II | relay outputs: III; input 24V: II |
| Control device construction | Device to be incorporated | Device to be incorporated |
| Terminal block | Plug-in male-female. Wire sizes: see the connector table | Plug-in male-female. Wire sizes: see the connect-tor table |
| Purpose of the controller | Electrical operating control | Electrical operating control |
| **User interface** | | |
| Buzzer | Integrated | not included on the controller, built into the user terminal |
| Display | LED 2 rows, decimal point, and multi-function icons | LED 2 rows, decimal point, and multi-function icons |
| **Connectivity** | | |
| NFC | Max distance 10mm, variable according to the mobile device used | Max distance 10mm, variable according to the mobile device used |
| Bluetooth Low Energy | Max distance 10m, variable according to the mobile device used | Max distance 10m, variable according to the mobile device used |
| BMS serial interface | Modbus over RS485, not opto-isolated | Modbus over RS485, not opto-isolated |
| FieldBUS serial interface | Modbus over RS485, not opto-isolated | Modbus over RS485, not opto-isolated |
| HMI interface | Modbus over RS485, not opto-isolated | Modbus over RS485, not opto-isolated |

**Analogue inputs (Lmax=10m)**

| | | |
|---|---|---|
| J2 S1, S2, S3: NTC<br>S5: 0-5V ratiometric / 4-20 mA / NTC | NTC: resolution 0.1 °C; 10Kohm @ 25 °C, error:±1°C in the range -50T50°C, ±3°C in the range 50T90°C;<br>0-5 V ratiometric: error 2% fs, typical 1%;<br>4-20mA: error 5% fs, typical 1%<br>0-10 V: error 2% fs, typical 1% | NTC: resolution 0.1 °C; 10Kohm @ 25 °C, error:±1°C in the range -50T50°C, ±3°C<br>in the range 50T90°C;<br>0-5 V ratiometric: error 2% fs, typical 1%; 4-20mA: error 5% fs, typical 1%<br>0-10 V: error 2% fs, typical 1% |
| J3 S4: 0-5 V ratiometric / 4-20 mA / NTC<br>S6: 0-5 V ratiometric /<br>0-10V / 4-20 mA / NTC | | |
| J9 S7: NTC (DIN version only) | - | NTC: resolution 0.1 °C; 10Kohm @ 25 °C, error:±1°C in the range -50T50°C, ±3°C in the range 50T90°C; |

**Digital inputs (Lmax=10m)**

| Model | UCHBP* (panel models) | UCHBD* (DIN rail models) |
|---|---|---|
| J2 | ID1(*) | Voltage-free contact, not optically-isolated, typical closing current 6 mA, voltage with contact open 13 V, max contact resistance 50Ω<br>(*) Fast digital input: 0-2 kHz; error 2% fs |
| J2 | ID2 | |
| J3 | ID3(*), ID4, ID5 | |
| J9 | D6 - avail. only on DIN version | |

| Valve output | UCHBP* (panel models) | UCHBD* (DIN rail models) |
|---|---|---|
| J14 | Available only on DIN version | CAREL E*V unipolar valve power supply: 13 Vdc, min winding resistance 40 Ω |

**Analogue outputs (Lmax=10m)**

| | |
|---|---|
| J14 | Y1, Y2 |

**Digital outputs (Lmax=10m)**

**Note:** the sum of current draw on NO1, NO2, NO3 and NO4 must not exceed 8 A

| | | |
|---|---|---|
| J6 NO1(5A), NO2(5A),<br>NO3(5A), NO4(5A) | 5A: EN60730: 5A resistive, 250Vac, 50k cycles; 4(1), 230Vac, 100k cycles; 3 (1), 230Vac, 100k cycles UL60730: 5A resis., 250Vac, 30k cycles; 1FLA, 6LRA, 250Vac, 30k cycles; Pilot Duty C300, 30k cycles | 5A: EN60730: 5A resistive, 250Vac, 50k cycles; 4(1), 230Vac, 100k cycles; 3 (1), 230Vac, 100k cycles UL60730: 5A resis., 250Vac, 30k cycles; 1FLA, 6LRA, 250Vac, 30k cycles; Pilot Duty C300, 30k cycles |
| J7 NO5(5A) | | |
| J11 NO6(5A) - only for DIN | | |

**Emergency power supply**

| | | |
|---|---|---|
| J10: Ultracap module (optional, available only on DIN version) | | 13 Vdc ±10% |

**Probe and terminalpowersupply (Lmax=10m)**

| | | |
|---|---|---|
| 5V | 5 Vdc ± 2% to power the 0 to 5 V ratiometric probes. Maximum current delivered: 35 mA protected against short-circuits | 5 Vdc ± 2% to power the 0 to 5 V ratiometric probes. Maximum current delivered: 35 mA protected against short-circuits |
| +V | 8-11 V to power the 4-20 mA current probes. Maximum current delivered: 80 mA<br>protected against short-circuits | 8-11 V to power the 4-20 mA current probes. Maximum current delivered: 80 mA protected against short-circuits |
| VL | Not used | Not used |
| J8 | User terminal power supply | User terminal power supply |

**Serialports**

| | | |
|---|---|---|
| BMS<br><br>Lmax=500 m, shielded cable (RS485 1½ twisted pair) (1) | • Integrated<br>• Protocol: Modbus<br>• HW driver: asynchronous half duplex RS 485 Circ. 2<br>• Not optically-isolated<br>• 3-pin plug-in connector, 3.81 mm pitch<br>• Max data rate: 115200 bit/s<br>• Max number of connectable devices: 16 | • Integrated<br>• Protocol: Modbus<br>• HW driver: asynchr.half duplex RS 485 Circ. 2<br>• Not optically-isolated<br>• 3-pin plug-in connector, 3.81 mm pitch<br>• Max data rate: 115200 bit/s<br>• Max number of connectable devices: 16 |

| Model | UCHBP* (panel models) | UCHBD* (DIN rail models) |
|---|---|---|
| Fieldbus<br><br>J5: Lmax=10 m, shielded cable (RS485 1½ twisted pair) (1) | • Integrated<br>• HW driver: asynchronous half duplex RS 485 Circuit 1. Typical reception resistance 96 kohms, equal to 1/8 of unit load, i.e. 1/256 of maximum load applicable on the line<br>• Not optically-isolated<br>• Max data rate: 19200 bit/s<br>• Maximum number of connectable devices: 16<br>• Protocol: Modbus RTU | • Integrated<br>• HW driver: asynchr.half duplex RS 485 Circuit 1. Typical reception resistance 96 kohms, equal to 1/8 of unit load, i.e. 1/256 of maximum load applicable on the line<br>• Not optically-isolated<br>• Max data rate: 19200 bit/s<br>• Max number of connectable devices: 16<br>• Protocol: Modbus RTU |

| Cable lengths | | |
|---|---|---|
| Analogue inputs/outputs, digital inputs / outputs, probe power | <10m (*) (*) in the panel version, if using the +13 V power supply in domestic environments, the maximum cable length is 2 m. | |
| Valve | < 2 m, < 6 m with shielded cable | < 2 m, < 6 m with shielded cable |
| BMS and Fieldbus serial cables | <500m with shielded cable | <500m with shielded cable |

| Conformity | | |
|---|---|---|
| Electrical safety | EN/UL 60730-1, EN/UL 60335-1 | EN/UL 60730-1, EN/UL 60335-1 |
| Electromagnetic compatibility | EN 61000-6-1, EN 61000-6-2,<br>EN 61000-6-3, EN 61000-6-4 | EN 61000-6-1, EN 61000-6-2,<br>EN 61000-6-3, EN 61000-6-4 |
| Applications with flammable refrigerant gases | EN/UL 60079-15, EN/UL 60335-2-34,<br>EN/UL 60335-2-40, EN/UL 60335-2-89 | EN/UL 60079-15, EN/UL 60335-2-34,<br>EN/UL 60335-2-40, EN/UL 60335-2-89 |
| Wireless compliance | RED, FCC, IC | RED, FCC, IC |

**Note: (1)** it is recommended to use a BELDEN 8761 cable (AWG 22).

## 9.1 Connector/cable table

| Ref. | Description | Wiring terminals | Wire cross Section (mm²) | Lmax (m) |
|---|---|---|---|---|
| J1 | Controller power supply | Panel model: plug-in terminal, screw, 2-pin, pitch 5.08<br>DIN rail model: plug-in terminal, screw, 2-pin, pitch 5.08 | 0.5…1.5<br>0.21…3.31 | 10 |
| J2 | Inputs S1, S2, S3, S5, ID1, ID2; outputs Y2, Y2 | 10-pin Microfit crimp connector | 0.05…0.52 | 10 |
| J3 | Inputs S4, S6, ID3, ID4. ID5 | 8-pin Microfit crimp connector | 0.05…0.52 | 10 |
| J4 | BMS | Plug-in screw terminal, 3-pin, pitch 3.81 | 0.081…1.31 | 500 |
| J5 | Fbus | Plug-in screw terminal, 3-pin, pitch 3.81 | 0.081…1.31 | 10 |
| J6 | Outputs NO1, NO2, NO3, NO4 | 6-pin Microfit crimp connector | 0.5…1.31 | 10 |
| J7 | Output NO5 | 3-pin Microfit crimp connector | 0.5…1.31 | 10 |
| J8 | Unit terminal | Connection cable P/N: ACS00CB000010 (L=3m)-/20 (L=1.5m) | 0.13 | 2* |
| J9 | Inputs S7, ID6 | 4-pin Microfit crimp connector | 0.05…0.52 | 10 |
| J10 | Ultracap | 3-pin JST connector | 0.13 | 2 |
| J11 | Output NO6 | 3-pin Microfit crimp connector | 0.5…1.31 | 10 |
| J14 | Unipolar ExV valve | CAREL ExV unipolar valve connector, pre-wired | - | 2, 6 with shield. cable |