Genesis 15.0
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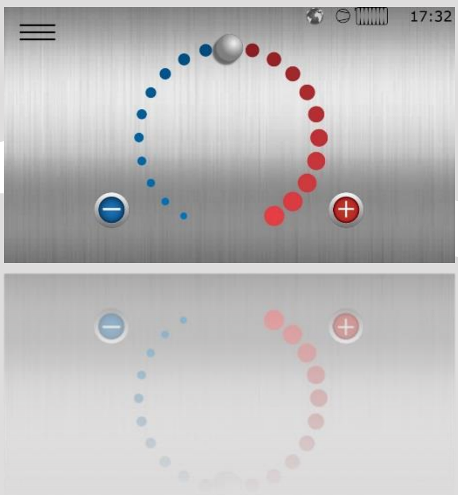
Functional description
Genesis 15.0

www.thermia.se



Foreword

This document is written for a specific software release and may not correspond with older software versions.

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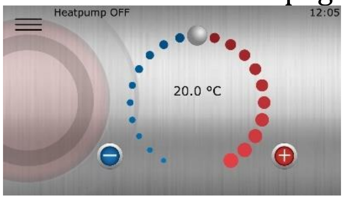
1 User interface

This chapter explains the basics of the graphical user interface. Some minor details may change depending on the machine profile and configuration.

1.1 Start page

The start page gives access to quick heating adjustment via the comfort wheel. The main menu can be accessed from the top left button on the start page. If an alarm is active the alarm icon will appear in the middle of the comfort wheel. This icon will provide quick access to the alarms page.



1.1.1 Primary/Secondary

On the starting page of a primary unit or single mega, two additional views will be added to the left sidebar.

- Comfort wheel - Allows for quick heating adjustment.
- Temperature overview - Gives a quick overview of the system temperatures.
- Heat pump overview - Gives a list of all registered secondaries and shows the ordered demand + gears. Also shows the total desired gear for each demand.

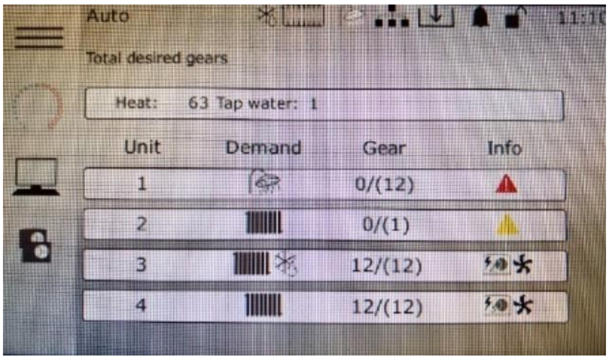
The secondary unit will replace the comfort wheel with the unit ID when communication is established with the primary unit.

1.1.2 Cascade

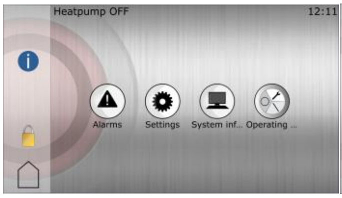
For cascade profile, there is an additional starting page providing a view of all configured outdoor units. The view consists of the following:

- Total desired gears
  - The number of desired gears for heat and tap water.
- Unit
  - Number that identifies a specific outdoor unit
- Demand
  - Displays the demand for the specific outdoor unit, heat, tap water or defrost.
- Gear
  - The actual gear and the requested gear
- Info – additional information for the specific outdoor unit
  - Fan icon – visible if the fan is running.
  - Immersion icon – visible if the heater is on, step 1-3

- Communication error – visible if the Modbus connection to the outdoor unit is malfunctioning.
- Level 1 alarm – red alarm icon visible if there is a level 1 alarm from the outdoor unit.
- Level 2 alarm – yellow icon visible if there is a level 2 alarm from the outdoor unit.



1.2 Main menu



The main menu has four sub menus: Alarms, Settings, System information and Operating mode.

Other icons such as Heat, Tap water, Cooling and Mix valves will appear in the main menu depending on current configuration. These links provide quick access to settings for the activated functions.

1.2.1 Information buttons

There are information buttons located in the top left sidebar in several submenus. When pressed an information popup will appear with information about the current submenu. This information is tailored on the current access level.

1.2.2 Access code

To gain access to more advanced settings and read outs, the user must enter an access code. This is done by pressing the lock icon in the left side bar. When the heat pump is unlocked an icon will appear in the top bar. The heat pump will then be unlocked for 8h, before it must be re-entered.

End user
202020 - Used when lock mode is enabled. Lock mode can only be enabled by installer or service technician in Settings/System settings/Screen settings.

Installer
607080 - Enables basic heat pump configuration and readouts.

Service technician
718293 - Enables advanced heat pump configuration and readouts. Needed for machine profile configuration and total factory reset.

1.3 Alarms

The alarms page shows active and historical alarms depending on the selected sidebar view. Active alarms can be acknowledged with the clear alarm button in the left sidebar.

1.4 Settings

The settings menu shows settings for installed functions and a few default submenus such as: System settings, Installation, Compressor settings, Circulation pumps, Temperature calibration, Manual test, Machine profile and Factory reset.

1.4.1 Installation

The installation page is where the installer configures the features installed in the heat pump. This will add submenus to the settings page and activates Modbus communication to accessories.

NB! Installing a function does not enable it. This needs to be done in the corresponding sub menu.

1.5 System information

The system information menu gives access to heat pump readouts.

1.5.1 Operating data

The operating data has two different views that can be selected from the left sidebar. The top view shows temperatures, setpoints and pressures from activated functions and the bottom view shows control signals to pumps and directional valves for activated functions.

1.5.2 Operating times

The operating times are only saved every other hour and when the operating mode is set to OFF. This is to maintain the service life of the flash memory in the CM-card. The operating times can be reset if required, in the factory reset menu. The operating times is automatically reset when switching machine profile.

Operating times calculated are:

- Compressor
- Tap water
- Passive cooling
- Active cooling
- External auxiliary heater
- Internal immersion heater step 1
- Internal immersion heater step 2
- Internal immersion heater step 3
- Outdoor immersion heater step 1 (Athena only)
- Outdoor immersion heater step 2 (Athena only)
- Outdoor immersion heater step 3 (Athena only)

1.5.3 Heat pump status

The heat pump status page provides access to diagnostic readouts, such as:

- **Start restrictions** - Shows active restrictions that currently prevents the compressor from starting.
- **Reason for stop** - Shows and logs compressor stop reasons.
- **Latest inverter codes** - Shows and logs the latest inverter codes. Note that some inverter codes may appear during normal circumstances.
- **Communication analyzer** - Shows the status of the Modbus communication to devices on the internal and accessory bus.
- **Expansion valve status** - Shows criteria's that needs to be fulfilled for the expansion valve regulation to achieve optimal efficiency.
- **Limit reason** - Shows active limitations that currently restrict the heat pump.

1.5.4 Change log

The change log shows settings that have been modified by the end user. Changes made while the installer access code is active will not be logged.

1.6 Operating mode

1.6.1 Auto

Automatic operation.

1.6.2 Service

The compressor is switched off, but external components (system pump, distribution circuits, etc.) are still active. Auxiliary is permitted if the service mode is combined with only auxiliary operation. This operating mode is only available for light commercial heat pumps and heat pumps with primary/secondary enabled.

Primary - The primary unit is switched off, but still allows secondaries, auxiliary heaters and external components to operate.
Secondary - The secondary unit is switched off. The primary is informed that the unit is not able to run.

1.6.3 Auxiliary heater only

Set in combination with Service mode. The button is only available when some form of auxiliary is activated. The function is used during service or as a back-up mode. In this mode compressor operation is blocked and the Auxiliary heaters is used to provide heating, pool and tap water. External auxiliary heater cannot produce tap water.

Primary - All units are switched off. Only auxiliary heaters are permitted to operate.

1.6.4 Off

All functions and units are switched off.

Primary - All units are switched off. This does not change the operating mode on the secondary units.

Secondary - The secondary is switched off locally. The primary is informed that the unit is not able to run.

1.6.5 Restart

Restarts the CM card without disconnecting the power. Useful when configuring the features that requires restart. The restart button is only visible when and access code is entered and requires the compressor to be switched off before it can be used.

1.7 Menu tree

Main menu -> Alarms

2 Heat

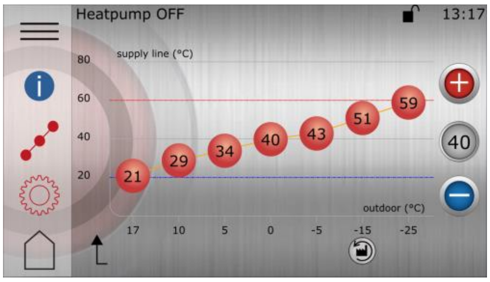
Heating operation is available during heating season (cold outside). During heating season, the heat pump will monitor the temperature of the heating system and maintain the desired supply line temperature. The desired supply line temperature is calculated from the heat curve.

2.1 Heat curve

The heat curve shows the desired supply line temperature based on the outdoor temperature. The user can adjust the incline of the heat curve and each of the seven coordinates can be adjusted individually.

If the outdoor sensor is not connected, the temperature is shown as --°C and the set point is calculated from an outdoor temperature of 0°C. The desired supply line can never be more/less than the curve maximum or minimum.

If the outdoor temperature falls below -25°C (outside the curve), the desired supply line temperature is calculated linearly between the last coordinate (outdoor -25°C) the supply line maximum (outdoor -40°C).



2.1.1 External set point

The function makes it possible to set a fixed supply line temperature setpoint for heating. This function can be activated and controlled by BMS (external Modbus). The comfort wheel and the heat curve are disabled when this function is activated. The maximum and minimum supply line settings still apply. The function can only be activated if a radiator system is chosen.

NB! Room sensor and Buffer tank (type 3) is not supported in combination with external setpoint.

2.1.2 Comfort wheel

The comfort wheel on the start page enables the user to quickly change the desired room temperature by offsetting the heat curve. How much each step on the comfort wheel offsets the heat curve is determined by the comfort factor.

Example: An increase of +1 on the comfort wheel with comfort factor 2 means that the heat curve is offset by +2K.

2.2 Heating season

Heating season is required for heating to start. During heat season the heat pump will monitor the heating system temperatures.

Heating season is calculated based on the difference between outdoor temperature and seasonal stop setting (default 17°C) over time. The result is summed with this temperature difference, forming an integral in degree minutes. The range of the integral is from -150 to 150.

At start-up the heating season is determined by the outdoor temperature in correlation with the seasonal stop setting. If the outdoor temperature is above the seasonal stop setting, heat season will be initialized to not active, and vice versa.

Heating season: Integral <-100. Heat production is permitted, and the system or condenser pump circulate radiator water.

Heat stop: Integral >100. Heat production is not permitted. The set point for heating and all distribution circuits with heat regulation is set to 0°C, and the system and condenser pump stop circulating hot radiator water.

2.3 Room sensor

A room sensor can be connected for better room temperature stability, and mainly to compensate for external factors, like sunlight, wind or a wood furnace. Note that the heat curve still needs to be approximately set for the desired room temperature. The deviation in room temperature is multiplied by the room sensor influence and is added to the desired supply line temperature calculated from the heat curve.

Active mode	Regulation of room temperature is active, and the desired temperature can now be set via the comfort wheel and the room sensor.
Passive mode	Regulation based on room temperature is switched off. The set point calculation is based only on the heat curve. The comfort wheel shows the current room temperature and the standard offset. In the case of room sensor error, the room sensor is automatically set to Passive mode and returns to regulating the desired supply line temperature in accordance with the heat curve.

There are currently two types of room sensors, Modbus RS and PT1000.

2.3.1 Modbus RS

Modbus room sensor. This room sensor is available for all products and enables desired room temperature adjustment directly on the room sensor.

2.3.2 PT1000

Basic PT1000 room sensor. The module is only available for Diplomat Inverter Mini, Calibra series and Atlas series. This configuration also allows for any PT1000 room sensor to be installed.

2.4 Demand calculation - Variable speed heat pumps

The demand calculation for variable speed compressors uses a PID-calculation. The demand calculation manages compressor start and stop, compressor gear and auxiliary heaters.

2.4.1 PID

Proportional - The difference between the supply temperature and the desired supply temperature multiplied by a kp factor which changes depending on the supply / return temperature delta. Higher delta means less kp.

Supply temperature = System supply line if connected, otherwise Condenser out / Supply line (HP).

Integral - The difference between heat pump supply temperature and the desired supply temperature multiplied by a ki factor and integrated over time. The integral is capped to -/+ 1,4.

Derivative – The change of the return temperature over time multiplied by a kd factor. It only has an effect if the return line temperature changes rapidly.

Return temperature = System return line if connected, otherwise Condenser in / Return line (HP).

2.4.2 Desired gear

Each integer in the PID-sum corresponds to one "gear". Each time the compressor gear shift delay elapses, the value of the PID-sum is added to the total desired gear for the heat demand. For this reason, the gear shift delay setting should be sufficiently long to give the heating system enough time to see the effect of each gear change.

If the heat demand calculation has a deficit lower than the total number of compressor gears, the compressor can switch to a higher gear without waiting for the compressor gear shift delay. If the demand calculation has a surplus greater than the number of compressor gears * 0.4, the heat demand is re-evaluated. This can take place no more than once every 60s. If the compressor start is blocked by the restriction time, the demand will request minimum gear until the compressor has started and the gear shift delay has passed, or any of the above conditions have been met. This is to prevent an overshoot when the restriction is removed.

Example: If the demand calculation is -2.7 when the compressor gear shift delay has passed, the compressor will shift up two gears.
Example: If the demand calculation is +1.9, the compressor will shift down one gear.

2.4.1 Compressor

The compressor starts when a demand calculation value of -4 (default) or less is reached. The compressor starts on the min gear.

The compressor stops when a value of +4 (default) or more is reached, and the compressor is operating on the lowest possible gear for heating and that the gear shift delay has passed. Note that other demands and protective functions may force the compressor into a higher gear, and in this case the heat demand can be fulfilled in a higher gear.

For buffer tank start/stop, see buffer tank.

2.4.2 Internal immersion heater

The internal heater starts when the desired gear for heating exceeds the number of available compressor gears + 3 gears for each step.

See the Auxiliary heaters chapter for more information.

2.4.3 External auxiliary heater

The external auxiliary heater starts when the desired gear for heating exceeds the number of available compressor gears + start limit (-6 default).

See the Auxiliary heaters chapter for more information.

2.4.1 Ignore demand calculation

The demand calculation for heating is ignored when the temperature of the heating system is unreliable. When the demand calculation is ignored, it is shown as -- in the GUI.

If there is no system supply line sensor or system pump, this takes place when the heat pump produces tap water, anti-legionella or pool, and a short time after the directional valve has switched back to heating.

If the directional valve for pool is located after the external auxiliary heater, the demand calculation is ignored while pool is being produced.

2.5 Demand calculation - Fixed speed heat pumps

The heat demand calculation for fixed speed heat pumps uses an integral calculation, where each integer corresponds to desired supply line deviation in degree minutes (°min). The value of the integral decides when the compressor, internal heater and external heater starts and stops.

2.5.1 Compressor

The compressor starts when the integral has reached a value of -60 (default start limit) or lower. The integral is instantly set to -60 if the supply line temperature is 10K below the desired temperature.

Heat demand stops when the integral has reached a value of 0 or above. The integral is instantly set to 0 if the supply line temperature is 10K (compressor hysteresis) above the desired temperature.

2.5.2 Internal immersion heater

The internal immersion heater starts when the integral has reached a value of -600 (default start limit). Each step requires an additional 40 integral.

Step	Start integral	Stop integral
1	-600	-60 (compressor start)
2	-640	-600
3	-680	-640

2.5.3 External auxiliary heater

The external immersion heater starts when the integral has reached a value of -720 (default start limit).

2.6 High heating system temperature

Monitoring of high temperature is always active and is intended primarily for installations that require higher temperatures in the heating system than the compressor alone can supply. Both supply line and return line temperatures (condenser in sensor) are monitored with individual alarms and settings.

High system supply line temperature	An information alarm is triggered if the system supply line temperature exceeds the set limit value (default 70°C). The alarm does not permit compressor operation toward the heating system, and the auxiliary is permitted to take over.
High return line temperature	Return line temperature (condenser in) is monitored during compressor start up in heating operation. If the return line temperature exceeds Max return line temperature (default) 65°C the compressor will not be allowed to start.
System temp. above curve max	If the temperature of the heating system exceeds the supply line maximum setting by 5K, the heat demand will automatically be fulfilled.

2.7 Parameters

Parameter name	Description
7-point heat curve	Setting for the desired supply line temperature at outdoor temperature 17, 10, 5, 0, -5, -15, -25. Each of the seven points can be adjusted individually.
Desired indoor temperature - Comfort wheel	Setting for the desired indoor temperature. Requires the heat curve to be correctly configured. Changing the desired indoor temperature will offset the entire heat curve according to the comfort factor setting.
Enable heat	Enable or disable heat production.
Heating type	Radiator: Heat curve 40 and supply line maximum 60 (max 85) Floor heating: Heat curve 30 and supply line maximum 45 (max 45) Custom: Same as radiator, but also enables supply line minimum to be decreased to 10.
Heat curve	Setting for the heat curve incline. The value indicates the setpoint at 0°C outdoor temperature
Supply line minimum	Minimum value for the desired system supply line. Used for the low system supply line temperature alarm.
Supply line maximum	Maximum value for the desired system supply line. Used to automatically fulfil the heat demand if the system supply line temperature gets too high (system temp. above curve max. Used to calculate the desired system supply line if the outdoor temperature is below -25°C
Seasonal stop	Seasonal stop temperature used for heat season integral calculation.
Heat time	Used when multiple demands are queued (heat, tap water, pool). Decides how long heating should run before switching to the next demand.

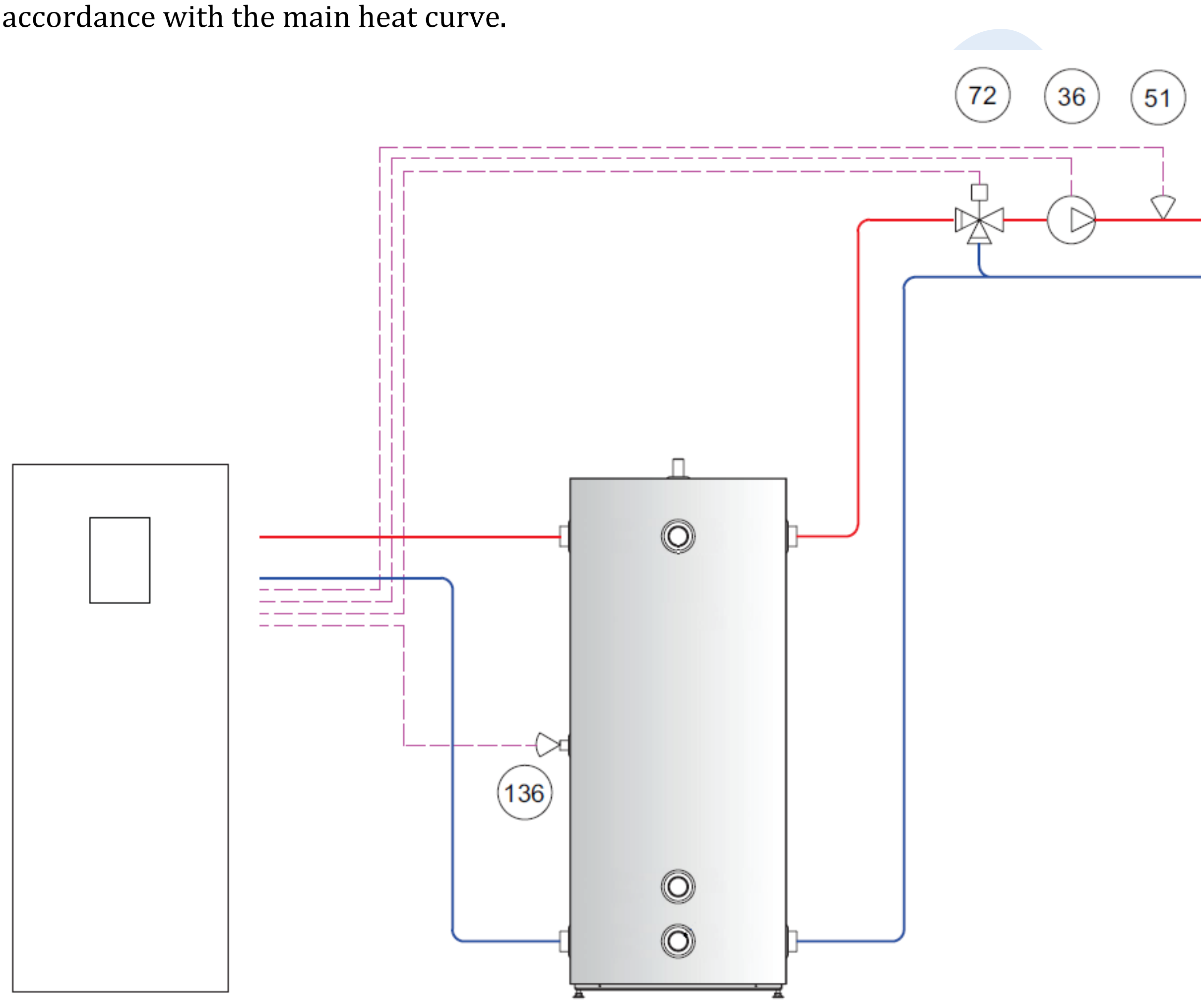
Comfort factor	Decides how much the heat curve should be offset when making adjustments via the comfort wheel.
Gear shift delay	Decides how often the heat demand is re-evaluated (how often the compressor changes gear in heating). Should be set to approximate system circulation time. Is also used when stopping heating operating.
Start/stop calculated demand threshold	Setting for when the heating demand should start/stop when in heating season. Does not ned to be adjusted normally, only if the minimum gear is increased.
Unprioritized heating	Enable unprioritized heating. Heat production will only start when active cooling is running.
Fixed supply line set point	Enable fixed supply line setpoint. The heat curve is no longer used. The desires system supply line will be set to the supply line setpoint setting. Intended for BMS use.
Supply line setpoint	Setpoint used when fixed supply line set point is enabled. Intended for BMS.
System return line sensor	Enables the system return line sensor. Is used for improved condenser pump control and demand calculation (derivative).

3 Buffer tank

Buffer tank control is enabled by selecting a buffer tank type. Only types supported by the current heat pump configuration can be selected.
NB! Buffer tank control in combination with Primary/Secondary is only supported by type 4 and 5.
NB! Buffer tank is not supported for Calibra Cool.

3.1 Type 1

Type 1 can only be selected if auxiliary heater is not installed. The heat demand is calculated from the system supply sensor and the system mix valve will regulate in accordance with the main heat curve.



3.1.1 Start/Stop

The heat pump starts and stops producing heat depending on if the heat pump is configured to start on heat curve or fixed temperature offset.

Start on heat curve demand	Heat demand will start/stop on demand calculation -4/+4 (default). Same conditions as without buffer tank.
Start on fixed temperature offset	**Start** - The heat demand starts on tank temperature offset.

	Stop - The heat demand is fulfilled when the buffer tank temperature is reached.

3.1.2 Charging set point

The heat pump will charge the buffer tank after the heat demand has been fulfilled. The charge set point is dependent on the Auto mode setting.

Auto mode	**OFF**	The heat pump will charge the buffer tank in accordance with the desired tank temperature.
	ON	The heat pump will charge the buffer tank in accordance with the desired temperature from main curve + overcharge.

3.1.3 Seasonal stop permitted

When 'Start on fixed temperature offset' is selected, the user can select if the heat pump should charge the buffer tank when heating season is not active.

Seasonal stop permitted = 0 (Default configuration)	The heat pump will always charge the buffer tank, independently of heating season.
Seasonal stop permitted = 1	The heat pump will only charge the buffer tank during heating season.

3.2 Type 2

Type 2 can only be selected if auxiliary heater is not installed. The function requires an active system pump and is not supported by an external auxiliary heater (controlled by Genesis) or Pool.

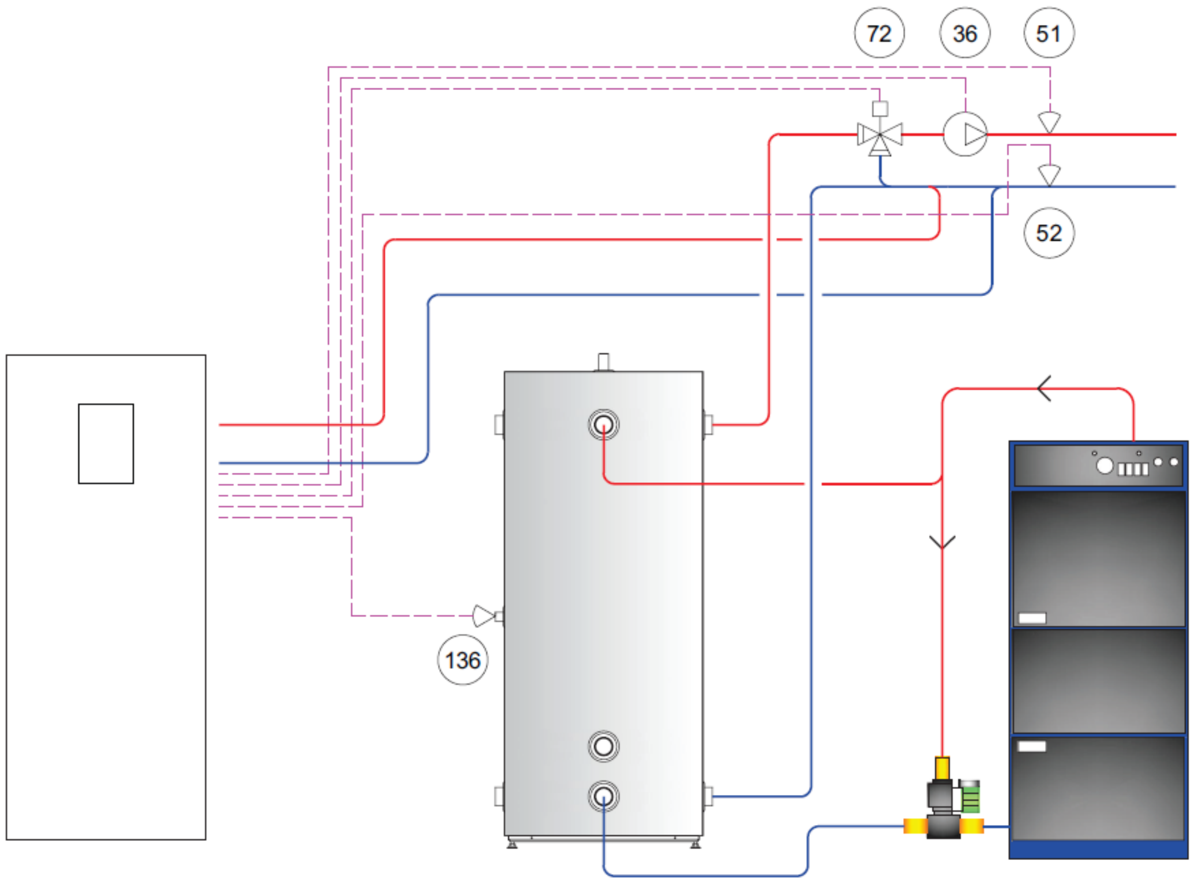
If the buffer tank sensor is missing, the system shunt will close completely to disconnect the buffer tank and compressor heating is used instead.

When Smart grid - Comfort or Boost is active, the system shunt will switch to cooling regulation to charge the buffer tank with compressor heating.

3.2.1 Start/Stop

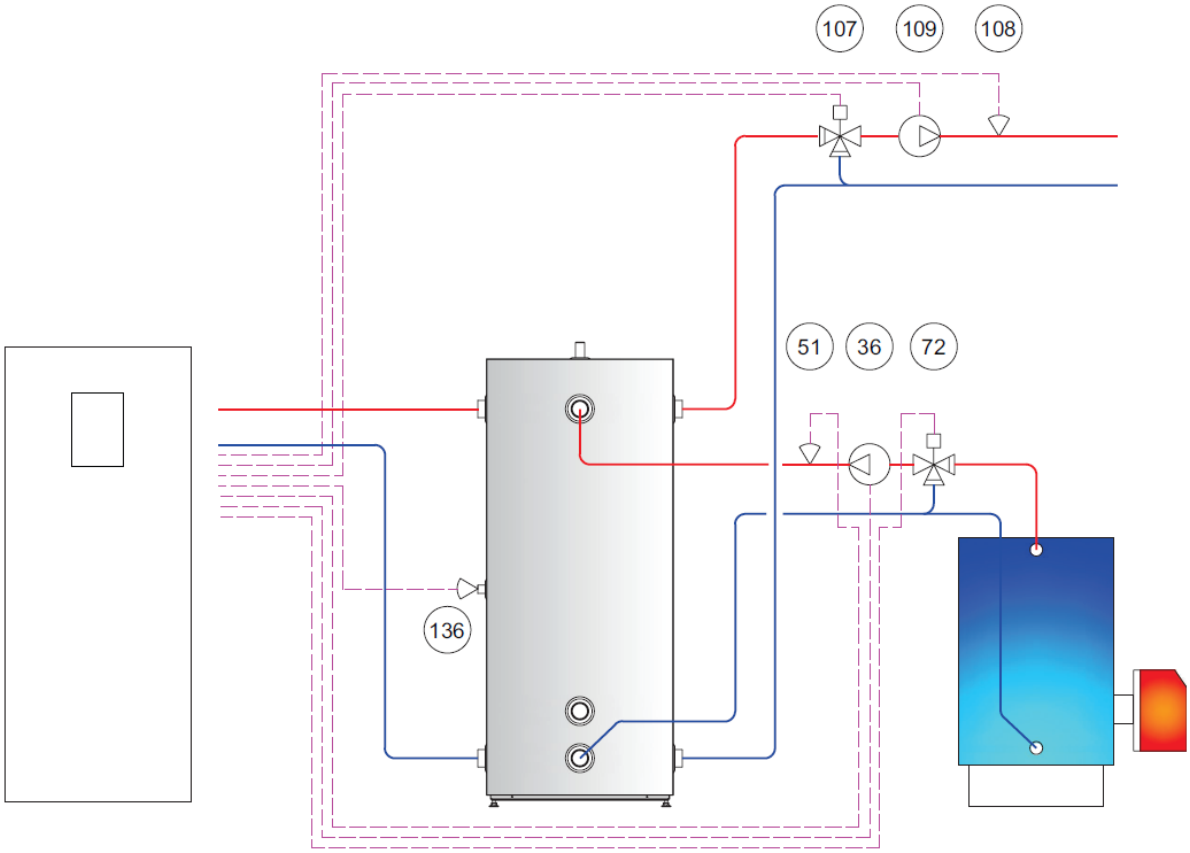
If the buffer tank temperature is hotter than the desired system supply + overcharge, the compressor will be switched off and the system mix valve will regulate to maintain the desired system supply temperature from the main heat curve.

If the buffer tank temperature is colder than the desired system supply, the system mix valve will fully close and the compressor will be controlled based on the calculated demand for heating. The same way as without buffer tank.



3.3 Type 3

Type 3 can only be selected if auxiliary heater and distribution circuit 1 are installed. The heat demand is calculated from the distribution circuit 1 sensor. This also applies if a room sensor is activated.



3.3.1 Start/Stop

The heat pump starts and stops to produce heating depending on if the heat pump is configured to start on heat curve or fixed temperature offset.

Start on heat curve demand	Heat demand will start/stop on demand calculation -4/+4 (default). Same conditions as without buffer tank.
Start on fixed temperature offset	**Start** - The heat demand starts on tank temperature offset. **Stop** - The heat demand is fulfilled when the buffer tank temperature is reached.

3.3.2 Charging set point

The heat pump will charge the buffer tank after the heat demand has been fulfilled. The charge set point is dependent on the Auto mode setting.

Auto mode	**OFF**	The heat pump will charge the buffer tank in accordance with the desired tank temperature.
	ON	The heat pump will charge the buffer tank in accordance with the desired temperature from main curve + overcharge.

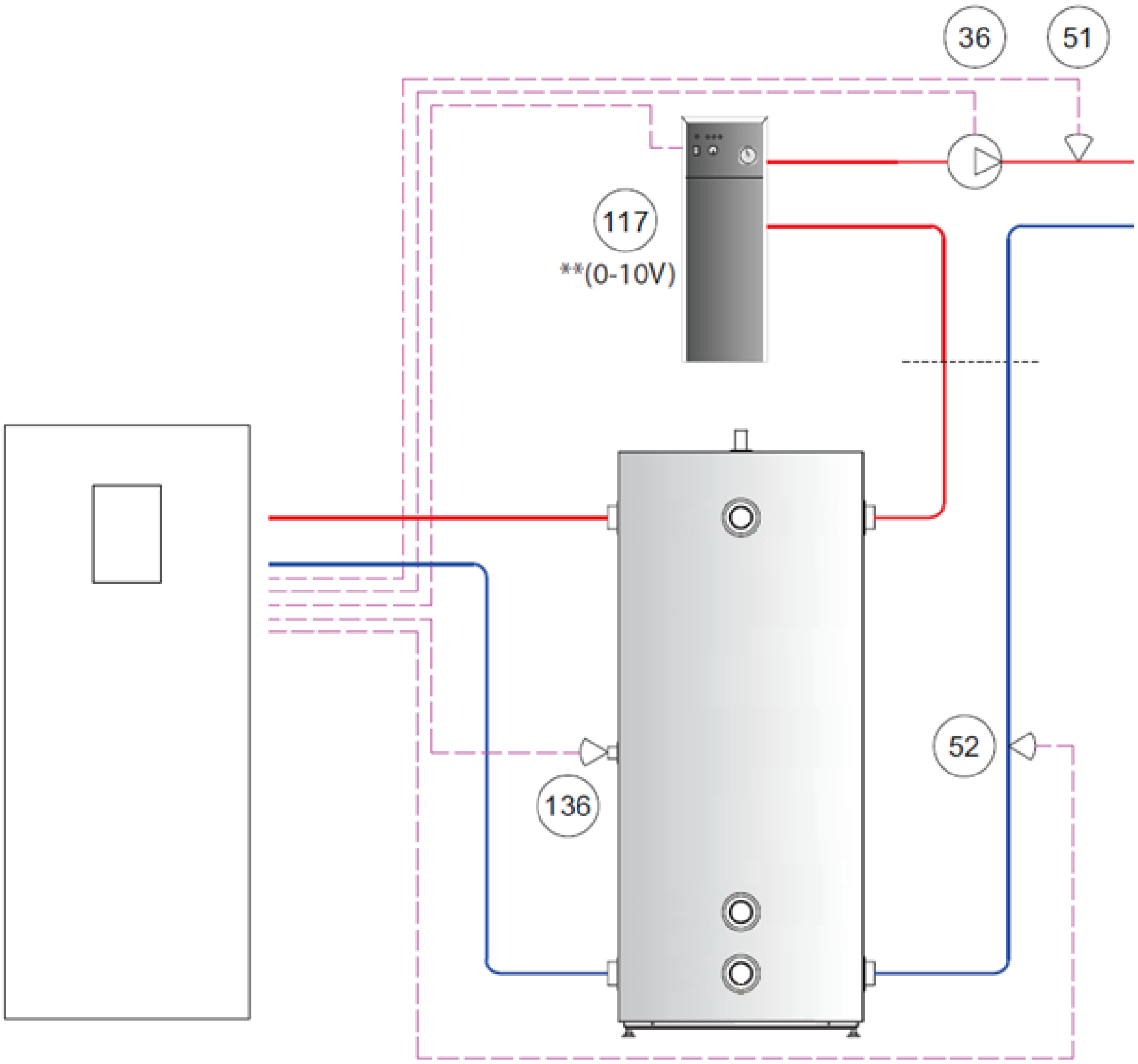
3.3.1 Seasonal stop permitted

When 'Start on fixed temperature offset' is selected, the user can select if the heat pump should charge the buffer tank when heating season is not active.

Seasonal stop permitted = 0 (Default configuration)	The heat pump will always charge the buffer tank, independently of heating season.
Seasonal stop permitted = 1	The heat pump will only charge the buffer tank during heating season.

3.4 Type 4

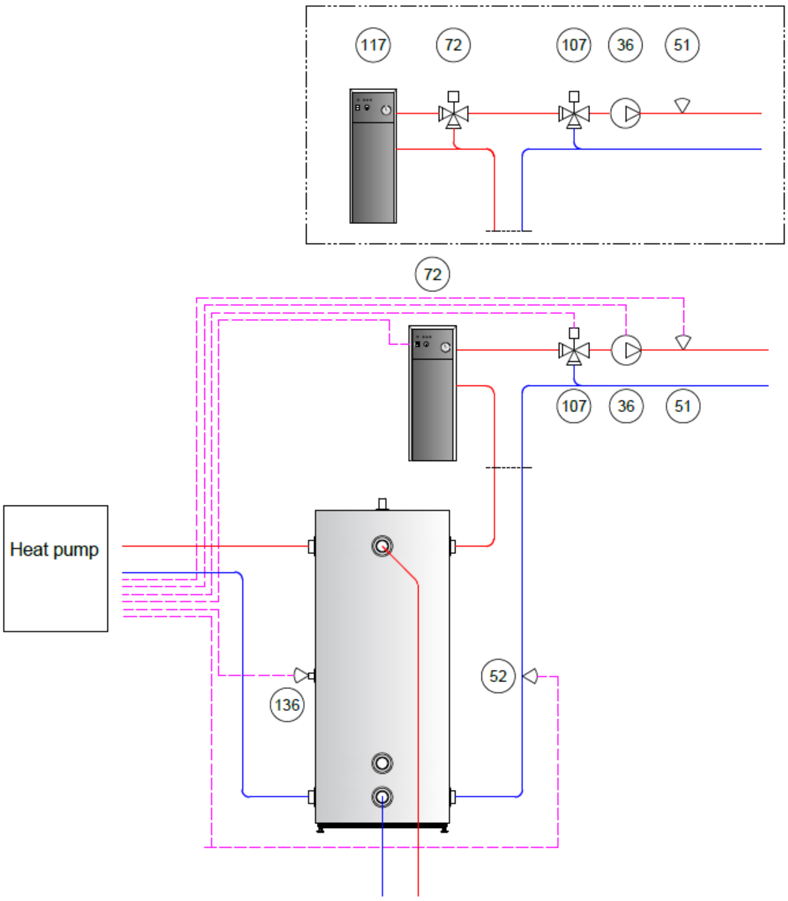
Type 4 is currently only selectable with the Mega and Athena series. The heat demand is calculated the same way as without buffer tank, with the exception that the heat demand calculation uses the highest temperature of system supply/buffer tank for the proportional part.



System return line sensor is optional but recommended to further improve the heat demand calculation (derivative) and condenser pump speed control. System return line sensor is enabled separately.

3.5 Type 5

Type 5 can only be selected if distribution circuit 1 is installed. This type is only selectable with the Mega series and Athena series. The heat demand is calculated the same way as without buffer tank, with the exception that the heat demand calculation uses the highest temperature of system supply/buffer tank for the proportional part. The distribution circuit 1 mix valve will maintain the desired system supply line temperature during heating season which allows for buffer tank overcharge. Overcharge is used during active cooling to store surplus heat in the buffer tank until the max tank temp is reached.



System return line sensor is optional but recommended to further improve the heat demand calculation (derivative) and condenser pump speed control. System return line sensor is enabled separately.

4 Distribution circuit 1-5

4.1 Distribution circuit 1

Distribution circuit 1 can be used in heating or cooling mode.

4.1.1 Heating

While in heating mode the desired temperature is set by the distribution circuit heat curve or by constant temperature. The mix valve regulation is only active during heating season. When the regulation is not active the mix valve will fully close. The distribution circuit pump operates continuously when the mix valve regulation is active.

The mix valve will open to heat and close to cool.

4.1.2 Cooling

While in cooling mode the desired temperature is set to the desired temperature setting. The mix valve regulation is always active, unless cooling season dependent is activated. When cooling season dependent is activated, the mix valve will only regulate during cooling season. The distribution circuit pump operates continuously when the mix valve regulation is active.

The mix valve will open to cool and close to heat.

If internal brine pump boost is activated, the internal brine pump will operate simultaneously with the distribution circuit 1 pump. The brine pump will then operate on standby flow unless the compressor is already operating.

4.1.3 Auto

While in auto mode the active season controls if the distribution circuit is in heating or cooling mode. This mode is always season dependent.

4.2 Distribution circuit 2-5

4.2.1 Heating

While in heating mode the desired temperature is set by the distribution circuit heat curve or by constant temperature. The mix valve regulation is only active during heating season, unless heating season dependent is de-activated. If heating season dependent is de-activated the regulation is always active. When the regulation is not active the mix valve will fully close. The distribution circuit pump operates continuously when the mix valve regulation is active.

The mix valve will open to heat and close to cool.

4.2.2 Cooling

While in cooling mode the desired temperature is set to the desired temperature setting. The mix valve regulation is only active during cooling season, unless cooling season dependent is de-activated. If cooling season dependent is de-activated the regulation is always active. The distribution circuit pump operates continuously when the mix valve regulation is active.

The mix valve will open to cool and close to heat.

If internal brine pump boost is activated, the internal brine pump will operate simultaneously with the distribution circuit 1 pump. The brine pump will then operate on standby flow unless the compressor is already operating.

4.2.3 Auto

While in auto mode the active season controls if the distribution circuit is in heating or cooling mode. This mode is always season dependent.

4.2.4 Dew point sensor

When dew point sensor is enabled, the controller will monitor the dew point temperature and increase the desired temperature if necessary, to avoid condensation. The desired temperature is set to 2K higher than the calculated dew point.

4.2.5 Room sensor

The formula for adjusting the set point assumes that the heat curve is set corresponding to 20°C indoor temperature. This is followed by a calculation of how much the set point (from the heat curve) should be adjusted in order to reach the desired room temperature. Room sensor is not supported in combination with the constant temperature setting.

5 Tap water

Tap water starts on weighted temperature or decreasing tank temperature. The weighted temperature is calculated between the top and bottom tap water sensors in accordance with the setting of sensor influence. When tap water demand starts, the tap water valve switches over to the tap water tank and the compressor starts producing tap water. If heating season is inactive the tap water valve is kept in tap water position until the demand is fulfilled and compressor has fully stopped, before returning to the heating position, which is the default position.

For Athena it is not possible to turn off tap water instead there is a Low mode. To ensure defrost capability.

Sensor influence: Default 0.65 weighting towards the bottom tap water sensor. If only one tap water sensor is connected, the weighted temperature will automatically be the same as the connected sensor, regardless of weighting.

5.1 Tap water modes

Calibra and Atlas supports three tap water modes and Athena supports four tap water modes selectable by the end user. Other heat pumps operate in normal mode.

The Economy and Comfort mode have predefined, non-adjustable tap water settings. The tap water settings are only adjustable in Normal mode. Settings made in normal mode persists when switching modes and does not affect Economy and Comfort mode.

5.1.1 Low

Athena only, keeps tap water tank hot enough for defrosting the outdoor unit.

Profile	Min gear	Max gear	Start temp	Stop temp.
Athena 18	1	12	25°C	30°C
Athena 14	1	6	25°C	30°C

5.1.2 Economy

The economy mode gives the most efficient tap water production, but with a lower capacity and longer charge time.

Profile	Min gear	Max gear	Start temp	Stop temp.
Atlas 18	4	4	40°C	50°C
Atlas 12	5	5	40°C	51°C
Calibra Eco 16	4	4	40°C	53°C
Calibra Eco 12	5	5	40°C	54°C
Calibra Eco 8	5	5	40°C	54°C
Calibra 12	5	5	40°C	55°C
Calibra 7	5	5	40°C	60°C

Athena 18	1	6	37°C	45°C
Athena 14	1	6	37°C	45°C

5.1.3 Normal

The normal mode is a factory optimized setting with a good compromise between comfort and economy. Normal mode settings can be adjusted.

Profile	Min gear	Max gear	Start temp	Stop temp.
Atlas 18	5	9	40°C	60°C
Atlas 12	5	10	40°C	60°C
Calibra Eco 16	5	7	40°C	60°C
Calibra Eco 12	5	9	40°C	60°C
Calibra Eco 8	5	7	40°C	60°C
Calibra 12	5	9	40°C	60°C
Calibra 7	5	7	40°C	60°C
Athena 18	1	12	39°C	52°C
Athena 14	1	6	39°C	52°C

5.1.4 Comfort

The comfort mode gives the highest tap water capacity and the fastest recharge time, but with a somewhat lower efficiency and a slightly increased heat pump sound level.

Profile	Min gear	Max gear	Start temp	Stop temp.
Atlas 18	5	12	40°C	65°C
Atlas 12	5	12	40°C	65°C
Calibra Eco 16	5	9	40°C	60°C
Calibra Eco 12	5	11	40°C	60°C
Calibra Eco 8	5	8	40°C	60°C
Calibra 12	5	12	40°C	60°C
Calibra 7	5	9	40°C	60°C
Athena 18	6	12	40°C	60°C
Athena 14	6	6	40°C	60°C

5.2 Starting conditions

Tap water production will start if the weighted tap water temperature is below the start temperature, top-up conditions are fulfilled or decreasing tank temperature.

Domestic heat pumps cannot start tap water production with the compressor if an alarm of class A or B is active. This is to notify the end user of errors.

5.2.1 Decreasing tank temperature

Start on decreasing tank temperature is activated as default but can be deactivated. The feature is used to detect large tap water withdrawal to start tap water production earlier the normal. Start on decreasing tank temperature requires the top tank temperature to be below 63°C. The bottom tank temperature is monitored to detect decreasing temperature. This feature is not enabled for light commercial heat pumps.

Rapidly decreasing tank temperature	Bottom temperature < 56°C (default) and the temperature has decreased more than 3 K within ~60s.
Decreasing tank temperature	Bottom temperature < 43°C (default) and the temperature has decreased more than 1 K within ~60s.

5.2.2 Top-up

The function permits tap water production to start instead of the compressor switching off when there are no other demands. Top-up is allowed if the weighted tap water temperature is 3°C from the start temperature as default but varies depending on the difference between start/stop temperature.

5.3 Stop conditions

Tap water production will stop if the weighted tap water temperature reaches stop temperature. If the stop temperature is not reached, tap water will also be aborted on the following conditions.

- Outside envelope for lowest permitted gear for tap water.
- Operating pressure - 0.2 bar(g) offset = 41.3 bar(g).
- Max. time (3.5 hours).
- High discharge temperature - 3 K offset. Diplomat inverter 117°C, Mega 127°C, Calibra/Atlas 122°C.
- Class B alarm, only domestic heat pumps.

5.3.1 Max. time

The tap water demand has a maximum time of 3.5 hours during the heating season. The maximum time can be ignored for Primary/Standalone units if there is a system supply line sensor, and the system pump is activated. Secondaries do not have this time restriction.

5.4 Gear calculation

If there is no other demand, the compressor will start on minimum gear for tap water. If heating or pool is queued, the desired gear for tap water is increased to produce the tap water more quickly.

The desired gear for tap water can also be increased if the tap water lower temperature is decreasing (1K in a short time) or if the weighted tap water temperature is below **Min. temperature tap water.**

**Min. tap water temperature is a calculated temperature limit that increases the required compressor gear if the tap water temperature does not increase fast enough. “Fast enough” is defined by the expectation to finish within max time.*

The desired gear for tap water demand does not decrease the compressor speed. This is dealt with by other protective functions, usually the envelope management.

5.5 Anti-legionella

Anti-legionella is available with internal immersion heater, start signal for ext. heater or with TWC. Different combinations of anti-legionella are not supported.

Anti-legionella (internal immersion heater)	The function is only supported by the domestic heat pump with internal immersion heaters. The function is activated by default but can be switched off under Settings/Tap water. **Blocked by:** Class A/B alarm, tripped overheating protection, max. time. Anti-legionella (internal immersion heater) always starts in conjunction with a tap water start. This means that anti-legionella is operated first by the compressor, and if the bottom tap water sensor has not reached the stop temperature for anti-legionella the internal immersion heater is activated to fulfil the anti-legionella demand. While anti-legionella is running, the heat pump is prevented from switching demands. If the weighted tap water temperature falls below the start temperature for tap water in the anti-legionella's internal immersion heater phase, the compressor is permitted to restart. **Max. time:** So that the controller does not lock in anti-legionella operation, the demand has 7 hours to be completed. If this time elapses, a class B alarm is triggered, and anti-legionella is not permitted to run while the alarm is active. **Tap water boost:** The function manually triggers an anti-legionella start but ignores top heating time. If anti-legionella starts when weighted tap water temp. > stop temperature for anti-legionella -5 K, anti-legionella is completed with only the internal immersion heater, without starting the compressor.
Anti-legionella (start signal for ext. heater)	The function is only supported by the Mega series and is activated under Settings/Tap water. Mega using BM-SLL also needs to have R1 configured in the dynamic allocation page. **Blocked by:** Class A alarm, no tank sensor. Anti-legionella (start signal via BM) starts when the programming requests start, if the stop limit for anti-legionella is not reached. Anti-legionella runs until the bottom tap water sensor reaches stop temperature. This form of anti-legionella is free-standing and can be run together with all other demands.
Anti-legionella (TWC)	The function requires TWC. Settings for anti-legionella are accessible under Settings/Tap water. **Blocked by:** Class A alarm, no end tank sensor. TWC anti-legionella starts when the programming requests start, if the stop limit for anti-legionella has not been reached. Anti-legionella runs until the temperature in the end tank reaches stop temperature. This form of anti-legionella is free-standing and can be run together with all other demands.

5.5.1 Scheduling

Anti-legionella is blocked while Genesis is unlocked with access code and 12 hours from start-up. The blocking does not apply to tap water boost. If it is the first time anti-legionella is to be run, it will run on the first occasion after the initial 12h block. The next anti-legionella cycle is scheduled after anti-legionella completion, in accordance with the setting for top heating interval.

Scheduling for anti-legionella (internal immersion heater) actively checks the tank temperature and delays the next anti-legionella operation, with peak heat range, if the stop temperature for anti-legionella has been reached. This is to prevent anti-legionella starting in the event of a tap water draw off if the heater temperature has been above the stop limit for anti-legionella.

The previous run and the next run can be viewed in Settings/Tap water.

5.5.1 Peak heating time

When stop temperature is reached, the anti-legionella demand continues in peak heating time. The regulation of activation/deactivation continues to be active, which means that the temperature in the tank may be a little higher than the stop limit for anti-legionella.

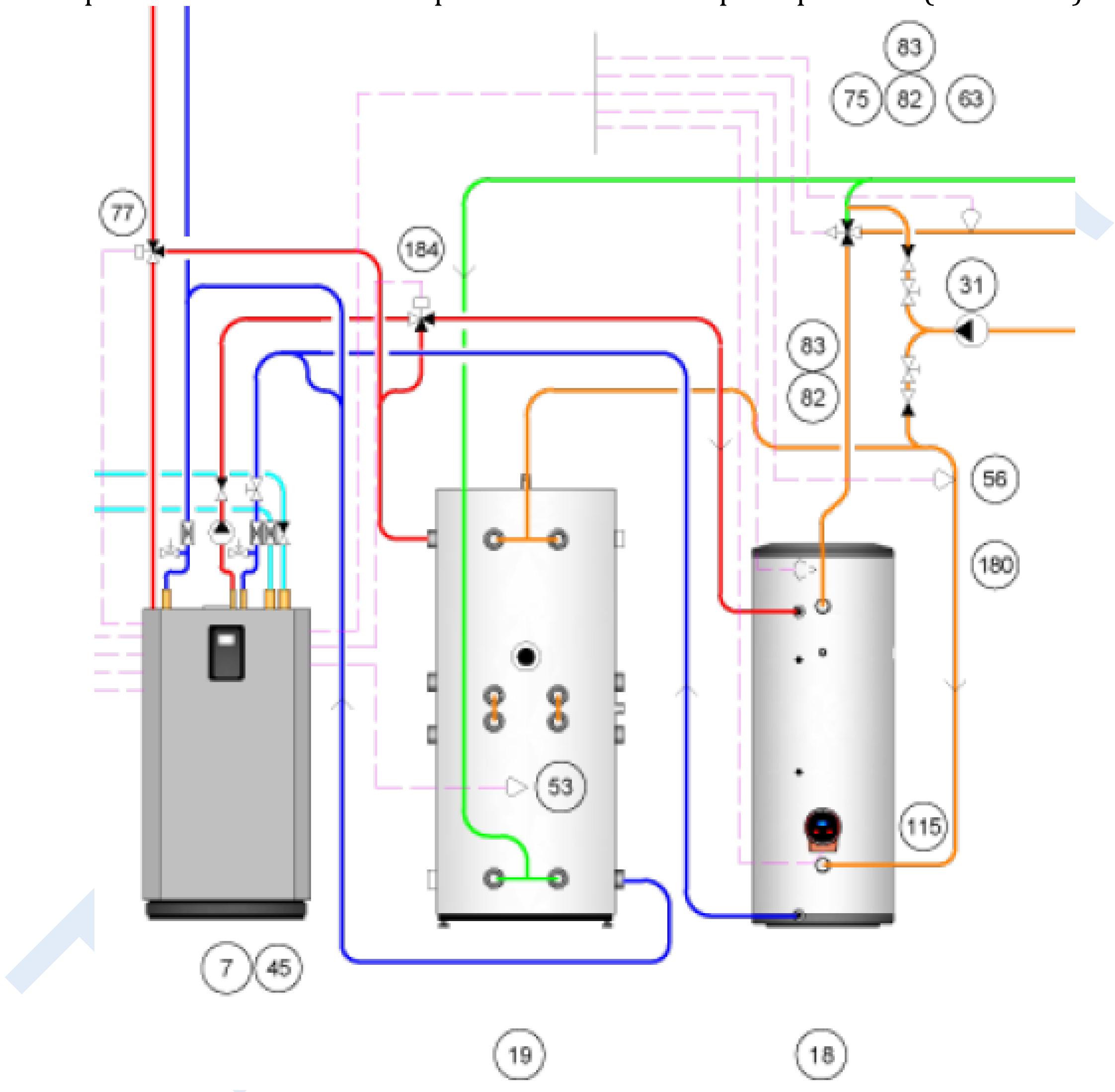
5.6 Parameters

Parameter name	Description
Enable tap water	Enable tap water production. Cannot be disabled for Athena. Instead use Low mode.
Enable tap water on system	Enable tap water production for the system. Only visible on a primary unit.
Enable tap water on primary	Enable tap water production on the primary unit. Only visible on a primary unit.
Separate sensor (autonomous hot water)	Enable autonomous tap water.
Low	Low mode. Tap water tank temperature is changed to 25-30°C.
Economy	Economy mode. Optimized for efficient tap water production.
Normal	Normal mode. Default tap water mode.
Comfort	Comfort mode. Optimized for high tap water capacity.
Boost tap water	Triggers anti-legionella.
Start	Start temperature for Normal mode.
Stop	Stop temperature for Normal mode.
Sensor influence	Setting for tap water weighted calculation.
Tap water time	Used when multiple demands are queued (heat, tap water, pool). Decides how long tap water should run before switching to the next demand.
Start on decreasing temperature	Enable or disable start on decreasing temperature.
Enable anti-legionella	Enable or disable anti-legionella.
Top heating interval	Anti-legionella interval in days.

Top heating time	Time that anti-legionella continuous to run with internal immersion heater after anti-legionella stop temperature have been reached. The internal immersion heater may increase the tank temperature up to 12°C above the stop temperature in this stage.
Stop temperature	Stop temperature for anti-legionella. Refers to tap water lower.
Allow internal immersion heater (only available for Philip)	Allow the internal immersion to assist the compressor if the compressor is not able to meet the heating demand.

6 TWC

The Tap Water Control function an immersion heater to make sure the temperature in the end tank does not get too low and a mix valve to regulate the temperature of the outgoing tap water. The mix valve maintains the set point for outgoing tap water. The mix valve opens to heat and closes to cool. The TWC return temperature is only used for monitoring. The tap water circulation pump runs continuously. The immersion heater is activated when the end tank temperature is below the start temperature (default 60°C) and stops when the end tank temperature is above stop temperature (default 65).

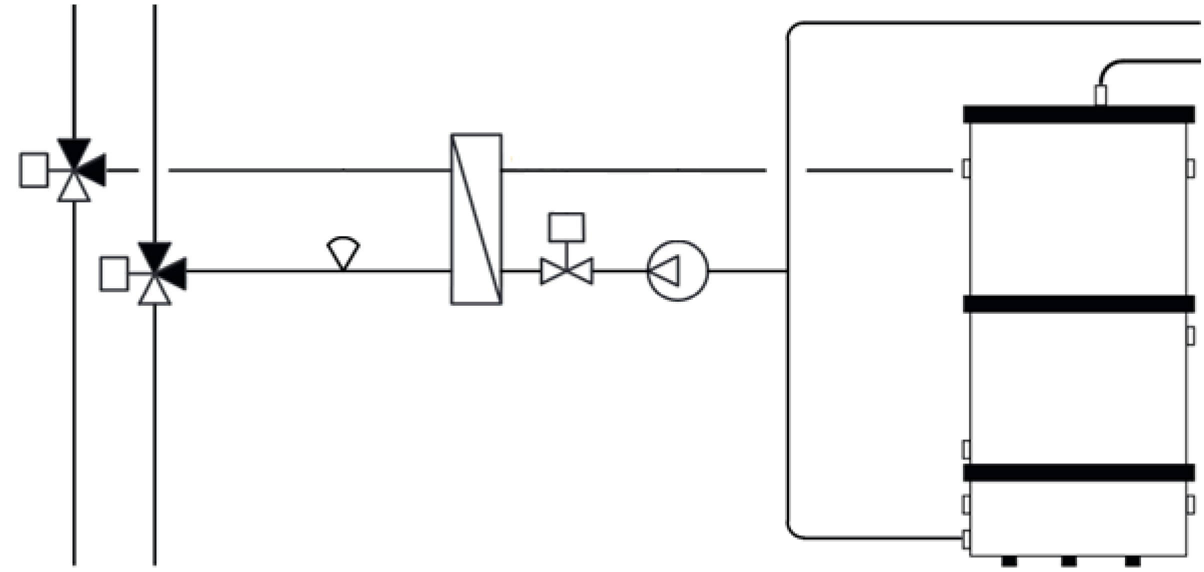


6.1 TWC anti-legionella

The TWC anti-legionella function allows for scheduled activation of the immersion heater in the end tank. The immersion heater will only operate when anti-legionella is scheduled.

7 WCS

The Water Charge System controls the charge temperature of the tap water storage tanks. The pump and mix valve regulation starts when tap water production is active. The mix valve regulates to maintain the set point of the return line temperature. The mix valve closes if the return line temperature falls and opens if the temperature rises.



7.1 WCS hot gas charging

The wcs feature can also be used for hot gas charging when tap water production is not active. The charge temperature for hot gas is set separately from the tap water charge temperature.

Operating pressure is ignored for a short period of time after switching to tap water charging to prevent temporary high temperatures from stopping the heat pump.

In Primary/Secondary mode, this also apply to hot gas pumps in secondary heat pumps. WCS regulation stops when all hot gas pumps in the installation have stopped.

8 Hot gas

8.1 Hot gas pump

The hot gas pump function is only available for the Mega series and is intended for tap water charging. The hot gas pump is only active when the compressor is running, and the discharge temperature is above start temperature (default 65°C) and within the lower/upper temperature limits (default 60-125°C).

The hot gas pump will stop if the end tank temperature is above 85°C (If hot gas directional valve is activated, the storage tank must also be above 85°C).

8.1.1 Variable speed

The hot gas pump can be controlled with 0-10V to control the temperature going to the tap water storage tanks and the end tank (if directional valve hot gas is enabled). The hot gas pump is controlled to maintain the desired charge temperature which is set to tap water top/end tank + offset.

NB! The variable speed feature requires a tap water top sensor (to avoid boiling) and cannot be used in combination with distribution circuit 1 and WCS hot gas charging. This feature is also only available for Mega series 2019+ with BM-SLL.

8.1.2 Hot gas directional valve

The function requires TWC and is used to switch over hot gas charging between the tap water end tank and storage tank.

The end tank is disconnected if:

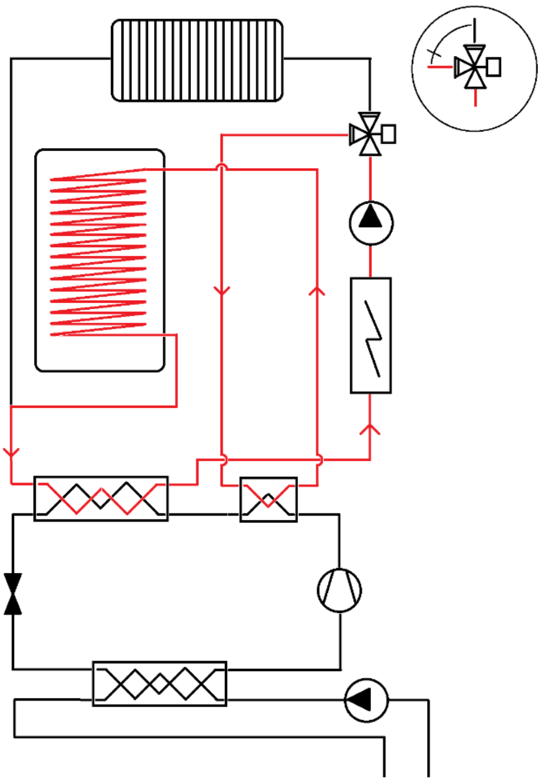
- The temperature in the end tank exceeds the **disconnect end tank at temperature** setting (default 80°C) while none of the reconnect conditions are met.

The end tank is reconnected if:

- The temperature in the end tank is less than **Connect end tank temperature** setting (default 70°C) OR if the temperature in the tap water storage tank is above 85°C.
- The temperature in the end tank is less than the TWC **start temperature electric heater** setting (default 60°C) +3K (to avoid starting the electric heater).

8.2 HGW

The HGW function only applies to domestic heat pumps with a hot gas heat exchanger. When the compressor is not producing tap water and the start conditions are fulfilled, the HGW mix valve sends a partial flow over the hot gas heat exchanger to charge the tap water tank.



8.2.1 Start conditions

- Tap water must be activated.
- Sensors for HGW and tap water must be connected.
- Discharge temperature > Top temperature tap water + Start delta temperature.
- Top tap water temperature < HGW max. temperature – 5.
- The compressor must have been in operation for at least 30 minutes.
- The compressor speed must be above set rpm threshold (1800 for Diplomat Inverter series and 1200 rpm for Atlas series)
- 30 minutes must have elapsed since the last tap water production (to stabilize discharge pipe temperature).
- If internal immersion heater is active, top tap water temperature must be < stop temperature tap water.

8.2.2 Stop conditions

- Internal immersion heater is active and top tap water temperature > stop temperature tap water
- Top tap water temperature > HGW max. temperature or discharge temperature

8.2.3 **Mix valve control**

The HGW mix valve always tries to maintain HGW desired temperature. The shunt opens to decrease charge temperature and closes to increase charge temperature. When HGW control is active, the shunt can close to a minimum of 13% and open to a maximum of 40%. Desired temperature will normally be set to the top sensor for tap water + HGW charge offset, and can never be set to more than HGW max.

9 Pool

Pool starts and stops based on the pool return temperature. During pool operation the pool mix valve regulates to maintain the desired charging temperature. The pool pump is operated continuously. The pool demand can also be interlocked with a digital input. The directional valve for pool can be located both before and after external auxiliary heater. If the directional valve is located after the external auxiliary heater, the user can choose whether external auxiliary heater may be used in pool operation.

Pool requires: EM1, EM2, EM3:0 or EM3:5. EM2 and EM3:0 do not support pool mix valve or pool pump.

9.1 Buffer tank

Pool in combination with buffer tank is only supported by buffer tank type 1, 4 and 5.

9.1.1 Type 1

The directional valve for pool is always located after the system mix valve. During pool operation the system mix valve will maintain the desired charge temperature and the system pump will start, if it is not already active. The compressor will only start if temperature in the buffer tank is lower than the desired charge temperature.

9.1.2 Type 4

The directional valve for pool can be located before the buffer tank (pool before tank setting) or after the external auxiliary heater (pool positioned after ext. aux. heater setting).

When the pool is positioned after the external auxiliary heater the compressor will only start if the temperature in the buffer tank is lower than the desired charge temperature.

When used with primary/secondary only individual pool is supported and the directional valve is always located before the tank.

9.1.3 Type 5

Same as type 4, with the exception that the distribution circuit 1 mix valve will regulate to maintain the desired charge temperature during pool operation if the directional valve for pool is located after the external auxiliary heater.

9.2 Start/stop

Pool starts when the pool return temperature is below the desired temperature - half of the hysteresis.

Pool stops when the pool return temperature is above the desired temperature + half of the hysteresis.

The pool demand has a maximum time of 3.5 hours during the heating season. The maximum time can be ignored, if the system supply sensor is connected and system pump is enabled, and the pool directional valve is located before the external auxiliary heater.

9.3 Demand calculation

The demand calculation for pool aims to maintain the desired charge temperature. The demand calculation is also affected by the desired pool temperature. The demand calculation uses a different sensor based on system configuration and available sensors. In most cases the pool supply or condenser out sensor will be used.

- The system supply temperature is used if the directional valve is located after auxiliary heater and pool configuration is global. Global pool can only be deactivated in primary/secondary mode.
- The pool supply sensor is used if the criteria for system supply is not met.
- The condenser out is used if no other sensor is available.

The setting for desired charging temperature must be greater than settings for desired pool temperature.

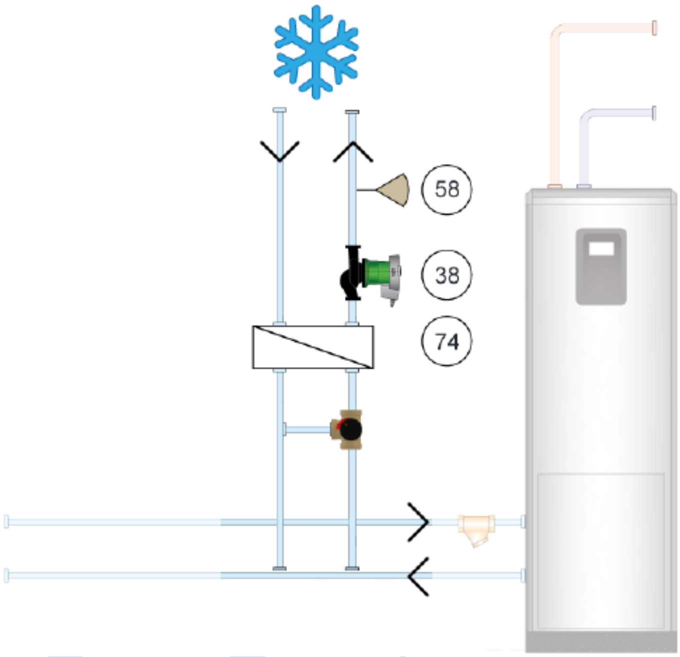
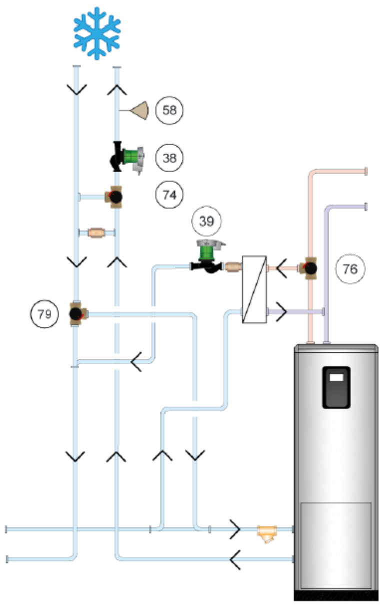
9.4 Parameters

Parameter name	Description
Enable pool	Enable pool production.
Enable pool on system	Enable pool production on the system. Only visible on primary units
Desired temperature	Desired pool temperature
Pool hysteresis	Pool hysteresis setting. Affects when pool start/stop.
Desired charge temperature	Pool desired charge temperature.
Gear shift delay	Decides how often the pool demand is re-evaluated (how often the compressor changes gear).
Pool time	Used when multiple demands are queued (heat, tap water, pool). Decides how long pool should run before switching to the next demand.
Kp	Proportional part in the pool mix valve regulation.
Ki	Integral part in the pool mix valve regulation.
Minimum opening degree	Minimum opening degree for the mix valve regulation.
Maximum opening degree	Maximum opening degree for the mix valve regulation.
Global directional valve	Enable global pool (one pool directional valve for the entire system). Pool and heating cannot run at the same time. Only visible for Mega primaries.
Pool positioned after ext. aux. heater	Setting for pool directional valve location. If enabled the system supply line can be used pool demand calculation. System pump will start for pool when not in heat season.
Enable ext. aux. heater for pool	Enable external auxiliary heater for pool. Requires Pool positioned after ext. aux. heater = 1.
Enable int. immersion heater for pool	Enable internal immersion heater for pool. Only visible when internal immersion heater is enabled.
Pool before tank	Setting for pool directional valve location. If enabled the compressor will start for pool regardless of buffer tank temperature.

10 Cooling

10.1 Cooling - Without cooling tank

Cooling without cooling tank. This is the cooling mode used for all domestic heat pumps, except for Calibra cool. Passive cooling is supported on BM for Atlas series. All other domestic heat pumps require EM2 or EM3:0.

Passive cooling - Passive cooling can be activated independently of active cooling. Passive cooling circulates brine to borehole in order to cool. If the compressor is already in operation when a passive cooling demand arises, evaporator cooling is also produced.	**Passive and/or Active cooling -** Active cooling can be activated independently of passive cooling. In active cooling, the compressor/evaporator are used to cool brine. The heat produced is used for heating, tap water or pool if possible; otherwise, it is dumped to borehole or air cooler.
	

10.1.1 Cooling season

Passive and active cooling will only start during the cooling season (warm outside). Cooling season is calculated from the difference between outdoor temperature and the setting for seasonal start (default 25°C) over time. The result is summed with this temperature difference, forming an integral in degree minutes. The range of the integral is from -150 to 150.

Cooling season: Integral >100. In the cooling season, the circulation pump for the cooling system starts and the cooling shunt begins to regulate in accordance with the set point for desired cooling temperature.
Cooling stop: Integral <-100. In cooling stop, the circulation pump for the cooling circuit stops and the cooling shunt closes.

10.1.2 Passive cooling

Passive cooling starts when the cooling season starts. If room sensor for cooling is enabled the room temperature also needs to be above the desired room temperature + **passive cooling room sensor offset**.

10.1.3 Active cooling

Active cooling starts when the cooling supply line temperature exceeds the **start temp. cooling** setting. If room sensor for cooling is enabled, active cooling will only start if the room temperature is above the desired room temperature + **active cooling room sensor offset**.

10.1.4 Gear calculation

During active cooling the compressor speed is regulated to maintain a brine out temperature that is slightly above the **stop temp. cooling** setting.

If room sensor for cooling is enabled the setpoint is set to the same value as the **desired cooling supply**.

If the compressor is running and the brine out temperature is higher than the cooling supply temperature, the cooling supply temperature is used instead of the brine out temperature. This feature is mainly used when running cooling in combination with primary/secondary.

10.1.5 Disconnect borehole

The borehole is disconnected from the brine circuit when any of the following conditions are met:

- Heat dump to borehole is active
- Brine in is warmer than cooling supply temperature for 60 seconds.

The borehole is reconnected when any of the following conditions are met:

- Cooling is no longer running.
- Heat dumping has been inactive for one hour (default).
- The compressor is no longer running.
- Brine in is colder than cooling supply temperature for 60 seconds.

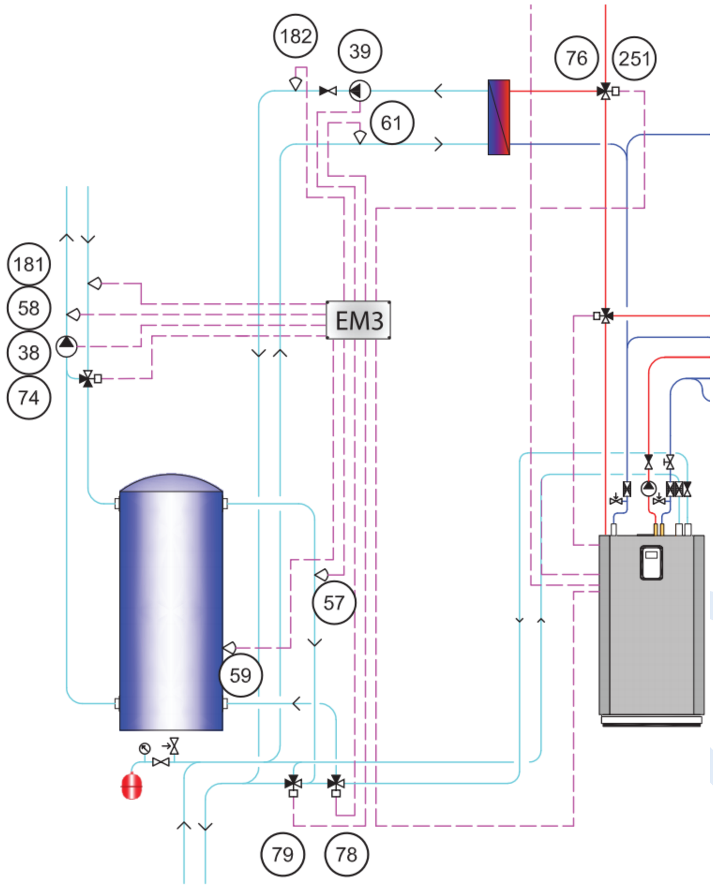
10.1.6 Surplus heat

Heat dumping only takes place when all demands are fulfilled (heating, pool, tap water) and cannot make use of the surplus heat. When heat dump is activated, the dump valve disconnects the heating system. The installer selects dumping to borehole or surplus chiller. The selection only affects disconnection of borehole. Control of surplus chiller is active even in dumping to borehole.

Heat	• The heating system can receive surplus heat if the calculated demand < 1. • The heating system can no longer receive surplus heat if the calculated demand > 4 (start/stop limit for heating). Gear shift delay for heating must pass before the heating system can receive surplus heat again after this stop condition have been met.
Tap water	• Tap water can receive surplus heat if weighted temperature < stop temp. – 1/3 of start-/stop temperature difference. • Tap water can no longer receive surplus heat if weighted temperature > stop temperature.
Pool	• The pool demand can receive surplus heat if pool return < stop temp. – 1/3 of start-/stop temperature difference. • The pool demand can no longer receive surplus heat if pool return > stop temperature.

10.2 Cooling - With cooling tank

Cooling with cooling tank. This is the cooling mode used for all Light commercial heat pumps. This feature requires EM1 or EM3:4.



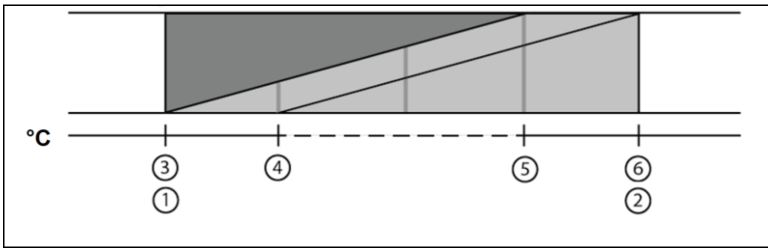
10.2.1 Cooling season

Passive and active cooling will only start during the cooling season (warm outside). Cooling season is calculated from the difference between outdoor temperature and the setting for seasonal start (default 25°C) over time. The result is summed with this temperature difference, forming an integral in degree minutes. The range of the integral is from -150 to 150. During cooling season, the circulation pump and cooling mix valve control is active.

Cooling season: Integral >100. In the cooling season, the circulation pump for the cooling system starts and the cooling shunt begins to regulate in accordance with the set point for desired cooling temperature.
Cooling stop: Integral <-100. In cooling stop, the circulation pump for the cooling circuit stops and the cooling shunt closes.

10.2.2 Passive-/Active cooling

Passive and Active cooling starts on cooling tank temperature (59). The start temperature for passive cooling and the stop temperature for active cooling are calculated automatically with fixed relations to the **start temp. cooling** and **stop temp. cooling** setting. This is done even if only passive cooling or active cooling is activated. The picture below illustrates the calculated start temperature for passive cooling and stop temperature for active cooling in relation to the **start temp. cooling** and **stop temp. cooling** settings.



1. Stop temperature, cooling
2. Start temperature, cooling
3. Passive cooling - Stop
4. Active cooling - Stop (calc)
5. Passive cooling - Start (calc)
6. Active cooling - Start

Example: If start temperature = 18°C and stop temperature = 10°C. Passive cooling start will be calculated to 16°C and Active cooling stop = 14°C.

If room sensor for cooling is enabled the room temperature also needs to be above the desired room temperature + passive-/active cooling room sensor offset to start cooling.

10.2.3 Gear calculation

During active cooling the compressor speed is regulated to maintain a brine out temperature that is slightly above the **stop temp. cooling** setting. If the brine out temperature is higher than the cooling tank, the cooling tank temperature is used instead. If room sensor for cooling is enabled the setpoint is set to the same value as the **desired cooling supply**.

10.2.4 Disconnection of borehole

The borehole is disconnected from the brine circuit when any of the following conditions are met:

- Heat dump to borehole is active
- Brine in is warmer than cooling tank return for 60 seconds.

The borehole is reconnected when any of the following conditions are met:

- Cooling is no longer running.
- Heat dumping has been inactive for one hour (default). Only applicable if surplus heat borehole is selected.
- The compressor is no longer running.
- Brine in is colder than cooling tank return for 60 seconds.

10.2.5 Dew point sensor

EM3:4 offers support for dew point compensation and requires the room sensor HTRT-10A. When dew point sensor is enabled, the controller will monitor the dew point temperature and increase the desired cooling supply if necessary, to avoid condensation. The desired temperature is set to 2K higher than the calculated dew point.

10.2.6 Surplus heat

Heat dumping only takes place when all demands are fulfilled (heating, pool, tap water) and cannot make use of the surplus heat. When heat dump is activated, the dump valve disconnects the heating system. The installer selects dumping to borehole or surplus chiller. The selection only affects disconnection of borehole. Control of surplus chiller is active even in dumping to borehole.

Heat	• Heat can receive surplus heat if the calculated demand < 1. • Heat can no longer receive surplus heat if the calculated demand > 4 (start/stop limit for heating). Gear shift delay for heating must pass before the heating system can receive surplus heat again after this stop condition has been met.
Tap water	• Tap water can receive surplus heat if weighted temperature < stop temp. – 1/3 of start-/stop temperature difference. • Tap water can no longer receive surplus heat if weighted temperature > stop temperature.
Pool	• Pool can receive surplus heat if pool return < stop temp. – 1/3 of start-/stop temperature difference. • Pool can no longer receive surplus heat if pool return > stop temperature.

10.2.7 Shunted surplus

This function is only available on EM3:4. The mix valve opening degree is calculated in accordance with the compressor gear calculation. The mix valve only opens if the cooling demand is larger than the heating demands (heat, pool or tap water).

E.g., if the cooling demand is twice as big as heating the opening degree will be 50%.
E.g., if the cooling demand is five times bigger than heating the opening degree will be 80%.

10.3 Cooling – Athena

Athena 18 HC and Athena 14 HC can produce cooling on supply line. The outdoor unit cannot run both warm and cool demands at the same time. It will favour warm demands first. The compressor will stop before switching between a warm and a cold demand.

The Athena models 18 H and 14 H are unable to produce cooling.

The outdoor unit is unable to produce cooling when the ambient temperature is too high (above 40°C) or too low (below 15°C). This limitation is visible in compressor start restrictions. The outdoor unit fan will start periodically (every 15 minutes for 60s) if the outdoor unit ambient temperature is too high to run cooling while the real outdoor temperature is lower (in cases where direct sunlight increases the temperature) in an attempt to lower the outdoor unit ambient temperature and start cooling.

10.3.1 Cooling season

Cooling will only start during the cooling season (warm outside). Cooling season is calculated from the difference between outdoor temperature and the setting for seasonal start (default 25°C) over time. The result is summed with this temperature difference, forming an integral in degree minutes. The range of the integral is from -150 to 150.

Cooling season: When the integral >100 the cooling season starts.
Cooling stop: When the integral <-100 cooling season stops.

10.3.2 Gear calculation

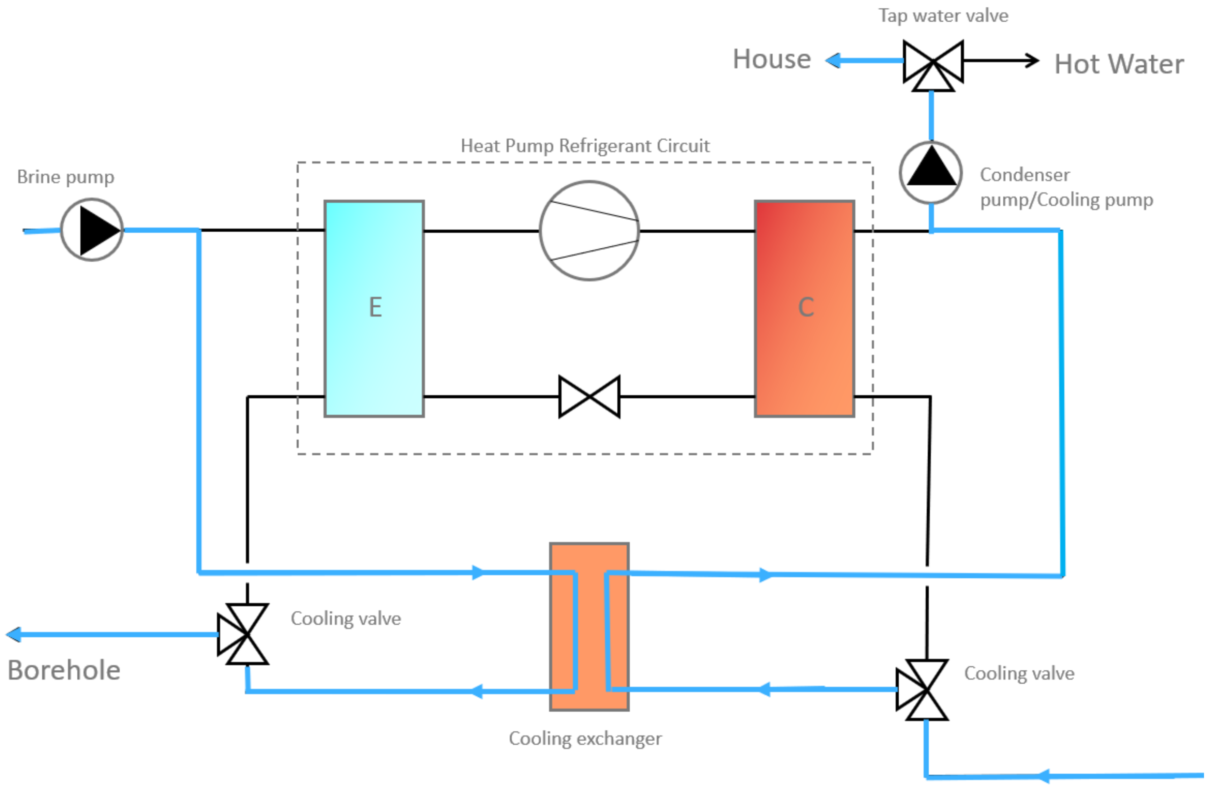
During active cooling the compressor speed is regulated to maintain a condenser out temperature that is slightly above the **stop temp. cooling** setting.

10.3.3 Dew point switch

Dew point switch is available as an accessory to Athena models, it is connected to BM-Card's digital input.
If the dew point switch is enabled, it will prohibit cooling when it detects a risk for condensation. While the restriction is active an icon will appear in top bar.

10.4 Cooling - Calibra cool

Calibra Cool has built in passive cooling and does not support active cooling. Unlike other products, Calibra cool cannot produce heat and passive cooling at the same time, since they use the same system.



10.4.1 Start/stop

Passive cooling starts when cooling season is active (warm outside). Cooling season is calculated from the difference between outdoor temperature and the setting for seasonal start (default 21°C) over time. The result is summed with this temperature difference, forming an integral in degree minutes. The range of the integral is from -150 to 1000 (default).

Cooling season: Integral >100. In the cooling season, the circulation pump for the cooling system starts and the cooling shunt begins to regulate in accordance with the set point for requested cooling temperature.
Cooling stop: Integral <-100. In cooling stop, the circulation pump for the cooling circuit stops and the cooling shunt closes.

When passive cooling starts, the cooling valves will disconnect the evaporator and condenser. Passive cooling is blocked for 90s after compressor shutdown.

When passive cooling is running, the brine pump/-valve regulates the brine flow in order to maintain the **desired cooling supply** on the supply line/condenser out. The range of the desired cooling supply can be limited by the installer to prevent condensation.

10.4.2 Ext. start cooling

Cooling season can be activated regardless of outdoor temperature via the external start cooling digital input. By doing this heating season will be forced to seasonal stop.

10.4.3 Cooling indication

Cooling indication is a closing relay (R1) that indicates when passive cooling is active. The feature can be used to set external thermostats to cooling mode. The indication stays active when tap water is produced, but not during pool operation.

10.4.4 Cool exchanger freeze protection

Cool exchanger freeze protection is only active for Calibra Cool BW profile. This feature is meant to protect the water side of the cool exchanger from freezing if the brine in/-out or cool exchanger temperature gets too cold.

If the cool exchanger temperature (T34) falls below 0,5°C or if the brine in/-out temperature is less than -10°C, the compressor and brine pump will stop immediately, and the cool exchanger freeze protection alarm will appear.

10.5 Parameters

Parameter name	Description
Enable passive cooling	Enable passive cooling demand. Will only be adjustable for end user if previously enabled by installer.
Enable active cooling	Enable active cooling demand. Will only be adjustable for end user if previously enabled by installer.
Allow heat and cool simultaneously	When disabled heating and cooling season cannot be active at the same time. Only available for Calibra, Calibra Cool and Atlas.
Enable dew point switch	Enable dew point switch, that prevents cooling when triggered. Only available for Athena.
Surplus heat: Borehole=1, Chiller=2	Surplus heat dump source: If borehole is selected the brine temperature is assumed warm after heat dump. Affects the disconnect borehole reconnect delay.
Seasonal start	Seasonal start temperature used for cooling season integral calculation.
Cooling integral max.	Setting for the cooling season integral max value. Only available for Calibra cool
Desired cooling supply	Setting for desired cooling supply temperature. Setpoint for cooling mix valve.
Desired cooling supply min.	Setting for desired cooling supply temperature min. Minimum setpoint for cooling mix valve. Only used with room sensor.
Start temp. cooling	Start temperature for active cooling.
Stop temp. cooling	Stop temperature for passive cooling.
Gear shift delay	Decides how often the cooling demand is re-evaluated (how often the compressor changes gear).
Reconnect delay, directional valve, borehole	Affects how long passive cooling is blocked after dumping surplus heat to borehole.
Unprioritized cooling	Enable unprioritized cooling. Cooling will only start when heat is running.

End user limit min.	Limits the desired cooling supply for end user. Only visible for installers.
End user limit max.	Limits the desired cooling supply for end user. Only visible for installers.
Enable room sensor	Enables room sensor for cooling.
Passive cooling room sensor offset	Affects when passive cooling starts/stops on room temperature. Domestic heat pumps only.
Active cooling room sensor offset	Affects when passive cooling starts/stops on room temperature. Domestic heat pumps only.
Room sensor influence	Affects how much room temperature deviation affects the desired cooling supply line temperature.

11 Defrost

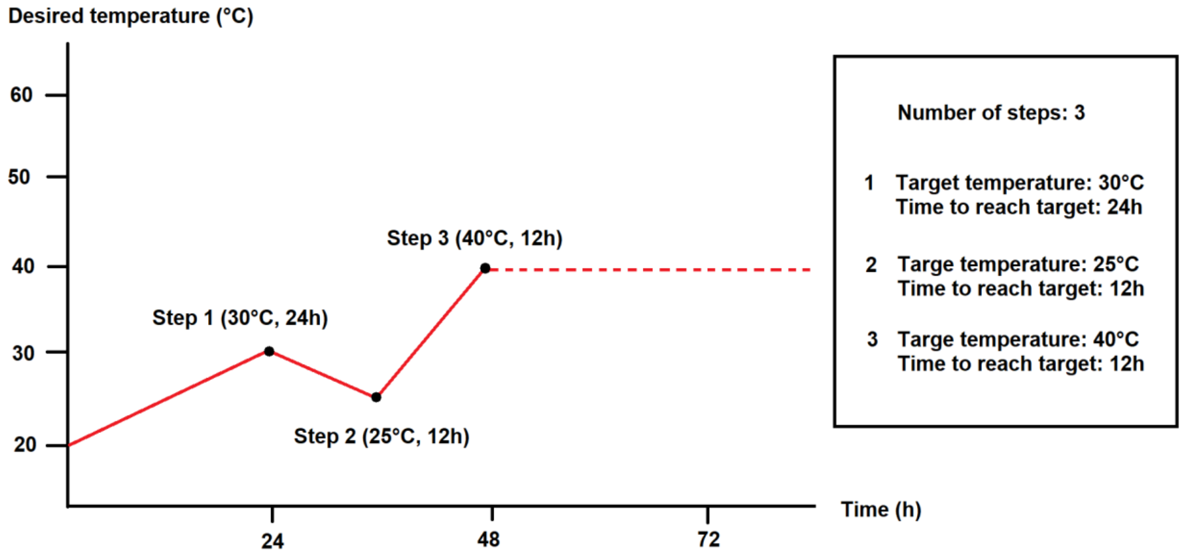
In order to reduce ice build-up on the outdoor units the heat pump has a defrost program.

When defrosting the outdoor unit receives heat stored in the heating system primarily, if there is not sufficient heat in the buffer tank/radiators to perform a complete defrost the heat will be absorbed from the tap water tank. This means that the condenser pump will run during the whole defrost process. The limit for switching to tap water tank is if the condenser inlet temperature is less than 25°C or if the measured flow is too low. For this reason, the tap water is not possible to turn off, instead there is a new mode Low that maintains sufficient heat in the tap water tank to defrost the outdoor unit. In the event that there is still insufficient heat in the tap water tank the indoor electric heater will start in order to satisfy the defrost conditions.

This program can also be started manually from the GUI that will start the compressor and will run the defrost program.

12 Concrete drying

The concrete drying program allows the user to schedule the desired supply line set point with up to 20 steps. Between each step the supply line set point is interpolated linearly. The starting point (step 0) is always 20°C. To start concrete drying the heat pump must be set to operating mode - auto and heat must be enabled. When the last step of the program has been completed, the desired supply line will be maintained, until the program is manually stopped.



Concrete drying is considered a heat demand with supply line set point scheduling. Compressor and auxiliary heater will be controlled accordingly. Other demands such as tap water, pool and cooling will still be able to run, but should be disabled to avoid temperature disturbances during concrete drying. Should the heat pump be power cycled, the current step will be resumed.

13 Calendar (online)

The calendar function is enabled and scheduled from Thermia Online and this option is only available if the heat pump software is at least 15.0. The Calendar can be paused from the heat pump.

13.1 Heating

The heating program have two modes, Economy and Comfort. Each mode uses a different desired room temperature. Comfort is the default mode when the program function is enabled. The user configures the time periods in which Economy mode should be active.

13.2 Tap water block

The tap water program has two modes, Normal and Block (block). Normal is the default mode when the program function is enabled. The user configures the time periods in which Antifreeze (block) mode should be active. In Antifreeze mode, the tap water start and stop temperatures are significantly lowered, in order to only run tap water to prevent freezing, hence more or less blocking tap water.

14 Ventilation test

Mega Eco series use a flammable refrigerant (R454b), which requires a safety ventilation feature in case of leakage. Ventilation and leakage detection is handled by a separate safety card, refrigerant safety module (RSM). If refrigerant leakage is detected, compressor start is prevented by opening the inverter safe stop circuit.

A ventilation test should be performed at commissioning. This is done via manual test (or by changing the test schedule). If no test has been performed within 12h of startup, the test will start automatically. The ventilation test will be scheduled normally after that. By default, the test will run on the first Monday of the month at 00:00 by default.

The ventilation test starts by verifying that the cabinet pressure is at atmospheric level with a pressure switch (when the fan is off). The fan starts and runs for 60s. During this time, the fan is expected to create sufficient under pressure inside the cabinet. The test is OK when the pressure switch is triggered by under pressure.

In primary/secondary the heat pumps will perform the ventilation test one by one (ID priority).

15 Manual test

Manual test allows to manually override control signals to enabled features. Manual test is only available when the access code for installer or service technician is entered. Manual test is automatically disabled when the access code timer expires (after 8h).

15.1 Compressor

When starting the compressor in manual test, it will run on the selected gear. It is not possible to adjust the compressor speed freely. The brine pump and condenser pump are turned on automatically and will run on the selected speed. The pumps can still be turned off manually. The expansion valve is controlled automatically (the same way as in Auto) and all safety features still apply in manual test.

The 20 minute start to start restriction time does not apply in manual test.

15.2 Directional valve tap water

The directional valve can only change positions every 60s. This restriction delay is mainly used in Automatic mode and might be removed from manual test in the future. The HGW-mix valve does not have this restriction.

15.3 High pressure switch test

The high pressure switch test is only available on the Mega series. The test is started on the last page in manual test.

The test is performed by running the compressor (gear 4), brine pump (100%) and condenser pump (30%) for two minutes. The operating pressure stop is disabled. When two minutes have elapsed the condenser pump is turned off. The high pressure is expected to rise until the high pressure switch is triggered. When triggered the test is complete. The trigger pressure is shown.

16 Demand management

If several demands arise simultaneously, the heat pump will circulate through the demands. The time between demand changes is determined by the settings for Heating time, Tap water time and Pool time.

If there are several hot demands (heating, tap water and pool), tap water will be run more often than heating and pool. Tap water →Heating →Tap water →Pool →Tap water…

Tap water is permitted to run at the same time as heating or pool at times of high demand if external auxiliary heater is activated. Tap water will always run with compressor and heating or pool with compressor and/or external auxiliary heater.

Passive and Active cooling can run simultaneously with all heat demands (heating, tap water, pool). Except for Calibra Cool.

Heating and pool can only run at the same time with the individual pool feature.

17 Compressor

17.1 Start restriction

NB! Athena Only. If the outdoor temperature is below -20°C no compressor start will be allowed instead the immersion heaters will start producing

Active compressor start restrictions are listed under System information/Heat pump status/Start restrictions.

17.1.1 Restriction time

In order to preserve the compressor's service life, it is prevented from starting too often in a short time.
This is done with two restriction times that look at when the compressor last started and when it last stopped. The longer of these two times is restricting. This means that the compressor cannot start more than three times within an hour. When the compressor is limited by restriction time, an icon appears in the top bar and various icons in the drop-down, depending on which demands are waiting.

Start to start time = 20 min. Stop to start time = 5 min.

Manual test - When manual test is activated or has already been activated, the time condition for start to start time is always fulfilled.

17.2 Reason for stop

The reason for stop page shows and logs the 30 most recent compressor stop reasons. This reason for stop list is reset at controller restart. This page can be found under System information/Heat pump status/Reason for stop.

17.3 Start sequence

1. A demand arises.
2. The brine pump starts and runs at maximum speed for 10 seconds.
3. Expansion valve sets start opening degree (and wait for pressure equalization on Atlas/Calibra 12-18).
4. Condenser pump starts and runs at minimum speed.
5. The compressor starts and holds the start rpm for a short time, before returning to the desired gear for the running demand.
6. The expansion valve begins to regulate.
7. Start sequence finished.

17.3.1 Compressor start rpm

Product	Start rpm
Mega series	1500*(1)
Diplomat Inverter L/-M	1500
Diplomat Inverter Mini	3000
Calibra series	3000
Atlas series	3000

*1. The inverter starts the compressor at 3000rpm on Mega series 2019 and 1800rpm on Mega series 2020 before returning to start rpm.

17.4 Stop sequence (pump down)

Pump down is carried out when the compressor is to carry out a normal stop (fulfilled demand, EVU, Off position, etc.). Pump down is done when the compressor has come to its lowest speed during shutdown. The expansion valve closes in order to empty the evaporator of refrigerant before the compressor shuts down. In this way, liquid is prevented from entering the compressor during the stop sequence, and liquid refrigerant is prevented from mixing with the oil during compressor start. The pump down sequence can take several minutes, depending on pressure and compressor speed.

17.5 Gearbox

The tables below show what the default setup of the gearbox. Ranges and default values are determined with regards to output, vibrations, noise and compressor's envelope. Each gear can be adjusted to avoid noise.

17.5.1 Mega

Gear	Eco XL	XL	XL (2020)	L	L (2020)	M	M (2020)	S	S (2020)
1	1500	1500	1500	1500	1500	1500	1500	1500	1500
2	2000	2000	2000	2000	2000	2000	2000	1655	1655
3	2500	2500	2500	2500	2500	2500	2500	1850	1850
4	3005	3005	3005	3005	3005	3005	3005	2100	2100
5	3500	3500	3500	3500	3500	3500	3500	2400	2400
6	4000	4000	4000	4000	4000	4000	4000	2700	2700
7	4500	4500	4500	4500	4500	4500	4500	3005	3005
8	5000	5000	5000	5000	5000	5000	5000	3500	3500
9	5395	5500	5350	5500	5350	5500	5350	4000	4000
10	6000	6000	6000	6000	6000	6000	6000	4500	4500

17.5.2 Diplomat Inverter

Gear	L	M	Mini
1	1800	1205	1200
2	2200	1505	1505
3	2710	1850	1905
4	3000	2200	2200
5	3400	2705	2600
6	4000	3200	3000
7	4650	3505	3400
8	5200	3950	3900
9	5800	4300	4300

17.5.3 Calibra

Gear	16 Eco	12	12 Eco	8 Eco	7
1	1205	1200	1200	1505	1200
2	1510	1510	1505	1805	1505
3	1810	1810	1805	2105	1905
4	2110	2110	2105	2600	2200
5	2410	2410	2405	3000	2600
6	2850	2950	2950	3500	3000
7	3200	3200	3200	3900	3400
8	3500	3550	3600	4300	3900
9	4050	4000	4000	4700	4300
10	4450	4500	4500	4900	--
11	4800	5000	5300	--	--
12	--	5300	--	--	--

17.5.4 Calibra Cool

Gear	7
1	1200
2	1505
3	1905
4	2200
5	2600
6	3000
7	3350
8	3950
9	4300
10	--
11	--
12	--

17.5.5 Atlas

	Atlas 18		Atlas 12	
Gear	Default	Range	Default	Range
1	1300	1200-1490	1200	1200-1490
2	1510	1510-1790	1510	1510-1790
3	1810	1810-2090	1810	1810-2090
4	2110	2110-2390	2110	2110-2390
5	2450	2410-2699	2410	2410-2849
6	2850	2700-3099	2950	2850-3099
7	3200	3100-3499	3200	3100-3449
8	3500	3500-3949	3700	3450-3899
9	4000	3950-4349	4000	3900-4399
10	4350	4350-4699	4400	4400-4799
11	4800	4700-4999	4900	4800-5149
12	5300	5000-5300	5300	5150-5300

17.5.6 Athena

	Athena 18		Athena 14	
Gear	Default	Range	Default	Range
1	3000	3000-3000	3000	3000-3000
2	3420	3420-3420	3420	3420-3420
3	3780	3780-3780	3780	3780-3780
4	4080	4080-4080	4080	4080-4080
5	4440	4440-4440	4440	4440-4440
6	4800	4800-4800	4800	4800-4800
7	5160	5160-5160	-	-
8	5520	5520-5520	-	-
9	5940	5940-5940	-	-
10	6420	6420-6420	-	-
11	6960	6960-6960	-	-
12	7200	7200-7200	-	-

17.6 Gear restrictions

Compressor speed is determined primarily by the demand calculation for each demand, but there are restrictions or safety features that can prevent or force the compressor to increase or decrease the speed.

- Minimum-/Maximum gear
- BBR limitation.
- Brine monitoring.
- Envelope size and pressure
- Discharge pipe monitoring.
- Inverter temperature monitoring.
- High super heat monitoring

17.6.1 Prioritization

Minimum-/Maximum gear is always respected. If several restrictions are active simultaneously, the following prioritization is made to override the compressor's gear:

Priority	Gear change	Description
1	↓ Change down ↓	Brine monitoring
2	↑ Change up ↑	Envelope size
3	↓ Change down ↓	Envelope pressure/temperature (high condensation, low evaporation)
4	↓ Change down ↓	Envelope size
5	↑ Change up ↑	Envelope pressure/temperature (high evaporation, low condensation)
6	↓ Change down ↓	Discharge pipe monitoring and Inverter temperature monitoring

17.7 Discharge temperature monitoring

Discharge temperature monitoring protects the compressor from high discharge temperature by limiting the compressor speed. The compressor speed is decreased when the discharge temperature exceeds **gear down temperature** and does not allow the compressor to speed up until the discharge temperature is below **release temperature**. The compressor will stop immediately if the **stop temperature** is exceeded.

Product	Gear down temp.	Release temp.	Stop temp.
Diplomat Inverter L/-M	115°C	105°C	120°C
Diplomat Inverter Mini	123°C	115°C	125°C
Calibra 12/-7	123°C	115°C	125°C
Atlas 18/-12	123°C	115°C	125°C
Mega XL/-L/-M/-S	-	-	130°C

The Mega series only uses the stop temperature limit.

17.8 Inverter temperature monitoring

Inverter temperature monitoring prevents the inverter from overheating by limiting the compressor speed if the inverter temperature exceeds 94°C and prevents the compressor speeding up again until the temperature drops below 89°C. This feature is only enabled for: Diplomat Inverter M 230, Diplomat Inverter Mini, Calibra series, Atlas series and Mega series.

The inverter temperature is visible under System information/Inverter data.

17.9 High super heat monitoring

High super heat monitoring protects the compressor from high super heat when the expansion valve is fully open, by limiting the compressor speed. This is normally only necessary in the case of high supply line temperature and high brine temperature.

This feature is only enabled for: Diplomat Inverter Mini, Calibra 12, Calibra 7, Atlas 18 and Atlas 12.

If the super heat is above 9K the compressor will be prevented to speed up. The compressor can speed up again if the super heat is below 8K.

If the super heat is above 10K and the expansion valve is fully open, the compressor speed will decrease.

17.10 Power output limitation

Power output limitation prevents the heat pump from generating too much heating power. The controller calculates the power output from the heat pump using sensor data and motor power from the inverter.

This feature is currently only supported on the Mega series. This feature may also require an inverter parameter upgrade to gain access to the motor power.

If the max power output is exceeded the compressor will speed down one gear after 10 minutes, until the max power no longer is exceeded. Then the compressor will be unable to speed up for 60minutes.

Model	Range (kW)
Mega XL	31-120
Mega L	21-90
Mega M	16-55
Mega S	15-40

17.11 Envelope management

The envelope represents the compressor's operating range, and its size changes depending on the compressor's current speed. The compressor's position in the envelope is calculated in accordance with the metrics from the low-pressure transducer and high-pressure transducer.

The outer limits of the envelope can be shown in red or blue to indicate whether it is OK to be outside the envelope, for instance at start up.

The controller will always take actions in order to keep the compressor within the envelope. This is done by speeding up/slowing down the compressor (to run in the largest possible envelope) and by increasing/reducing speed of the condenser pump and the brine pump. In the event of high evaporation, the controller will also close the expansion valve to lower the evaporation temperature.

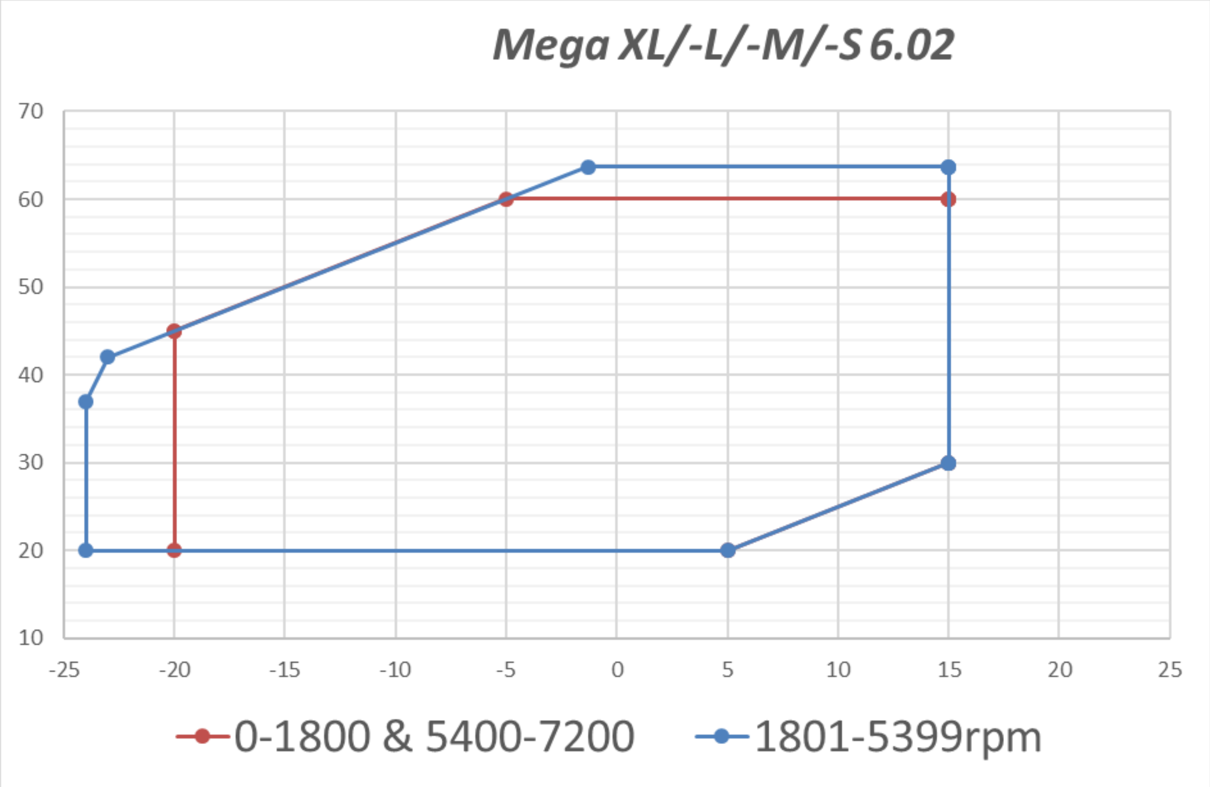
Red, dotted = When the envelope's borders are shown as a dotted red line, the time condition for envelope stop does not apply. This happens when the compressor is not operating, or for 120 seconds from compressor start-up. During the dotted red period, compressor operation outside the envelope is permitted. This is to enable management of temporary high or low temperatures during start-up. Protective measures will still be taken.

Blue, solid = If the envelope's borders are shown as a solid blue line, the compressor will stop if it is outside the limits for more than 40 seconds if no further action can be taken.

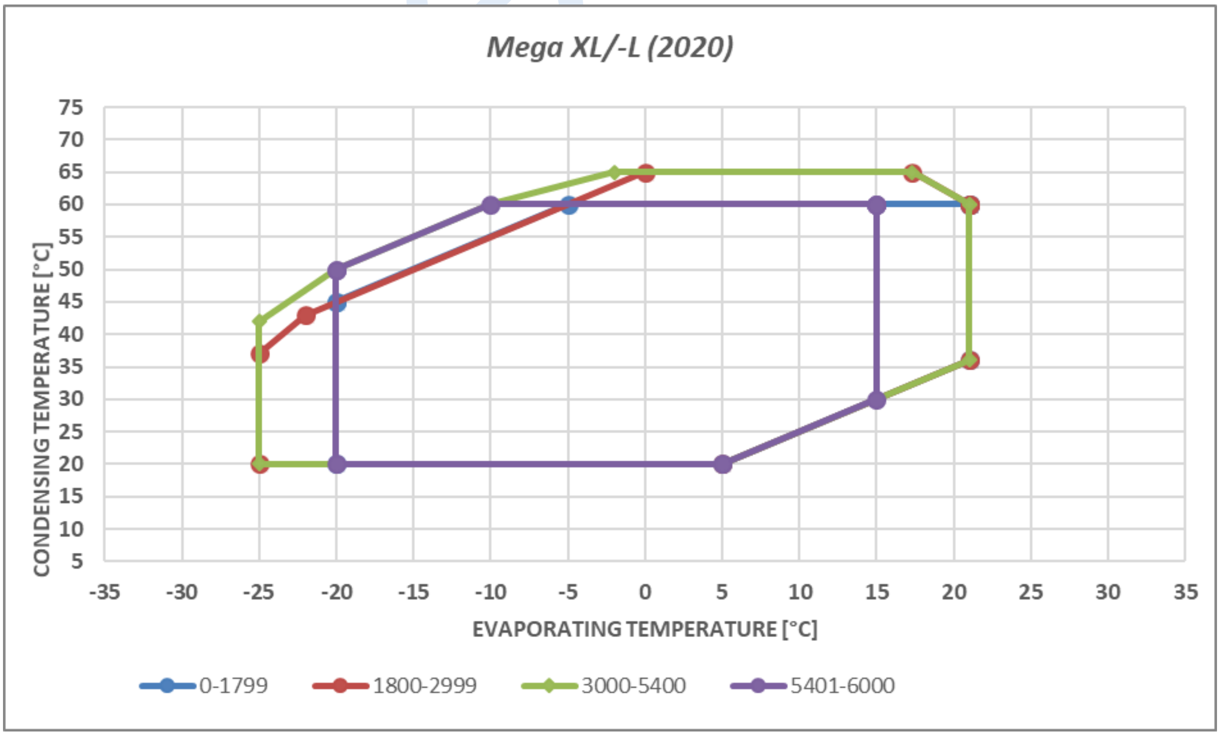
17.12 Envelope definitions

17.12.1 Mega XL/-L/-M/-S (OLD)

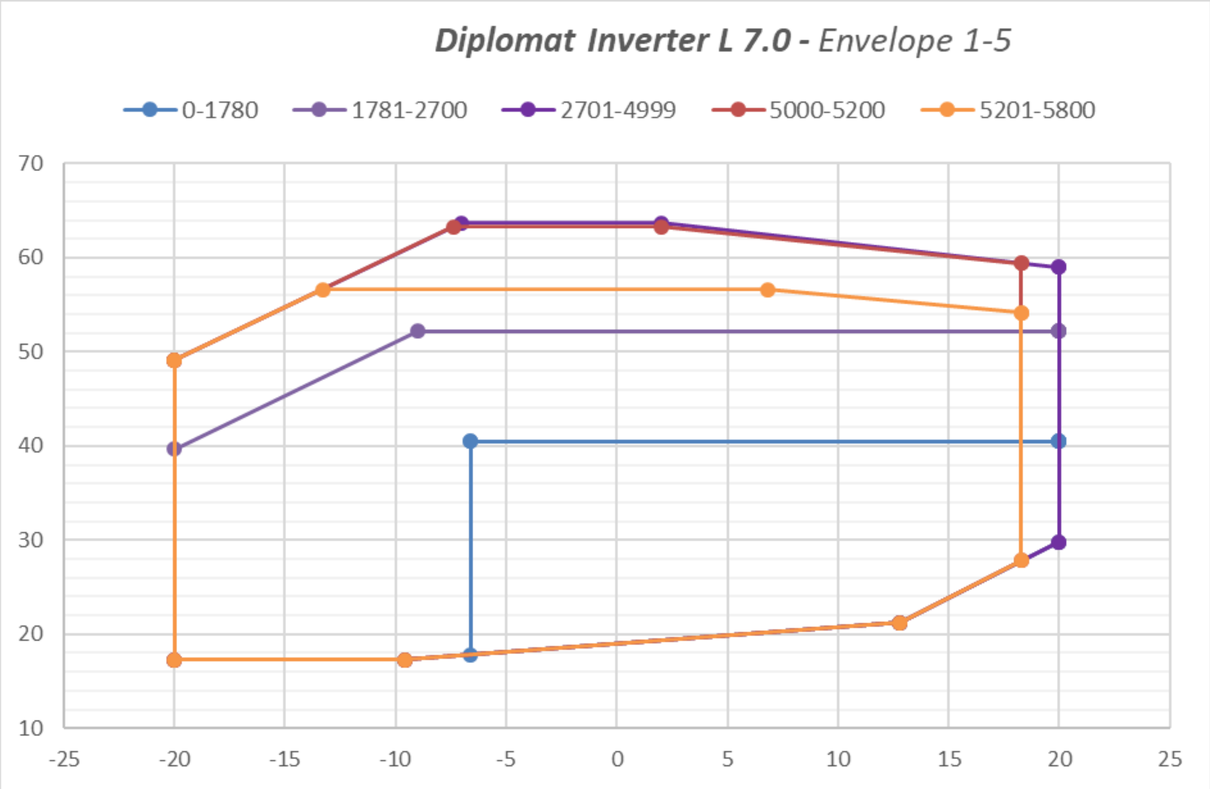
Y = Condensing temperature, X = Evaporating temperature



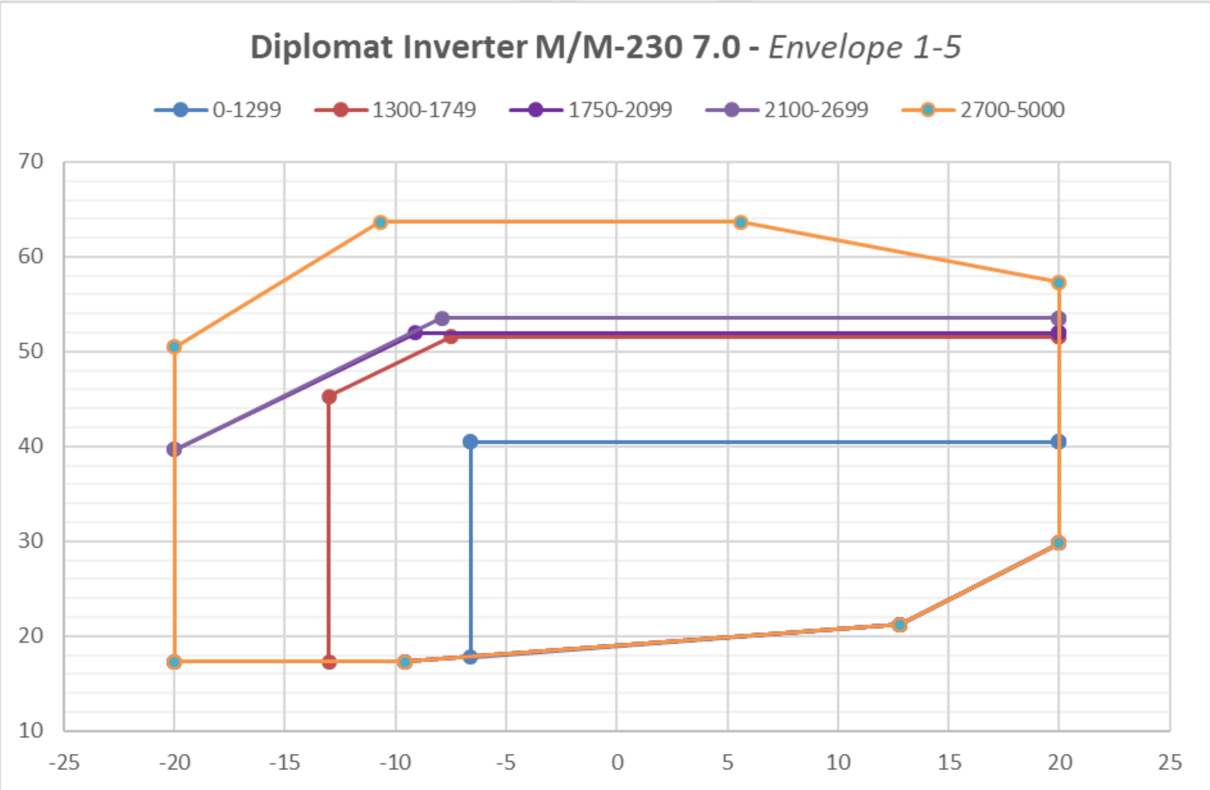
17.12.2 Mega XL/-L (2020)



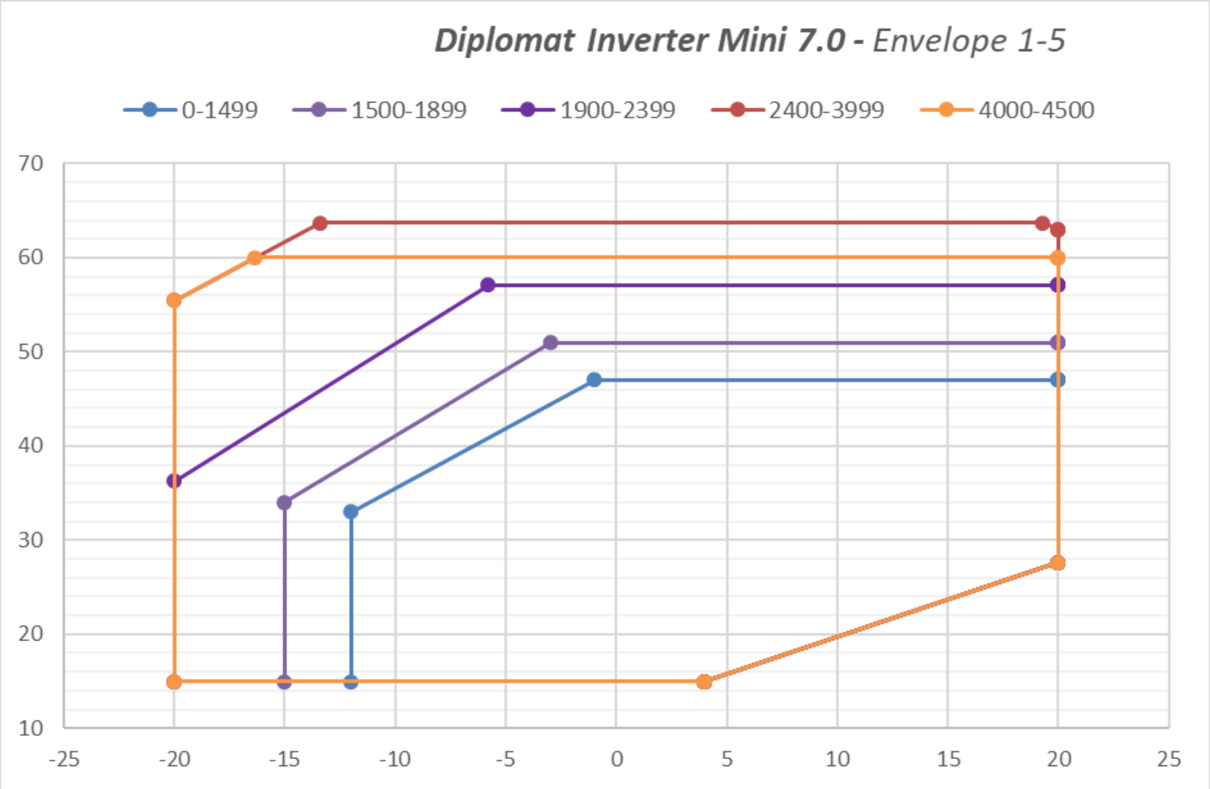
17.12.3 Diplomat Inverter L



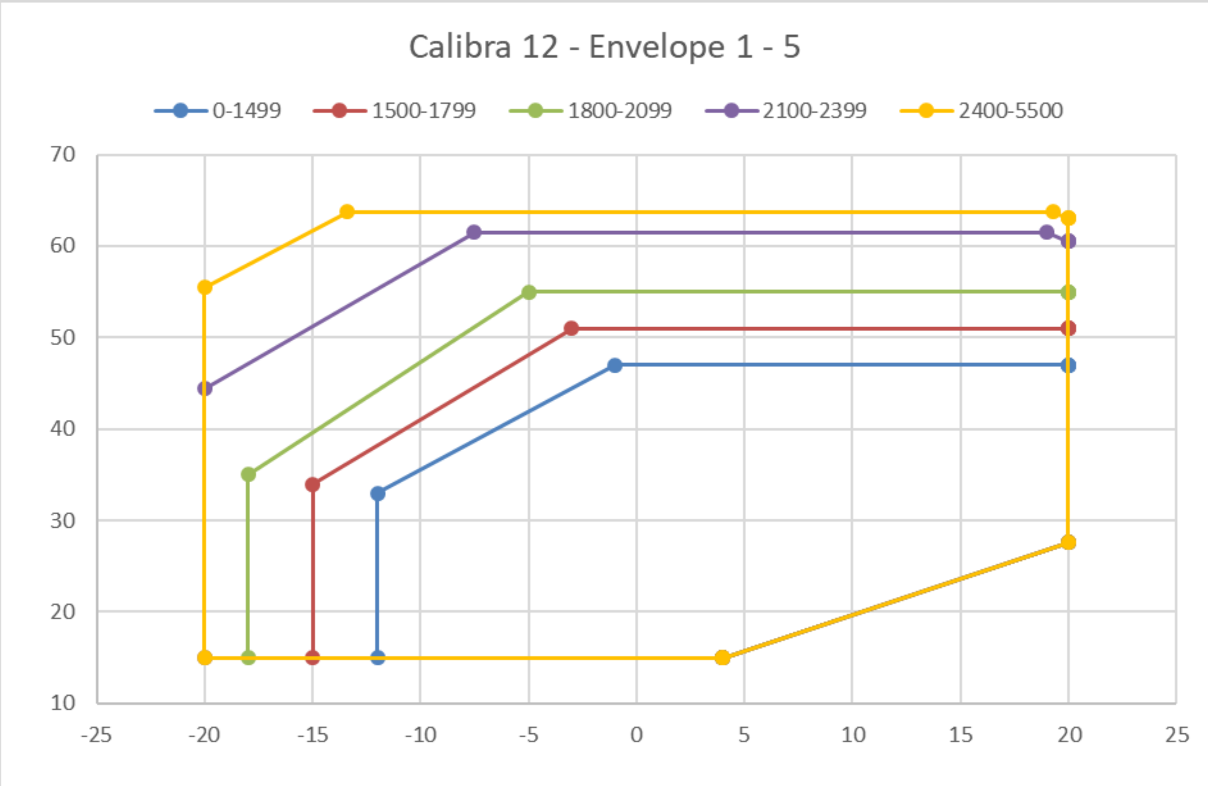
17.12.4 Diplomat Inverter M



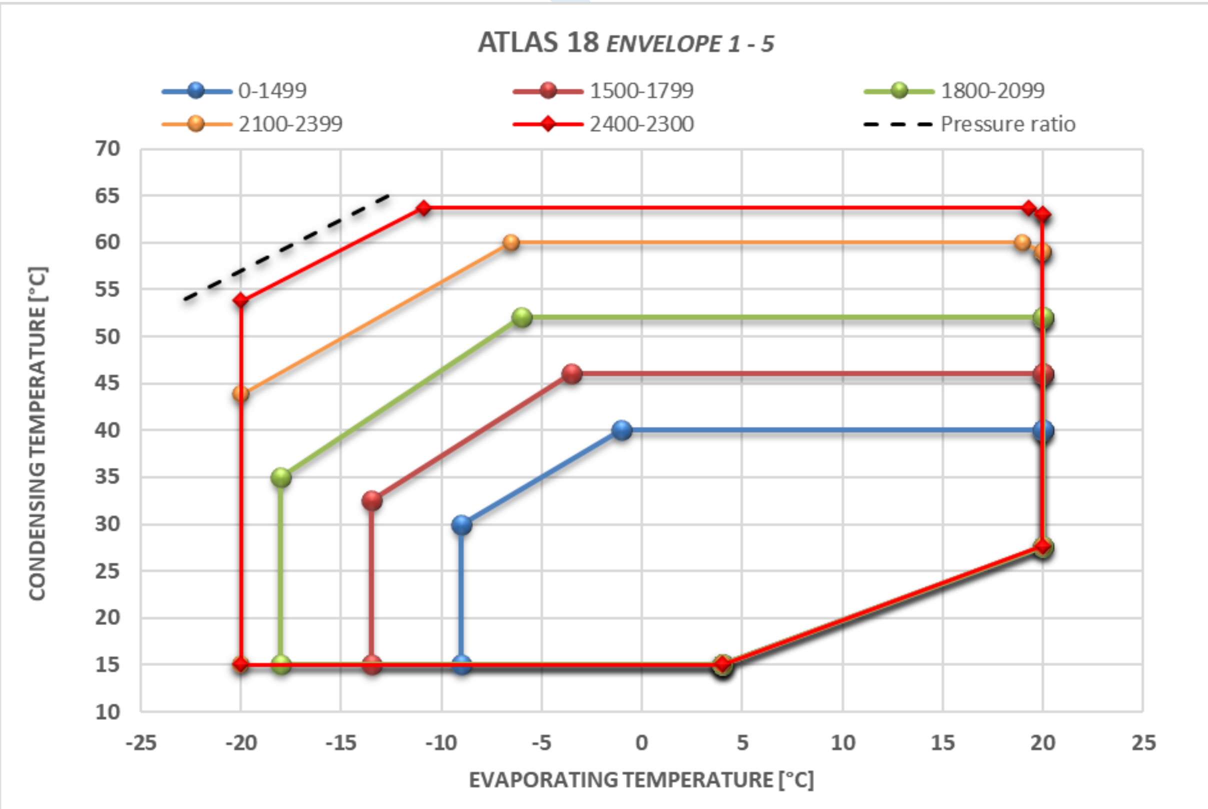
17.12.5 Diplomat Inverter Mini / Calibra 7



17.12.6 Calibra 12 / Atlas 12



17.12.7 Atlas 18



17.13 Pressure ratio

Pressure ratio is a protective stop for the compressor. The protective stop checks the ratio between low pressure and high pressure. The compressor is stopped immediately if there is too great a difference. The switch-off limit is always outside of the largest compressor envelope, at high condensation and low evaporation temperature.
The switch-off limit is unique for each compressor type. How this is managed depends on the Machine Profile. An alarm for pressure ratio is triggered, regardless of pressure, if a machine profile has not been configured.
See also alarm information concerning pressure ratio.

17.14 Oil boost

The oil boost function is to ensure that the compressor receives enough lubrication, and to retrieve oil from the refrigerant circuit. This is done by raising the compressor speed for a short period of time.

Oil boost is not required for the following products: Diplomat Inverter L, Diplomat Inverter Mini, Calibra, Atlas.

17.14.1 Mega XL/-L/-M/-S

The oil boost runs when the compressor speed has been below 3,000 rpm for more than one hour. The period is paused if the compressor is operating at a speed of above 3,000 rpm. The period is zeroed if the compressor has operated at a speed of above 4,200 rpm for longer than the oil boost period, or if the compressor has been switched off. The oil boost operates at 4,200 rpm for 60 seconds before it is terminated. (Preparation time is not included.)

For Mega M and Mega S, the period between oil boosts varies from 1 hour to 5 hours, depending on the average super heat of the last hour of compressor operation. A lower super heat means longer time between oil boosts.

The period is zeroed if the compressor is operating at a speed of above 3,000 rpm or if the compressor is switched off. The oil boost is operated for one minute at 4,200 rpm.

The oil boost function was entirely controlled by the inverter before Genesis version 6.0.

17.14.1 Diplomat Inverter M/-M-230

The oil boost is activated after the compressor has operated for a total of two hours at a compressor speed below 1,800 rpm. The oil boost is operated for five minutes at 1,805 rpm, and primarily towards the radiator circuit. If the temperature towards the system exceeds the maximum curve, the oil boost is permitted to operate towards the tap water tank instead. The aggregated period is zeroed if the compressor has operated at a speed of above 1,800 rpm for longer than the oil boost period (5 mins.).

18 Auxiliary heaters

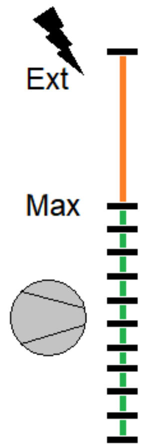
The auxiliary will only be activated when the compressor is doing all it can and this is not enough to fulfil the demand for heating, pool or tap water. Only internal immersion heater can produce tap water, but only under certain conditions. When there is a normal deficit (the compressor is active and running at full speed) auxiliary is activated only after a start delay (default 0), but when the compressor is prevented from starting, auxiliary may be activated immediately, without start delay.

18.1 External auxiliary heater

The external auxiliary heater requires a system supply line sensor. If outdoor temperature dependency is activated, external auxiliary heater is prevented to start if the outdoor temperature is above set outdoor temperature. External auxiliary heater can only produce heating and pool (if pool after external auxiliary heater is activated).

External auxiliary heater is treated as 'extra' gears in addition to the compressor gears. The number of gears external auxiliary heater corresponds to is the same as the start limit for external auxiliary heater.

With standard settings for a Mega with external auxiliary heater, there are 16 gears in total (10+6) available for heating and pool. Each of the 6 extra gears is dependent on the start limit for external auxiliary heater. All 16 gears must be allocated, and the demand calculation must be below the start limit before external auxiliary heater is activated.



External auxiliary heater is also permitted to start if a great need for heating or pool arises while the compressor is producing tap water.

18.1.1 Control signal 0-10 V

The external auxiliary heater also controls a 0-10 V signal which regulates system supply line temperature in accordance with calculated set point and desired delay. The output signal is operated with a PI control and a control range which affects how often the output signal is permitted to change. The output signal can also be restricted by changing setting for Min./Max. opening degree. These restrictions apply even if the auxiliary is not active.

The signal is used for system shunt in the case of buffer tank without external auxiliary heater.

Pre-heating period: When external auxiliary heater starts, auxiliary shunt 0-10 V will be closed until the pre-heating period has elapsed.

Burn out time: When the stop limit is reached, the external auxiliary heater continues to be active in the burn out time and the boiler circulation pump starts. When the overrun period has elapsed, the external auxiliary heater switches off.

Burn out time is ignored when the heat pump is put into OFF position.

Burnout time delay: The boiler circulation pump continues to operate in burn out time delay after the burn out time has elapsed, and external auxiliary heater has switched off.

18.1.2 Auxiliary heater with expansion card

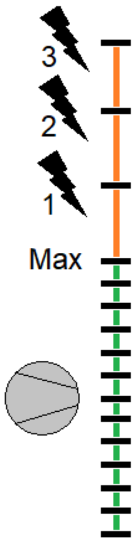
System pump, system shunt and system supply line sensor should be connected to expansion card.

18.2 Internal immersion heater

Internal immersion heater is available on domestic heat pumps and Mega S-E. Internal immersion heater can be used to produce heat, pool, tap water and anti-legionella.

The number of heater steps with and without compressor can be limited individually. An overall limitation can be set by BBR and the current limiter function.

The internal immersion heater is controlled by the demand calculation for heat in the same way as the compressor. Each step corresponds to 3 compressor gears and requires the calculated demand for heating to be -3 or below to step up each heater step.



Step 3 is prevented from starting for two hours from when power is switched on for all demands.

18.2.1 Immersion heaters Athena

For Athena there is an outdoor immersion heater as well as an indoor immersion heater. In the settings it is possible to choose which are allowed to run. When only Indoor or Outdoor immersion heater is enabled, it will function as normal. When both are enabled the Outdoor immersion heater is not permitted run when the compressor is on and when the outdoor temperature is above -1 °C.

For anti-legionella and tap water only the indoor immersion heater is used if enabled otherwise the outdoor heater will be used.

The power consumption for Athena heaters:

- Outdoor:
  - Step 1 = 3,2 kW
  - Step 2 = 5,6 kW
  - Step 3 = 8,8 kW
- Indoor:
  - Step 1 = 3 kW
  - Step 2 = 6 kW
  - Step 3 = 9 kW

18.3 Anti-legionella

Stepping up – The auxiliary in tap water always tries to step up to the highest possible step in order to finish anti-legionella as quickly as possible. Step up is allowed if condenser out < stop temp. anti-legionella +9.

Between each step up there is a delay of 15 seconds before next heater step can start.

Stepping down – The auxiliary heater rejects all steps if condenser out > stop temp. anti-legionella +12.

18.3.1 Overheating protection

Tripped overheating protection is detected by the phase detection on the BM card. The alarm is class B, and the controller will not be able to activate functions that require internal immersion heater.

19 Current limiter

The current limiter function allows for restriction of internal immersion heater, external auxiliary heater and compressor speed if the measured current of one of the phases exceeds the max. phase current setting.

The function is available with EM2, EM3:0 and CG EM340/330.

Primary/secondary: In this mode the current limiter can be connected to the primary or you can connect a current limiter to each unit individually.

The EM3 current limiter will not display currents below 5A. This is because the measurement uncertainties of the ring cores are too great at low amps.

19.1 Internal immersion heater

The internal immersion heater will step down when the measured current exceeds the set max. phase current. If the measured current is still too high when the last step is active, the internal immersion heater will turn off.

The internal immersion heater is prevented from stepping up if measured current exceeds the Max. phase current – hysteresis.

19.2 External auxiliary heater

External auxiliary heater limitation is optional. The external auxiliary heater is limited if the measured current exceeds the max. phase current setting. The 0-10V control signal is limited first. If the measured current is still too high when the 0-10V control signal reaches 0, the auxiliary heater will turn off.

19.3 Compressor

The compressor speed may only be limited if the internal immersion heater and the external auxiliary heater (optional) are no longer active. The compressor speed is limited when the measured current exceeds the set max. phase current setting. If the compressor is running on the lowest possible speed and the current is still above the max. phase current, the compressor shuts down and is prevented from starting until the compressor can speed up again.

The compressor is prevented from speeding up:
Measured current > Max. phase current – hysteresis.

19.4 Primary/Secondary

In primary/secondary mode one main current limiter can be used to limit the secondaries. Internal immersion heater and auxiliary heaters will step down before the compressor speed of the secondaries are limited. The limitation uses the same control logic as listed above.

19.5 CG Energy meter

When using the Carlo Gavazzi energy meter for current limitation the energy meter submenu will be added to System information. In the energy meter view, you can also monitor current (A), voltage (V), power (W) for all phases and total energy (kWh).

20 Brine monitoring

The brine monitoring ensures that the brine temperatures do not fall below the set minimum temperature by speeding up the brine pump and lowering the compressor speed.

In primary/secondary mode, the brine monitoring is configured on the primary unit. All settings will then be shared to each secondary unit and each unit will monitor the brine temperature individually.

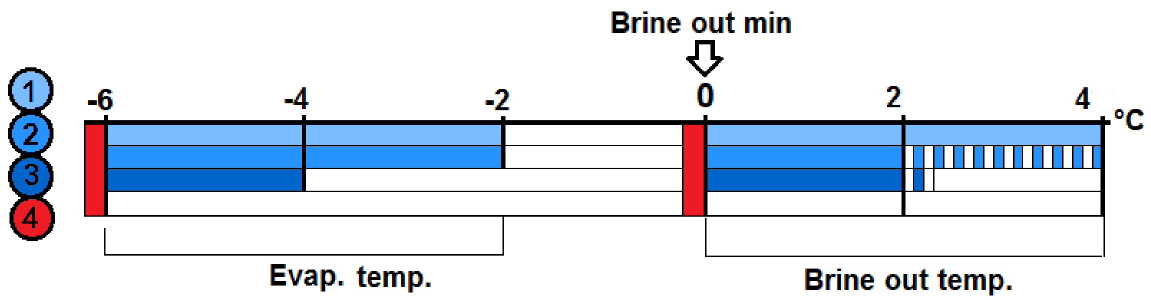
NB! Legacy secondaries is not limited by brine monitoring.

20.1 Brine out monitoring

The brine out monitoring speeds up the brine pump and limits the compressor speed in different stages if the brine out temperature get close to the **Brine out minimum** setting. If the brine out temperature falls below **Brine out minimum** setting the compressor will stop immediately.

If Evaporation freeze protection is enabled, the evaporation temperature (dew point) will also be monitored. This is to prevent the fluid from freezing in the evaporator in the case of low evaporating temperatures.

1	**Brine pump speed up:** The brine pump speeds up to maximum if: • Brine out temperature is less than **Brine out minimum** limit + 4K. • Evaporation freeze protection: Evaporation temperature is lower than **Brine out minimum -**2K.
2	**Compressor prevent speed up:** The compressor is prevented from speeding up if: • Brine out temperature is lower than **Brine out minimum** limit + 2K. The compressor will remain restricted until the brine out temperature is higher than **Brine out minimum** +4K. • Evaporation freeze protection: Evaporation temperature is lower than **Brine out minimum** -2K.
3	**Compressor speed down:** The compressor speeds down if: • Brine out temperature is lower than **Brine out minimum** +2K. The compressor speed is decreased one gear at a time every 30 seconds until brine out temperature has increased by 0.3K. • Evaporation freeze protection: Evaporation temperature is lower than **Brine out minimum** -4K.
4	**Compressor stop:** The compressor stops if: • Brine out temperature is lower than **Brine out minimum** • Evaporation freeze protection: Evaporation temperature is lower than **Brine out minimum** -6K.



20.2 Brine out monitoring (Calibra Cool WW)

In Calibra Cool WW the brine monitoring is enabled by default, with fixed settings. The monitoring takes protective measures to prevent the water from freezing in the evaporator.

	Brine valve: The brine valve fully opens if the brine out temperature is lower than 6°C or if the evaporation temperature is lower than 1°C.
	Compressor prevent speed up: The compressor is prevented to speed up if the brine out temperature is lower than 3°C or if the evaporating temperature is lower than 1°C.
	Compressor speed down: The compressor is forced to speed down if brine out temperature is lower than 3°C or if the evaporation temperature is lower than 1°C.
	Compressor stop: The compressor stops immediately if the brine in temperature is lower than brine out minimum or if the evaporation temperature is lower than 0,5°C.

20.3 Brine in monitoring

The compressor is limited if the brine in temperature approaches the limit value. In comparison to brine out monitoring, this function cannot speed up the brine pump.

This feature is disabled for Calibra Cool WW.

	Compressor prevent speed up: The compressor is prevented from speeding up if: • Brine in temperature is lower than **Brine in minimum** +2K.
	Compressor speed down: The compressor speeds down if: • Brine in temperature is lower than **Brine in minimum** +1K. The compressor speeds down one gear every 15 minutes (shift down delay). The compressor is also prevented from speeding up for 15 minutes (shift up delay) after this restriction has been active.
	Compressor stop: The compressor stops if: • Brine in temperature is lower than **Brine in minimum**.

21 Flow guard

21.1 Regular flow guard monitoring

Flow guard monitoring is active when the internal/external brine pump or compressor is running. The flow guard can be configured to only monitor flow during compressor operation. Flow error will stop the compressor immediately.

During the compressor start sequence, the flow guard sensor is ignored for 25 seconds by default. This is affected by the compressor start delay setting - 5 seconds.

The flow guard alarm can be configured to allow restart attempts. If restart attempts are enabled the heat pump can restart three times within two hours. Time between restart attempts is 20 minutes from stop to start (not to be confused with restriction time).

Flow = Closed circuit

The flow error alarm prevents the brine pump from running until the alarm has been acknowledged. This is to prevent brine leakage in the case of broken brine circuit. This also blocks passive cooling.

21.2 Calibra Cool WW

In Calibra Cool WW the flow guard monitoring is enabled by default with fixed settings. The monitoring checks for unexpected flow behaviour and ensures flow before starting the compressor.

21.2.1 Compressor start

During the compressor start sequence, the flow guard sensor should give flow signal within 25 seconds by default. This is affected by the compressor start delay setting - 5 seconds. The heat pump is allowed to restart 6 times within three hours. Time between restart attempts is 20 minutes from stop to start (not to be confused with restriction time).

The flow guard monitoring does not check for loss of flow during normal compressor operation, since the brine valve may close and reduce the flow below the flow guard's threshold. In the case of complete flow loss, the brine monitoring protects from freezing.

21.2.2 Unexpected behaviour

The flow guard monitoring validates the functionality of the flow guard, brine valve and cooling directional valve by checking for unexpected flow. No flow is expected if passive cooling is running or if the brine valve is fully closed. If the flow is unexpected a Class-A alarm will appear. This alarm is self-acknowledging if the flow returns to normal.

21.3 Athena

All Athena outdoor units are equipped with a flow meter that measures the flow through the outdoor unit. If there is not sufficient flow the compressor will not start/ power down.

21.4 Primary/Secondary

Flow guard in combination with primary/secondary mode has two configurations, Global and Individual flow guard.

Global: In global configuration flow guard requires an external brine pump. The flow guard must be located where it can detect flow from all heat pumps.

The flow guard sensor is connected and activated on the primary unit. This will automatically share the enable flow guard setting and flow guard status to all secondary units. When a demand arises, the primary starts the external brine pump. The primary requires a flow before a start order is sent to the secondaries.

The primary will always give an alarm if a flow problem is detected and will send a stop order to all units until the alarm is acknowledged. Genesis secondaries will only give an alarm if the unit was in operation when the flow was lost.

Individual: In individual configuration the flow guard monitoring is handled individually by all units. Each unit has their own flow guards.

22 Outdoor unit freeze protection

All water filled pipes must at all times remain frost free. All Athena products has a built-in freeze protection. An icon will show if the freeze protection is active. Freeze protection is not active in operating mode OFF.

Outdoor freeze protection has four levels of activity:

1) When the outdoor temperature is below 5°C continuously run the condenser pump at standby flow.
2) When ambient outdoor temperature is below -20°C or the condenser temperatures are below 8°C then start the condenser pump.
3) When ambient outdoor temperature is below 5°C and the condenser temperatures are below 5 °C then it starts the compressor. The compressor is running until the condenser temperatures are above 8 °C.
4) When ambient outdoor temperature is below 5°C and the condenser temperatures are below 2°C then the internal immersion heater is started. The immersion heater is running until the condenser temperatures are above 5 °C.

23 Smart grid/EVU

Smart grid consists of two digital inputs which give four different combinations: Normal, Comfort, EVU and Boost. These modes are used to affect the desired temperature of the heat pump in heating, tap water and pool.

In Primary/Secondary mode, smart grid is only connected to the primary unit. The primary unit will distribute the smart grid signal to all secondaries.

SG-1	SG-2	Open circuit = 0, closed circuit = 1.
0	0	**Normal mode:** Normal operation
0	1	**Comfort mode**: **Heat** - Desired room temperature is offset from Normal (default -2K). Buffer tank type 1: Buffer tank overcharge is set to the Buffer tank overcharge - Comfort (default 5k). Buffer tank charge temperature is limited to 55°C, unless the heat curve required a higher temperature. **Tap water** - Start and stop temperature for tap water is set to Comfort values (default start temperature 45°C and stop temperature 60°C). **Pool** – Desired pool temperature is offset from Normal (default 0K).
1	0	**EVU**: The function blocks compressor operation and internal immersion heater. Other components such as circulation pumps, directional valves and external auxiliary heater are still controlled. Inverter communication alarm and inverter alarms are disabled during EVU.
1	1	**Boost mode:** **Heat** - Desired room temperature is offset from Normal (default -2K). Buffer tank type 1/3: sets desired tank temperature to 55°C, and if 'Allow immersion heater during boost' is enabled, the internal immersion heater is also used. Buffer tank type 2: If the buffer tank temperature is colder than desired system supply line, the system mix valve will switch behaviour and instead redirect the flow through the buffer tank and charge it with the compressor. Buffer tank type 4/5: Same as heating without buffer tank. The buffer tank will not be charged. **Tap water** - Sets the tap water mode to Boost. Start and stop temperature is set to boost values (default start temperature 55°C and stop temperature 65°C). If ”Allow immersion heater during boost” is enabled, an anti-legionella cycle will trigger if the bottom tank temperature is two degrees below the stop temperature for anti-legionella. **Pool** – Desired pool temperature is offset from Normal (default 0K).

24 Smart price

Smart price uses the hourly electrical price from Nord pool to optimize the heat pump operation in heating and tap water, with the goal of saving money for the end user. The electrical prize is translated to an index spanning from -100 (expensive) to +100 (cheap), which is communicated to the heat pump.

24.1 Activation

Smart price is activated from Thermia Online by activating it in the Premium services tab. This option is only available if the heat pump software is at least 13.0 and the country is set to Sweden. It is also crucial that the time zone setting in Online is correct.

24.2 Heat

Smart price affects heating by adjusting the desired system supply temperature. The desired supply temperature is lowered during expensive periods and increased during cheap periods. How much heating is affected can be adjusted with the influence slider in Online.

When room sensor is enabled and active, if will still strive towards the normal desired room temperature.

24.3 Tap water

Smart price affects tap water by adjusting the start/stop temperature and the weighted temperature. How much tap water is affected can be adjusted with the influence slider in Online.

Tap water is made more unlikely to start and will not fully charge the tap water tank if it does start when the price is high.

If the price is low, tap water is made increasingly more likely to start before an expensive period.

24.4 Anti-legionella

Anti-legionella is allowed to start 24h hours earlier than normal if the price is very cheap (above index 50). Note that anti-legionella is never prohibited to start and may start when the price is high.

24.5 Smart price vs Calendar

If both smart price and calendar are configured and enabled, calendar will be prioritized, e.g., if there is an active calendar event, it will override desired smart price setting for that specific function configured in the calendar event.

25 External alarm

External alarm input which, in the event of a broken circuit, generates a class C information alarm. For the alarm to be given, the function must be activated under Alarm control/Sum alarm. Alarm = Broken circuit.

26 Expansion valve regulation

Expansion valve regulation takes place in two stages:

1. Calculation of a pressure set point.
2. Regulation of opening degree of the expansion valve.

26.1 Calculation of pressure set point

The expansion valve regulation aims to maintain **pinch** (pressure in relation to brine out). In order to protect the compressor, it is still essential to monitor the superheat. If the superheat becomes too low or too high, actions are taken.

26.1.1 Why do we control pinch?

The expansion valve regulation is considered to have better stability when maintaining desired pinch, compared to superheat (pressure/suction gas), since the brine out temperature is not that heavily affected by the expansion valve opening degree. With a stable regulation it is easier fine tune the regulation and get good performance.

26.1.2 Reduction of pinch

When compressor speed, brine in temperature and condenser in temperature have been stable for five minutes, there is a possibility of reducing the pinch. This is done within the expansion valve's control parameters, which are dependent on compressor speed.

The purpose of this is to try to find the greatest stable evaporation pressure, even if the sensors are not completely calibrated and even if this evaporation pressure may vary slightly depending on other circumstances, such as brine delta.

26.1.3 Increase of pinch

If the regulation has become unstable as a result of external circumstances (e.g., fluctuating brine in temperature) the regulation forgets everything it has learned about previous attempts to reduce pinch. If internal sensors (suction gas, etc.) are instable, the regulation will not reduce the pinch setpoint until next gear change.

26.2 Calculation of opening degree

When the regulator has calculated a pressure set point, an opening degree is calculated in accordance with conventional PD regulation. The intensification factors are dynamic, i.e., more intensification at higher compressor speed, for example.

26.2.1 Start sequence

The expansion valve opens to the prescribed start opening degree before compressor start. When the BM card sends feedback that the opening degree has been reached, the compressor is permitted to start.

26.2.2 Prevent high pressure

This function is only active when the compressor is switched off. If the pressure is too high on the pressure side (above 41.3 bar) the expansion valve will open to reduce the pressure.

27 Primary/Secondary

Enables up to 15 heat pumps (secondaries) to be controlled by a single unit (primary). The primary and secondary units communicate via TCP/IP and requires all units to be on the same network. Primary unit can also control up to 15 fixed speed heat pumps (legacy) with EM1 and EM3.

Primary/Secondary is only supported on Mega series, Atlas series and Diplomat Inverter series. Atlas series does not support Legacy control.

27.1 Configuration

One unit is configured to be the primary unit. This unit manages the demand calculations and controls all secondary units and all expansion modules. All other heat pumps are configured to be secondary units. All units must be restarted when the configuration is complete for the new settings to come into play. After restart, the units will connect to each other automatically on the network if the network settings are valid.

All other features (heat, tap water, hot gas etc.) are configured individually.

27.1.1 Primary

The user enables genesis or legacy heat pump control and how many secondaries that are to be expected.

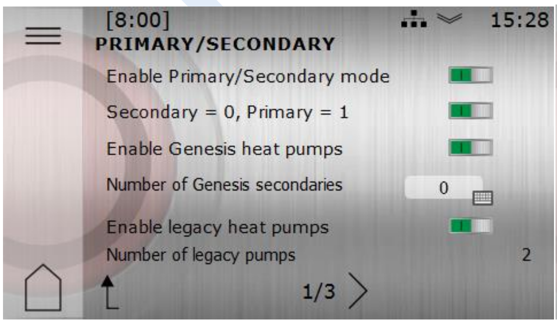
27.1.2 Secondary

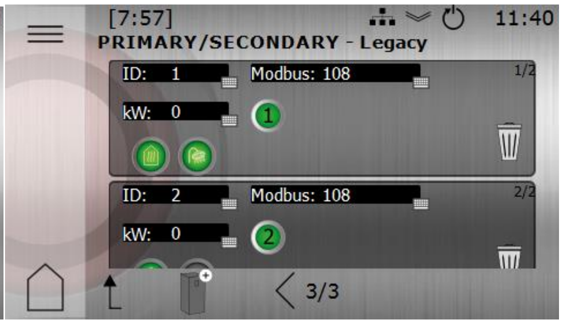
The user assigns a unique heat pump id to each secondary unit. This id is shown on the start page when communication with the primary is established.

27.1.3 Legacy secondary

Legacy settings are made in the Primary. When Legacy is activated, page 3 will be accessible. The user configures ID, Output, Modbus address and position, as well as activates which demands each Legacy unit can run (heat, tap water, pool and active cooling).

ID	1-16	Heat pump's ID. Affects start/stop order. Can be set from 1 to 16.
kW	0-65535	Not currently in use. Only for information.
Modbus	EM1: 108-115 EM3: 10-17	The setting corresponds to Modbus ID for EM1 or EM3. EM1 = UnitID + 100. EM3 = FunctionID + 10 (jumper)
Position	1-2	The setting corresponds to heat pump 1-2 in the wiring diagram.





27.1.4 Re-initialization

The primary validates the secondaries before communication can be established. If the secondary does not fulfil the criteria, it will be rejected. If a secondary is rejected, it will not try to communicate to the primary again, until it is manually re-initialized or if the primary is restarted. This is done by pressing the re-initialization button in the primary/secondary on the secondary heat pump or by restarting the heat pump.

The primary will automatically re-initialize communication to the secondaries during start up.

Version error	The Secondary does not have the same version as the Primary.
Pump already registered	Secondaries are already registered, but under a different ID. Change to the old ID or restart the primary.
ID already registered	Another secondary has the same ID. Change to a new ID.
Multiple primaries detected	Two or more primaries found on the same communication port.
Multiple errors	A combination of the errors above.

27.1.5 Communication mode

Broadcast is the only communication mode currently supported. Broadcast means that the units 'call out' on the network, and the units themselves decide which data is to be managed.

The broadcast address is calculated from the current network settings. The broadcast address needs to be the same on all units.

Other communication modes may be introduced later.

27.1.6 Port number

All units which are to communicate with one another must have the same Port setting. Default port = 5871.

NB! Only one Primary per network is permitted (in broadcast mode) with the same port number.

NB! If the Port number needs to be changed, be careful which port number you choose. This is because other applications in the network may have the same port setting and may disrupt the communication. One example of a suitable range is 5800-5900. Suitable ports can also be looked up on the internet.

27.2 Gear control

The secondary units communicate to the primary unit which demands they can produce. Every connected unit corresponds to a certain number of gears. These gears are added together and correspond to the total number of gears the primary can distribute to the demands. The primary calculates how many gears that are needed for each demand and distributes the desired gears among the units.

Each secondary communicates the number of available compressor gears to the primary. Other features have a fixed value of available gears.

Legacy	4 gears per unit
External auxiliary heater	6 gears (start limit for external auxiliary heater)
Internal immersion heater	3 gears per step (9 in total).

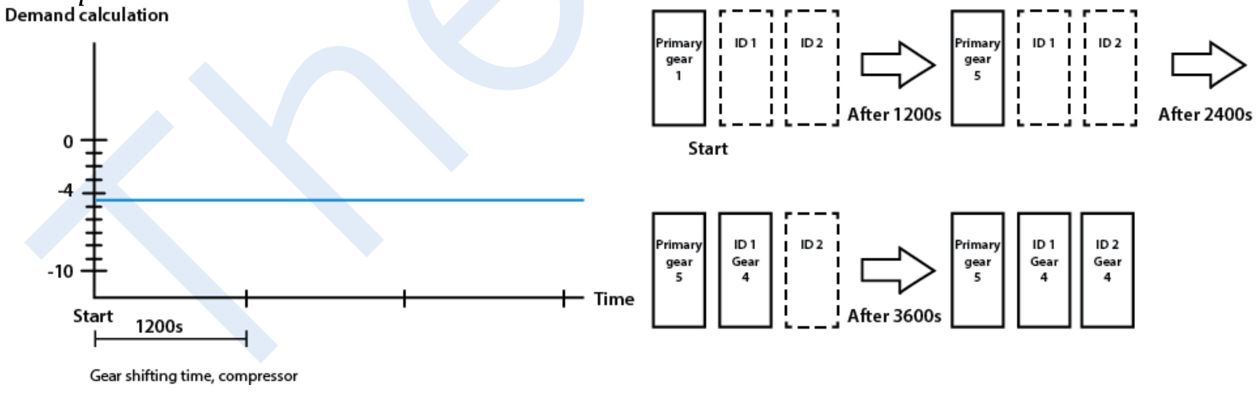
27.2.1 Start priority

The unit with the smallest number of starts is prioritized to start. The start counter is reset if the primary unit restarts. If all units have the same amount of starts, the Primary unit is prioritized, followed by Genesis secondaries (with lowest ID), followed by Legacy secondaries (with lowest ID). New units are started if there are no available units running on low gear. Low gear in this context compares to gear 4, which is the Oil boost threshold for Mega.

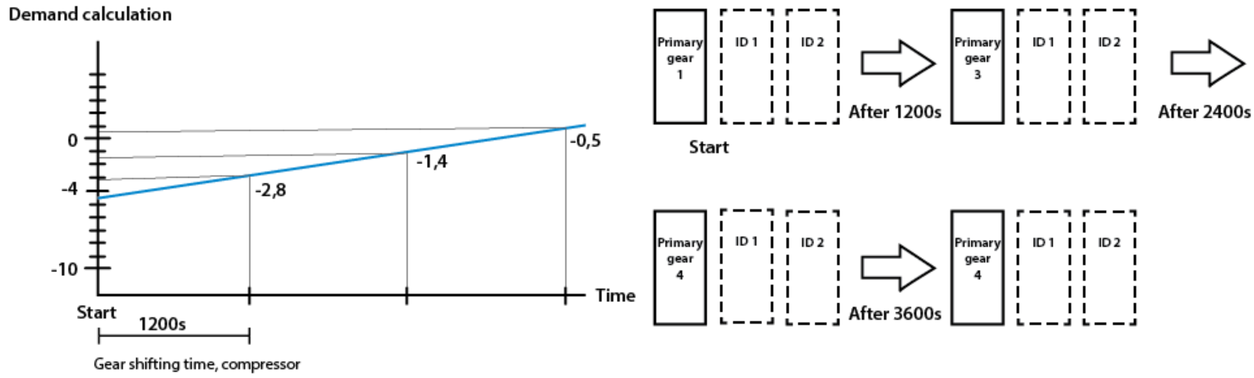
27.2.2 Speed up priority

Units in operation running on the lowest gear have speed up priority.

Example. Demand calculation -4.5 constant



Example. Rising demand calculation



27.2.3 Speed down priority

Units in operation running on the highest gear have speed down priority. Units in tap water operation is not affected by this.

27.2.4 Stop priority

Units in operation with the highest operating time will be prioritized to stop. Legacy heat pumps will always be stopped before Genesis heat pumps.

27.2.5 External auxiliary heater

External auxiliary heater is only permitted to start when all gears are allocated. The external auxiliary heater is always stopped before the secondaries gear down/stop.

27.2.6 Immersion heater

The internal immersion heater is managed by the primary unit. The secondaries are only allowed to use the internal immersion heater if the primary has ordered excess gears to the secondaries.

Example. If the primary (Atlas heat pump) orders 15 gears (12 + 3) to a secondary (Atlas heat pump) this will result in max compressor operation and internal immersion heater step one.

27.2.7 Gear equalization

The primary unit always tries to equalize the gear in operation on heat pumps in heating or pool operation. This is mainly to reduce noise level. Units allocated to tap water are not subject to gear equalization. Gear equalization is not performed if the equalization would result in a heat pump running on gear 4 or lower. This is in order to keep the compressor speed above the oil boost speed limit.

27.3 Tap water

In the primary, tap water for the entire installation is activated, including if the primary itself can produce tap water. The primary receives information about which units can produce tap water. When a tap water demand arises, the icon for tap water is shown in the primary's GUI even if the primary itself does not produce tap water.

27.3.1 Stop conditions

The primary unit is informed when the secondaries are finished with the tap water production. These units are disconnected from the tap water system. If no other demand is queued, the unit is switched off.
The tap water demand is fulfilled when the stop temperature is reached or when every unit have reported finished. The secondaries report that they are finished on the following conditions:

Genesis secondaries	Same as stand alone. Please refer to the chapter Tap water - Stop conditions.
Legacy secondaries	Operating pressure switch.

The operating pressure switch is held for five minutes in the primary after the secondary has released, to avoid frequent starts or stops. During this five-minute period, units which have stopped on operating pressure switch will therefore not receive a start order.

27.3.2 Individual tap water (autonomous tap water)

This function means that the Secondary is no longer dependent on start orders and temperatures from the Primary. The tap water demand is managed entirely by the secondary unit and requests made by the primary during tap water operation is ignored. The tap water sensor is connected to the secondary. This is the default configuration for domestic heat pumps.

Individual tap water does not support WCS.

27.4 Heat

Heating in primary/secondary requires all units to be connected to the same heating system. Heat is enabled individually on each secondary.

27.5 Pool

Pool in primary/secondary mode have two general configurations, Global and individual. This mode is configured in the primary unit.

27.5.1 Global pool

In global mode the directional valve for pool is “Global”, meaning that the entire heating system is disconnected when pool heating is being produced. Tap water can still be produced during pool heating. Pool should be enabled on all units being able to produce pool.

27.5.2 Individual pool

In individual mode every unit producing pool heating have their own directional valve, much like tap water. Pool should be enabled on all units being able to produce pool, including the primary unit.

27.6 Cooling

Cooling in primary/secondary assumes that all units are connected to the same brine circuit.

Passive cooling is activated on the Primary and individually on each Genesis secondary unit that you wish to help with brine circulation. Passive cooling must always be activated on the Primary for passive cooling to work in the installation.

Active cooling is activated only on the primary. This will automatically activate active cooling on all secondaries.

27.7 Communication errors

Communication between primary and secondary units (Genesis) is faulty after ten seconds without communication. If communication is re-established, the primary and secondary automatically returns to normal mode.

Com. to primary error	The Secondary cannot find a Primary or has lost communication with its Primary. The secondary will be controlled on condenser out and will regulate based on the latest set point it received from the primary. The ID number on the start page is replaced by the usual comfort wheel.
Com. to secondary error	The Primary has lost communication with a secondary which was previously connected to the Primary. An alarm is triggered if a secondary has not communicated with the Primary for ten seconds.
Too few secondaries detected	The number of secondaries that communicate with the Primary does not correspond with the expected number (settings for 'Number of Genesis secondaries').
Legacy pump communication	The alarm concerns communication to the EM1. If the alarm is active, the primary knows that the Legacy pumps are not available. Communication to EM1-Legacy is regarded as faulty when 75% of the Modbus package (timeouts + errors) is faulty during a measured 60-second period.

27.8 Alarm handling

The primary receives information about the operational status of the secondaries, e.g., if there is an alarm related to Primary/Secondary. If a higher-class alarm is active, the primary/secondary icon is replaced by the usual alarm icon.

Secondary pump class A	A secondary emits an alarm when there is an A alarm. The alarm is prepared to show which secondary.
Secondary pump class B	A secondary emits an alarm when there is a B alarm. The alarm is prepared to show which secondary.
Legacy pump pressure switch alarm	The alarm is related to the operating pressure switch and is used to finish tap water production. This is a quick solution to show when the operating pressure switch has tripped, and not actually a true alarm.
Legacy pump general error	The alarm signal is connected to the EM1 from the external alarm output on Legacy. If a Legacy unit reports an alarm, the start signal to that unit continues to be active. This is because the old Robust uses the same electrical signal for start as for sum alarm.

28 Athena standard cascade

Athena cascade setup can consist of up to four outdoor units that can be controlled by one indoor standard unit.

28.1 Configuration

The default configuration is one outdoor unit with heating enabled together with buffer tank type 4. The configuration can be changed when logged in using the Cascade settings where outdoor unit 1-4 can be enabled/disabled and heating for each unit can be enabled/disabled.

If tap water is enabled, outdoor unit 1 and 2 can also enable tap water in the cascade menu to fulfil tap water demands.

The ID of the outdoor unit is connected to the Modbus slave id (71-74) and is managed by the setting of the gateway card, see chapter 34.1 for more details how to configure.

28.2 Gear control

Every outdoor unit corresponds to a certain number of gears and these gears are added together and correspond to the total number of gears the can be distributed to the demands.

The number of gears available is calculated as described in the table.

Athena 14	6 gears per unit
Athena 18	12 gears per unit
Internal immersion heater	3 gears per step (9 in total).

The outdoor units have their own compressor control and could be running a higher and lower gear than requested due to the envelope restrictions controlled by the outdoor unit.

28.2.1 Start priority

The unit with the smallest number of starts is prioritized to start. If all units have the same amount of starts, the first unit is prioritized. New units are started if there are no available units running on low gear. Low gear in this context compares to gear 4.

28.2.2 Speed up priority

Units in operation running on the lowest gear have speed up priority.

28.2.1 Speed down priority

Units in operation running on the highest gear have speed down priority. Units in tap water operation is not affected by this.

28.2.2 Stop priority

Units in operation with the highest operating time will be prioritized to stop.

28.2.1 Immersion heater

The outdoor units are only allowed to use the internal immersion heater if all ordered compressor gears are distributed.

28.2.1 Gear equalization

The controller always tries to equalize the gear in operation in heating. This is mainly to reduce noise level. Units allocated to tap water are not subject to gear equalization. Gear equalization is not performed if the equalization would result in outdoor unit(s) running on gear 4 or lower.

28.3 Tap water

If tap water is enabled, the default is to enable it only on outdoor unit 1. Tap water can only be enabled on outdoor unit 1 and/or outdoor unit 2 even if there are more outdoor units enabled.

28.3.1 Stop conditions

The tap water demand is fulfilled when the stop temperature is reached or when the outdoor have reached the operation limit.

28.4 Pool

Not supported at this time.

28.5 Cooling

Not supported at this time.

28.6 Alarm handling

If there is more than one outdoor unit and there is an error of one of them, the operation will operate as normal with a yellow alarm notification visible. At the same time on the active alarm page the outdoor unit error is visible with the error code provided from the outdoor unit and further described in the outdoor unit error code chapter 44.9.

If all outdoor units have an error, there will be a specific class A alarm "all outdoor unit alarm" raised that will block all operation.

29 Circulation pumps

29.1 System pump

When the system pump is activated, it operates continuously during the heating season. The system pump is normally not in operation when heating season is not active. The speed of the system pump is not regulated. Activation of the system pump deactivates standby operation on the condenser pump.

29.1.1 Auxiliary heater EM2/-3

If auxiliary with EM2/-3 is used, the system pump should be connected to the expansion card instead.

29.1.2 Pool

If the directional valve for pool is located after the external auxiliary heater, the system pump will always start when pool heating is produced. Even during heat stop.

29.2 EQ pump

Only for Athena EQ.

29.3 Condenser pump

29.3.1 Normal operation – Variable speed heat pumps

The speed of the condenser pump follows the compressor speed as default but can be configured to run only at maximum speed. Different for tap water. The speed of the condenser pump can be overridden by protective functions.

Tap water - At the start of tap water/anti-legionella, the condenser pump will be at minimum speed for tap water until condenser out is hotter than the start temperature. After this, the speed of the condenser pump begins to follow the pressure linearly with the current position and the envelope's upper limit, where this limit corresponds to maximum speed for tap water.

29.3.2 Normal operation – Fixed speed heat pumps

The speed of the condenser pump is regulated to maintain the desired delta setting (default 8K) between minimum and maximum speed setting. Somewhat different in tap water operation.

Tap water – Min speed until the supply line is higher than min dhw change temp (default 50°C). Delta regulation (default 8K same as) until when the supply line temperature is between min/max dhw change temp. Max speed when the supply line temperature is above max dhw charge temp.

29.3.3 Standby flow

The condenser pump runs on standby flow during the heating season when the compressor is not running. This is not the case if a system pump or buffer tank is activated.

29.3.4 Continuous operation

Activating continuous operation will cause the condenser pump to run continuously. When the compressor is not running, the speed of the condenser pump is determined by the setting for Standby flow.

29.3.5 Protective functions

If several of the protective functions below request conflicting orders for increasing/decreasing speed, the regulation will prioritize or block a speed change.

Speeding up of the condenser pump is prevented if the compressor runs at a low gear (due to any noise this may cause). The idea is that the compressor should change up to obtain a larger envelope instead.

Low subcooling	↓	The speed is reduced to the lowest set speed. Subcooling is low. Below 1-2K.
High condensation	↑	The speed is increased to the highest set speed. Above envelope.
High discharge temp	↑	The speed is increased to the highest set speed. See Discharge monitoring.
High inverter temperature	↑	The speed is increased to the highest set speed. See Inverter monitoring.
Low condensation	↓	The speed is reduced to the lowest set speed. Below envelope.
High return	↓	The speed is reduced to the lowest set speed. Condenser in temperature > (System return line temperature +2K). Only if system return line sensor is enabled. This is to be able to handle cases where the system circuits close or when pressure-controlled system pumps lower the speed.

30 Brine pump

30.1.1 Normal operation

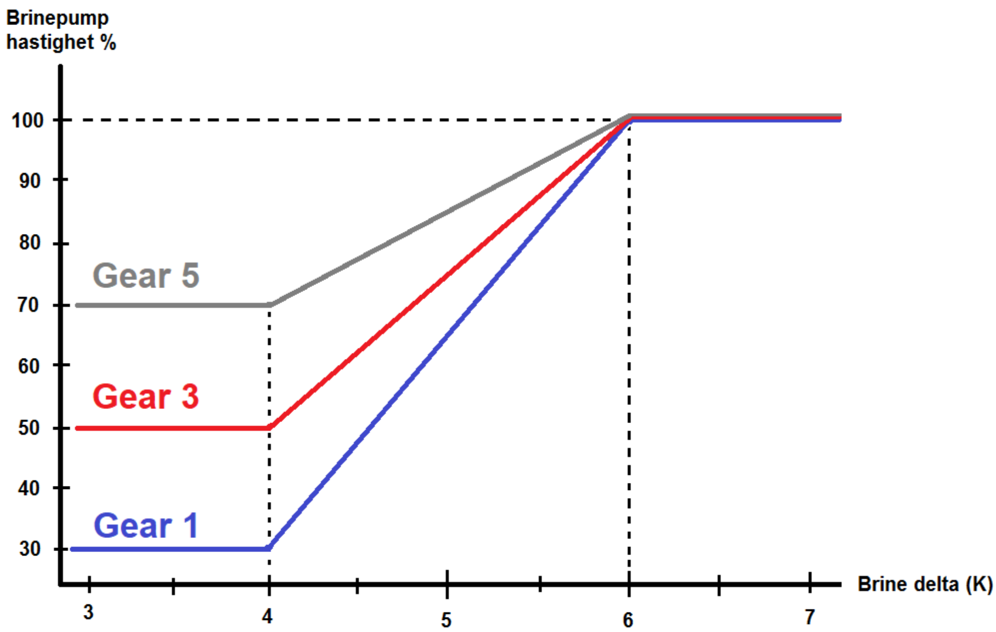
The speed of the brine pump follows the compressor speed as default but can be configured to run only at maximum speed. This is dependent on the setting for 'Circulation pump (HP) Speed'. The speed of the brine pump can be overridden by protective functions.

Almost all speed reductions of the brine pump are filtered, but at different speeds depending on the degree of seriousness. This has been introduced to reduce the risk of spontaneous oscillation when speed changes are introduced by safety functions, and to minimize disruptions to the expansion valve regulation.

Auto	The brine pump speed follows the compressor speed linearly between the brine pump settings for minimum and maximum speed. The regulation also takes account of brine delta.
Fixed	The brine pump is operated at maximum speed.

30.2 High delta control

When in Auto mode the regulation considers brine delta based on the "Alarm limit brine delta" default 6K setting. If the brine delta is 4 K or less, the speed of the brine pump is determined by the compressor speed. If the brine delta is 6 K (alarm limit brine delta) or more, the brine pump operates at maximum speed. If the brine delta is between 4 K and 6 K (alarm limit brine delta), the speed of the brine pump is determined linearly between normal and maximum speed based on the delta.

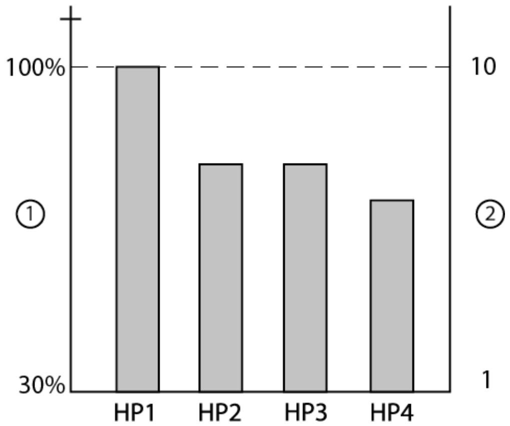


The graph shows three examples of the brine pump speed at different brine delta and compressor speeds.

30.3 Protective functions

Low evaporation	↑	The speed of the brine pump is increased to the highest set speed. Left of envelope.
High evaporation	↓	The speed of the brine pump is reduced to the lowest speed (not settable: 15% Diplomat Inverter, 30% Mega). Right of envelope.
Brine monitoring	↑	The speed of the brine pump is increased to the highest set speed. See brine monitoring.

When in primary/secondary mode, the unit that runs on highest gear sets a minimum brine pump speed for all units.



1. Min. speed for all units.
2. Current gear.

30.3.1 Continuous operation

Activating continuous operation will cause the brine pump to operate continuously. When the compressor is not operating, the speed of the brine pump is determined by the setting for Standby flow. The function also affects external brine pump.

30.3.2 Standby flow

The brine pump operates on standby flow with continuous operation and passive cooling if the compressor is not operating.

30.4 External brine pump

External brine pump starts at the same time as the internal brine pump. If brine pump continuous operation is activated, the external brine pump will also operate continuously.

If primary/secondary is activated, external brine pump also starts when the primary gives a start order to any secondary or when the primary sees that the compressor of a secondary is in operation.

The external brine pump speed on BM and EM3:0 is not regulated. To get speed regulation use the external brine pump control featured on the EM3:1 card.

30.4.1 External brine pump control

The external brine pump control feature is used to maintain the desired external brine delta when the compressor is running. If brine delta control is disabled, the external brine pump will run at max speed. The brine delta is considered to be an absolute value, meaning that is does not matter if the delta is negative or positive. Because of this the brine delta control works for both heating and cooling operation.

External brine pump control is only available on EM3:1 and can be enabled at the same time as the regular external brine pump.

Intermediate exchanger: If intermediate heat exchanger is enabled the external brine pump control will start when the compressor is running and stop when the compressor is no longer running.

If intermediate heat exchanger is NOT enabled the external brine pump control will only start if the external brine delta is larger than the desired delta + 1 and stop if the external brine delta is less the desired delta - 1 and the external brine pump is at minimum speed.

30.5 External start brine pump

The internal and external brine pump can be started via external start signal.

In primary secondary mode, the signal is shared with secondaries that have enabled "Ext. start brine pump on secondary" in the brine pump settings menu.

30.6 Brine valve

The brine pump is replaced by a brine valve on Calibra Cool WW. The brine flow should be provided by an external brine pump.

The brine valve is controlled to maintain the desired brine delta (default 3K). The brine delta will be limited by brine out monitoring if needed.

31 Control module (CM)

The control module (CM) is the main controller of the heat pump and manages the graphical user interface with the built in 4.3” touch display.

31.1 USB-port

The USB-port is only used for logging and software updates, and this is done via a USB-memory stick. The USB-memory stick must use the **FAT32** file system. No other file systems are supported.

31.2 Software

The Genesis software is installed on the CM-card. The Genesis software also contains software for the BM-card and EM3-cards. At system start up the CM-card updates and configures the BM-card and EM3-cards to the correct version automatically. The Genesis software can be updated via OTA and USB.

31.2.1 OTA-updates

The Genesis software can be updated via Over The Air updates introduced in Genesis 10.2. This feature is only available with Access code login and requires a working internet connection.

To update go to Settings/System settings/Update. The system will check for updates once every hour (if enable OTA updates is enabled) and when entering the Update menu. Press the update button to download and install available updates. When the update is started the operating mode will be set to OFF automatically and will wait for the compressor to stop before installing the software. The operating mode will be switched back automatically when the update is completed.

31.2.2 USB-updates

The Genesis software can be manually updated via a USB memory stick.
IMPORTANT! When updating it is recommended to install the software versions in the order they are released. Meaning that 8.0 should be installed before installing 9.0, and 9.0 should be installed before installing 10.0. Our goal is to remove this dependency after Version 10.02 and forward. Skipping software versions may result in settings becoming invalid or lost. If you still choose to do this, we recommend that you perform a total factory reset when the final version is installed. By doing this you will need to reconfigure the settings done during the heat pump commissioning and any settings done by the end user.

Current version	Next version
=< 6.02	7.0
7.0	7.01
7.01 / 7.02	8.0
8.0	9.0 / 9.01
9.0	9.01 / 10.0 / 10.01
9.01	10.0 / 10.01

10.0	10.1

How to update:

1. Transfer the installation file to the root of a USB memory stick (not to a folder).
2. Place the heat pump in off mode and wait for the compressor to stop.
3. Insert the USB-memory stick.
4. An installation window will automatically appear with all the available installation files on the memory stick.
5. Select the software you wish to install and confirm.
6. Wait for the progress bar to complete and for the system to reboot.
7. The USB-memory stick can be removed as soon as the progress bar is complete.

If no installation file is found in the root of the USB memory stick, the installation window will not appear. The installation file needs to have the correct file extension in order to be installed.

- Genesis version 1.0 - 7.0 only supports the .m2f format.
- Genesis version 7.01 - 8.0 supports the .m2f and .m3f format.
- Genesis version 9.0 and later only supports the .m3f format.
- Genesis version 10.2 is password protected and can only be installed if Genesis 9.0 or later already is installed.

If the 'Install failed' message appears when installing the software, this may be due to a corrupt or incomplete installation file. It may also be because of insufficient memory on the CM-card. In this case restart the heat pump to free up memory.

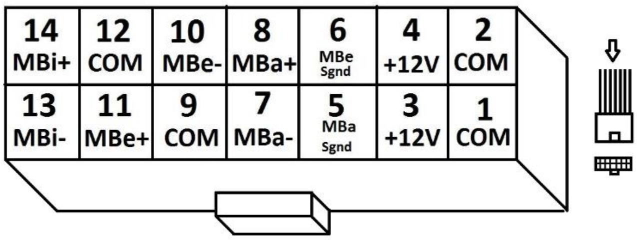
Downgrading software

The genesis software does not fully support downgrading in term of settings (both internal and user settings). A factory rest is recommended if downgrades must be carried out. Genesis version 9.0 cannot be downgraded to 8.0 or older.

IMPORTANT! Make sure that the product supports the older software before downgrading.

31.3 CM Legacy

31.3.1 I/O Overview



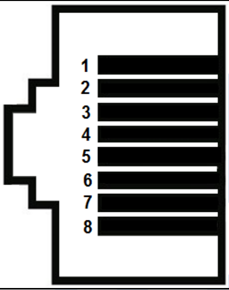
31.3.2 Termination

Modbus termination can be activated in the Settings/Modbus submenu. This will connect a 120 ohm resistor inside the CM-card on MBa or MBe. By doing this another 120 ohm resistor should be connected manually on the other side of the connection cable on the last Modbus slave.

31.4 CM SL

31.4.1 I/O Overview

#	Description	Colour	
1	V IN-		
2	V IN+		
3	MBa		
4	MBe		
5	MBe		
6	MBa		
7	MBi		
8	MBi		



32 Building module (BM)

The BM card manages measurement of pressure and temperatures, as well as control of DO and AO.

32.1 Updating

The BM card software is updated automatically by the CM card at start up.

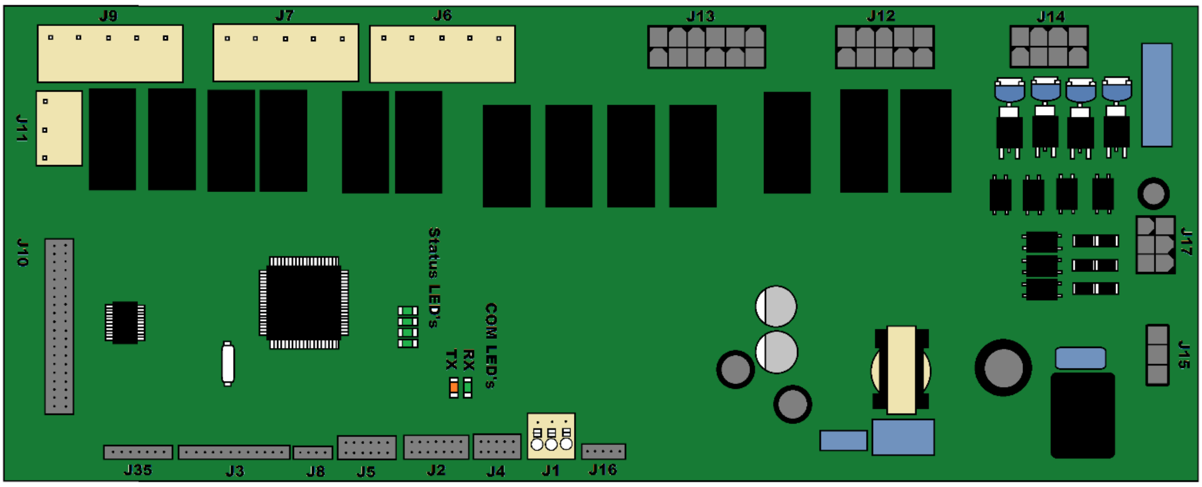
32.2 Safe stop

The safe stop relay on the BM card is potential-free and is connected to the inverter as an extra safety switch. If the circuit is broken, the inverter will stop the compressor immediately and will be prevented from starting.

The circuit is broken if:

- The BM card is not powered.
- The CM card has no communication with the BM card or Inverter.
- Extremely low pressure (1.625 bar).
- Extremely high pressure (45.0 bar).
- Tripped high pressure switch.

32.3 BM-Legacy (old)



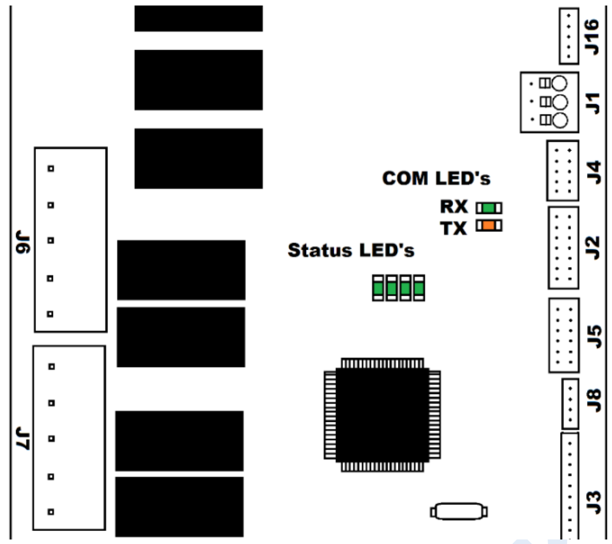
32.3.1 I/O Overview

I/O	Description
J1	Modbus communication MBi (Inverter).
J2	Modbus communication MBi, MBa & MBe. Supply 12 V DC to CM card.
J3	Digital inputs HP switch, Flow sensor, Smart grid (EVU, Boost).
J4	Modbus communication MBa & MBe (BMS & Accessories).
J5	Signal & Feedback to/from circulation pumps
J6	Relay outputs (use depends on machine profile).
J7	Relay outputs (use depends on machine profile).
J9	Relay outputs (use depends on machine profile).
J10	Sensor pressure (0-10 V) and temperatures (PT1000).
J11	Reserved.
J12	Relay output for External auxiliary heater and Sum alarm.

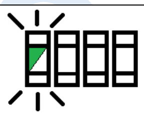
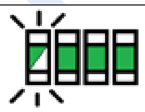
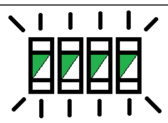
J13	Supply to Brine/condenser pump. Safe stop.
J14	Directional valve/HGW.
J15	Supply BM card.
J16	Expansion valve Stepper motor.
J17	Phase detection

32.3.2 Status LEDs

The BM card has two sets of LED lights in the middle of the card. The lights indicate the card's status and Modbus communication.



Modbus communication is indicated by two LEDs (RX/TX) that flash when the BM card reads or sends messages.

<table>
<tr><td>RX</td><td colspan="2">Flashes when BM card processes a message, even if the message is not addressed to the BM-card.</td></tr>
<tr><td>TX</td><td colspan="2">Flashes when the BM card replies to a message.</td></tr>
<tr><td>Normal mode</td><td></td><td>Indicated by only one flashing diode. Other diodes are extinguished.</td></tr>
<tr><td>Safe stop</td><td></td><td>Compressor blocked. Indicated by one flashing led and the other led are lit continuously.</td></tr>
<tr><td>Update mode</td><td></td><td>Indicated by all leds flashing in a pattern from left to right. During this sequence, machine profile cannot be configured.</td></tr>
</table>

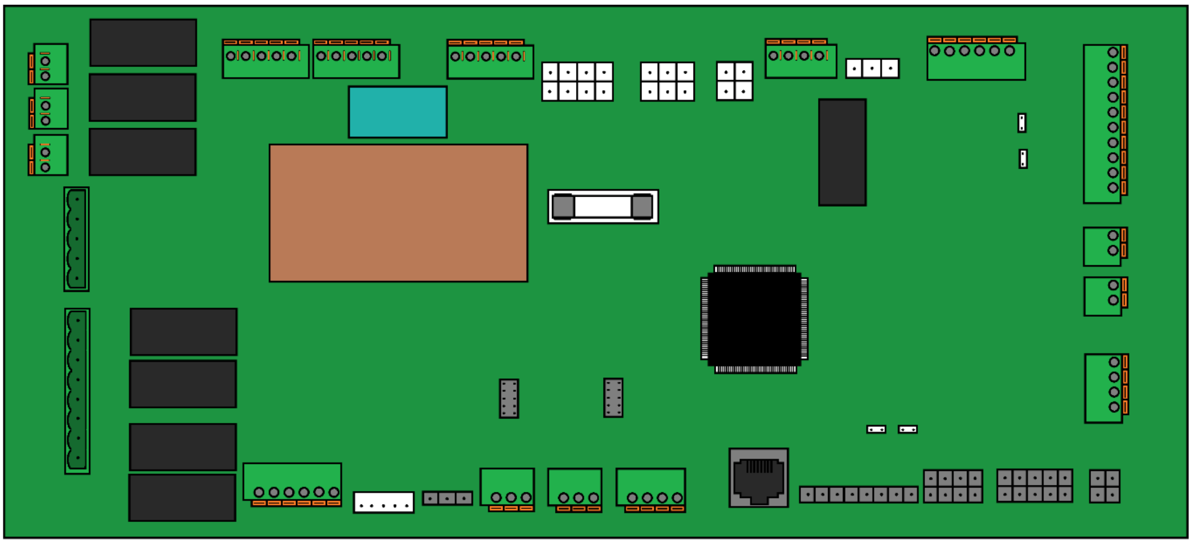
32.4 BM-SLX (new)

BM-SLX has two different card sizes, SLL and SLM. The SLL-card is a full sized I/O card, and the SLM-card have less I/O optimized for cost.

IMPORTANT: Products using the SLL-card do NOT support the SLM-card and products using SLM do NOT support the SLL card. The wrong BM-card will cause the Machine profile error.

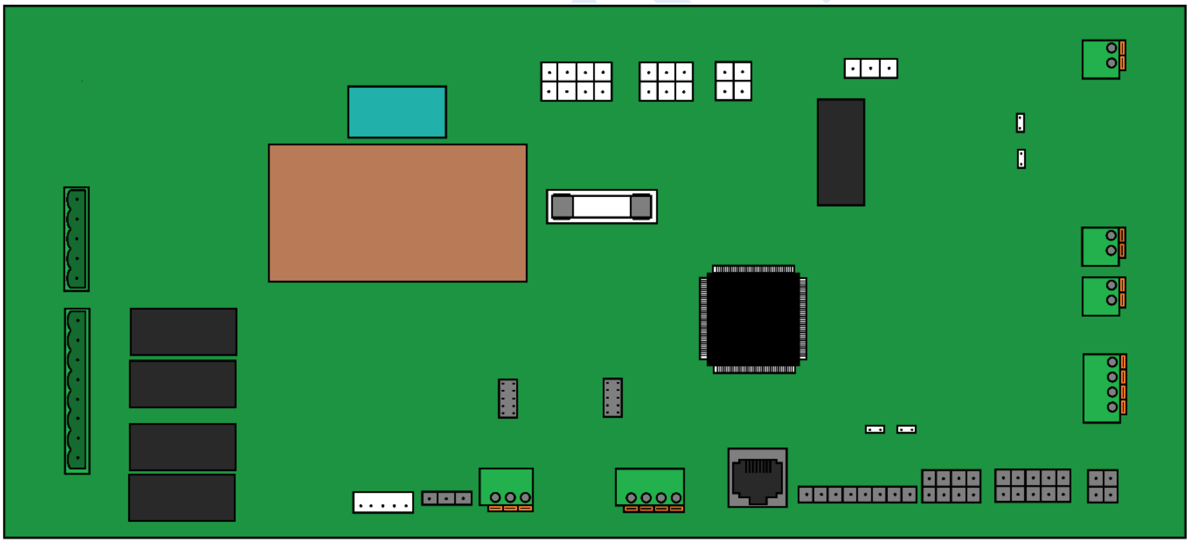
32.4.1 BM-SLL

Heat pumps with this card must have Genesis version 7.01 or later. Downgrading the software may cause the card to permanently malfunction.



32.4.2 BM-SLM

Heat pumps with this card must have Genesis version 7.0 or later. Downgrading the software may card the card to permanently malfunction.



32.4.3 Jumpers

The SLX-cards have several red jumpers that affect card functionality.

Jumper	Function
M1	Control signal type selector for AO24. Mounted = 0-10V. Not mounted = PWM
M2	Control signal type selector for AO25. Mounted = 0-10V. Not mounted = PWM
M7	Control signal type selector for Y609. Mounted = 0-10V (light commercial). Not mounted = PWM (domestic).
M8	Control signal type selector for Y609. Mounted = 0-10V (light commercial). Not mounted = PWM (domestic).
MBa_D- MBa_D+ MBa_GND	Jumpers are removed when mounting the ISO-SL card. The MBa2 connection on the BM-card will not work if the jumpers are removed and no ISO-SL card is mounted.

MBe_D-	Jumpers are removed when mounting the ISO-SL card. The MBe BMS connection on the BM-card will not work if the jumpers are removed and no ISO-SL card is mounted.
MBe_D+	
MBe_GND	

32.4.1 I/O Overview

I/O text	I/O type	Comment
X12 Supply/Phase Detect	3 x Internal opto	
Pressure Sensors 2-4	AI 0-5V	
Pressure Sensors 6-7	AI 0-5V	
CP control & feedback	AI PWM	
CP control & feedback	AI PWM	
CP control & feedback	AO PWM/0-10V	
CP control & feedback	AO PWM/0-10V	
AO25	AO PWM/0-10V	Only SLL
AO24	AO PWM/0-10V	Only SLL
Pressure Sensors 1-5	DI pot free	
D21, D22, D23	DI pot free	Only SLL and SLM rev >21.
Expansion	Modbus-Accessory	
BMS	Modbus-External	
MBi	Modbus-Internal	
FR4, FR5, FR6, FR7	Relay (16A) 230V feed	
R1, R2, R3	Relay (16A) Pot free	Only SLL
Y615	Stepper motor	
Y607 1-6	Temperature sensor	
Y607 2-7	Temperature sensor	
Y607 3-8	Temperature sensor	
Y607 4-9	Temperature sensor	
Y607 5-10	Temperature sensor	
Y606 1-3	Temperature sensor	
Y606 2-4	Temperature sensor	
T35	Temperature sensor	
T36	Temperature sensor	
T37	Temperature sensor	
T32	Temperature sensor	Only SLL
T33	Temperature sensor	Only SLL
T31	Temperature sensor	
T34	Temperature sensor	
TR8, TR9	Triac (L1)	SLM only have four pin molex

32.4.2 Status LEDs

The BM card has two sets of LED lights in the middle of the card. The lights indicate the card's status and Modbus communication.

RX	Flashes when the BM card processes a message, even if the message is not addressed to the BM-card.
TX	Flashes when the BM card replies to a message.
LED 1	Safe stop relay open. Lit during start up. Normally not lit.
LED 2	Status led. Normally not lit. Blinks during software update.
LED 3	Status led. Normally not lit. Blinks during software update.
LED 4	Status led/Heartbeat led. Should blink continuously at even intervals.

32.4.3 Reset button

The reset button located on the BM-card is a software restart button and does not reset any parameters. Currently the reset button does not serve any purpose.

32.4.4 Termination

Modbus termination on the SLX-cards requires the ISO-SL card, which is a small extension card that also galvanically isolates both MBa and MBe. Termination is carried out by placing jumpers on the ISO-SL card, marked ”TERM MBa” and ”TERM MBe”.

The ISO-SL card is always mounted on the Mega series.

ISO-SL. PCB for galvanic isolation of MBa and MBe. Fitted on BM SLL.

33 Refrigerant safety card (RSM)

Mega Eco only. Refrigerant safety module, RSM. The circuit board monitors refrigerant levels inside the cabinet and controls safety ventilation. Ventilation tests are performed automatically every 28 days.

34 Outdoor unit cards

Athena A/W only

34.1 Gateway

Converts CAN to Modbus.

34.1.1 Changing Modbus ID

The Modbus ID on the gateway card is required to be set correctly depending on if it is a standalone or cascade setup.

Product	Outdoor unit no	Modbus ID	Rotary switch
Athena Standard	1	70	‘C’
Athena Compact	1	70	‘C’
Athena Total	1	70	‘C’
Athena Cascade	1	71	1
Athena Cascade	2	72	2
Athena Cascade	3	73	3
Athena Cascade	4	74	4

At delivery the Modbus ID should be set to a correct ID and the position of the rotary switch should be at ‘C’.

If the GW is not configured with a correct base address, then the base address is required to be set accordingly:

1. Switch off the gateway.
2. Set the rotary switch in interval [A…F]. ([C] for Athena).
3. Switch on the gateway
4. The gateway registers a new base address between decimal 50 and 100 with an increment of 10 and saves this information in the non-volatile memory. (C = 70) The process is confirmed by a simultaneous flashing of all LEDs
5. If the rotary switch stays in the current position, the Modbus address equals from now on the base address
6. If the Modbus address has to be set to a value with the format decimal base address + [1…9], the gateway has to be switched off once again
7. Set the rotary switch in interval [1…9] and switch on the gateway
8. The valid Modbus address from now on is decimal base address + [1…9] only. NOT 0!

34.2 Outdoor unit Control card (IWS)

Responsible for controlling the outdoor unit.

34.2.1 Dip switches

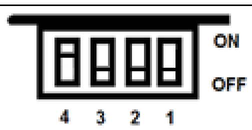
The dip switches on the card defines which functions that the outdoor unit has. They are defined as follows:

Dip switches 1.

Switch	Default	Description
SW1	ON	Standard settings
SW2	OFF	Not used
SW3	OFF	Cooling enabled, if the heat pump has cooling capability (Athena HC) this should be on.
SW4	ON	Heating enabled on by default.

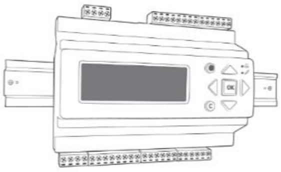
Dipswitches 2.

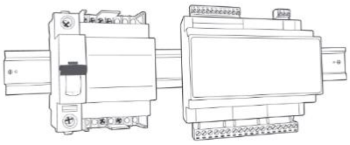
Switch	Default	Description
SW1	OFF	If heat pump is used in dual mode. This should be on.
SW2	OFF	Not used
SW3	OFF	Not used
SW4	ON	Standard setting.



35 Accessories

35.1 Expansion module 1 (EM1)





35.1.1 Updating

Genesis does not support EM1 software updates.

35.1.2 Installation ID

Installation ID is a unique ID for the expansion module. The ID needs to be configured in accordance with the table below for the CM to communicate with the correct expansion module. Multiple expansion modules with the same ID are not supported and cause communication problems.

ID	Name
1	TWC/WCS
2	Distribution circuit 2-3
3	Distribution circuit 4-5
4	Cooling
5	Pool
7	Legacy
8	Legacy
9	Legacy
10	Legacy
11	Legacy
12	Legacy
13	Legacy
14	Legacy
15	Legacy

35.1.3 I/O Overview

	TWC/WCS	Shunt	Cooling	Pool	Legacy
AI1	TWC Supply	Supply Shunt 1	Cooling Supply	Pool Supply	HP1 Condenser Out
AI2	TWC Return	Return Shunt 1	Cooling Return	Pool Return	HP1 Brine Out
AI3	TWC Coldwater	Supply Shunt 2	Cooling Tank	Shunt Supply	HP2 Condenser Out
AI4	TWC End tank	Return Shunt 2	Cooling Tank Return	Shunt Return	HP2 Brine Out
UI1	Hot gas Supply	Room: Temp 1	Surplus Heat Supply		HP1 Tap water Lower
UI2	WCS Return	Room: Moist 1	Surplus Heat Return		HP1 Tap water Top
UI3		Room: Temp 2		Room: Temp	HP2 Tap water Lower
UI4		Room: Moist 2		Room: Moist	HP2 Tap water Top
DI1	External WCS start			Ext. pool stop	HP1 Running
DI2					HP1 Alarm
DI3					HP2 Running
DI4					HP2 Alarm

DI5					HP1 Operating pressure
DI6					
DI7					HP2 Operating pressure
DI8					
AO1	TWC control	Shunt 1 Shunt control	Cooling Supply Control	Pool Control	
AO2	Hot gas control	Shunt 2 Shunt control	Surplus Heat Control		
AO3	WCS control				
AO4					
AO5					
DO1	TWC Pump	Shunt 1 Pump	Cooling Supply Pump	Pool Pump	HP1 Start signal
DO2	Hot gas Pump	Shunt 2 Pump	Disc. Borehole Valve		HP2 Start signal
DO3	TWC Heater 1		Cooling Tank Valve	Pool Valve	HP1 Valve tap water
DO4	Valve hot gas		Surplus Heat Pump		HP2 Valve tap water
DO5	WCS Pump		Surplus Heat Valve		
DO6			Surplus Heat Fan 1		
DO7			Surplus Heat Fan 2		

AI = Analog Input, UI = Universal Input, DI = Digital Input, AO = Analog Output, DO = Digital Output

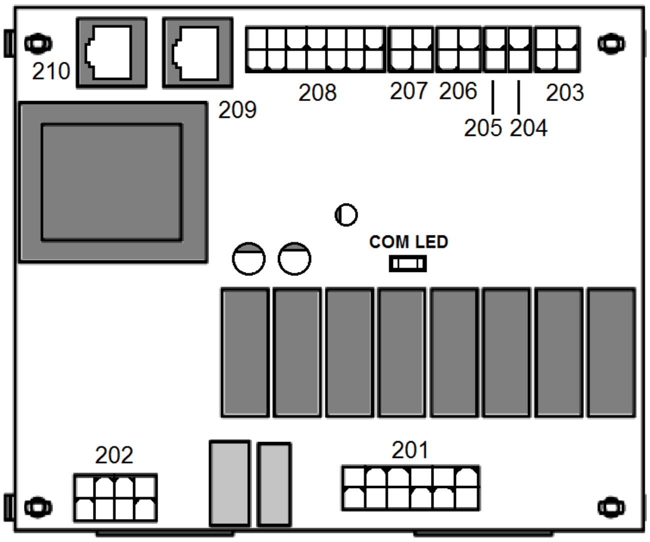
35.1.1 Status LEDs

P1 Rx/Tx = Yellow (reading Modbus package) or Green (sending Modbus package)

The R/Tx light should flash yellow and green. There is something wrong with the Modbus connection if the light is yellow.

35.2 Expansion module 2 (EM2)

NB The EM2 card uses an NTC sensor and 120s 230V shunt.



35.2.1 Updating

The EM2-card does not support firmware updates via Genesis.

35.2.2 I/O Overview

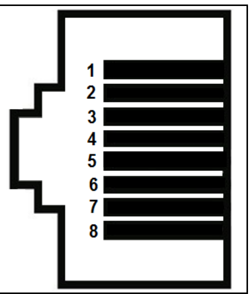
I/O	Description
201	Relay outputs
202	Mix valve control
203	Power meter
204	DI - Ext start brine pump
205	DI - Spare
206	DI - Ext stop pool
207	DI - Spare
208	Temperature measurement
209	MBa Modbus communication
210	MBa Modbus communication

35.2.3 Status LEDs

Flashing red COM LED = Communication error
Continuous red COM LED = Working communication

35.2.4 RJ45 Pinout EM2

No.	Description	Colour*	
1			
2			
3	Sgnd		
4	Sgnd		
5	Mba-		
6	Mba-		
7	Mba+		
8	Mba+		

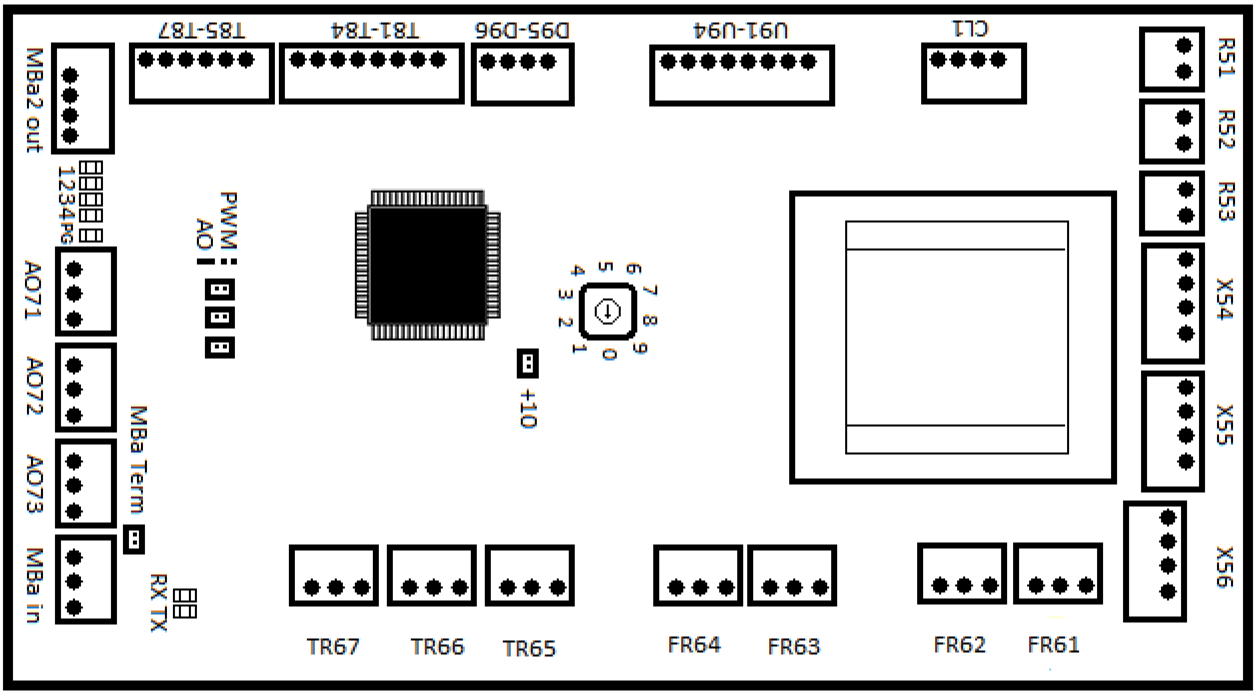


**Colour may vary*

35.3 Expansion module 3 (EM3)

EM3 is a circuit board designed for Genesis and replaces EM1 and EM2 in new products. The card serves both private and commercial segments.

For Mega products produced between 2015-2019 that has Genesis version 11.0: EM3 can also replace all EM1 cards, except for EM1 cards that control Legacy heat pumps.



35.3.1 Updating

The EM3 card software is updated automatically by the CM card. This is done if the EM3 card does not have the expected software on restart of the controller.

35.3.2 Function ID

Function ID is a unique ID for the expansion module. The ID needs to be configured as in the table below for the CM card to communicate with the correct expansion module. Multiple expansion modules with the same ID are not supported and cause communication problems. For ID 10 and above the M5 jumper needs to be connected.

ID	Name
0	Domestic
1	TWC/WCS
2	Distribution circuit 2-3
3	Distribution circuit 4-5
4	Cooling
5	Pool
10	Legacy
11	Legacy
12	Legacy
13	Legacy
14	Legacy
15	Legacy
16	Legacy
17	Legacy

35.3.3 Jumpers

Jumper	Function
M1	Control signal type selector for AO71. Mounted = 0-10V (default). Not mounted = PWM
M2	Control signal type selector for AO72. Mounted = 0-10V (default). Not mounted = PWM
M3	Control signal type selector for AO73. Mounted = 0-10V (default). Not mounted = PWM
M4	Modbus termination. Terminated with 120 ohms when mounted. Not mounted by default.
M5	Modbus function ID extender. Adds 10 ID's. Used for Legacy heat pump control. Not mounted by default

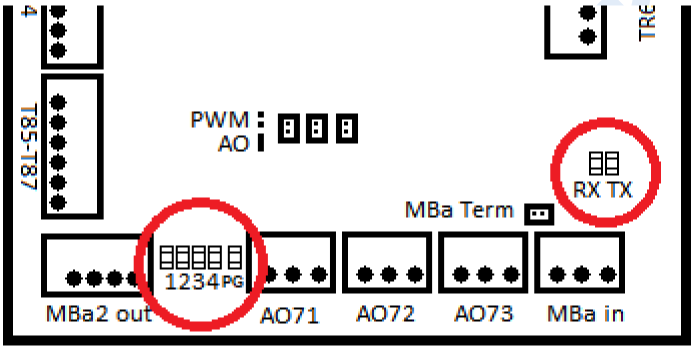
35.3.1 I/O Overview

EM3:	Domestic	TWC/WCS	Distribution circuit 2-5	Cooling	Pool	Legacy
T81	DC 1 supply line	TWC supply line	Supply line 2/4	Cooling supply line	Supply line	HP1 Cond. out
T82	Cooling supply line	TWC return	Return line 2/4	Cooling return	Return	HP1 Brine Out
T83	Pool return	End tank	Supply line 3/5	Cooling tank		HP2 Cond. out
T84	Pool supply line	Ext. brine in	Return line 3/5	Cooling tank return		HP2 Brine Out
T85	System supply line	Ext. brine out		Heat dump supply		
T86	Buffer tank	WCS Return		Heat dump return		
T87				Cooling tank supply		
U91	External alarm		Room: Temp 2/4	Room: Temp		HP1 Operation
U92	Flow guard		Room: Moisture 2/4	Room: Moist		HP1 Alarm
U93	Ext. start brine CP		Room: Temp 3/5			HP2 Operation
U94	Ext. stop pool	Ext. start WCS	Room: Moisture 3/5		Ext. Stop pool	HP2 Alarm
D95	Smart Grid 1	Dynamic	Dynamic	Dynamic	Dynamic	HP1 Operating pressure
D96	Smart Grid 2	Dynamic	Dynamic	Dynamic	Dynamic	HP2 Operating pressure
AO71	DC 1 mix valve	TWC Shunt	Shunt 2/4	Cooling supply mix valve	Shunt	
AO72	Cooling mix valve	WCS Shunt	Shunt 3/5	Surplus heat fan control		
AO73	Ext. Aux. heater mix valve	Ext. brine pump rpm		Surplus heat mix valve (shunted surplus)		
R51	Ext. auxiliary heater	TWC auxiliary heater				HP1 Start
R52	Sum alarm	Ext. brine pump ctrl on/off	Dynamic	Dynamic	Dynamic	HP2 Start
R53	Ext. Brine pump	Dynamic	Dynamic	Dynamic	Dynamic	
FR61	DC 1 pump	TWC Pump	Pump 2/4	Cooling pump	Pool Pump	
FR62	Cooling pump	WCS Pump	Pump 3/5	Surplus heat pump		
FR63	Surplus heat pump			Surplus heat fan		
FR64	System pump					
TR65	Borehole dir. valve	Hot gas VXV	Dir. valve cooling 2/4	Disc. borehole dir. valve	Pool dir. valve	HP1 dir. valve tap water
TR66	Surplus heat dir. valve		Dir. valve cooling 3/5	Cooling tank dir. valve		HP2 dir. valve tap water
TR67	Pool dir. valve			Surplus heat dir. valve		
CL 1	Current Limiter L1					
CL 2	Current Limiter L2					
CL 3	Current Limiter L3					

T = Temperature input, U = Universal input, D = Digital input, AO = Analog output, R = Potential-free relay, FR = Feeding relay, TR = Triac, CL = Current limiter

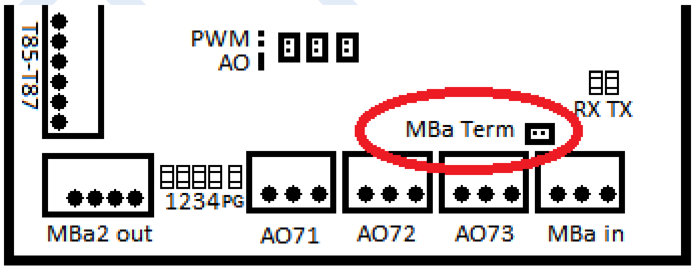
35.3.2 Status LED's

LED	Description
1	Alarm LED. Currently not used. Is normally not lit.
2	Indication LED. Flashes when the EM3-card is updating. Is normally not lit.
3	Indication LED. Flashes when the EM3-card is updating. Is normally not lit.
4	Heartbeat LED. Should always flash at even intervals. Indicates that the software on the EM3 card is running.
PG	Power LED. Should always be lit when the EM3 card has power.
RX	Receiving LED. Flashes when the EM3 card is receiving a Modbus message on the Modbus serial line. The message does not need to be addressed to the EM3 card. Should blink when Modbus communication is active. If the RX does not blink, check configuration and connections.
TX	Transmitting LED. Flashes when the EM3 card is transmitting a Modbus message on the serial line. Only blinks when the EM3 card responds to a Modbus message. If the EM3-card is the only Modbus accessory, the RX and TX should continuously blink at about the same time. If RX blinks, but TX never blinks, check configuration and function ID selector.



35.3.3 Termination

Modbus termination is carried out by placing a jumper on M4 adjacent to MBa1.



35.4 HTRT10A Room humidity sensor

Room sensor used for EM3. HTRT10A is a 0-10V room sensor.

35.5 Energy meter (CG EM 340)

Electrical energy meter that can be used for monitoring or current limitation.

36 Dynamic allocation of I/O

Dynamic allocation is available for the Mega series with BM-SLL. This makes it possible to swap usage for Digital inputs (DI), relay outputs (R) and temperature (T) on BM-SLL and EM3:1-5.

EM3 can be selected when an EM3 feature is installed (after reboot).
NB! EM3 Legacy control does not support Dynamic allocation.

36.1 Mega

	BM SLL		EM3	
Digital inputs	**DI22**	**DI23**	**DI95**	**DI96**
External alarm	Default	-	-	Optional
Flow guard	-	Default	-	-
External start brine	-	-	Optional	-
Smart Grid 2	Optional	Optional	-	-

	BM SLL			EM3	
Digital outputs	**R1**	**R2**	**R3**	**R52**	**R53**
Sum alarm	Default	-	-	-	-
Compressor operation	-	Default	-	-	-
Ext. aux. heater on/off	-	-	Default	-	-
Ext. anti-legionella	Optional	Optional	Optional	Optional	-
Burn out pump	Optional	Optional	Optional	-	Optional

Example:
It is possible to switch the function on relay R1, from Sum alarm to either Burn out pump or External anti-legionella.

37 Inverters

37.1 Danfoss VLT CDS 30X

Used by: Mega XL/-L/-M/-S. The inverter has preconfigured motor settings for each compressor type.

37.1.1 Control

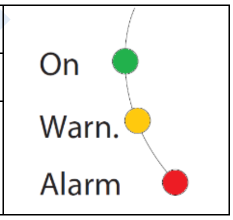
The compressor is controlled by sending a start/stop signal and desired compressor speed to the inverter. The inverter controls ramping and alarm handling.

The safe stop circuit on the BM-card is connected to a digital input on the inverter. If the circuit is broken the safe stop alarm appears and the compressor will stop immediately.

Note: On newer Mega-models the high pressure switch is mounted on the safe stop circuit. Meaning that if the high pressure switch is triggered, the safe stop alarm will appear.

37.1.2 Status LEDs

On	Control section is working. Should always be lit.
Warn.	Indicates a warning. Normally not lit.
Alarm	Indicates an alarm. Normally not lit. Will light up during heat pump start up, until controller is ready.



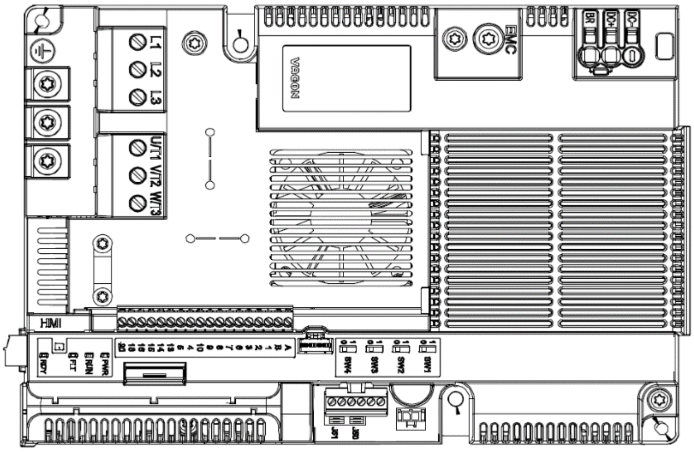
37.2 Vacon 20 CP

Used by: Diplomat Inverter L/-M.

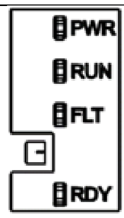
The compressor is controlled by sending a start/stop signal and desired compressor speed to the inverter. The inverter controls ramping and alarm handling.

The safe stop circuit on the BM-card is connected to a digital input on the inverter. If the circuit is broken, the compressor stops immediately.

Note: Breaking the safe stop circuit will not generate an inverter error code.

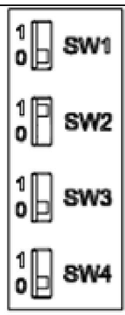


37.2.1 Status LEDs

PWR	The inverter is powered	
RUN	The compressor is running	
FLT	The inverter has an active alarm	
RDY	The inverter is ready to start the compressor and has no active alarms. The LED flashes if a warning is active.	

37.2.2 DIP switches

The DIP-switches on the Inverter are preconfigured and should not be changed.

Switch	Default	Description	
SW1	0	**Switch SW1 -** The digital inputs (terminals 8-10 and 14-16) on the standard I/O board can be isolated from ground by setting the dip switch SW1 to position 1. The switch in the position 0 means that the common of digital input has been connected to the ground. The default position is 0.	
SW2	1	**Switch SW2 and SW3 -** Analogue inputs can be used as either current inputs or voltage inputs. The signal type is selected with two switches on the control board. The switch SW2 is related to analogue input AI1. In position 1 the analogue input AI1 works in voltage mode. In position 0 the analogue input works in current mode. The default position for SW2 is 1. The voltage range is 0...10V and the current is 0/4.....20 mA. The switch SW3 is related to analogue input AI2. In the position 1 the analogue input AI2 works in voltage mode. In the position “0” the analogue input works in current mode. The default position for SW3 is 0. The voltage range is 0...10V and the current is 0/4.....20 mA.	
SW3	0		
SW4	0	**Switch SW4 -** The switch SW4 is related to the RS485 connection. It’s used for bus termination. The bus termination must be set to the first and to the last device on the network. The switch SW4 in position 0 means that termination resistance is connected, and the termination of the bus has been set. If the Vacon 20 CP is the last device on the net, this switch must be set to 0 position. The default position for SW4 is 0.	

37.3 Carel PSD

Used by: Diplomat Inverter M 230, Diplomat Inverter Mini, Calibra series and Atlas series.

37.3.1 Control

The compressor is controlled by sending a start/stop signal and desired compressor speed to the inverter. The inverter controls ramping and alarm handling.

37.3.2 Safe stop

The safe stop circuit on the BM-card is connected to a digital input on the inverter. If the circuit is broken the STO-alarm appears and the compressor will stop immediately.

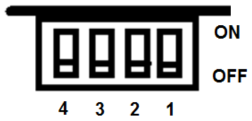
Note: On the Calibra and Atlas series the high pressure switch is mounted on the safe stop circuit. Meaning that if the high pressure switch is triggered, the STO-alarm will appear.

37.3.3 Status LEDs

Power	The inverter is powered. Should always be lit.
Run	Compressor operating. Should be lit when the compressor is running.
Fault	The inverter has an active alarm. Is lit for 3 minutes during start up but should not be lit otherwise.
Data	The CM communicates with the inverter.

37.3.4 DIP-Switches

The DIP-switches on the Inverter are preconfigured and should not be changed.

Switch	Default	Value	Description	
SW1	OFF	1	The four dipswitches affect the Modbus ID, in the range of 0-14. The Modbus ID is equal to the binary sum (1, 2, 4, 8) of all four dipswitches. If the dipswitches are set to 15 (all DIP-switches = ON), data communication settings are forced to: 19200 bit/s; no parity; 2 stop bits; ID 1 independently to related parameters setting. This communication configuration is not supported by the Genesis software.	
SW2	OFF	2		
SW3	OFF	4		
SW4	OFF	8		

38 Modbus

38.1 Internal Modbus (MBi)

MBi refers to internal Modbus communication in the heat pump between CM card, BM card and Inverter.

38.2 Accessory Modbus (MBa)

MBa refers to Modbus communication between heat pump and accessories: Modbus communication to all accessories is switched off as default. Modbus communication to the accessories is activated after controller reboot if a function that requires accessory is activated in the installation page.

38.3 External Modbus, BMS (MBe)

MBe refers to external Modbus communication between the heat pump and a BMS (building management system). MBe is an interface that allows external equipment to monitor and control the heat pump via Modbus RTU (RS-485) or TCP. Modbus RTU uses the MBe serial line connection, while Modbus TCP uses the ethernet port. The heat pump is a Modbus slave and will only answer to queries. RTU and TCP have the same register interface.

38.3.1 RTU (RS-485)

The heat pump is allocated a unique address. The settings for baud rate, parity and stop bit need to be the same on all devices communicating on the serial line.

Address:	1-247.
Baud rate (bps):	2,400, 4,800, 9,600, 14,400, 19,200, 28,800, 38,400, 57,600, 115,200.
Parity:	Even, None, Odd
Stop bit:	Stop bit is dependent on the parity setting: Even & Odd = 1, None = 1 or 2.

38.3.2 TCP

The heat pump is allocated network settings and a port number. Default port for TCP is 502. While using Modbus TCP, the answer from heat pump is delayed 500 ms to reduce load on the processor.

NB Using Modbus, TCP communication takes place via the network port (RJ45) and NOT via the MBe terminal.

38.3.3 External outdoor temperature

When enabled the outdoor temperature is provided by external Modbus. The outdoor sensor alarm is cleared automatically when a temperature is provided.

The outdoor temperature must change at least once every 12 hours. If the temperature fails to change within this time, the heat pump will use the regular outdoor temperature input instead. If no outdoor sensor is connected the outdoor sensor alarm will appear and use 0°C as fallback.

38.4 Galvanic isolation

All units in an RS-485 network must share a common earth, but the network can be galvanically isolated from other circuits. The purpose of galvanic isolation is to reduce disturbances and ensure secure communication. This is a more important issue in property products which normally have longer cables that are more susceptible to disturbances. Light commercial heat pumps have galvanic isolation.

38.5 Termination

Modbus termination is normally not necessary but gets more important as the cable length and baud rate increases. The main purpose of termination is to get a more stable communication line.

38.6 Communication analyzer

The communication analyzer shows the status of Modbus communication on internal (MBi) and accessory (MBa) serial line.

Note! The % can fluctuate for a bit after the initial reset if the communication is faulty.

Errors:	Modbus message is incorrect or corrupt. Can also be caused by electrical interference.
Time outs:	Modbus message was not received by the slave, or the slave does not answer within the time limit.
Packets:	The total number of Modbus messages that have been sent.

38.7 Fault tracing

General fault tracing for Modbus communication

- Check cabling and connections for bad contact or short-circuit.
- Check communication settings (baud rate, address, parity & stop bit).
- Check that the time-out time (length of time the Master waits for an answer before sending a new enquiry) is not too short.
- Check the earth connection of the units.
- Check the polarity of the units. Try exchanging the locations of + and - / A and B.
- Check that there are not multiple slaves with the same ID or more than one Master on the same loop.

39 BBR

The BBR function sets a permanent upper limit for the heat pump power usage. The heat pump power usage is estimated by the controller and limits both the compressor and the internal immersion heater. Compressor operation is always prioritized over the internal immersion heater.

BBR is not available for Athena.

To reconfigure the limitation, the installer must contact the heat pump support and generate an unlock code, based on the MAC-address of the CM-card. This MAC-address is shown in page 2 of Settings/System settings/Network settings.

40 Exercise run

Exercise runs are permitted if the component has been inactive for more than seven days. Starting an exercise run requires all demands to be fulfilled and the compressor to be off (includes secondary units in primary/secondary mode).

The exercise run will only run one component at the time.

40.1 Pump exercise

During the exercise run sequence pumps will run for 40s (ON) + 40s (OFF).

- System pump
- Brine pump
- Condenser pump
- Hot gas pump
- Pool - Pump
- Cooling - Surplus heat pump
- Cooling - Circulation pump
- WCS - Pump
- Distribution circuit 1-5 - Pump
- Ext. auxiliary heater -Burn out pump

40.2 Mix valve exercise

During the exercise run sequence mix valves will run for 240s (100%) + 240s (0%).

- HGW - mix valve
- Pool - Mix valve
- Cooling - Mix valve
- Cooling - Surplus heat fan/mix valve
- Cooling - Shunted surplus mix valve
- WCS - Mix valve
- Distribution circuit 1-5 - Mix valve

40.3 Directional valve exercise

During the exercise run sequence directional valves will run for 40s (ON) + 40s (OFF).

- Directional valve tap water
- Pool - Directional valve
- Cooling - Directional valve surplus heat
- Cooling - Directional valve cooling tank
- Cooling - Directional valve disconnect borehole
- TWC - Hot gas directional valve

41 System settings

41.1 Network settings

DHCP	Dynamic Host Configuration Protocol - Dynamic allocation of network settings. This is done by a router, for example.
Static	Network settings are allocated manually. This is used if there is no DHCP server. This is necessary, for example, for a Switch or CM card to CM card.
Assign IP	(Only available in static mode). By pressing the “assign IP” button, the CM-card will be assigned IP = 192.168.0.10X and Network mask: 255.255.255.0. *X =Heat pump ID in Primary secondary. Primary = 0.
IP address	A unique identifier on the network.
Network mask	If you have selected a static IP address, you should give a network mask. *Example: If you use a 192.168.xxx.xxx IP address, the Network mask should be set to 255.255.255.0*
IP gateway	Gateway is used to communicate outside a local network.
MAC address	Media Access Control is a unique address for all electronics that are to communicate over a network. Used, for example, for online configuration

41.2 Date/time

Setting of the heat pump's date and time.

The heat pump clock is used for: Online connection, logging to USB, programming of anti-legionella, time stamps for stop causes and alarms.

In Primary/Secondary mode, the primary unit will synchronize the date and time settings on all secondary units.

41.2.1 Date/Time sync

Date/Time can be synchronized with the Thermia Online server. The heat pump installation must be registered, and a Time zone must be set to sync Date/Time.

41.3 Online

For Online to function:

- Online must be activated.
- The heat pump must have internet access.
- Date and time must be set correctly for the online server certificate to be valid.
- The installation must be registered with the CM card's MAC address at: www.online-genesis.thermia.se
- Port 443 must be open in the local network/firewall to establish connection with the online server.

41.4 Screensaver

The screensaver comes into effect three minutes after the last time you pressed on the display. The screen saver is not activated while the access code is active.

If there is a class A alarm, the screensaver turns RED.

If there is a class B, D or E alarm, the screensaver turns YELLOW.

41.5 Lock mode

When lock mode is enabled all end user settings will be blocked. The end user can still gain access to these settings if the end user access code is entered. This mode needs to be enabled by the installer.

41.6 Logging

USB-logging can be activated and deactivated in the **Settings/System settings** submenu if a USB memory stick is detected. This logs all temperatures, pressures and control signals to the USB-memory until the memory stick is full or logging is turned off.

When logging is activated, it generates about 20-60 Mb of data per day. When the USB memory is full, an icon is shown in the top bar and logging will not transfer new files to the USB memory.

If an alarm has occurred, the CM card automatically saves a log file that contains all data 2 minutes prior to the alarm and last until 2 minutes past the alarm. These log files are saved to local memory if no usb-memory is connected and are possible to extract later.

Log files are organized in a file structure which contains profile name, serial number or mac address, software version and date.

Example:

Heat_pump_logs/Atlas_12_400V_FC6947C9DC53/11.00.000/20210629

NB! Do not change the clock while logging is in progress. This will change the timestamp in the logfiles.

NB! Avoid restarting the Heat pump when logging is activated. This can in some cases lead to USB-mounting issues and logging will stop.

NB! Do not remove the USB memory while logging is in progress. First deactivate logging and wait until the progress bar has completed. This will ensure that all data will be written to the USB-memory, and that it is correctly unmounted.

41.6.1 Log files

Thermia log viewer 4.0 or above is required in order to analyse the data generated by Genesis 11.0 or above.

The log files are compressed in .zip format. Thermia log viewer 4.0 unzips the log files automatically.

42 Machine profile

Genesis software supports multiple products and must be able to manage the differences between the products. This is managed with machine profile configuration. This is done from the factory and is retained between software updates, but if the CM card is replaced, the machine profile must be re-configured. The selected machine profile for the CM card is shown under System information →Version information.

The machine profile menu can only be accessed while the heat pump is in OFF-mode and the compressor is not running. Machine profile configuration is also blocked while the status text in the top left corner is displaying: "configuring..."

NB! After version 8.0 the Machine profile no longer needs to be reconfigured when the BM-card is replaced. This is now done automatically.

NB! A factory reset is automatically performed when configuring the machine profile. This is to ensure that all settings are factory default. This will also reset operating times and clear the alarm history.

42.1 Supported machine profiles

This list shows the Genesis version where the machine profile was introduced.

Light commercial	Version
Mega XL	1.0
Mega XL (2019)	7.1
Mega XL (2020) *(1)	10.0
Mega Eco XL	14.0
Mega Eco L	15.0
Mega L	1.3
Mega L (2019)	7.1
Mega L (2020) *(1)	10.0
Mega M 086LXXX	1.5
Mega M	6.0
Mega M (2019)	7.1
Mega M 230	6.0
Mega M 230 (2019)	7.1
Mega S	6.0
Mega S (2019)	7.1
Mega S 230	6.0
Mega S 230 (2019)	7.1
Mega S-E 400V	12.0

**(1) Machine profile is selected automatically when selecting a Mega profile and the inverter is from the 2020 model.*

Domestic	Version
Diplomat Inverter L	2.0
Diplomat Inverter M	3.1
Diplomat Inverter M 230	4.0
Diplomat Inverter Mini	7.0
Calibra 12 400V	8.0
Calibra 12 230V	8.0
Calibra 7	8.0
Atlas 18 400V	9.0
Atlas 12 400V	9.0
Atlas 12 230V	9.0

Calibra Cool 7 400V BW	10.0
Calibra Cool 7 400V WW	10.1
Calibra Eco 16 400V	10.2
Calibra Eco 12 400V	10.2
Calibra Eco 12 230V	11.0
Calibra Eco 8 400V	10.2
Calibra Eco 8 230V	10.2
Calibra Eco Cool 8 BW 400V	15.0
Calibra Eco Cool 12 BW 400V	15.0
Calibra Eco Cool 8 WW 400V	15.0
Athena Compact/Total 300L	11.0
Athena Total EQ	11.0
Athena Standard	14.0
Athena Standard Cascade	15.0

42.2 Machine profile alarm

During the CM-card start-up, a machine profile verification is performed automatically based on the selected machine profile. This check requires working Modbus communication with both the Inverter and BM card. If the verification detects the wrong combination of Inverter/BM-card, the machine profile alarm is triggered immediately if no machine profile is selected.

42.3 Supported features

42.3.1 Brine/Water

Installation	Mega series (new) 2019-2020 Mega series (upg) 2020+	Atlas series	Calibra series Dip. Inverter mini	Calibra Cool series	Mega series (old) 2015-2019	Dipl. Inverter L/-M
Heat	Yes	Yes	Yes	Yes	Yes	Yes
Room sensor	MB RS	MBRS, PT1000	MBRS, PT1000	MBRS, PT1000	MB RS	MB RS
Tap water	Yes	Yes	Yes	Yes	Yes	Yes
Pool	EM3	EM3	EM3	EM3	EM1	EM1, EM2
Passive cooling	EM3	BM, EM3	EM3	BM	EM1	EM1, EM2
Active cooling	EM3	EM3	EM3	No	EM1	EM1, EM2
TWC	EM3	No	No	No	EM1	EM1
WCS	EM3	No	No	No	EM1	No
Primary/Secondary	Yes	Yes	No	No	Yes	Yes
BMS	Yes	Yes	Yes	Yes	Yes	Yes
Distribution circuit 1	BM	BM	EM3	EM3	BM	BM
Distribution circuit 2	EM3	No	No	No	EM1	EM1
Distribution circuit 3	EM3	No	No	No	EM1	EM1
Distribution circuit 4	EM3	No	No	No	EM1	EM1
Distribution circuit 5	EM3	No	No	No	EM1	EM1
Auxiliary heater	BM	BM	EM3	EM3	BM	BM,

						EM2
Hot gas	Yes	No	No	No	Yes	No
HGW	No	Yes	No	No	No	Yes
Current limiter	CGEM	CGEM, EM3	CGEM, EM3	CGEM, EM3	CGEM	CGEM, EM2
Brine monitoring	Yes	Yes	Yes	Yes	Yes	Yes
Ext. brine pump	BM	EM3	EM3	EM3, BM*(2)	BM	EM2
Ext. brine pump ctrl.	EM3	No	No	No	No	No
Ext. start brine pump	Dyn	BM, EM3	EM3, BM*(1)	EM3	EM2	EM2
Buffer tank	BM	BM	EM3	No	BM	BM
Flow guard	Dyn	BM	EM3, BM*(1)	EM3*(2), BM	BM	BM
Sum alarm	Dyn	EM3	EM3	EM3	BM	BM
External alarm	Dyn	EM3	EM3	EM3	BM	BM
Smart grid	Dyn	EM3, BM	EM3, BM*(1)	EM3, BM	BM	BM

MB RS = Modbus RS, EMx = Expansion module x, BM = Building module, CGEM = Carlo Gavazzi energy meter
**(1) Requires BM-SLM hardware revision 22 and later.*
**(2) Only Calibra Cool BW series.*

42.3.2 Air/Water

Installation	Athena Compact/Total	Athena Total EQ	Athena Standard	Athena Standard Cascade
Heat	Yes	Yes	Yes	Yes
Room sensor	MBRS, PT1000	MBRS, PT1000	MBRS, PT1000	MBRS, PT1000
Tap water	Yes	Yes	Yes	Yes
Pool	EM3	EM3	EM3	No
Passive cooling	Yes	Yes	Yes	No
Active cooling	Yes	Yes	Yes	No
TWC	No	No	No	No
WCS	No	No	No	No
Primary/Secondary	No	No	No	No
BMS	Yes	Yes	Yes	Yes
Distribution circuit 1	BM	BM	BM	BM
Distribution circuit 2	No	No	No	No
Distribution circuit 3	No	No	No	No
Distribution circuit 4	No	No	No	No
Distribution circuit 5	No	No	No	No
Auxiliary heater	BM	BM	BM	BM
Hot gas	No	No	No	No
HGW	No	No	No	No
Current limiter	CGEM, EM3	CGEM, EM3	CGEM, EM3	No
Brine monitoring	No	No	No	No
Ext. brine pump	No	No	No	No
Ext. brine pump ctrl.	No	No	No	No
Ext. start brine pump	No	No	No	No
Buffer tank	BM	No	BM	BM

Flow guard	No	No	No	No
Sum alarm	EM3	EM3	EM3	EM3
External alarm	EM3	EM3	EM3	EM3
Smart grid	BM	BM	BM	BM

MB RS = Modbus RS, EMx = Expansion module x, BM = Building module, CGEM = Carlo Gavazzi energy meter

43 Factory reset

A total factory reset can be performed by pressing the factory reset menu. The reset retains the Machine profile, BBR settings and Operating times, but resets all other settings. It is also possible to clear the alarm history on this page. Factory reset and alarm history reset require restart.

44 Alarms

44.1 Class-A alarms

Class-A alarms prevents compressor operation. When compressor operation is blocked, auxiliary heater operation is still permitted.

Name	Product	Description
All outdoor unit alarm	Athena cascade	All outdoor units enabled has an error, see specific error for each outdoor unit
Brine in cool exchanger sensor error	Calibra Cool	Sensor missing - Only for Calibra Cool 7 400V BW
Brine temp	All	Stopped at limit value for brine monitoring more than five times in five hours. The alarm is only triggered if brine monitoring and brine alarm are activated.
BM-card communication	All	The CM-card have lost communication with the BM-card. This alarm will hide all other active alarms until communication is restored.
BM-card configuration error	All	The CM-card was unable to configure the BM-card according to the selected machine profile. Make sure the latest Genesis software is installed, and if that does not help, something is most likely wrong with the BM-card.
Cool exchanger freeze protection	Calibra Cool	Cool exchanger freeze protection triggered. Brine temperatures were too low. Only for Calibra Cool 7 400V BW.
Defrost failure	Athena	Could not defrost too low flow rate or too low refrigerant temperature. Outdoor unit error code: 50015
Defrost low pressure	Athena	Expansion valve does not open. Could be caused by low refrigerant levels. Outdoor unit error code: 50047
Discharge pipe sensor	All	Sensor missing - (pos 416)
Envelope below		Stopped on envelope (low condensation) more than five times in five hours. A stop occurs if the compressor has been outside the operating envelope for 40 seconds and no additional actions can be made.
Envelope right		Stopped on envelope (high evaporation) more than five times in five hours. A stop occurs if the compressor has been outside the operating envelope for 40 seconds and no additional actions can be made.
Flow guard, unexpected behaviour	Calibra Cool	The flow guard reports an unexpected flow signal. The sensor reported flow when no flow was expected. Only for Calibra Cool 7 400V WW
Gateway communication	Athena	The gateway card detects a fault in the communication between the CM module and the gateway card in the outdoor unit. Outdoor unit error code: 30055
Hexadecimal switch	Athena	DIP switch of the outdoor unit control card is set incorrectly. Outdoor unit error code: 30008
High discharge temperature	All	Stopped on high discharge temperature more than three times in eight hours. Stop temperature is listed in the discharge temperature monitoring chapter.
High pressure switch	All except Athena	The high-pressure switch is a mechanical circuit-breaker (NC) on the high-pressure side in the refrigerant circuit that opens if the pressure gets too high. The signal from the circuit-breaker is connected to a digital input on the BM card or on the safe stop circuit on newer models. This alarm should normally never trigger because of the operating pressure alarm but may do so in the case of rapidly increasing pressure. • High pressure is usually caused by poor flow or air in the heating system.
High pressure transducer error, low voltage fault.	Calibra, Atlas	The signal from the high pressure transducer is below the minimum voltage (<0.5V). Short circuit to GND or lose cable. This alarm is only available for Calibra and Atlas series. This alarm was disabled in Genesis 12.0 with the introduction of another transducer brand.
High pressure transducer error, high voltage fault	Calibra, Atlas	The signal from the high pressure transducer is above the maximum voltage (>4.5V). Short circuit to positive 5V. This alarm is only available for Calibra and Atlas series. This alarm was disabled in Genesis 12.0 with the introduction of another transducer brand.

Low pressure transducer error, low voltage fault	Calibra, Atlas	The signal from the low pressure transducer is below the minimum voltage (<0.5V). Short circuit to GND or lose cable. This alarm is only available for Calibra and Atlas series. This alarm was disabled in Genesis 12.0 with the introduction of another transducer brand.
Low pressure transducer error, high voltage fault	Calibra, Atlas	The signal from the low pressure transducer is above the maximum voltage (>4.5V). Short circuit to positive 5V. This alarm is only available for Calibra and Atlas series. This alarm was disabled in Genesis 12.0 with the introduction of another transducer brand.
I/O AI calibration	Diplomat Inverter, Mega	BM card - Calibration error for transmitter input. The BM card's calibration of analogue inputs is corrupt or non-existent. This alarm may appear if the BM-card has been damaged. Cannot be fixed by installer. Change the BM card. This alarm should never appear on the BM-SLX cards (since they do not need calibrating). If the alarm does appear, try updating the Genesis software to 9.0 or later. If the software is up to date, change the BM-card.
I/O Phase detection	All	BM card - Phase detection alarm BM card *Self-acknowledging. The I/O phase detection alarm. One or more phases are missing at the BM-card phase detection input. Threshold is 90V between phase and Neutral. Products supporting internal immersion heater use the phase detection input to detect a tripped overheating protection.
I/O Settings	All	BM card - The BM card is not configured correctly. This alarm should never appear if the Genesis software is 8.0 or later, since the BM-card is configured automatically during start up. This alarm was introduced in Genesis 6.2. In older versions 7.2 or older, the BM-card configuration was done by configuring the machine profile. If this alarm appears when updating the software, the BM-card was not correctly configured.
I/O Stepper motor	All	BM card - Setting error for the expansion valve. The BM card's stepper motor settings are corrupt or non-existent. This alarm may appear if the BM-card has been damaged. Try rebooting the heat pump and controller and the controller might be able to reconfigure the settings. If this alarm still appears after reboot, change the BM-card.
I/O Temp calibration	All	BM card - Calibration error on temp. sensor.
Inverter (*)	All	Stopped on Inverter alarm more than three times within two hours. This alarm is disabled during EVU. *The error code can be translated with the table for Inverter alarms. The error codes are shown differently depending on machine profile/product.
Inverter communication	All except Athena	The CM card has no Modbus communication with the Inverter. This alarm is disabled during EVU.
Inverter uC communication	Atlas, Calibra	The CM card has no Modbus communication with the Inverters safety controller.
Liquid line sensor	All except OEM Legend	Sensor missing - (pos 431)
Low brine flow/pressure	All	Flow guard alarm for the brine circuit. The flow guard is connected to a digital input on the BM card or EM-card. An alarm is triggered if the circuit is broken.
Low compressor rpm	Atlas, Calibra, Diplomat Inverter	The compressor has run at too low a speed (below 880 rpm) and stopped more than five times in five hours. Diplomat Inverter L, -M. The Vacon 20 CP and Carel PSD inverters have their own safety function which reduces the compressor speed to protect themselves from overloading. When this happens, the inverter overrides and reduces the compressor speed. If the speed gets below 880rpm the controller will stop the compressor. Ignored during compressor start-up. • Check inverter cooling (Fan and contact with cold plate and heat exchanger). • Check the cables between the inverter and compressor. • Examine operational conditions (e.g., abnormally high brine temperature) • Troubleshoot compressor
Low pressure	All	Stopped on low pressure more than five times within five hours. Low pressure limit = 2.3 bar. • Usually caused by poor flow or air in the brine circuit.
Low superheat	All except OEM Legend	Stopped on low overheating more than five times in five hours. Stop takes place if the overheating has been under 1 K for 3 minutes continuously.
Machine profile	All	Machine profile is incorrectly configured, or no profile is selected. A machine profile validation check is performed at start up. Check BM-card type and Inverter type.
Mean pressure	Athena	The mean pressure is below the minimum level.

		Outdoor unit error code: 50006
No BM card detected.	All	Alarm triggered when no BM card has been detected during start up. The alarm can only be acknowledged by restarting the heat pump. This alarm was removed 9.0 and later.
No compression	Athena	No compression detected. Outdoor unit error code: 50027
Operating pressure	All	Stopped on operating pressure more than five times within five hours. Switch-off limit = 41.5 bar (42,7bar on Mega 2020). • Usually caused by poor flow or air in the heating system.
Outside envelope		Stopped on envelope more than five times in five hours. A stop occurs if the compressor has been outside the operating envelope for 40 seconds and no additional actions can be made. This alarm is removed in Genesis 8.0 and later.
Outdoor unit communication error	Athena	The CM detects a fault in the communication between the outdoor unit and CM module.
Outdoor unit sensor error	Athena	One or more sensor from the outdoor unit, check latest outdoor unit codes for more information.
Outdoor unit error code (*)	Athena	A major fault has occurred in the outdoor unit, check latest outdoor unit codes for more information.
Outdoor unit speed set fault	Athena	The outdoor unit is unable to operate on the proper compressor speed. Turn off the power to the outdoor unit and indoor unit and turn the power back on after 10min.
Pressure ratio	All except OEM Legend	Stopped on pressure ratio more than five times within five hours. Too great a pressure difference between high- and low-pressure sides on the compressor.
Refrigerant low	Athena	Could be caused by low refrigerant levels or expansion valve not working correctly. Outdoor unit error code: 50029
RMS internal failure	Mega Eco	A general problem with the Refrigerant safety module (RSM). Try restarting the RSM by cutting the power.
Refrigerant leakage detected	Mega Eco	Refrigerant leakage detected by the RSM.
Refrigerant leakage sensor failure	Mega Eco	A problem with the refrigerant leakage sensor is detected. Check cables.
Suction gas sensor	All except OEM Legend	Sensor missing - (pos 421)
Startup configuration	All	Start-up configuration failed. The BM-card did not respond during heat pump start up. The heat pump needs to be restarted.
Ventilation test failed	Mega Eco	Safety ventilation could not create sufficient under pressure inside the cabinet. Safety ventilation cannot be guaranteed.
Wrong outdoor id	Athena	The outdoor unit has an unsupported id. The Genesis software is too old, or the outdoor unit control card needs to be replaced.
Motor overload detected	OEM Legend	When the compressor motor protection is triggered.

44.2 Class-B alarms

Class-B alarms must be acknowledged. There are self-acknowledging exceptions. Prevents tap water operation for domestic heat pumps.

Name	Product	Description
Anti-legionella max. time exceeded	All	The anti-legionella cycle has not been completed within 7 hours from start. Something is expected to be wrong.
Brine in sensor	All except Athena	Sensor missing - (pos 413)
Brine out sensor	All except Athena	Sensor missing - (pos 412)
Buffer tank config error	All	Buffer tank settings were not configured correctly in the previous software and could not be converted to the buffer tank type setting. Buffer tank type needs to be reconfigured. This alarm was introduced in Genesis 10.0.

Buffer tank sensor	All	Sensor missing - (pos 23)
CG EM340 communication	All	Communication alarm for the Carlo Gavazzi energy meter 340. The CM-card has no Modbus communication with the CG EM340.
Condenser in sensor	All	Sensor missing - (pos 411)
Condenser out sensor	All	Sensor missing - (pos 405)
Cool circuit return sensor		Sensor missing - (pos 181)
Cool circuit supply sensor		Sensor missing - (pos 58)
Cool tank return sensor		Sensor missing - (pos 57)
Cooling circuit supply 2 sensor		Sensor missing - (pos 58). Cooling circuit supply sensor error for EM2. This alarm was removed in Genesis 7.0 and later.
Cooling tank sensor		Sensor missing - (pos 59)
Delta temp brine max		The brine delta has exceeded set alarm limit.
Distr. Circ. 2 room sensor		Sensor missing - Distribution circuit 2, EM3:2
Distr. Circ. 3 room sensor		Sensor missing - Distribution circuit 3, EM3:2
Distr. Circ. 4 room sensor		Sensor missing - Distribution circuit 4, EM3:3
Distr. Circ. 5 room sensor		Sensor missing - Distribution circuit 5, EM3:3
Distribution circuit 1 sensor		Sensor missing - Distribution circuit 1 supply line, (pos 108)
Distribution circuit 2 sensor		Sensor missing - Distribution circuit 2 supply line, (pos 208)
Distribution circuit 3 sensor		Sensor missing - Distribution circuit 3 supply line, (pos 208)
Distribution circuit 4 sensor		Sensor missing - Distribution circuit 4 supply line, (pos 208)
Distribution circuit 5 sensor		Sensor missing - Distribution circuit 5 supply line, (pos 208)
EM1 communication		Communication alarm for EM1 ID 1-5. The CM card has no Modbus communication with one or more EM1 cards.
EM2 communication		Communication alarm for the EM2 card. The CM card has no Modbus communication with the EM2 card.
EM3 communication: 0-9		Communication alarm for EM3 ID 0-9. The CM card has no Modbus communication with one or more EM3 cards.
EM3 communication: 10-19		Communication alarm for EM3 ID 10-19. The CM card has no Modbus communication with one or more EM3 cards.
Evaporation temp min. error		Evaporating temperature too low (brine monitoring). Limit is set by offset from brine out min temp. Does not block tap water on domestic heat pumps.
Ext brine in sensor		Sensor missing - External brine pump control, EM3:1 (pos 48)
Ext brine out sensor		Sensor missing - External brine pump control, EM3:1 (pos 49)
HGW sensor		Sensor missing - (pos 407)
Internal immersion heater		Overheating protection for the internal immersion heater has tripped. Detected by the phase detection input on the BM-card. Internal immersion heater operation is disabled. 400V heat pumps: An alarm is triggered if there is no voltage to the L1 and L2 phase detection input on the BM card.

		230V heat pumps: An alarm is triggered if there is no voltage to the L1 phase detection input on the BM card.
Min. temp. brine in		Brine in temperature has fallen below minimum limit for brine monitoring. This alarm does not block tap water on domestic heat pumps.
Min. temp. brine out		Brine out has fallen below set limit for brine monitoring. Does not block tap water on domestic heat pumps.
Outdoor unit sensor error		Sensor missing – Check the latest outdoor error codes to see which sensor are affected.
Outdoor sensor		Sensor missing - Outdoor temperature is set 0°C when the sensor is not connected. (pos 50)
Outdoor unit error (*)		A fault has occurred in the outdoor unit, check latest outdoor unit codes for more information.
Pool return sensor		Sensor missing - (pos 60)
Surplus heat return sensor		Sensor missing - (pos 61)
Surplus heat supply sensor		Sensor missing - (pos 182)
System return line sensor		Sensor missing - (pos 52)
System supply line sensor		Sensor missing - Prevents external auxiliary heater operation. (pos 51)
Tap water charge system sensor		Sensor missing - (pos 54)
Tap water control sensor		Sensor missing - Outgoing tap water after mix valve. (pos 63)
Tap water end tank sensor		Sensor missing - Requires that TWC anti-legionella is activated.
Tap water middle sensor		Sensor missing - (pos 53)
Tap water return sensor		Sensor missing - (pos 56)
Tap water top sensor		Sensor missing - (pos 55)

44.3 Class-C alarms

Class-C alarms are information alarms.

Name	Description
Above envelope	Stopped on envelope (high condensation temperature)
Below envelope	Stopped on envelope (low condensation temperature)
Brine too cold for cooling	Brine temperature is too low for cooling. Cooling function is disabled.
Cool tank control	Alarm for temperature deviation as in alarm settings for Cooling - Cool Tank
Cooling circuit control	Alarm for temperature deviation as in alarm settings for Cooling - Shunt Valve
Defrost low pressure	Expansion valve does not open. Could be caused by low refrigerant levels.
Distribution circuit 1 control	Alarm for temperature deviation as in alarm settings for Distribution Circuit 1
Distribution circuit 2 control	Alarm for temperature deviation as in alarm settings for Distribution Circuit 2
Distribution Circuit 3 control	Alarm for temperature deviation as in alarm settings for Distribution Circuit 3
Distribution circuit 4 control	Alarm for temperature deviation as in alarm settings for Distribution Circuit 4
Distribution circuit 5 control	Alarm for temperature deviation as in alarm settings for Distribution Circuit 5
Envelope left	Stopped on envelope (low evaporation temperature)
Envelope right	Stopped on envelope (high evaporation temperature)
External alarm	Alarm input for external alarm. Requires function to be activated under alarm control/sum alarm
Failed defrost	Could not defrost, too low flow rate or too low refrigerant temperature.
High return line temperature	The temperature of the condenser in exceeds the set limit (default 65°C). The alarm prevents all compressor operation. When the alarm is active, external auxiliary heater operation is permitted. This alarm was removed in Genesis 6.2.
High system supply line temperature	Alarm is triggered if the temperature of the system supply line sensor exceeds the set limit (default 70°C). The alarm prevents compressor operation to the heating system but allows external auxiliary heater operation.
Low system supply line temperature	The supply line temperature (system supply line or condenser out) is below Supply line minimum or has been below 70% of the set point for more than three hours. The alarm is only triggered if external auxiliary heater is activated.
Mean pressure	The minimum mean pressure limiter has been triggered.
No compression	No compression detected.
Outdoor unit (*)	A minor fault has occurred in the outdoor unit, check latest outdoor unit codes for more information.
Outdoor unit sensor	One or more sensor from the outdoor unit reports a fault, check latest outdoor unit codes for more information.
Refrigerant low	Could be caused by low refrigerant levels or expansion valve not working correctly.
Room sensor	Room sensor missing or communication error to Modbus room sensor.
Surplus heat control	Alarm for temperature deviation as in alarm settings for Surplus heat.
TWC control minimum	Alarm for low temp. as in alarm settings for TWC Tap water supply line.
TWC return minimum	Alarm for low temp. as in alarm settings for TWC HWC return temp.
WCS control	Alarm for temperature deviation from charging set point as in alarm settings for WCS.

44.4 Class-D alarms

Class-D alarms are self-acknowledging and are used as information and communication alarms for genesis heat pumps in primary/secondary mode. Class-D alarms also prevent tap water operation on secondary units.

Name	Description
Com. to primary error	The Secondary cannot find a Primary or has lost communication with its Primary.
Com. to secondary error	The Primary lost communication with a secondary which was previously connected to the Primary.
Multiple primaries detected	One or more additional primary units was found on the same communication port. This is not allowed. Resolve the issue by changing the communication port setting on one of the heat pump groups.
Secondary pump class A	A secondary emits an alarm when there is an A alarm.
Secondary pump class B	A secondary emits an alarm when there is a B alarm.
Too few secondaries detected	The number of secondaries that communicate with the Primary does not correspond with the expected number (settings for 'Number of Genesis secondaries').

44.5 Class-E alarms

Class-E alarms are self-acknowledging and are used only as information and communication alarms for Legacy secondaries in primary/secondary mode.

Name	Description
Legacy pump communication	Communication errors
Legacy pump general error	Sum alarm
Legacy pump pressure switch alarm	Operating pressure switch

44.6 Alarm history

Alarm history shows the 100 most recent alarm events in all alarm classes. An event is when an alarm is activated or acknowledged. The alarm log is updated once per minute and at start-up.

The alarm history can be cleared via settings/factory resetting. Resetting comes into effect after restart.

44.7 Sum alarm

The sum alarm relay closes when an alarm from the selected classes is active. Used to signal external equipment.

Selectable alarm classes are:

A
A + B
A + B + C
A + B + C + D
A + B + C + D + E

44.8 Inverter error codes

Error codes in this chapter represent error codes shown in the case of Inverter class A alarms and in the **Latest inverter codes**. The error codes are read out from the inverter via Modbus and require the Modbus communication to be working and the inverter to be correctly configured.

The alarm lists in this chapter have been compiled with the aid of the inverter manuals, meaning this means that certain alarms may never appear in the Thermia configuration.

In the genesis software there are four inputs for inverter error codes: word_1_2, word_1_1, word_2_2, word_2_1. When an error code can include more than one alarm, the code is shown in hexadecimal form (HEX). Otherwise, it is shown in decimal form (DEC).

The value of error codes from USB logging is always in decimal form (DEC).

Machine profile	Inverter type
Mega XL	Danfoss VLT CDS 30X
Mega L	Danfoss VLT CDS 30X
Mega M	Danfoss VLT CDS 30X
Mega M 086L3018	Danfoss VLT CDS 30X
Mega M 230	Danfoss VLT CDS 30X
Mega S	Danfoss VLT CDS 30X
Mega S 230	Danfoss VLT CDS 30X
Mega S-E 400V	Danfoss VLT CDS 30X
Diplomat Inverter L	Vacon 20 CP
Diplomat Inverter M	Vacon 20 CP
Diplomat Inverter M 230	Carel PSD series
Diplomat Inverter Mini	Carel PSD series
Atlas 18 400	Carel PSD series
Atlas 12 400	Carel PSD series
Atlas 12 230	Carel PSD series
Calibra 12 400	Carel PSD series
Calibra 12 230	Carel PSD series
Calibra 7	Carel PSD series
Calibra Cool 7 400V BW	Carel PSD series
Calibra Cool 7 400V BW	Carel PSD series

44.8.1 Danfoss VLT CDS 30X

0000	0000	0000	0000
word_1_1	word_1_2	word_2_1	word_2_2
Error code 1		Error code 2	

Example 1: Error code 0000-4000-0000-0000 = Mains phase loss

Example 2: Error code 0100-4000-0000-0000 = Mains phase loss + Mains failure

Example 3: Error code 0000-0060-0000-0000 = Overcurrent (20) + Torque limit (40)

Trip-lock: Internal fault A38 and Dangerous failure A72 are Trip lock alarms. This means that the inverter must be restarted completely for the alarm to be acknowledged. Remember that the power must be disconnected for at least 30 seconds before the Inverter has completely discharged.

Error code 1 (HEX)	Description	Remedy
0000-**0001**-0000-0000	**Brake check** A28. The brake resistor is not connected or not working.	Check 2-15 Brake Check.
0000-**0002**-0000-0000	**Power card temp** A69. The temperature sensor on the power card is either too hot or too cold.	Check that the ambient operating temperature is within limits. Check for clogged filters. Check fan operation. Check the power card.
0000-**0004**-0000-0000	**Earth Fault** A14. There is current from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself.	Remove power to the frequency converter and repair the earth fault. Check for earth faults in the motor by measuring the resistance to ground of the motor leads and the motor with a megohmmeter.
0000-**0008**-0000-0000	**Control card temperature** A65. The cut-out temperature of the control card is 80 °C.	Check that the ambient operating temperature is within limits. Check for clogged filters. Check fan operation. Check the control card.
0000-**0010**-0000-0000	**Control word timeout** A17. There is no communication to the frequency converter. The warning is only active when 8-04 Control Word Timeout. Function is NOT set to [0] Off. If 8-04 Control Word Timeout Function is set to [5] Stop and Trip, a warning appears, and the frequency converter ramps down until it stops then displays an alarm.	Check connections on the serial communication cable. Increase 8-03 Control Word Timeout Time. Check the operation of the communication equipment. Verify a proper installation based on EMC requirements.
0000-**0020**-0000-0000	**Over Current** A13. The inverter peak current limit (approximately 200% of the rated current) is exceeded. The warning lasts about 1.5 s, then the frequency converter trips and issues an alarm. This fault can be caused by shock loading or quick acceleration with high inertia loads. It can also appear after kinetic back-up if the acceleration during ramp up is quick. If extended mechanical brake control is selected, trip can be reset externally.	Remove power and check if the motor shaft can be turned. Check that the motor size matches the frequency converter. Check parameters 1-20 to 1-25 for correct motor data.
0000-**0040**-0000-0000	**Torque limit** A12. The torque has exceeded the value in 4-16 Torque Limit. Motor Mode or the value in 4-17 Torque Limit Generator Mode. 14-25 Trip Delay at Torque Limit can change this from a warning only condition to a warning followed by an alarm.	If the motor torque limit is exceeded during ramp up, extend the ramp up time. If the generator torque limit is exceeded during ramp down, extend the ramp down time. If torque limit occurs while running, possibly increase the torque limit. Make sure that the system can operate safely at a higher torque. Check the application for excessive current draw on the motor.

0000-**0080**-0000-0000	**Motor thermistor over temp** A11. Check whether the thermistor is disconnected. Select whether the frequency converter issues a warning or an alarm in 1-90 Motor Thermal Protection.	Check for motor overheating. Check if the motor is mechanically overloaded. When using terminal 53 or 54, check that the thermistor is connected correctly between either terminal 53 or 54 (analogue voltage input) and terminal 50 (+10 V supply). Also check that the terminal switch for 53 or 54 is set for voltage. Check 1-93 Thermistor Source selects terminal 53 or 54. When using digital inputs 18 or 19, check that the thermistor is connected correctly between either terminal 18 or 19 (digital input PNP only) and terminal 50. Check 1-93 Thermistor Source selects terminal 18 or 19.
0000-**0100**-0000-0000	**Motor ETR overload temperature** A10. According to the electronic thermal protection (ETR), the motor is too hot. Select whether the frequency converter issues a warning or an alarm when the counter reaches 100% in 1-90 Motor Thermal Protection. The fault occurs when the motor runs with more than 100% overload for too long.	Check for motor overheating. Check if the motor is mechanically overloaded. Check that the motor current set in 1-24 Motor Current is correct. Ensure that Motor data in parameters 1-20 to1-25 are set correctly. If an external fan is in use, check in 1-91 Motor External Fan that it is selected. Running AMA in 1-29 Automatic Motor Adaptation (AMA) tunes the frequency converter to the motor more accurately and reduces thermal loading.
0000-**0200**-0000-0000	**Inverter overload** A9. The frequency converter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection issues a warning at 98% and trips at 100%, while giving an alarm. The frequency converter cannot be reset until the counter is below 90%. The fault is that the frequency converter has run with more than 100% overload for too long.	Compare the output current shown on the LCP with the frequency converter rated current. Compare the output current shown on the LCP with measured motor current. Display the Thermal Drive Load on the LCP and monitor the value. When running above the frequency converter continuous current rating, the counter increases. When running below the frequency converter continuous current rating, the counter decreases.
0000-**0400**-0000-0000	**DC under voltage** A8. If the intermediate circuit voltage (DC link) drops below the under-voltage limit, the frequency converter checks if a 24 V DC backup supply is connected. If no 24 V DC backup supply is connected, the frequency converter trips after a fixed time delay. The time delay varies with unit size.	Check that the supply voltage matches the frequency converter voltage. Perform input voltage test. Perform soft charge circuit test.
0000-**0800**-0000-0000	**DC over voltage** A7. If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.	Connect a brake resistor. Extend the ramp time. Change the ramp type. Activate the functions in 2-10 Brake Function Increase 14-26 Trip Delay at Inverter Fault. If the alarm/warning occurs during a power sag the solution is to use kinetic back-up (14-10 Mains Failure).
0000-**1000**-0000-0000	**Short Circuit** A16. There is short-circuiting in the motor or motor wiring.	Remove power to the frequency converter and repair the short circuit.
0000-**2000**-0000-0000	**Inrush fault** A33. Too many power-ups have occurred within a short time period.	Let the unit cool to operating temperature.
0000-**4000**-0000-0000	**Mains ph. loss** A4. A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier on the frequency converter. Options are programmed at 14-12 Function at Mains Imbalance.	Check the supply voltage and supply currents to the frequency converter.
0000-**8000**-0000-0000	**"AMA Not OK"** Automatic Motor Adaptation	
0001-0000-0000-0000	**Live zero error** A2. This warning or alarm only appears if programmed by the user in 6-01 Live Zero Timeout Function. The signal on one of the analogue inputs is less than 50% of the minimum value programmed for that input. Broken wiring or faulty device sending the signal can cause this condition.	Check connections on all the analogue input terminals. Control card terminals 53 and 54 for signals, terminal 55 common. MCB 101 terminals 11 and 12 for signals, terminal 10 common. MCB 109 terminals 1, 3, 5 for signals, terminals 2, 4, 6 common. Check that the frequency converter programming and switch settings match the analogue signal type. Perform Input Terminal Signal Test.
0002-0000-0000-0000	**Internal fault** A38. When an internal fault occurs, a code number defined in Table 7.4 is displayed.	Cycle power. Check that the option is properly installed. Check for loose or missing wiring It may be necessary to contact your Danfoss supplier or service department. Note the code number for further troubleshooting directions.

0004-0000-0000-0000	**Brake overload** A26. The power transmitted to the brake resistor is calculated as a mean value over the last 120 seconds of run time. The calculation is based on the intermediate circuit voltage and the brake resistance value set in 2-16 AC brake Max. Current. The warning is active when the dissipated braking is higher than 90% of the brake resistance power. If [2] Trip is selected in 2-13 Brake Power Monitoring, the frequency converter trips when the dissipated braking power reaches 100%.	
0008-0000-0000-0000	**U phase loss** A30. Motor phase U between the frequency converter and the motor is missing.	Remove power from the frequency converter and check motor phase U.
0010-0000-0000-0000	**V phase loss** A31. Motor phase V between the frequency converter and the motor is missing.	Remove power from the frequency converter and check motor phase V.
0020-0000-0000-0000	**W phase loss** A32. Motor phase W between the frequency converter and the motor is missing.	Remove power from the frequency converter and check motor phase W.
0040-0000-0000-0000	**Fieldbus fault** A34. The fieldbus on the communication option card is not working.	
0080-0000-0000-0000	**24V supply low** A47. The 24 V DC is measured on the control card. The external 24 V DC backup power supply may be overloaded, otherwise contact the Danfoss supplier.	
0100-0000-0000-0000	**Mains failure** A36. This warning/alarm is only active if the supply voltage to the frequency converter is lost, and 14-10 Mains Failure is NOT set to [0] No Function.	Check the fuses to the frequency converter and mains power supply to the unit.
0200-0000-0000-0000	**1.8V supply low** A48. The 1.8 V DC supply used on the control card is outside of allowable limits. The power supply is measured on the control card.	Check for a defective control card. If an option card is present, check for an overvoltage condition.
0400-0000-0000-0000	**Brake resistor** A25. The brake resistor is monitored during operation. If a short circuit occurs, the brake function is disabled, and the warning appears. The frequency converter is still operational but without the brake function.	Remove power to the frequency converter and replace the brake resistor (see 2-15 Brake Check).
0800-0000-0000-0000	**Brake IGBT** A27. The brake transistor is monitored during operation and if a short circuit occurs, the brake function is disabled, and a warning is issued. The frequency converter is still operational but, since the brake transistor has short circuited, substantial power is transmitted to the brake resistor, even if it is inactive.	Remove power to the frequency converter and remove the brake resistor.
1000-0000-0000-0000	**Option change** A67. Option module configuration has changed. One or more options have either been added or removed since the last power-down.	Check that the configuration change is intentional and reset the unit.
2000-0000-0000-0000	**Drive initialized** A80. Drive initialized to default value. Parameter settings are initialized to default settings after a manual reset.	Reset the unit to clear the alarm.
4000-0000-0000-0000	**Safe Stop** A68. Loss of the 24 V DC signal on terminal 37 has caused the filter to trip.	To resume normal operation, apply 24 V DC to terminal 37 and reset the filter. **Comment:** This alarm may appear during normal conditions at first power up. This is caused by the safe stop circuit being normally open when the BM-card is booting/starting.
8000-0000-0000-0000	**Mech. brake low** A63. The actual motor current has not exceeded the “release brake” current within the “Start delay” time window.	

Error code 2 (HEX)	Description	Remedy
0000-0000-0000-**0020**	**No Flow**	
0000-0000-0000-**0040**	**Dry Pump**	
0000-0000-0000-**0080**	**End of Curve**	
0000-0000-0000-**0100**	**Broken Belt**	
0000-0000-0000-**0200**	**Discharge High** A19. Warning: The discharge temperature exceeds the level programmed in 28-25 Warning Level. Alarm: The discharge temperature exceeds the level programmed in 28-26 Emergency Level.	
0000-0000-0000-**0400**	**Start Failed** A18**.** The speed has not been able to exceed 1-77 Compressor Start Max Speed [RPM] during start within the allowed time (set in 1-79 Compressor Start Max Time to Trip). This may be caused by a blocked motor.	
0000-0000-0000-**0800**	**Speed Limit** W49. When the speed is not within the specified range in 4-11 Motor Speed Low Limit [RPM] and 4-13 Motor Speed High Limit [RPM], the frequency converter shows a warning. When the speed is below the specified limit in 1-86 Trip Speed Low [RPM] (except when starting or stopping) the frequency converter will trip.	
0000-0000-0000-**1000**	**External Interlock**	
0000-0000-0000-**2000**	**Illegal Option Combi.**	
0000-0000-0000-**4000**	**No Safety Option** A84. The safety option was removed without applying a general reset. Reconnect the safety option.	
0000-0000-**0002**-0000	**KTY error**	
0000-0000-**0004**-0000	**Fans error**	
0000-0000-**0008**-0000	**ECB error**	
0000-0000-**0200**-0000	**Current limit** A59. The current is higher than the value in 4-18 Current Limit. Ensure that Motor data in parameters 1-20 to 1-25 are set correctly. Possibly increase the current limit. Be sure that the system can operate safely at a higher limit.	
0000-0000-**2000**-0000	**Encoder loss** A90.	Check the connection to encoder/resolver option and eventually replace the MCB 102 or MCB 103.
0000-0000-**4000**-0000	**PTC Thermistor** A74**.** Alarm related to the ATEX option. The PTC is not working. Parameter value must not be written while motor is running. Stop motor before writing MCO profile to 8-10 Control Word Profile for instance.	
0000-0000-**8000**-0000	**Dangerous failure** A72. Safe Stop with Trip Lock. The Dangerous Failure Alarm is issued if the combination of safe stop commands is unexpected. This is the case if the MCB 112 VLT PTC Thermistor Card enables X44/10 but safe stop is somehow not enabled. Furthermore, if the MCB 112 is the only device using safe stop (specified through selection [4] or [5] in 5-19 Terminal 37 Safe Stop), an unexpected combination is activation of safe stop without the X44/10 being activated. The following table summarizes the unexpected combinations that lead to Alarm 72.	

44.8.2 Vacon 20 CP

0
Word_1_1
Error code

System fault and Application error have a 'Sub code' which we unfortunately cannot read out from the inverter via Modbus. We currently have no solution to this, but the alarms usually result in inverter change.

Error code 1 (DEC)	Description	Remedy
1	**Overcurrent.** AC drive has detected too high a current (>4*IH) in the motor cable: • sudden heavy load increase • short circuit in motor cables • unsuitable motor	Check loading. Check motor. Check cables and connections. Make identification run. Check ramp times. **Comment:** Make sure the latest heat pump software is installed. Compressor coasting speed was changed in Genesis 6.02 that reduces motor current during shutdown at high temperatures. Follow the overcurrent fault tracing guide.
2	**Overvoltage.** The DC-link voltage has exceeded the limits defined. • too short a deceleration time • brake chopper is disabled • high overvoltage spikes in supply • Start/Stop sequence too fast	Make deceleration time longer. Use brake chopper or brake resistor (available as options). Activate overvoltage controller. Check input voltage.
3	**Earth fault.** Current measurement has detected that the sum of motor phase current is not zero. Insulation failure in cables or motor	Check motor cables and motor.
8	**System fault** This alarm has several sub codes. These codes cannot be accessed by the heat pump controller.	Reset the fault and restart. Should the fault re-occur, contact the distributor near to you. **Comment:** Check power and earth connections. Try restart the inverter by cutting the power to the inverter and wait 30s before turning on the power. Should the alarm re-appear swap out the inverter.
9	**Undervoltage** DC-link voltage is under the voltage limits defined. • most probable cause: too low a supply voltage • AC drive internal fault • defect input fuse • external charge switch not closed	In case of temporary supply voltage break reset the fault and restart the AC drive. Check the supply voltage. If it is adequate, an internal failure has occurred. Contact the distributor near to you.
10	**Input phase** Input line phase is missing.	Check supply voltage, fuses and cable.
11	**Output phase** Current measurement has detected that there is no current in one motor phase.	
13	**AC drive under temperature** Too low temperature measured in power units heatsink or board. Heatsink temperature is under -10°C.	Check the ambient temperature.
14	**AC drive overtemperature** Too high temperature measured in power units heatsink or board. Heatsink temperature is over 100°C.	Check the correct amount and flow of cooling air. Check the heatsink for dust. Check the ambient temperature. Make sure that the switching frequency is not too high in relation to ambient temperature and motor load.
15	**Motor stalled** Motor is stalled.	Check motor and load. Insufficient motor power, check motor stall protection parametrization.
16	**Motor overtemperature** Motor is overloaded.	Decrease motor load. If no motor overload exists, check the temperature model parameters.
17	**Motor underload** Motor is under loaded	Check load. Check underload protection parametrization.
19	**Power overload** Supervision for drive power	Drive power is too high: decrease load.
25	**Watchdog** Error in the microprocessor monitoring Malfunction. Component fault	Reset the fault and restart. If the fault occurs again, please contact your closest Vacon representative.
27	**Back EMF** Protection of unit when starting with rotating motor	Reset the fault and restart. Should the fault re-occur, contact the distributor near to you.

30	**STO fault** Safe torque off signal does not allow drive to be set as ready	Reset the fault and restart. Should the fault re-occur, contact the distributor near to you.
35	**Application error** #0 Firmware Interface version between Application and Control not matching	Load a compatible application. Please contact your closest Vacon representative.
	Application error #1 Application software flash error	Reload Application
	Application error #2 Application header error	Load a compatible application. Please contact your closest Vacon representative.
41	**IGBT temp** IGBT temperature (Unit Temperature + I2T) too high	Check loading. Check motor size. Make identification run. **Comment:** Fault code is similar to overcurrent. Follow the overcurrent fault tracing guide.
50	**4 mA fault (Analog input)** Selected signal range: 4...20 mA (see Application Manual). Current less than 4 mA. Signal line broken detached. The signal source is faulty	Check the analogue input's current source and circuit.
51	**External fault** Error message on digital input. The digital input was programmed as an input for external error messages. The input is active.	Check the programming and check the device indicated by the error message. Check the cabling for the respective device as well.
52	**Keypad Communication fault** The connection between the control keypad and the frequency converter is broken.	Check keypad connection and keypad cable.
53	**Fieldbus communication fault** The data connection between the fieldbus master and fieldbus board is broken	Check installation and fieldbus master.
54	**Fieldbus Interface error** Defective option board or slot	Check board and slot.
55	**Wrong run command** Wrong run alarm and stop command	Run forward and backward are activated at the same time.
56	**Temperature** Temperature fault	Board OPTBH is installed, and measured temperature is above (or below) the limit.
57	**Identification** Identification alarm	Motor identification has not been successfully completed
63	**Quick Stop** Quick Stop activated	The drive has been stopped with Quick Stop digital input or Quick Stop command by fieldbus

44.8.3 Carel PSD series

NB! The error codes in this alarm list have been changed and apply only to Genesis 6.0 and later.

0	0000	0000
Word_1_1	Word_2_1	Word_2_2
Error code 1	Error code 2	

Error code 1 (DEC)	Description	Remedy
1-0000-0000	**Overcurrent SW** The drive has detected a current supplied that is too high due to: - sudden strong load increase - acceleration that is too high - wrong parameters values or inadequate motor	Check the load, the dimension of the motor and the cables. Decrease acceleration. Check the motor parameters. **Comment:** Make sure that the Genesis software is up to date. A change to the compressor coasting speed was made in 6.02. This will decrease the risk of overcurrent during the pump down sequence. If the problem persists, follow the fault tracing guide for overcurrent.
2-0000-0000	**Motor overload** The current supplied has exceeded the motor rated current over the maximum time accepted	Check the load, the dimension of the motor and the cables. Check the motor parameters.
3-0000-0000	**Overvoltage DC bus** The DC voltage of the intermediate circuit has exceeded the limits envisioned due to: - deceleration that is too high - high over-voltage peaks on the power supply network	Decrease deceleration.
4-0000-0000	**Undervoltage DC bus** The DC voltage of the intermediate circuit is below the limits envisioned due to: - insufficient power supply voltage - fault inside the drive	In the event of temporary cut-off of the power supply, reset the alarm and re-start the drive. Check the power supply voltage.
5-0000-0000	**Drive overtemperature:** The temperature inside the drive has exceeded the maximum level allowed.	Check that the quantity and flow of cooling air are regular. Check that there is not dust in the heat sink. Check the environment temperature. Ensure that the switching frequency is not too high with respect to the environment temperature and the motor load.
6-0000-0000	**Drive under temperature:** The temperature of the drive is inferior to the minimum level allowed.	Warm up the ambient where the drive is installed.
7-0000-0000	**Overcurrent HW:** The drive has detected an instantaneous current supplied that is too high due to: - sudden strong load increase - motor cables short circuit - wrong parameters values or inadequate motor	Check the load, the dimension of the motor and the cables. Check the motor parameters
8-0000-0000	**Reserved**	
9-0000-0000	**Reserved**	
10-0000-0000	**CPU error:** Loss of data in memory.	Call for assistance
11-0000-0000	**Parameters default:** Execution of reset parameter default command Parameters user setting corrupted	Set parameters again
12-0000-0000	**DC bus ripple too large:** Input power supply phase loss	Check the input power supply phases to the drive
13-0000-0000	**Data communication fault:** Data reception failure	Check the serial connection. Switch the drive off and back on again.
14-0000-0000	**Drive thermistor fault:** Internal fault	Call for assistance
15-0000-0000	**Reserved**	
16-0000-0000	**Reserved**	
17-0000-0000	**Motor phase loss:** Motor cable disconnected.	Check the connections of the motor cable.
19-0000-0000	**Speed fault:** Wrong parameters values or unsuited load	Switch the drive off and back on again and check the parameters are properly set. Check the motor load.

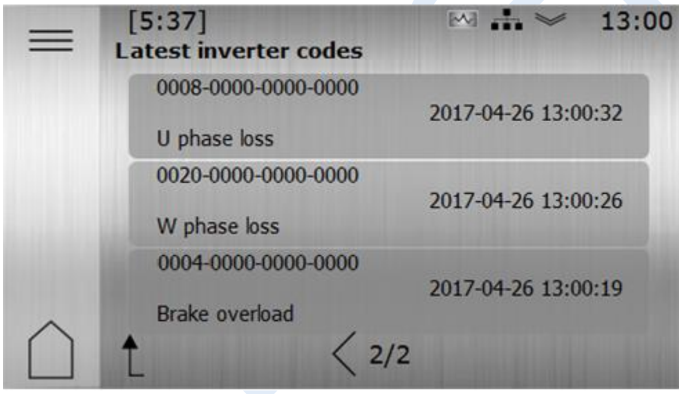
20-0000-0000	**PFC module error (fault):** PFC Overcurrent	Call for assistance. **Comment**: Check power and earth connections to the inverter. If connections are fine, there might be something wrong with the PFC module and the inverter needs to be replaced.
21-0000-0000	**Input power supply overvoltage:** To high supply voltage.	Check input power supply and if inductive load generating overvoltage are connected to the line.
22-0000-0000	**Input power supply undervoltage:** To low supply voltage.	Check input power supply.
23-0000-0000	**Reserved**	
24-0000-0000	**Reserved**	
25-0000-0000	**Ground fault:** The drive has detected a ground current too high.	Check ground insulation of the motor and wires.
26-0000-0000	**CPU sync error 1:** CPU Overload	Call for assistance.
27-0000-0000	**CPU sync error 2:** Loss of data in memory	Call for assistance.
28-0000-0000	**Drive overload:** The current supplied has exceeded the drive rated current over the maximum time allowed.	Check the load, the dimension of the motor and the cables. Check the motor parameters.
29-0000-0000	**Stop from safety uC (error code 2)**	An alarm is active on the micro safety controller. Check error code 2

Error code 2 (HEX)	Alarm Word	Remedy
29-0000-**0001**	**Current measure fault U, V, W:** Internal failure.	Reset the alarm. In case of persistence call for assistance.
29-0000-**0002**	**Unbalanced currents U, V, W:** Unbalanced loads.	Check loads and wiring. Check motor parameters setting.
29-0000-**0004**	**Overcurrent/Ground fault:** The drive has detected a current supplied that is too high due to: - sudden strong load increase - motor cables short circuit - wrong parameters values or inadequate motor - ground current too high	Check the load, the dimension of the motor and the cables. Check the motor parameters. Check ground insulation of the motor and wires
29-0000-**0008**	**STO:** Intervention of the external protection device connected to STO input. Wiring disconnection or failure. **Comment:** Safe stop circuit between BM and Inverter is open.	Check external protection device. Check wiring. **Comment:** This alarm may appear in the latest inverter codes page during normal conditions at first power up. This is caused by the safe stop circuit being normally open when the BM-card is booting/starting up. This alarm will also appear in latest inverter codes in the case of high-pressure switch alarm on Calibra and Atlas, due to the high-pressure switch is mounted on the STO-circuit.
29-0000-**0010**	**STO internal circuit fault**	Reset alarm. In case of persistence call for assistance.
29-0000-**0020**	**Power supply loss:** Power supply no more available.	Check external protection devices and input wiring.
29-0000-**0040**	**Motor drives error:** Internal failure.	Check the serial connection. Switch the drive off and back on again. In case of persistence call for assistance.
29-0000-**0080**	**Reserved:**	
29-0000-**0100**	**Data communication:** Data reception failure	
29-0000-**0200**	**Compressor stall detected:** Wrong parameters setting or excessive load or motor failure	Check motor parameters setting. Check motor and load.
29-0000-**0400**	**DC bus overcurrent:** The total current supplied to motor and DC bus powered auxiliary loads has exceeded the maximum level allowed.	Check loads, motor size and wiring. Check motor parameters setting
29-0000-**0800**	**DCbus current measure error:** Internal failure	Reset alarm. In case of persistence call for assistance.
29-0000-**1000**	**DCbus voltage out of range:** The DC voltage of the intermediate circuit has exceeded the limits envisioned due to: - high over-voltage peaks on the power supply network - insufficient power supply voltage - fault inside the drive	Check loads, motor size and wiring. Check motor parameters setting Check the power supply voltage.

29-0000-**2000**	**DCbus voltage measure error:** Internal failure	Reset alarm. In case of persistence call for assistance.
29-0000-**4000**	**Power supply undervoltage:** AC input voltage too low	Check power supply and wiring.
29-0000-**8000**	**Power supply voltage measure error:** Internal failure	Reset alarm. In case of persistence call for assistance.
29-**0001**-0000	**DCbus overload:** The total power of motor and DC bus powered auxiliary loads has exceeded the maximum level allowed.	Check loads, motor size and wiring. Check motor parameters setting
29-**0002**-0000	**DCbus load measure error:** Internal failure	Reset alarm. In case of persistence call for assistance.
29-**0004**-0000	**Drive overtemperature:** The temperature inside the drive has exceeded the maximum level allowed.	Check that the quantity and flow of cooling air are regular. Check that there is not dust in the heat sink. Check the environment temperature. Ensure that the switching frequency is not too high with respect to the environment temperature and the motor load.
29-**0008**-0000	**Drive undertemperature:** The temperature of the drive is inferior to the minimum level allowed.	Warm up the ambient where the drive is installed.
29-**0010**-0000	**Internal temperature sensor fault:** Internal failure	Reset alarm. In case of persistence call for assistance.
29-**0020**-0000	**Cpu sync error:** Internal failure	Reset alarm. In case of persistence call for assistance.
29-**0040**-0000	**Invalid Safety data set:** Safety data set missing or wrong. Loss of data in memory	Reset alarm. In case of persistence call for assistance.
29-**0080**-0000	**Reserved**	Reset alarm. In case of persistence call for assistance.
29-**0100**-0000	**Control circuit error:** Internal failure	Reset alarm. In case of persistence call for assistance.

44.8.1 Latest inverter codes

Inverter codes are temporarily logged in the **latest inverter codes** page when an inverter error code is received. This page is a fault tracing tool and does not necessarily mean that something is wrong with the inverter. Handle each error code from case to case.



Note: Some error codes may appear during normal conditions and may be a side effect of other issues. For example, the high pressure switch is mounted on the safe stop circuit on most heat pumps. If the high pressure switch is triggered the safe stop or STO-alarm will appear in the latest inverter codes.

44.8.2 Inverter alarm without error code

If an Inverter alarm occurs without an error code, this is probably because the Inverter has not generated an error code, or the Modbus communication is poor (in combination with communication alarm).

Diplomat Inverter L/-M: If the safe stop circuit between BM and inverter is broken, no error code is generated, but this will still finally trigger an Inverter alarm. If the RDY-led is blinking, make sure that the jumpers on the right side of the inverter (J50 and J51) are connected.

44.9 Outdoor unit error codes

The outdoor unit(s) error codes are handled differently depending on if it is an Athena standalone system or a cascade system.

A key difference for cascade is that only outdoor unit alarms will be raised until all outdoor units have an active alarm, then also class A alarm for all outdoor units faulty will be active. Also, that class B alarms for cascade will be raised after 10min from when the outdoor unit start sending the error code.

Error code	Alarm standalone	Alarm cascade	Remedy
10003	The minimum low pressure limiter has been triggered. • **No alarm until error code 50003 is raised**	The minimum low pressure limiter has been triggered. • **No alarm until error code 50003 is raised**	Refrigerant escaped. Expansion valve does not open. Fan not running.
10004	The high pressure limiter has responded. • **No alarm until error code 50004 is raised**	The high pressure limiter has responded. • **No alarm until error code 50004 is raised**	Check the flow rate and sensor connection on the heating side. Check the selected room temperature or heating curve
10006	The minimum mean pressure limiter has been triggered. • **Mean pressure (Class C)**	No alarm	Refrigerant escaped. Expansion valve does not open.
10015	The frost stat has been triggered in defrost mode. • **Failed defrost (Class C)**	No alarm	Water flow rate too low, water temperature too low.
10019	Sensor value of the outside temperature sensor outside the permissible range. • **Outdoor unit: 10019 (Class C)** • **Outdoor unit sensor (Class C)**	No alarm	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
10023	The maximum high pressure limiter has been triggered. • **Operating pressure (Class A)**	No alarm	Heating flow rate too low, selected room temperature/heating curve too high.
10024	Hot gas temperature has exceeded limit. • **Outdoor unit: 10024 (Class C)**	No alarm	Injection valve not working correctly. Expansion valve not working correctly. Refrigerant leak.
10025	Sensor value of the high pressure sensor outside the permissible range. • **Outdoor unit: 10025 (Class C)**	No alarm	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
10027	High pressure does not increase significantly above low pressure following compressor start-up and a delay time. • **Outdoor unit: 10024 (Class C)**	No alarm	Phase sequence incorrect or heat pump connection fuse has blown. Remove the cause. Then carry out a WPM reset.
10028	Superheating of the refrigerant at the evaporator discharge or the compressor intake for too long below the permissible limit. • **No alarm**	No alarm	Expansion valve not working correctly.
10029	Unexpectedly high deviation of the expansion valve opening from the pre-control characteristic. • **Refrigerant low (Class C)**	No alarm	Refrigerant leak. Expansion valve not working correctly.

10042	Sensor value of the condenser discharge sensor outside the permissible range. • **Outdoor unit: 10042 (Class C)** • **Outdoor unit sensor (Class C)**	Sensor value of the condenser discharge sensor outside the permissible range. • **Outdoor unit: 10042 (Class B)**	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
10047	The low pressure limiter has been triggered in defrost operation. • **Defrost low pressure (Class C)**	No alarm	Refrigerant escaped. Expansion valve does not open.
10099	Sensor value of the oil sump temperature sensor outside the permissible range. • **Outdoor unit: 10099 (Class C)** • **Outdoor unit sensor (Class C)**	Sensor value of the oil sump temperature sensor outside the permissible range. • **Outdoor unit: 10099 (Class B)**	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
20045	Speed deviation between set and actual compressor values for a defined time (low pressure compressor in the of two compressors). • **Outdoor unit speed set fault (Class A) after 6 occurrences within 3 hours**	Speed deviation between set and actual compressor values for a defined time (low pressure compressor in the of two compressors). • **Outdoor unit: 20045 (Class B) after 6 occurrences within 3 hours**	Inverter or compressor not working correctly. Check inverter BUS connection.
20057	Inverter: Inverter IGBT excess current. • **Outdoor unit: 20057 (Class C)** • **Inverter (Class A)**	Inverter: Inverter IGBT excess current. • **Outdoor unit: 20057 (Class B)**	Inverter fault.
20058	Inverter: PFC IGBT excess current. • **Outdoor unit: 20058 (Class C)** • **Inverter (Class A)**	Inverter: PFC IGBT excess current. • **Outdoor unit: 20058 (Class B)**	Inverter fault.
20059	Inverter: DC intermediate circuit excess voltage. • **Outdoor unit: 20059 (Class C)** • **Inverter (Class A)**	Inverter: DC intermediate circuit excess voltage. • **Outdoor unit: 20059 (Class B)**	Inverter fault.
20060	Inverter: DC intermediate circuit undervoltage. • **Outdoor unit: 20060 (Class C)** • **Inverter (Class A)**	Inverter: DC intermediate circuit undervoltage. • **Outdoor unit: 20060 (Class B)**	Inverter fault.
20061	Inverter: AC input excess voltage. • **Outdoor unit: 20061 (Class C)** • **Inverter (Class A)**	Inverter: AC input excess voltage. • **Outdoor unit: 20061 (Class B)**	Inverter fault.
20062	Inverter: AC input undervoltage. • **Outdoor unit: 20062 (Class C)** • **Inverter (Class A)**	Inverter: AC input undervoltage. • **Outdoor unit: 20062 (Class B)**	Inverter fault.
20063	Inverter: Voltage differences between the three input phases. • **Outdoor unit: 20063 (Class C)** • **Inverter (Class A)**	Inverter: Voltage differences between the three input phases. • **Outdoor unit: 20063 (Class B)**	Inverter fault.
20064	Inverter: Desaturation. • **Outdoor unit: 20064 (Class C)** • **Inverter (Class A)**	Inverter: Desaturation. • **Outdoor unit: 20064 (Class B)**	Inverter fault.
20065	Inverter: Inverter IGBTs excess temperature. • **Outdoor unit: 20065 (Class C)** • **Inverter (Class A)**	Inverter: Inverter IGBTs excess temperature. • **Outdoor unit: 20065 (Class B)**	Inverter fault.
20066	Inverter: PFC IGBTs excess temperature. • **Outdoor unit: 20066 (Class C)** • **Inverter (Class A)**	Inverter: PFC IGBTs excess temperature. • **Outdoor unit: 20066 (Class B)**	Inverter fault.
20067	Inverter: Rotor does not turn as expected.	Inverter: Rotor does not turn as expected.	Inverter fault.

	• **Outdoor unit: 20067 (Class C)** • **Inverter (Class A)**	• **Outdoor unit: 20067 (Class B)**	
20068	Inverter: Arithmetic fault in the measuring and analysis process. • **Outdoor unit: 20068 (Class C)** • **Inverter (Class A)**	Inverter: Arithmetic fault in the measuring and analysis process. • **Outdoor unit: 20068 (Class B)**	Inverter fault.
20069	Inverter: Input relay open. • **Outdoor unit: 20069 (Class C)** • **Inverter (Class A)**	Inverter: Input relay open. • **Outdoor unit: 20069 (Class B)**	Inverter fault.
20070	Inverter: Current differences between the three inverter IGBTs. • **Outdoor unit: 20070 (Class C)** • **Inverter (Class A)**	Inverter: Current differences between the three inverter IGBTs. • **Outdoor unit: 20070 (Class B)**	Inverter fault.
20071	Inverter: Current differences between the three PFC IGBTs. • **Outdoor unit: 20071 (Class C)** • **Inverter (Class A)**	Inverter: Current differences between the three PFC IGBTs. • **Outdoor unit: 20071 (Class B)**	Inverter fault.
20072	Inverter: LV range exceeded. • **Outdoor unit: 20072** • **Inverter (Class A)**	Inverter: LV range exceeded. • **Outdoor unit: 20072**	Inverter fault.
20073	Inverter: Motor excess speed. • **Outdoor unit: 20073 (Class C)**	Inverter: Motor excess speed. • **Outdoor unit: 20073 (Class B)**	Inverter fault.
20095	INV major fault central fault 1. • **Outdoor unit: 20095 (Class C)** • **Inverter (Class A)**	INV major fault central fault 1. • **Outdoor unit: 20095 (Class B)**	Inverter fault.
20096	INV major fault central fault 2. • **Outdoor unit: 20096 (Class C)** • **Inverter (Class A)**	INV major fault central fault 2. • **Outdoor unit: 20096 (Class B)**	Inverter fault.
20097	INV minor fault central fault 1. • **Outdoor unit: 20097 (Class C)** • **Inverter (Class A)**	INV minor fault central fault 1. • **Outdoor unit: 20097 (Class B)**	Inverter fault.
20098	INV minor fault central fault 2. • **Outdoor unit: 20098 (Class C)** • **Inverter (Class A)**	INV minor fault central fault 2. • **Outdoor unit: 20098 (Class B)**	Inverter fault.
20100	Low pressure below SOA ND limit for impermissible length of time. • **Envelope left (Class C)**	No alarm	Refrigerant circuit cannot offset operating conditions to SOA range for compressor.
20101	Low pressure above SOA low pressure limit for impermissible length of time. • **Envelope right (Class C)**	No alarm	Refrigerant circuit cannot offset operating conditions to SOA range for compressor.
20102	SOA range exceeded. • **Outdoor unit: 20102 (Class C)** • **Outdoor unit sensor (Class C)**	SOA range exceeded. • **Outdoor unit: 20102 (Class B)**	Refrigerant circuit cannot offset operating conditions to SOA range for compressor.
20103	High pressure below SOA high pressure limit for impermissible length of time. • **Below envelope (Class C)**	No alarm	Refrigerant circuit cannot offset operating conditions to SOA range for compressor.
20104	High pressure exceeds SOA HD limit for impermissible length of time. • **Above envelope (Class C)**	No alarm	Refrigerant circuit cannot offset operating conditions to SOA range for compressor.
20105	SOA range exceeded. • **Outdoor unit: 20105 (Class C)** • **Outdoor unit sensor (Class-C)**	SOA range exceeded. • **Outdoor unit: 20105 (Class B)**	Refrigerant circuit cannot offset operating conditions to SOA range for compressor.

20235	Inverter: High pressure sensor range undershot. • **Outdoor unit: 20235 (Class C)** • **Inverter (Class A)**	Inverter: High pressure sensor range undershot. • **Outdoor unit: 20235 (Class B)**	Inverter fault.
20236	Inverter: Compressor type configuration. • **Outdoor unit: 20236 (Class C)** • **Inverter (Class A)**	Inverter: Compressor type configuration. • **Outdoor unit: 20236 (Class B)**	Inverter fault.
20237	Inverter: High pressure sensor configuration. • **Outdoor unit: 20237 (Class C)** • **Inverter (Class A)**	Inverter: High pressure sensor configuration. • **Outdoor unit: 20237 (Class B)**	Inverter fault.
30008	The WP - Typ DIP switch of the IWS is set incorrectly. • **Hexadecimal switch (Class A)** • **Outdoor unit: 30008 (Class C)**	The WP - Typ DIP switch of the IWS is set incorrectly. • **Outdoor unit: 30008 (Class B)**	Isolate the heat pump from the power supply and set the DIP switch correctly.
30011	Sensor value of the suction gas temperature sensor for low pressure compressor outside the permissible range. • **Outdoor unit: 30011 (Class C)** • **Suction gas sensor (Class A)**	Sensor value of the suction gas temperature sensor for low pressure compressor outside the permissible range. • **Outdoor unit: 30011 (Class B)**	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
30016	Sensor value of the hot gas temperature sensor outside the permissible range. • **Outdoor unit: 30016 (Class C)** • **Discharge pipe sensor (Class A)**	Sensor value of the hot gas temperature sensor outside the permissible range. • **Outdoor unit: 30016 (Class B)**	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
30017	Sensor value of the evaporator temperature sensor outside the permissible range. • **Outdoor unit: 30017 (Class C)** • **Outdoor unit sensor (Class A)**	Sensor value of the evaporator temperature sensor outside the permissible range. • **Outdoor unit: 30017 (Class B)**	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
30020	Sensor value of the frost protection temperature sensor outside the permissible range. • **Outdoor unit: 30020 (Class C)** • **Outdoor unit sensor (Class A)**	Sensor value of the frost protection temperature sensor outside the permissible range. • **Outdoor unit: 30020 (Class B)**	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
30021	Sensor value of the injection temperature sensor outside the permissible range. • **Outdoor unit: 30021 (Class C)** • **Outdoor unit sensor (Class A)**	Sensor value of the injection temperature sensor outside the permissible range. • **Outdoor unit: 30021 (Class B)**	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
30026	Sensor value of the low pressure sensor outside the permissible range. • **Low pressure (Class A)**	No alarm	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
30031	Sensor value of the flow temperature sensor outside the permissible range. • **Outdoor unit: 30031 (Class C)** • **Outdoor unit sensor (Class A)**	Sensor value of the flow temperature sensor outside the permissible range. • **Outdoor unit: 30031 (Class B)**	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
30032	Sensor value of the return temperature sensor outside the permissible range. • **Outdoor unit: 30032 (Class C)** • **Condenser in sensor (Class B)**	Sensor value of the return temperature sensor outside the permissible range. • **Outdoor unit: 30032 (Class B)**	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.
30043	Sensor value of the exhaust air temperature sensor outside the permissible range. • **Outdoor unit: 30043 (Class C)**	Sensor value of the exhaust air temperature sensor outside the permissible range.	Check sensor, leads and the relevant plug-in connectors, and replace if faulty.

	• **Outdoor unit sensor (Class A)**	• **Outdoor unit: 30043 (Class B)**	
30053	At least two assemblies with the same bus ID are present on the bus system. • **Outdoor unit: 30053 (Class C)**	At least two assemblies with the same bus ID are present on the bus system. • **Outdoor unit: 30053 (Class C)**	Remove the cause. Then carry out a reset of the outdoor unit.
30055	Gateway/CM communication error. • **Gateway communication (Class A)**	No alarm	Check cables.
30094	High relevance communication objects have been incorrectly transferred repeatedly between the IWS and inverter. • **Outdoor unit: 30094 (Class C)**	High relevance communication objects have been incorrectly transferred repeatedly between the IWS and inverter. • **Outdoor unit: 30094 (Class B)**	Inverter fault. Check cables and the relevant plug-in connectors and replace if faulty. Check the power supply to the inverter.
50003	Multiple occurrences of message number X-0003 has led to heat pump interlock. • **Outdoor unit: 50003 (Class A)** • **Low pressure (Class A)**	Multiple occurrences of message number X-0003 has led to heat pump interlock. • **Outdoor unit: 50003 (Class A)**	Remove the cause. Then carry out a reset of the outdoor unit.
50004	Multiple occurrences of message number X-0004 has led to heat pump interlock. • **Outdoor unit: 50004 (Class A)** • **High pressure switch (Class A)**	Multiple occurrences of message number X-0004 has led to heat pump interlock. • **Outdoor unit: 50004 (Class A)**	Remove the cause. Then carry out a reset of the outdoor unit.
50006	Multiple occurrences of message number X-0006 has led to heat pump interlock. • **Outdoor unit: 50006 (Class A)** • **Mean pressure (Class A)**	Multiple occurrences of message number X-0006 has led to heat pump interlock. • **Outdoor unit: 50006 (Class A)**	Remove the cause. Then carry out a reset of the outdoor unit.
50015	Multiple occurrences of message number X-0015 has led to heat pump interlock. • **Outdoor unit: 50015 (Class A)** • **Failed defrost (Class C)** • **Defrost failure (Class A)**	Multiple occurrences of message number X-0015 has led to heat pump interlock. • **Outdoor unit: 50015 (Class A)**	Remove the cause. Then carry out a reset of the outdoor unit.
50027	Multiple occurrences of message number X-0027 has led to heat pump interlock. • **Outdoor unit: 50027 (Class A)** • **No compression (Class A)**	Multiple occurrences of message number X-0027 has led to heat pump interlock. • **Outdoor unit: 50027 (Class A)**	Remove the cause. Then carry out a reset of the outdoor unit.
50028	Multiple occurrences of message number X-0028 has led to heat pump interlock. • **Outdoor unit: 50028 (Class A)** • **Low superheat (Class A)**	Multiple occurrences of message number X-0028 has led to heat pump interlock. • **Outdoor unit: 50028 (Class A)**	Remove the cause. Then carry out a reset of the outdoor unit.
50029	Multiple occurrences of message number X-0029 has led to heat pump interlock. • **Outdoor unit: 50029 (Class A)** • **Refrigerant low (Class A)**	Multiple occurrences of message number X-0029 has led to heat pump interlock. • **Outdoor unit: 50029 (Class A)**	Remove the cause. Then carry out a reset of the outdoor unit.
50047	Multiple occurrences of message number X-0047 has led to heat pump interlock. • **Outdoor unit: 50047 (Class A)** • **Defrost low pressure (Class A)**	Multiple occurrences of message number X-0047 has led to heat pump interlock. • **Outdoor unit: 50047 (Class A)**	Remove the cause. Then carry out a reset of the outdoor unit.