Guide to the GOLD version F functions, Reversible heat pump, RX/HC

1. General

RX/HC is a complete reversible heat pump, fully integrated in the GOLD air handling unit.

There are four options to defrost the coils in the exhaust air:

Option 1. Reversing the media circuit.

Option 2. Reversing the media circuit + electric air heater

Option 3. Reversing the media circuit + air recirculation section RX/HC

Option 4. Reversing the media circuit + electric air heater + air recirculation section RX/HC

1.1 Installation

See the separate installation and maintenance instructions to install RX/HC.

See the separate installation instructions to install the air recirculation section RX/HC, if used.

2. Material specification

Air handling unit with integrated reversible heat pump **GOLD RX/HC**

For defrosting according to option 2 and 4 (see section 1): Electric air heater for defrosting. Installed in GOLD RX/HC from the factory.

For defrosting according to option 3 and 4 (see section 1): Air recirculation section RX/HC for defrosting.

3. Function

3.1 General

RX/HC has a reversible heat pump function that is controlled by the GOLD air handling unit's control system IQlogic via bus communication to the refrigerant circuit's control system iPro.

Operation and setting occurs via the GOLD air handling unit's hand-held micro terminal (see section 5. Settings).

The reversible heat pump circuit is controlled with three signals:

- Stop/Start (0/1)
- Heating/Cooling (0/1)
- Speed level compressor in per cent (25-100%)

When operation is requested, a start signal is sent for the production of heating or cooling.

Depending on the need in question, a signal is also sent for the operating level, 25-100%. When operation is not required, a stop signal is sent and 0 % signal for the operating level.

3.2 Start of RX/HC air handling units

Start of the reversible heat pump occurs after the GOLD air handling unit's ordinary start sequence. Operation of RX/HC is blocked during the GOLD air handling unit's ordinary start sequence.

3.3 Stop of RX/HC air handling unit

When stopping the GOLD air handling unit, operation of the reversible heat pump is shut down immediately.

Post-cooling of the refrigerant circuit and electric air heater for defrosting (if fitted) is carried out. After cooling is in progress two minutes after the last operation of the compressor or electric air heater.

3.4 Temperature regulation

The heat pump has its own control sequence (HC) in the GOLD air handling unit's temperature sequence. The sequence regulates the temperature requirement 0-100%, for the heating and cooling sequence respectively.

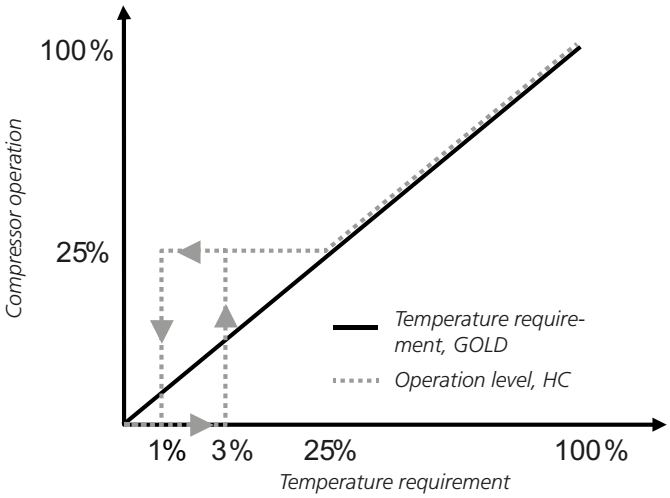
The heat pump is enabled when the temperature requirement exceeds 3% for 60 seconds and is disabled when the temperature requirement drops below 1% for 60 seconds (applies for Operating mode - Standard).

Size 011 - 035 (one compressor)

The refrigerant circuit contains a speed controlled compressor.

The compressor works between a MIN level (normal 25%) and maximum speed.

At a temperature requirement below 25% the compressor is run at 25% of max, at a need above 25% the compressor follows the temperature requirement. (see the diagram below)



Size 040 - 080 (two compressors)

The refrigerant circuit contains a speed controlled compressor and a compressor of the on/off type.

The speed controlled compressor works between a MIN level (total 12.5% per compressor, corresponding to 25% of the speed controlled compressor) and maximum speed.

Increasing temperature requirement

At a temperature requirement below 12.5% the speed controlled compressor is run at 25% of max, speed.

When the temperature requirement increases above 12.5%, the speed controlled compressor is regulated to follow the temperature requirement.

At a temperature requirement above 50%, the speed controlled compressor runs to max, speed.

When the temperature requirement increases above 62.5%, the on/off compressor and the speed controlled compressor are regulated to follow the temperature requirement.

At a temperature requirement of 100%, both compressors run at max, speed.

Decreasing temperature requirement

When the temperature requirement decreases below 100%, the on/off compressor is operational and the speed controlled compressor is regulated to follow the temperature requirement.

At a temperature requirement below 62.5% the speed controlled compressor is run at 25% of max, speed and the on/off compressor is operational.

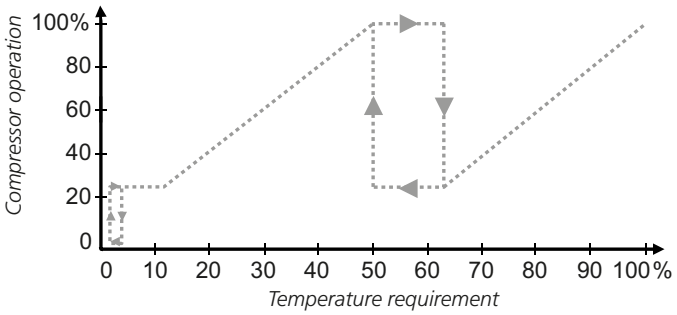
When the temperature requirement decreases below 50%, the on/off compressor shuts down and the speed controlled compressor is regulated to follow the temperature requirement.

At a temperature requirement below 12.5% the speed controlled compressor runs at 25% of max, speed.

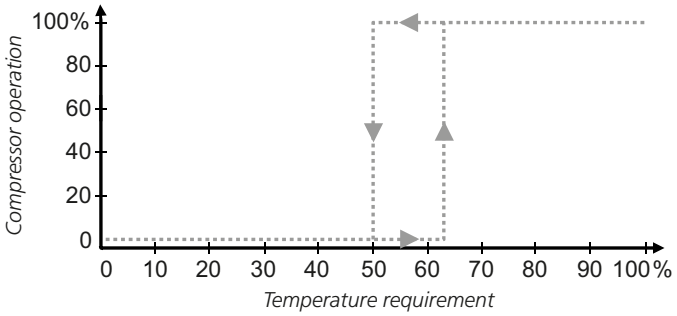
Total output

The diagram shows the total capacity in per cent, which is the same as the control signal from the control system.

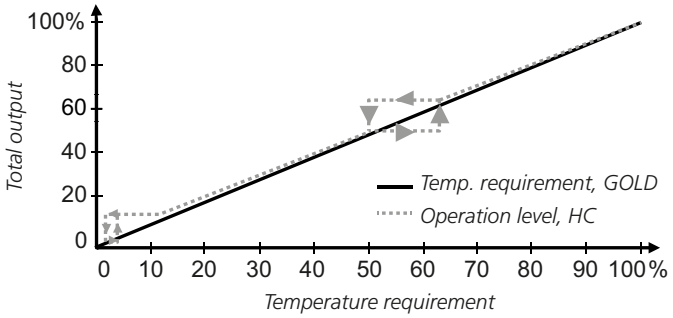
Compressor speed controlled



Compressor, on/off



Total output



3.5 Stabilization

In certain circumstances, there is a need to stabilise operation of the refrigerant circuit and the temperature control for GOLD.

During stabilization, operation of the refrigeration circuit is forced to be between MIN-100% of the compressor speed, regardless of the temperature control requirement.

The stabilisation time is normally 4 minutes + any time between sending the start request of the refrigeration circuit and the actual start of compressor operations. If the cooling circuit is (or recently been in) in operating mode Adapted operations, the stabilisation time is extended to 8 minutes.

Stabilization starts when one of the following occurs:
- The refrigerant circuit starts in stopped mode
- Defrosting is complete
- Oil return is terminated
- The number of compressors in operation is changed (except when the number changes from one to zero).

Operations return to normal mode after stabilization is complete and is controlled between MIN-100% according to section 3.4 Temperature control.

Stabilization stops when one of the following occurs:
- Stop of the GOLD air handing unit
- Defrosting requirement occurs (see section 3.9)
- Oil return starts (see section 3.8)

3.6 Comfort function

The comfort function is possible to select for heating and/or the cooling function.

When there is a need of low cooling/heating capacities, the lowest compressor speed will be too high, the function prioritises comfort before economy.

If the comfort function is selected and the temperature requirement is low (the corresponding compressor operation is lower than MIN level), comfort mode is enabled. Operation of the reversible heat pump is then locked to MIN level of the compressor speed. The rotary heat exchanger is allowed to regulate to maintain the required supply air temperature. If instead the temperature requirement exceeds MIN level, operations return to normal mode.

If any of the following occurs the comfort function is cancelled and operation of the reversible heat pump stops:

- Stop of the GOLD air handing unit
- Time for comfort mode exceeds 60 minutes (factory setting, can be set 5 – 180 minutes)
- Airflow limits for the supply air and/or extract air drop below the permitted minimum limit (factory setting 40% of the GOLD air handling unit's maximum flow, can be set 0 – 100%)
- Outdoor temperature limits for heating or cooling function are not met (factory setting, heating -25°C, cooling +15°C. Can be set, heating -50 – +50°C, cooling 0 – 50°C)
- The supply air temperature deviates from the set point to such an extent that it is within 1 K from the limit value for any of the alarms Supply air temperature above/below set point.
- Reheating attempts to start when operations are in heating mode or reheating attempts to start when operations are in cooling mode. This means that the rotor's heating/cooling capacity is not sufficient to balance the temperature and that there is an active regulation sequence after the rotor.

3.7 Adapted operations

When the evaporation and condensation temperatures are in a position outside of the optimal working range, the speed of the compressor is adapted to attempt to reach the optimal working range.

This is indicated on the hand-held micro terminal of the GOLD unit.

3.8 Oil return

If the speed of the compressor has been below 28% for more than 50 minutes, the speed is increased briefly to extend the life of the compressor.

This results in a larger delivered supply air capacity than requested. In order to avoid unnecessary system fluctuations, refrigeration circuit shut-off is prevented (independent of the temperature regulator's requirement) after the oil return is completed. This is done by starting the stabilization function.

3.9 Defrosting

Freezing occurs when operations are in heating mode and the temperature across the exhaust coil is below 0 °C.

Depending on the temperature, compressor speed, airflow as well as moisture content in the extract air and fresh air, freezing occurs with varying speed and behaviour.

The pressure drop across the exhaust coil is measured to detect the defrosting requirement or stop ongoing defrosting. Defrosting starts when the pressure drop exceeds a specific limit. When the pressure drop falls below another lower limit defrosting stops.

At defrosting with recirculation, the recirculation damper have a finishing sequence for protection against freezing.

Phases
Defrosting occurs by reversing the heat pump circuit. The exhaust coil then works as a condenser (as with the cooling function) and heats.

Start delay
When the pressure drop across the exhaust air coil exceeds the start limit, for a period longer than 60 seconds, defrosting starts.

Initiation
When defrosting is detected the Initiation phase starts. The recirculation damper then opens for recirculation, and if there is an electric air heater this starts. For recirculation the signal is sent with a delay of 60 seconds, if there is no recirculation the signal is sent without a delay.

Pre-defrosting
When the defrosting process starts, a signal is sent to the heating circuit which lowers the compressor speed and turns the flow directions through the four-way valve.

Defrosting
The defrosting process continues through ramping up the compressor speed and running until the control system requests that defrosting stops or until the maximum defrosting time has been reached.

Runoff
In the last part of the defrosting process, the compressor speed drops and the flow directions through the four-way valve are turned back.

Adaptive start and stop
Start and stop of the defrosting process is controlled by calculations in the control system, which take a number of different factors into consideration that are measured continuously.

Adaptation is performed after each defrosting to optimise the process.

Air recirculation section RX/HC (accessory)
When there is a defrosting requirement, the recirculation damper opens, and the outdoor air damper and the exhaust air damper close.

Recirculation operation is ensured before defrosting starts.

When defrosting is completed, the outdoor air damper and the exhaust air damper open, the recirculation damper closes and stabilization operations are run.
In order to reduce the risk of freezing, a termination sequence is started at the same time when the recirculation damper is opened and closed a number of times.

Electrical air heater RX/HC (accessory)
When there is a defrosting requirement, the electric air heater is enabled immediately.

Overheating protection is installed. Post-cooling is carried out if the air handling unit stops during or just after defrosting.

Critical defrosting
If the evaporation temperature in the heating circuit drops below a critical limit, defrosting starts.

If the control system discovers ongoing ordinary defrosting, critical defrosting is adapted to the ordinary defrosting sequence, e.g. recirculation starts.

3.10 Limitations

For operations outside the outdoor temperature limits and/or below air limits, the reversible heat pump function stops and the air handling unit acts as a GOLD RX.

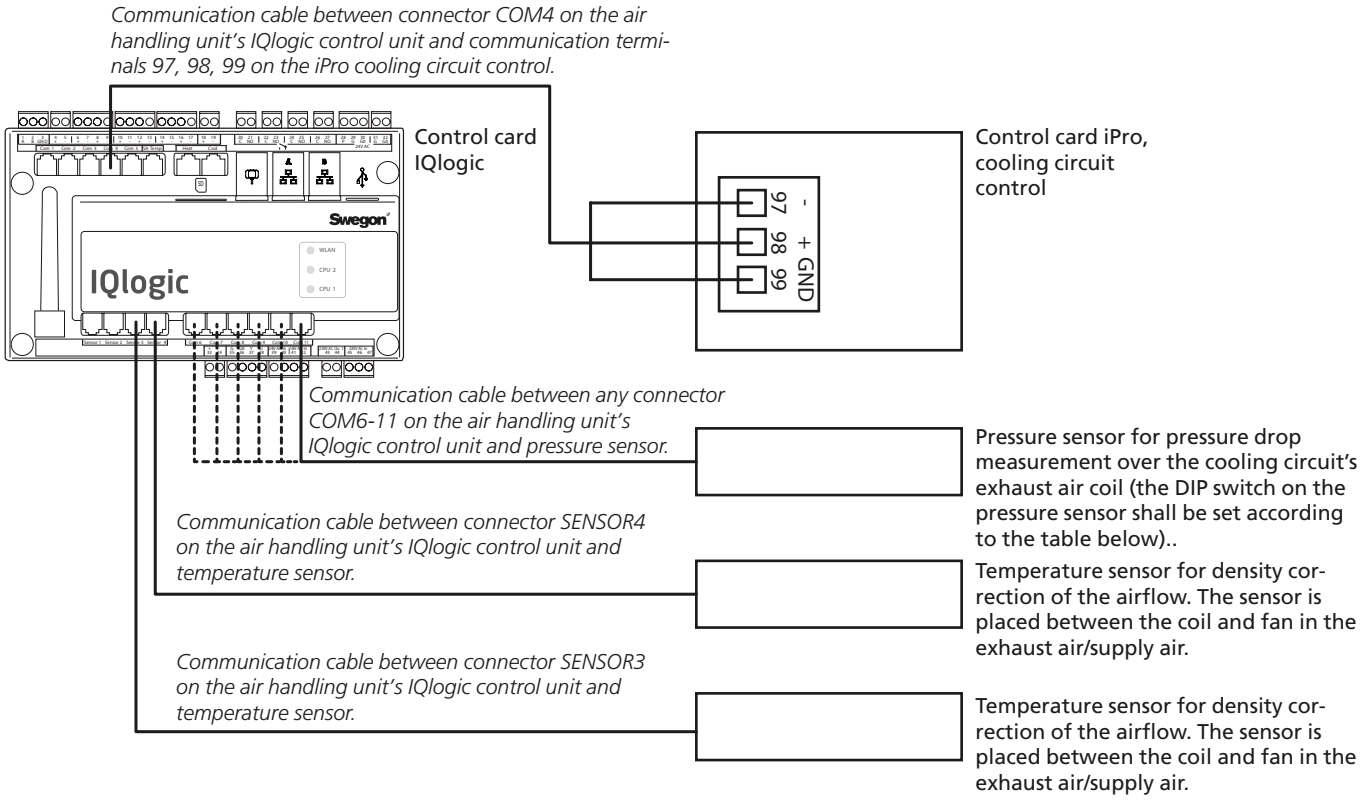
Outdoor temperature limit, cooling
Operation of the reversible heat pump in cooling mode is only permitted at an outdoor temperature above 15°C (adjustable value).

Outdoor temperature limit, heating
Operation of the reversible heat pump in heating mode is only permitted at an outdoor temperature above -25°C (adjustable value).

Air flow limits
Operation of the reversible heat pump is only permitted when the extract airflow and supply airflow exceed a minimum airflow limit. Values can be set for the extract air and supply air.

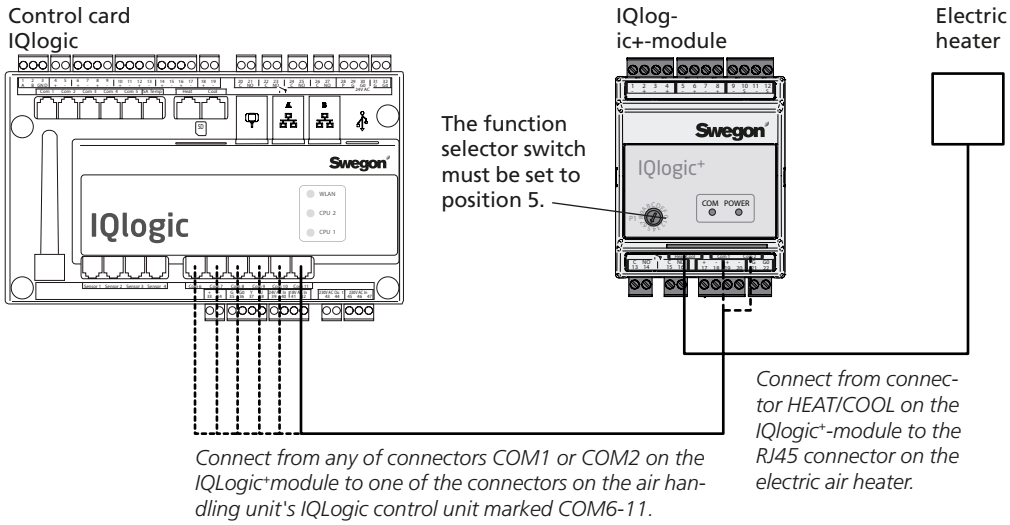
4. Wiring diagram

The following wiring diagram deals with connected components in addition to a standard air handling unit GOLD RX. For the wiring diagram standard GOLD RX, see the separate document.



	Switch no. (1=ON 0=OFF)				
Function	**1**	**2**	**3**	**4**	**5**
RX/HC defrosting	1	0	1	1	0

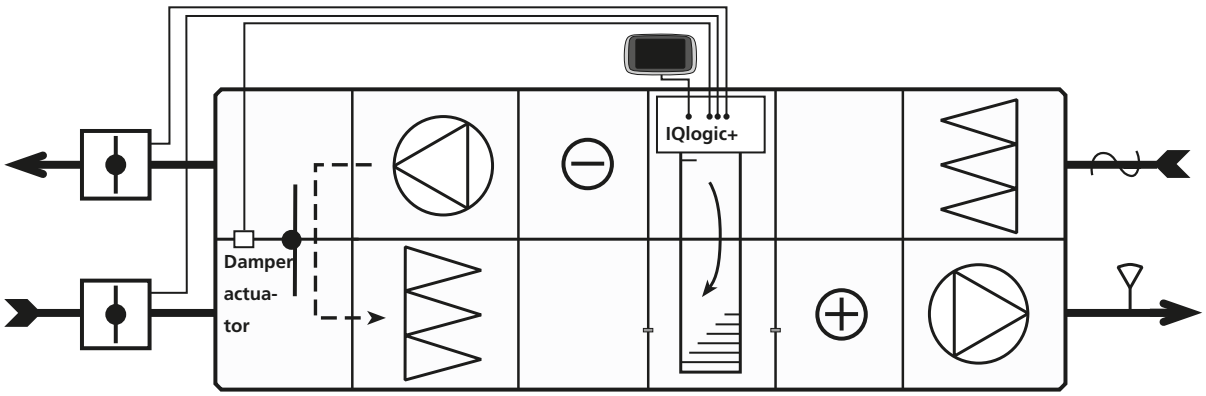
Electric air heater for defrosting (accessory)



5. Electrical connection of the air recirculation section RX/HC (accessory)

The electrical connections are to be wired by a qualified electrician in accordance with local electrical safety regulations.

The damper motor has a 0.9 metre long connection cable, 4 x 0.75 mm² and is connected in the junction box, IP54.



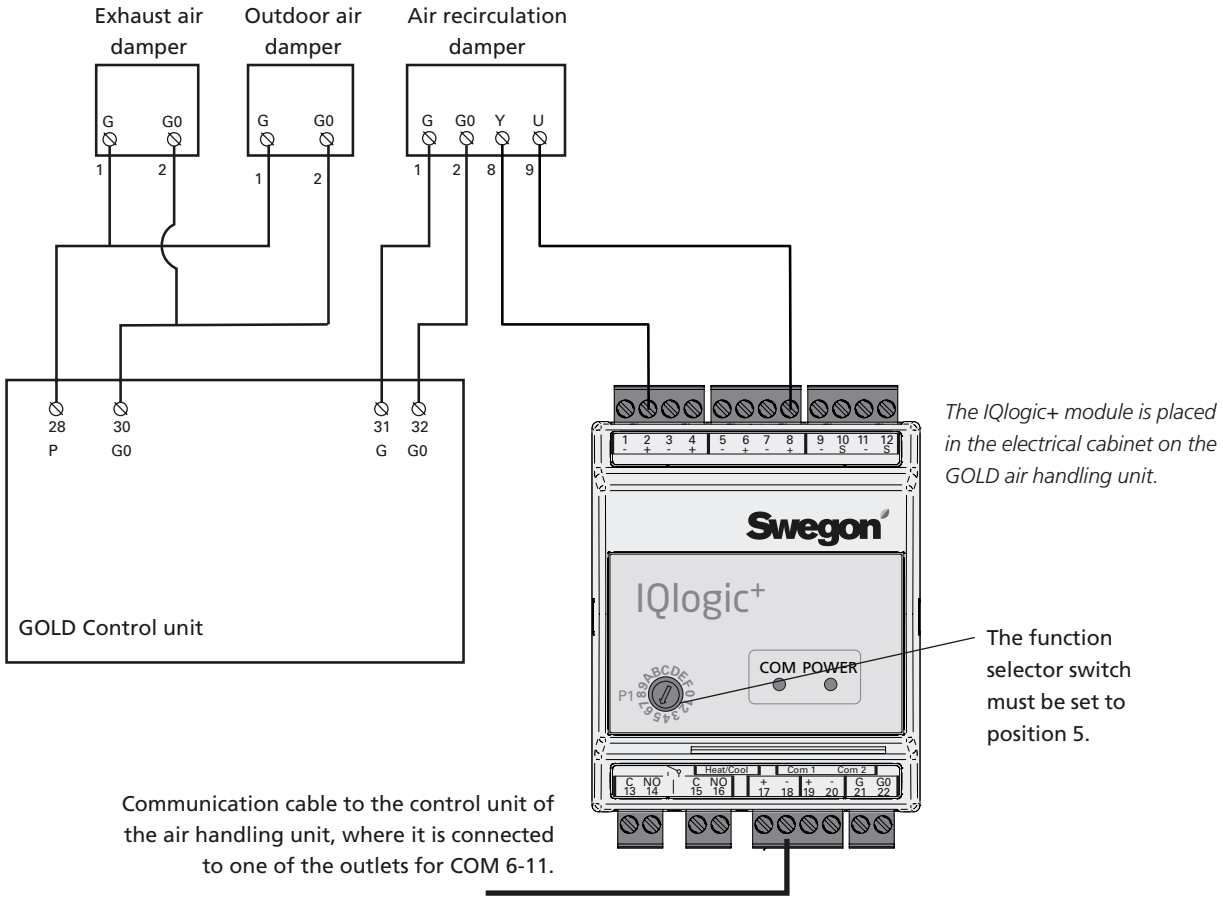
Requisite accessories

Outdoor air damper	TBSA-X-xxx-xxx-x-1 *or* TCSA-xxx, spring return
Exhaust air damper	TBSA-X-xxx-xxx-x-1 *or* TCSA-xxx spring return

Function

In normal mode the recirculation damper must be fully closed (deenergized state).

When defrosting is selected, the air recirculation damper should be completely open (actuating time: 90 seconds).



The IQlogic+ module is placed in the electrical cabinet on the GOLD air handling unit.

The function selector switch must be set to position 5.

Communication cable to the control unit of the air handling unit, where it is connected to one of the outlets for COM 6-11.

6. Settings

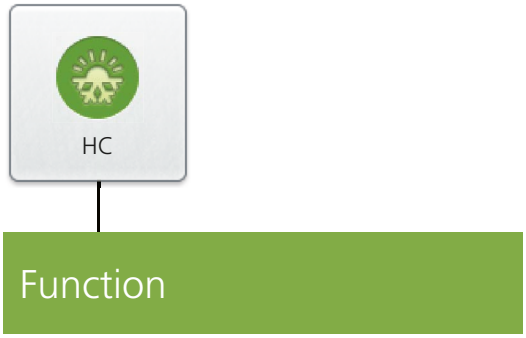
For basic details on how to use the hand-held terminal, see the Operation and Maintenance Instructions for the GOLD Air Handling Unit.

The functions for the reversible heat pump are activated manually under Functions/HC. This is only possible for GOLD RX (rotary heat exchanger).

HC is activated by setting Position HC in On. Other possible settings are shown when HC is activated.

If one or both of the accessories electric air heater HC or air recirculation section HC are fitted, these are activated by selecting the required accessory/accessories from the menu HC defrosting accessories. If both the electric air heater and the air recirculation section are activated, you can choose whether they are to be operated in sequence or in combination. Max. outdoor air temperature for recirculation can be set.

Set the required heating and cooling function, standard or comfort.



Set the required values for outdoor temperature limits for heating and cooling.

Outdoor temperature limits

Set the required values for airflow limits for supply air and extract air.

Air flow limits

Calibration is carried out at the factory. If recalibration is required, this can be carried out by pressing the calibration button. Remaining time is shown when calibration is in progress. Calibration date and lowest/highest air flow/pressure drop are shown when calibration is performed.

Calibration

Regulation sequence for heating and cooling can be set, see the separate Function manual installation.