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**DHW Management**  
**D-EIOOC00210-21\_01EN**

**Air to water heat pump units with scroll compressors**

**EWYT~CZ / EWAT~CZ**

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## 1. DOMESTIC HOT WATER

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This document describes all features of DHW option for production of domestic hot water in both single and multi-chiller applications with two separated water loops, one for normal operation and one for this option.

Basic set up of the DHW control requires to set one simple parameter available in the unit configuration menu.

Notice that, for Web HMI, "Connectivity Kit" is required.

### *HMI EVCO Parameters*

Parameter	Default	Range	Description
[15.09] DHW Enable	0	0 = Disabled 1 = Enabled	After a restart of the UC the function will be enabled to start

*Web HMI Path: Main Menu → Commission Unit → Configure Unit → Options*

Setpoint/Sub Menu	Default	Range	Description
Domestic Hot Water	Disable	Disable, Enable	After a restart of the UC the function will be enabled to start

## 2. SET-UP

In case the Domestic Hot Water option is selected the control system is improved to manage a secondary circuit to produce domestic hot water. The water is stored in a tank and its temperature is controlled by one immersion probe. The temperature is raised by the source passing technical water in a coil inside the tank.

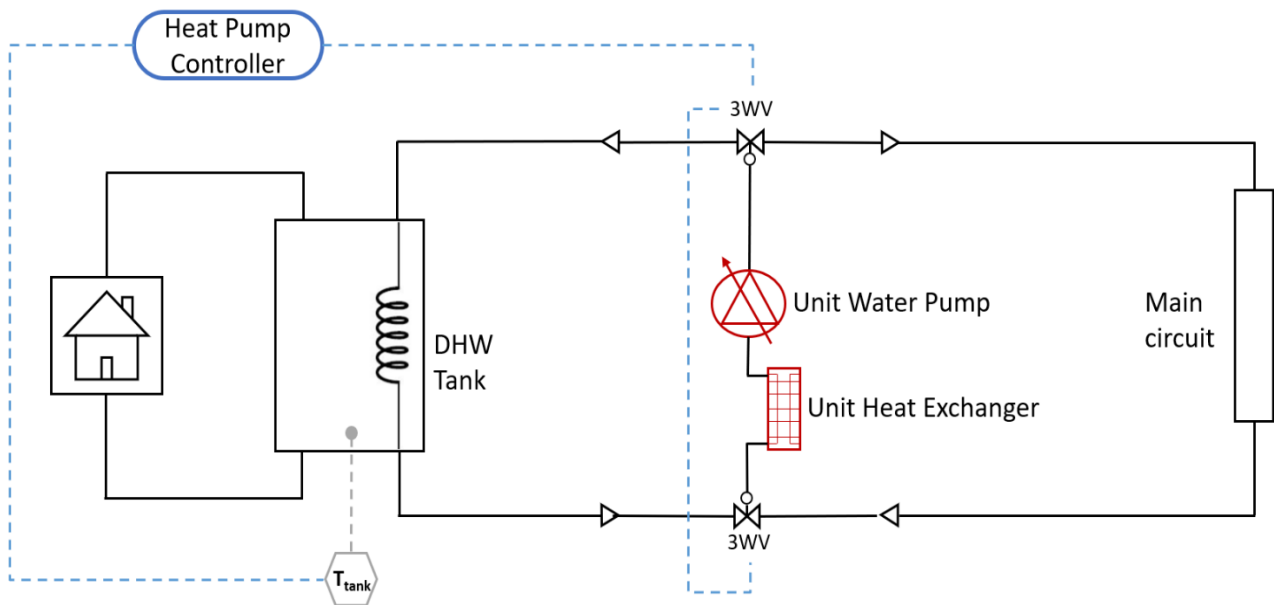
Use of the function will require the addition of the following components to the system:

- Temperature Sensor Tank  
Used for monitoring the temperature of the water inside the storage tank
- 3-Way Valve  
Manages which of the two loops (terminal or tank loop) exchanges heat with the unit in operation. 3WV default position must be the one associated with main circuit loop.

### 2.1 Single-Unit

This configuration temporarily stops capacity exchange with main circuit to allow water tank heating.

In this DHW system, the pump speed control must be set to “On-Off” or “Fixed Speed” (please refer to proper VPF documentation for this setting) while  $T_{\text{tank}}$  – *Tank Temperature* transducer must be an NTC-10K probe.



**WARNING:** Please note that during DHW operation VPF functions are not allowed. Check unit configuration before start.

## 2.2 Multi-Unit

For Multi-Unit setup, M/S functionality needs to be enabled on all units (please refer to M/S documentation for this setting). Tank setpoint, Start Db and Delay of DHW function will follow master's parameter values. In the same way, also the 3WV and DHW functional steps are managed only by master.

For this reason, master must be physically connected to 3WV on water circuit.

In this DHW system, the pump speed control must be set to “On-Off” or “Fixed Speed” (please refer to proper VPF documentation for this setting) while  $T_{\text{tank}}$  – *Tank Temperature* transducer must be an NTC-10K probe.

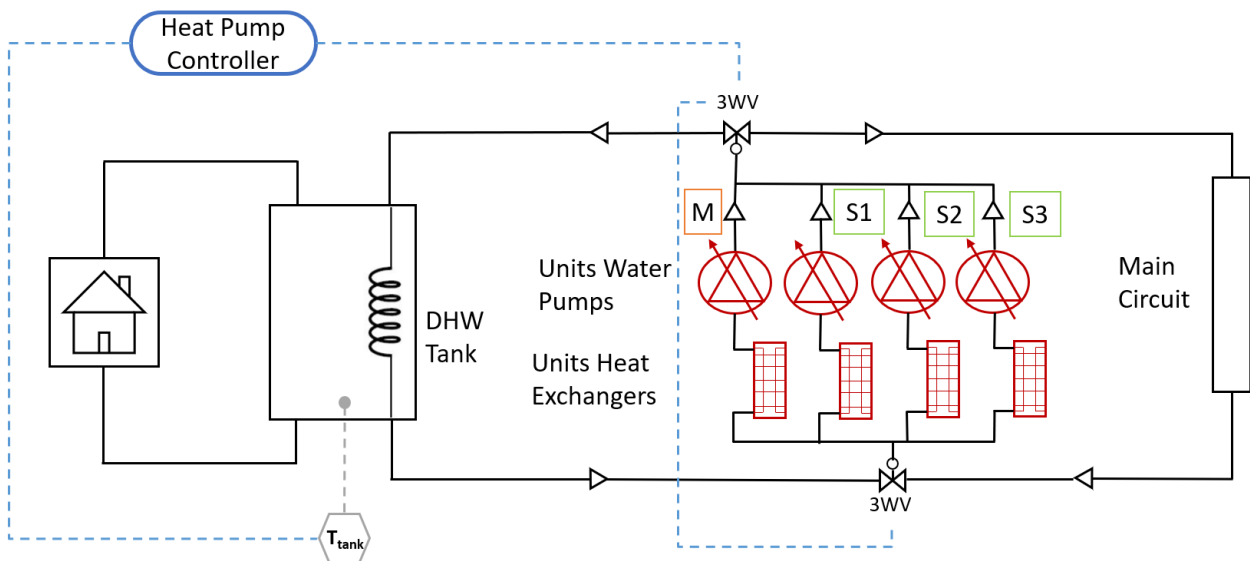
Moreover, several parameters must be set in order to have whole plant working properly. In particular:

1. **DHW Enable Setpoint**  
Domestic Hot Water function must be enabled in all units, master and slaves, that participates to the tank heating
2. **Remote Enable Setpoint**  
Slaves units cannot have IO Ext Module and require to enable via software the DHW function. This setpoint replaces the physical digital input and must be set ON for all slaves connected to tank water circuit.
3. **IO Extension Module Setpoint**  
The extension module must be enabled on Master unit and disabled on all Slaves units.
4. **DIP Switch on Slave's IO Extension Module**  
If a slave has IO Extension Module connected on Modbus network, all its DIP switches need to be set to OFF.
5. **Standby Setpoint**  
Master and slaves connected to tank water circuit must have same value on Standby Mode Setpoint

When M/S and DHW function are both enabled there are 2 possible cases:

### a) DHW Total

All unit in the plant participate to DHW function. M/S and DHW functionalities need to be enabled on all units. Following image shows a 4-units example.



DHW Total Configuration Scheme

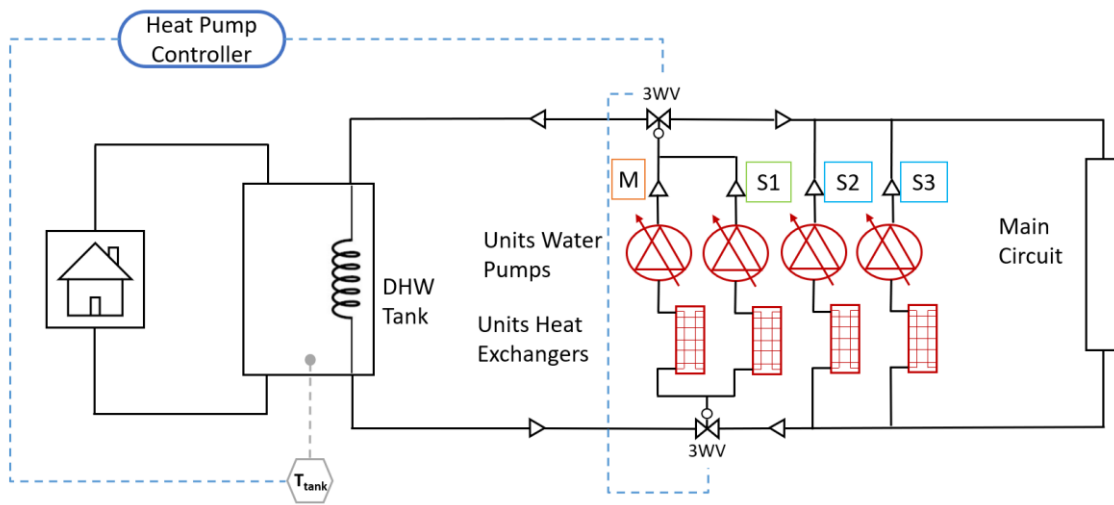
In case “(a) DHW Total”, parameters needed for this setup can be summarized in the following table:

Unit	DHW En	Remote En	IoExtModEn	Standby En	DIP Switches
<b>Master</b>	On	Off	On	On/Off	Address
<b>Slave #1</b>	On	On	Off	On/Off***	All Off
<b>Slave #2</b>	On	On	Off	On/Off***	All Off
<b>Slave #3</b>	On	On	Off	On/Off***	All Off

\*\*\*Slaves’ operating in DHW must have Standby En set as master

#### b) DHW Partial

Some units participate to DHW function while others are connected only to Main Circuit. This configuration allows Tank Heating and Space Heating/Cooling at the same time. Following images shows a 4-units example with master and one slave participating to DHW functionality.



*DHW Partial Configuration Scheme*

In case “(b) DHW Partial”, parameters needed for this setup can be summarized in the following table:

Unit	DHW En	Remote En	IoExtModEn	Standby En	DIP Switches
<b>Master</b>	On	Off	On	On/Off	Address
<b>Slave #1</b>	On	On	Off	On/Off***	All Off
<b>Slave #2</b>	Off	Off	Off	Off	All Off
<b>Slave #3</b>	Off	Off	Off	Off	All Off

\*\*\*Slaves’ operating in DHW must have Standby En set as master



**WARNING:** Please note that unit’s parameters settings must match plant configuration for both “DHW Total” and “DHW Partial”



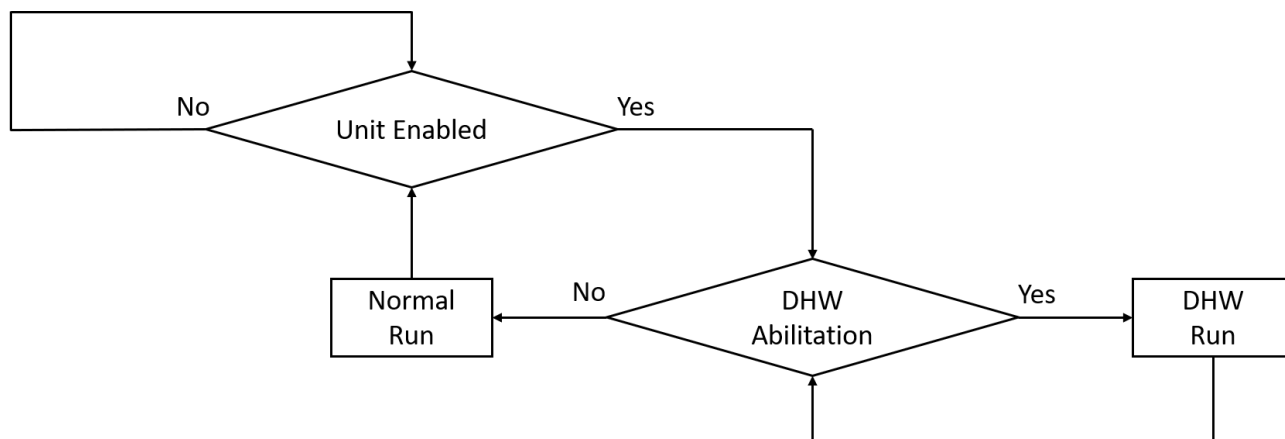
**WARNING:** Previous tables are referred only to the examples shown in images above.

### 3. DHW CONTROL

The production of domestic hot water takes place in "parallel" to the normal operation of the unit. When the machine is running and all DHW start conditions are reached, the unit performs the following steps:

1. Unit Pump-Down (go to 2. if Unit State = Off)
2. Water pump Shutdown
3. 3wv changeover
4. Unit Restart

Once the desired target has been reached or the DHW start conditions will no longer be met, the unit will return to standard operating mode and will be restarted, as shown in the next graph:



Precisely, the following table shows the starting condition for DHW:

IF	AND	Unit Enabled	
		3WV on Main Circuit	
		DHW Enabled	
		OR	Digital Input
			BMS Input (Remote Input)
		Unit Mode Cool/Heat Pump	
		Pump Control "On-Off" or "FixSpd"	
		Analog Input	
		NOT	Unit Alarm
THEN	DHW Start	NOT	Timer Active

Notice that in the starting conditions of the function the enabling of the unit is also present and this means that, if unit is turned off via unit switch or enable, the 3WV will be returned to the standard position (Main Circuit loop).

In this scenario there are two distinct inputs that enable/disable the DHW function, digital and analog, both required to go to DHW mode.

#### 3.1 Digital Input

This input can come from an external system, a contact from a simple thermostat or overwritten via BMS/HMI.

In the digital input management, after UC activates the DHW function, the unit gradually reaches 100% capacity to satisfy the DHW request as soon as possible. When the digital input is deactivated, production of domestic hot water ends and unit returns to the conditions prior to the activation of the function.

- If you want to make the function dependent on the Digital Input only, it is necessary to set the maximum possible value as target of DHW. In this case, if the unit does not activate DHW mode it is because the water temperature inside the tank is above the allowed limits of the machine.

### 3.2 Analog Input

In this case it is an immersion probe placed inside the tank and some parameters need to be configured:

- DHW Setpoint: tank water temperature target
- DHW StartDT: activation threshold of the function below the setpoint
- DHW Delay: delay between two different starts of DHW function

These three parameters together with the reading of the probe placed inside the water tank ( $T_{\text{tank}}$ ), determine the execution logic of the DHW function:

$\text{If } T_{\text{tank}} < \text{MIN}[\text{DHW Setpoint} - \text{DHW StartDT}, \text{Maximum HP Lwt}] \rightarrow \text{Analog Input} = \text{TRUE}$

DHW operations will terminate if this condition is no longer true.

- If you want to make the function dependent only on the Analog Input, it is necessary to short the Digital Input with a 16DC voltage.

### 3.3 3-Way Valve

The three-way valve takes care of the deviation of the water flow from the primary circuit to the tank in case of activation of the DHW function. This is automatically managed by the UC during operations. There are two different valve types:

- Feedback Valve  
This valve requires a digital enable input to divert the flow in one or the other direction and returns the valve start/end position via two digital outputs
- Temporized Valve  
This type of valve has only the digital enabling input and guarantees the complete switch in a certain time without returning feedback on the real position of the valve. Such a valve requires the configuration of a timer for switching operations.

### 3.4 Standby Mode

Unit can be configured to operates only on tank circuit activating a function called “Standby Mode”, during which space heating/cooling is not allowed.

During “Standby operations” the 3WV is always connected to Tank circuit and unit will start/stop to guarantee water tank setpoint.

- In case of Multi-Units setup, if master is configured to operates in “Standby Mode” all slaves connected to tank water circuit must have the same configuration.



#### 4. DHW SETUP MENU

Table below reports all writable and readable parameters available in DHW Settings menu when function is enabled.

*EVCO HMI Parameters*

Menu	Parameter	Default	Range	Description
[19] DHW	[19.00] Setpoint	45	0..Max Heating Sp	Temperature target for tank water
	[19.01] Start Db	2	0..10 °C	Allowed tank water temperature delta under setpoint before DHW function is called
	[19.02] Delay	30	0..600min	Delay between two DHW function calls
	[19.03] Temperature	-	°C	Actual water temperature inside tank
	[19.04] 3wv State	-	0..1	0 = Terminal Loop 1 = Tank Loop
	[19.05] DHW Alarm Code	-	0..31	DHW Alarm word. Each bit represents: Bit_0 = Double Position Error Bit_1 = Lost Start Position Reference Bit_2 = Lost End Position Reference Bit_3 = 3WV Switch Fail Bit_4 = Temperature Sensor Fault
	[19.06] 3wv Type	0	0..1	0 = Feedback 1 = Temporized
	[19.07] 3wv Switch Time	300	0..900sec	Required time for temporized valve to execute a full path switch. If 3WVs equipped with physical feedbacks are used, its value defines the alarm delay for valve reference loss.
	[19.08] Max Time	30	0..1440min	Defines maximum time during which DHW function can be active. Once elapsed this time, unit stops and 3WV is switched back on primary circuit and will not operate in DHW for at least a "Delay" time.
	[19.09] Standby Mode	0	0..1	0 = Standby Mode Disabled 1 = Standby Mode Enabled
	[19.10] Remote En	2	0..2	Represents a software function enabling that replaces digital input: 0 = Disable 1 = Enable 2 = NULL

All parameters can be configured in Web HMI at path:

"Main Menu -> Commission Unit -> Configure Unit -> DHW Settings"

## 5. TROUBLESHOOTING

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In this section are reported all alarm related to the domestic hot water functions and relative troubleshooting. Basically, all DHW errors can be divided into two different types: 3WV fault or Sensor Fault.

### 5.1 3WV Fault

A 3WV fault can be related to connection/wiring issue or to component break up and are available only in temporized valve configuration.

Symptom	Cause	Solution
EVCO HMI's register [07.00] report value [U016] and Bit_0, Bit_1, Bit2_ or Bit_3 of register [19.05]'s value is different from 0 Bell's led of Web HMI (Connectivity kit required) is blinking String in the alarm list: +UnitOffDHWAlarm String in the alarm log: ± UnitOffDHWAlarm String in the alarm snapshot: L UnitOffDHWAlarm	Errors in sensor wiring/connection	Check valve's cabling Check 3WV

### 5.2 Sensor Fault

This alarm can occur when the sensor used to measure the water temperature into tank is broken or not properly connected to chiller.

Symptom	Cause	Solution
EVCO HMI's bit_4 of register [19.05]'s value is different from 0 Bell's led of Web HMI (Connectivity kit required) is blinking	Errors in sensor wiring/connection	Check sensor's cabling

Notice that, in case of sensors fail during DHW operation, the 3WV returned in default position and normal unit operation are allowed.

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