EMERSON EXD-HP1 2 Controller with ModBus Communication Capability Instruction Manual

Contents

EMERSON EXD-HP1 2 Controller with ModBus Communication Capability

Product Information

Specifications

- **Power supply:** AC 24V
- **Power consumption:** EXD-HP1: 15VA, EXD-HP2: 20VA
- **Plug-in connector:** Removable screw terminals wire size 0.14…1.5 mm2
- **Protection class:** IP20
- **Digital Inputs:** Potential free contacts (free from voltage)
- **Temperature sensors:** ECP-P30
- **Pressure sensors:** PT5N
- **Output alarm relay:** SPDT contact 24V AC 1 Amp inductive load; 24V AC/DC 4 Amp resistive load
- **Stepper motor output:** Coil: EXM-125/EXL-125 or EXN-125 Valves: EXM/EXL-… or EXN-…
- **Type of action:** 1B
- **Rated impulse voltage:** 0.5kV
- **Pollution Degree:** 2

Product Usage Instructions

Mounting

The EXD-HP1/2 controller can be mounted on a standard DIN rail. Ensure that the controller is equipped with core cable ends or metallic protective sleeves when connecting wires. When connecting the wires of EXM/EXL or EXN valves, follow the colour coding as listed below:

Terminal	EXM/L-125 wire color	EXN-125 wire color
EXD-HP1	Brown	Red
6	Blue	Blue
7	Orange	Orange
8	Yellow	Yellow
9	White	White
10	–	–
EXD-HP2	Brown	Red
30	Blue	Blue
31	Orange	Orange
32	Yellow	Yellow
33	White	White
34	–	–

Interfacing and Communication
If Modbus communication is not being used, it is necessary to establish interfaces between the EXD-HP1/2 controller and the upper-level system controller. The external digital input should be operated in the function system's compressor/demand. Ensure that necessary precautions are in place to protect the system.

Operating Conditions
The digital input status for the compressor is as follows:

- **Compressor starts/run:** closed (Start)
- **Compressor stops:** open (Stop)

Note:
Connecting any EXD-HP1/2 inputs to the supply voltage will permanently damage the EXD-HP1/2.

Electrical Connection and Wiring
When making electrical connections and wiring, follow these instructions:

- Use a class II category transformer for a 24VAC power supply.
- Do not ground the 24VAC lines.
- It is recommended to use individual transformers for the EXD-HP1/2 controller and third-party controllers to avoid possible interference or grounding problems in the power supply.
- Strip the wire insulation approximately 7 mm at the end.
- Insert the wires into the terminal block and tighten the screws securely.
- Ensure that the wires are properly connected and there are no loose connections.

Display/Keypad Unit (LEDs and Button Functions)
The display/keypad unit of the EXD-HP1/2 controller has the following LED indicators and button functions:

- **ON:** Data display
- **ON:** alarm
- **ON:** ModBus
- Circuit 1

FAQ (Frequently Asked Questions)

- **Q: Can the EXD-HP1/2 controller be used with flammable refrigerants?**
  A: No, the EXD-HP1/2 controller has a potential ignition source and does not comply with ATEX requirements. It should only be installed in a non-explosive environment. For flammable refrigerants, use valves and accessories that are approved for such applications.
- **Q: How should I dispose of the EXD-HP1/2 controller once it reaches the end of its life?**
  A: The EXD-HP1/2 controller should not be disposed of as commercial waste. It is the user's responsibility to pass it to a designated collection point for safe recycling of Waste Electrical and Electronic Equipment (WEEE directive 2019/19/EU). For further information, contact your local environmental recycling centre.

General information

EXD-HP1/2 are stand-alone superheat and or economizer controllers. EXD-HP1 is intended for the operation of one EXM/EXL or EXN valve whereas EXD-HP2 is designed for the operation of two independent EXM/EXL or two EXN valves.

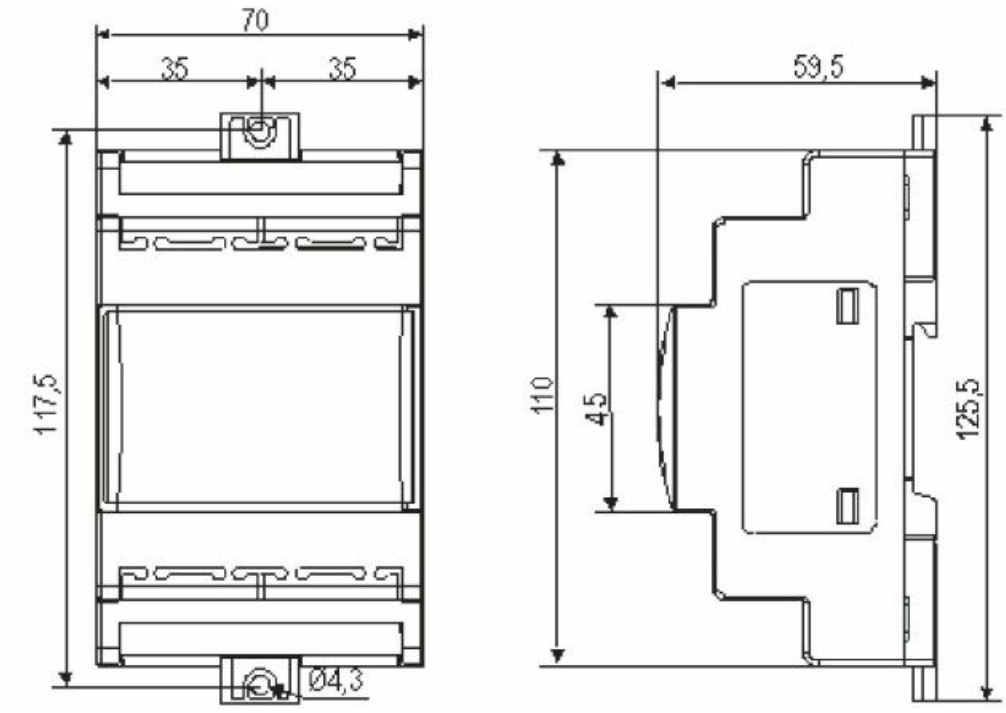
Note:
It is possible to use only Circuit 1 from EXD-HP2. In this case, circuit 2 must be disabled (C2 parameter) and the sensors and the valve for the second circuit are not needed.

ModBus communication is described in a Technical Bulletin and it is not covered by this document.

Technical Data

Power supply	24VAC/DC ±10%; 1A
Power consumption	EXD-HP1: 15VA EXD-HP2: 20VA
Plug-in connector	Removable screw terminals wire size 0.14. 1.5 mm^2
Protection class	IP20
Digital Inputs	Potential free contacts (free from voltage)
Temperature sensors	ECP-P30
Pressure sensors	PT5N
Operating/surrounding temp.	0…+55°C
Output alarm relay	SPDT contact 24V AC 1 Amp inductive load; 24V AC/DC 4 Amp resi stive load
Activated/energized:	During normal operation (no alarm condition)
Deactivated/de-energized:	During alarm condition or power supply is OFF
Stepper motor output	Coil: EXM-125/EXL-125 or EXN-125 Valves: EXM/EXL-… or EXN-…
Type of action	1B
Rated impulse voltage	0.5kV
Pollution Degree	2
Mounting:	For standard DIN rail
Marking	

Dimensions (mm)



Warning -Flammable refrigerants:

EXD-HP1/2 has a potential ignition source and does not comply with ATEX requirements. Installation only in non-explosive environments. For flammable refrigerants only use valves and accessories approved for it!

Safety instructions

- Read operating instructions thoroughly. Failure to comply can result in device failure, system damage or personal injury.
- It is intended for use by persons having the appropriate knowledge and skill.
- Before installation or service disconnect all voltages from the system and device.
- Do not operate the system before all cable connections are completed.
- Do not apply voltage to the controller before the completion of wiring.
- Entire electrical connections have to comply with local regulations.
- Inputs are not isolated, potential free contacts need to be used.
- **Disposal:** Electrical and electronic waste must NOT be disposed of with other commercial waste. Instead, it is the user's responsibility to pass it to a designated collection point for the safe recycling of Waste Electrical and Electronic Equipment (WEEE directive 2019/19/EU). For further information, contact your local environmental recycling centre.

Electrical connection and wiring

- Refer to the electrical wiring diagram for electrical connections.
- **Note:** Keep controller and sensor wiring well separated from supply power cables. The minimum recommended distance is 30mm.
- EXM-125, EXL-125 or EXN-125 coils are supplied with fixed cable and JST terminal block at the cable end. Cut the wires close to the terminal block. Remove the wire insulation approximately 7 mm at the end. It is recommended that the wires end to be equipped with core cable ends or metallic protective sleeve. When connecting the wires of EXM/EXL or EXN, consider the colour coding as follows:

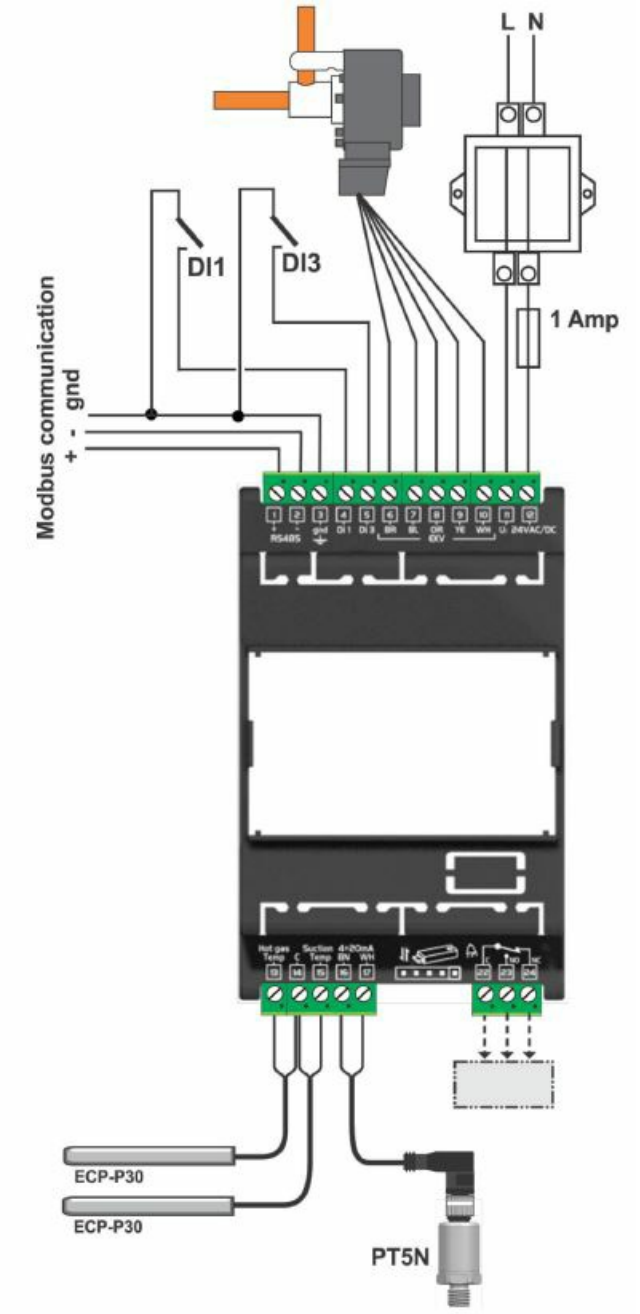
EXD	Terminal	EXM/L-125 wire color	EXN-125 wire color
EXD-HP1	6 BR 7 BL 8 OR 9 YE 10 WH	Brown Blue Orange Yellow White	Red Blue Orange Yellow White
EXD-HP2	30 BR 31 BL 32 OR 33 YE 34 WH	Brown Blue Orange Yellow White	Red Blue Orange Yellow White

- The digital input DI1 (EXD-HP1) and DI1/D12 (EXD-HP1/2) are the interfaces between EXD-HP1/2 and the upper-level system controller if the Modbus communication has not been used. The external digital shall be operated in the function system's compressor/demand.
- If the output relays are not utilized, the user must ensure appropriate safety precautions are in place to protect the system.

Operating condition	Digital input status
Compressor starts/run	closed (Start)
Compressor stops	open (Stop)

Note:
Connecting any EXD-HP1/2 inputs to the supply voltage will permanently damage the EXD-HP1/2.

Wiring base board (EXD-HP 1/2):

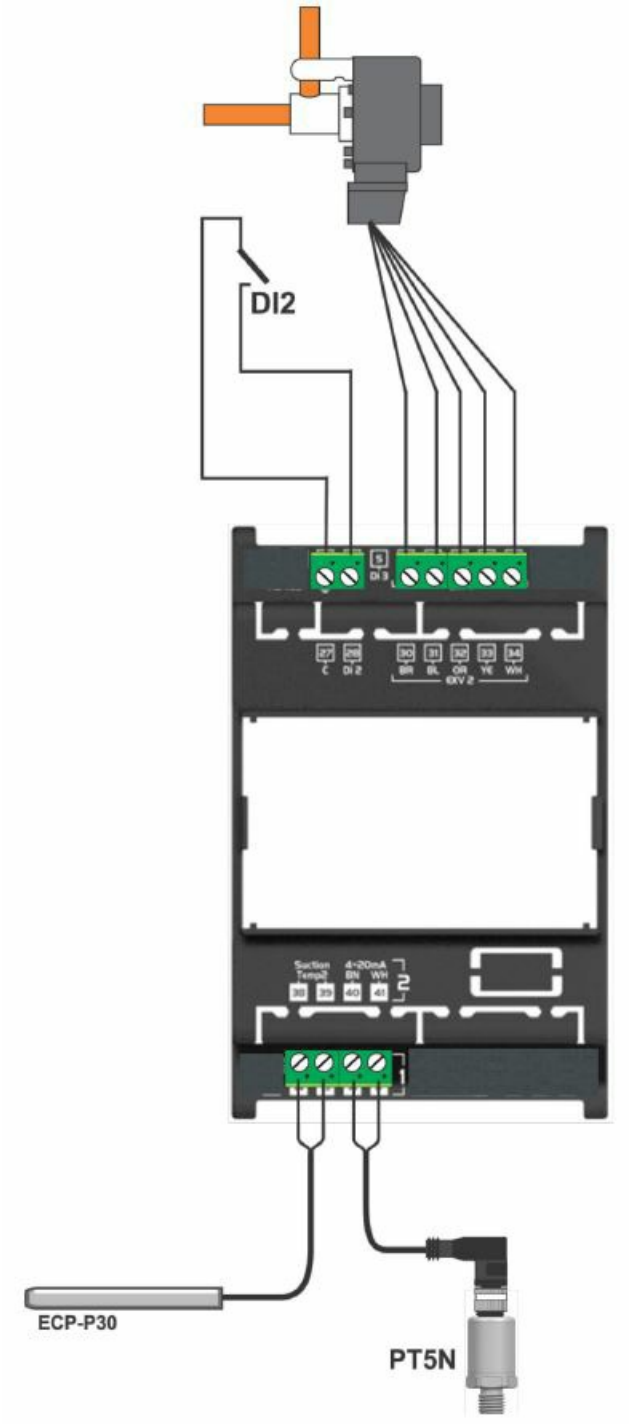


Note:

- The base board is for the function of superheat control or Economizer control.
- Alarm relay, dry contact. The relay coil is not energized during alarm conditions or power off.
- Hot gas discharge sensor input is mandatory only for the economizer control function.

Warning:
Use a class II category transformer for a 24VAC power supply. Do not ground the 24VAC lines. We recommend using individual transformers for the EXD-HP1/2 controller and for third-party controllers to avoid possible interference or grounding problems in the power supply.

Wiring: Upper board (EXD- HP 2):



Note:

- The upper board is only for the function of superheat control.
- The upper board does not need to be wired if the circuit 2 is disabled.

Preparation for Start-up

- Vacuum the entire refrigeration circuit.
- **Warning:** Electrical Control Valves EXM/EXL or EXN are delivered in partially open position. Do not charge the system with refrigerant before the closure of the valve.
- Apply supply voltage 24V to EXD-HP1/2 while the digital input (DI1/DI2) is OFF(open). The valve will be driven to a close position.
- After the closure of the valve, start to charge the system with refrigerant.

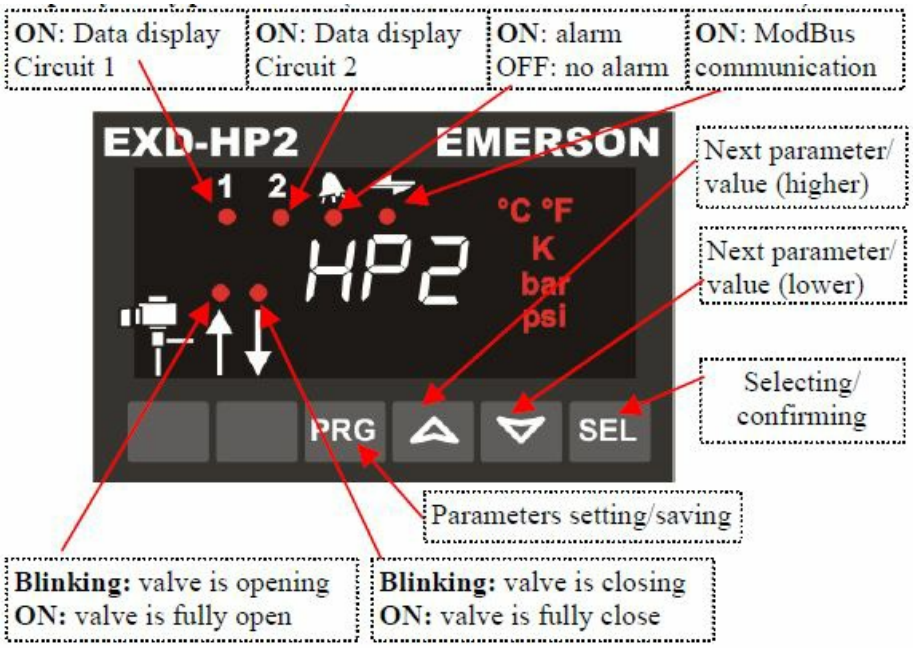
Setup of parameters

(need to be checked/modified before start-up)

- Make sure that digital input (DI1/DI2) is off (open). Turn the power supply ON.
- Four main parameters Password (H5), type of function (1uE), refrigerant type (1u0/2u0) and pressure sensor type (1uP/2uP) can be set only when digital input DI1/DI2 is off (open) while the power supply is ON (24V). This feature is for added safety to prevent accidental damage to compressors and other system components.
- Once the main parameters have been selected/saved the EXD-HP1/2 is ready for startup. All other parameters can be modified at any time during operation or standby if it is necessary.

Display/keypad unit

Display/keypad unit (LEDs and button functions)



Procedure for parameter modification:
The parameters can be accessed via the 4-button keypad. The configuration parameters are protected by a numerical password. The default password is “12”. To select the parameter configuration:

- Press the PRG button for more than 5 seconds, A flashing “0” is displayed
- Press ▲ until “12” is displayed; (password)
- Press SEL to confirm the password
- Press ▲ or ▼ to show the code of the parameter that has to be changed
- Press SEL to display the selected parameter value
- Press ▲ or ▼ to increase or decrease the value
- Press SEL to temporarily confirm the new value and display its code

- Repeat the procedure from the beginning “press  or  to show…”

To exit and save the new settings:

- Press  to confirm the new values and exit the parameters modification procedure.

To exit without modifying/saving any parameters:

- Do not press any button for at least 60 seconds (TIME OUT).

Reset all parameters to factory setting:

- Make sure that digital input (DI1/DI2) is Off (open).
- Press  and  together for more than 5 seconds.
- A flashing “0” is displayed.
- Press  or  until the password is displayed (Factory setting = 12).
- If the password was changed, select the new password.
- Press  to confirm the password
- Factory settings are applied

Note:
In standard mode, the actual superheat is shown on the display. In the case of liquid injection and economizer function this change to discharge temperature.

- To display other data of circuit 1 of EXD-HP1/2 or 2 of EXD-HP2:
  - Press  and  together for 3 seconds to show data from Circuit 1
  - Press  and  together for 3 seconds to show data from Circuit 2
- **To display data of each circuit:** Press  the button for 1 second until the index number according to the below table appears. Release the  button and the next variable data will appear. By repeating above procedure, variable data can be displayed in a sequence as Measured superheat (K) → Measured suction pressure (bar) → Valve position (%) → Measured suction gas temperature (°C) → Calculated saturated temperature (°C) → Measured discharge temperature (°C) (if economizer function is selected) →REPEATING….

Variable data	Circuit 1 (EXD-HP1/2)	Circuit 2 (EXD-HP2)
Default Superheat K	1 0	2 0
Suction pressure bar	1 1	2 1
Valve position %	1 2	2 2
Suction gas temp °C.	1 3	2 3
Saturation temp. °C	1 4	2 4
Discharge temp. °C	1 5	–

Note

1. Discharge temp. is available only if the economizer function is selected.
2. After 30 minutes, the display reverts to index 0.

Manual alarm reset/clearing functional alarms (except hardware errors):

Press PRG and SEL together for 5 seconds. When the clearing is done, a “CL” message appears for 2 seconds.

Manual mode operation

Press PRG and ▼ together for 5 seconds to access to manual mode operation.

List of parameters in scrolling sequence by pressing ▼ the button

Code	Parameter description and choices	Min	Max	Factory setting	Field setting
1Ho	Manual mode operation; circuit 1	0	1	0	
	0 = off; 1 = on				
1HP	Valve opening (%)	0	100	0	
2Ho	Manual mode operation; circuit 2	0	1	0	
	0 = off 1 = on				
2HP	Valve opening (%)	0	100	0	

Note:
During manual operation, functional alarms such as low superheat are disabled. It is recommended to monitor the system operation when the controller is operated manually. Manual operation is intended for the service or temporary operation of the valve at a specific condition. After achieving the required operation, set the parameters 1Ho and 2Ho at 0 so the controller automatically operates the valve(s) according to its setpoint(s).

List Of Parameters

List of parameters in scrolling sequence by pressing ▼ button:

Code	Parameter description and choices			Min	Max	Factory setting
H5	Password			1	1999	12
Adr	ModBus address			1	127	1
br	Modbus baudrate			0	1	1
PAr	Modbus parity			0	1	0
-C2	Circuit 2 of EXD-HP2 enabled			0	1	0
	0 = Enabled;	1 = Disabled				
-uC	Units conversion			0	1	0
	0 = °C, K, bar; 1 = F, psig This Parameter affects only the display. Internally the units are always SI-based.					
HP-	Display mode			0	2	1
	0 = No display	1 = Circuit 1	2 = Circuit 2 (only EXD-HP2)			

Parameters Circuit 1				
1uE	Function	0	1	1
	0 = Superheat control 1 = Economizer control (Only for R410A/R407C/R32)			
1u4	Superheat control mode	0	4	0
	0 = Standard control coil heat exchanger 1 = Slow control coil heat exchanger 2 = fixed PID 3 = fast control plate heat exchanger (not for 1uE = 1) 4 = Standard plate heat exchanger (not for 1uE = 1)			
	Refrigerant	0	15	2

1u0	0 = R22 1 = R134a 2 = R410A 3 = R32 4 = R407C 5 = R290* 6 = R448A 7 = R449A 8 = R452A 9 = R454A* 10 = R454B* 11 = R454C* 12 = R513A 13 = R452B* 14 = R1234ze* 15 = R1234yf * *) EXN not permitted **<u>*) Warning -Flammable refrigerants:</u> EXD-HP1/2 has a potential ignition source and does not comply with ATEX requirements. Installation only in non-explosive environments. For flamm able refrigerants only use valves and accessories approved for it!**				
1uP	Installed pressure sensor type			0	3	2
	0 = PT5N-07… 2 = PT5N-30…	1 = PT5N-18… 3 = PT5N-10P-FLR				
1uu	Start valve opening (%)			10	100	20
1u9	Start opening duration (second)			1	30	5
1uL	Low superheat alarm function			0	2	1
	0 = disable (for flooded evaporator) 2 = enable manual reset		1 = enable auto reset			
1u5	Superheat set-point (K) If 1uL = 1 or 2 (enabled auto or manual reset) If 1uL = 0 (disabled)			3 0.5	30 30	6 6
1u2	MOP function			0	1	1
	0 = disable	1 = enable				
1u3	MOP set-point (°C) saturation temperature Factory setting acc ording to selected refrigerant (1u0). The default value can be changed			see MOP table		

Code	**Parameter description and choices**	**Min**	**Max**	**Factory se tting**
1P9	Low pressure alarm mode circuit 1	0	2	0
	0 = disabled 1 = enabled auto reset 2 = enabled manual reset			
1PA	Low pressure alarm cut-out circuit 1	-0.8	17.7	0
1Pb	Low pressure alarm delay circuit 1	5	199	5
1Pd	Low-pressure alarm cut-in circuit 1	0.5	18	0.5
1P4	Freeze protection alarm function	0	2	0
	0 = disabled, 1 = enabled auto-reset, 2 = enabled manual reset			

1P2	Freeze alarm cut-out circuit 1	-20	5	0
1P5	Freeze protection alarm delay, sec.	5	199	30
1P-	Superheat control circuit 1 fixed PID (Kp factor) Display 1/10K	0.1	10	1.0
1i-	Superheat control circuit 1 fixed PID (Ti factor)	1	350	100
1d-	Superheat control circuit 1 fixed PID (Td factor) Display 1/10K	0.1	30	3.0
1EC	Hot gas temperature sensor source	0	1	0
	0 = ECP-P30 1 = Via Modbus input			
1PE	Economizer control circuit 1 fixed PID (Kp factor) Display 1/ 10K	0.1	10	2.0
1iE	The economizer control circuit 1 fixed PID (Ti factor)	1	350	100
1dE	Economizer control circuit 1 fixed PID (Td factor) Display 1/ 10K	0.1	30	1.0
1uH	High superheat alarm mode circuit 1 0 = disabled 1 = enabled auto-reset	0	1	0
1uA	High superheat alarm setpoint circuit 1	16	40	30
1ud	High superheat alarm delay circuit 1	1	15	3
1E2	Positive correction of measured Hotgas temperature.	0	10	0
Parameters Circuit 2 (only EXD-HP2)				
Code	**Parameter description and choices**	**Min**	**Max**	**Factory se tting**
2u4	Superheat control mode	0	4	0
	0 = Standard control coil heat exchanger 1 = Slow control coil heat exchanger 2 = fixed PID 3 = fast control plate heat exchanger 4 = Standard plate heat exchanger			
2u0	System Refrigerant	0	5	2
	0 = R22 1 = R134a 2 = R410A 3 = R32 4 = R407C 5 = R290* 6 = R448A 7 = R449A 8 = R452A 9 = R454A* 10 = R454B* 11 = R454C* 12 = R513A 13 = R452B* 14 = R1234ze* 15 = R1234yf * *) EXN not permitted **<u>*) Warning -Flammable refrigerants:</u> EXD-HP1/2 has a potential ignition source and does n ot comply with ATEX requirements. Installation only in non-explosive environments. For flam mable refrigerants only use valves and accessories approved for it!**			

2uP	Installed pressure sensor type (When DI2 is off)	0	3	1
	0 = PT5N-07… 1 = PT5N-18… 2 = PT5N-30… 3 = PT5N-10P-FLR			
2uu	Start valve opening (%)	10	100	20
2u9	Start opening duration (second)	1	30	5
2uL	Low superheat alarm function	0	2	1
	0 = disable (for flooded evaporator) 1 = enable auto reset 2 = enable manual reset			
2u5	Superheat set-point (K) If 2uL = 1 or 2 (enabled auto or manual reset) If 2uL = 0 (disabled)	3 0.5	30 30	6 6
2u2	MOP function	0	1	1
	0 = disable 1 = enable			
2u3	MOP set-point (°C) saturation temperature Factory setting according to selected refrigerant (2u0). The default value can be changed	see MOP table		
2P9	Low-pressure alarm mode circuit 2	0	2	0
	0 = disabled 1 = enabled auto reset 2 = enabled manual reset			
2PA	Low-pressure alarm cut-out (bar) circuit 2	-0.8	17.7	0
2Pb	Low-pressure alarm delay (sec) circuit 2	5	199	5
2Pd	Low-pressure alarm cut-in (bar) circuit 2	0.5	18	0.5
2P4	Freeze protection alarm function	0	2	0
	0 = disable, 1 = enable auto-reset, 2 = enable manual reset			

Code	Parameter description and choices	Min	Max	Factory setting
2P2	Freeze alarm cut-out circuit 2	-20	5	0
2P5	Freeze protection alarm delay, sec.	5	199	30
2P-	Superheat control circuit 2 (Kp factor), fixed PID Display 1/10K	0.1	10	1.0
2i-	Superheat control circuit 2 (Ti factor), fixed PID	1	350	100
2d-	Superheat control circuit 2 (Td factor), fixed PID – Display 1/10K	0.1	30	3.0
2uH	High superheat alarm mode circuit 2 0 = disabled 1 = enabled auto-reset	0	1	0
2uA	High superheat alarm setpoint (K) circuit 2	16	40	30
2ud	High superheat alarm delay (Min) circuit 2	1	15	3

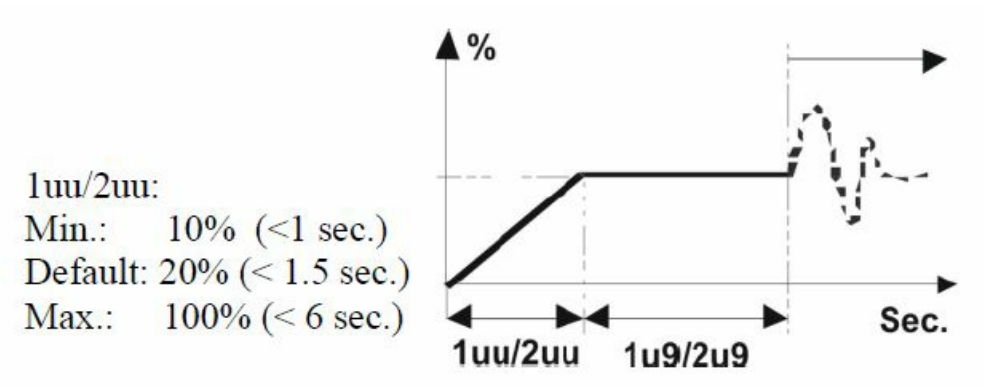
Selection for both circuits and discharge temperature control				
Code	**Parameter description and choices**	**Min**	**Max**	**Factory setting**
Et	Valve type 0 = EXM / EXL 1 = EXN	0	1	0
	Note: EXD-HP2 can drive two similar valves i.e. both valves must be either EXM/EXL or EXN.			
1E3	Discharge Temperature Setpoint Start Setpoint	70	140	85
1E4	Discharge Temperature Control band	2	25	20
1E5	Discharge Temperature limit	100	150	120

MOP table (°C)

Refrigerant	Min.	Max.	Factory s etting	Refrigerant	Min.	Max.	Factory s etting
R22	-40	+50	+15	R452A	-45	+66	+15
R134a	-40	+66	+15	R454A	-57	+66	+10
R410A	-40	+45	+15	R454B	-40	+45	+18
R32	-40	+30	+15	R454C	-66	+48	+17
R407C	-40	+48/	+15	R513A	-57	+66	+13
R290	-40	+50	+15	R452B	-45	+66	+25
R448A	-57	+66	+12	R1234ze	-57	+66	+24
R449A	-57	+66	+12	R1234yf	-52	+66	+15

Control (valve) start-up behavior

(Parameter 1uu/2uu and 1u9/2u9)



Upload/download Key: Function
For serial production of systems/units, the upload/download key allows the transmission of configured parameters among a range of identical systems.

Uploading procedure:
(storing configured parameters in key)

- Insert the key while the first (reference) controller is ON and press the button; the “uPL” message appears followed by the “End” message for 5 seconds.
- Note: If the “Err” message is displayed for failed programming, repeat the above procedure.

Downloading procedure:
(configured parameters from key to other controllers)

- Turn off the power to the new controller
- Insert a loaded Key (with stored data from the reference controller) into the new controller and turn on the power supply.
- The stored parameters of the key will be downloaded automatically into the new controller memory; The “doL”

message appears followed by an “End” message for 5 seconds.

- The new controller with the new loaded parameters setting will start to operate after the “End” message disappears.
- Remove the key.
- **Note:** If the “Err” message is displayed for failed programming, repeat the above procedure.

Error/Alarm handling

Alarm code	Description	Related parameter	Alarm relay	Valve	What to do?	Requires manual reset after resolving alarm
1E0/2E0	Pressure sensor 1/2 error	–	Triggered	Fully close	Check the wiring connection and measure the signal 4 to 20 mA	No
1E1/2E0	Temperature sensor 1/2 error	–	Triggered	Fully close	Check the wiring connection and measure the resistance of the sensor	No
1Ed	Discharge hot gas temperature sensor 3 error	–	Triggered	Operating	Check the wiring connection and measure the resistance of the sensor	No
1П-/2П-	EXM/EXL or EXN electrical connection error	–	Triggered	–	Check the wiring connection and measure the resistance of the winding	No
1Ad	Discharge hot gas temperature above the limit		Triggered	Operating	Check valve opening/ check liquid flow for flash gas free/check discharge hot gas temperature sensor	No
1AF/2AF	Freeze protection	1P4/2P4: 1	Triggered	Fully close	Check the system for causes of low pressure such as insufficient load on the evaporator	No
1AF/2AF blinking		1P4/2P4: 2	Triggered	Fully close		Yes
1AL/2AL	Low superheat (<0,5K)	1uL/2uL: 1	Triggered	Fully close	Check the wiring connection and operation of the valve	No
1AL/2AL blinking		1uL/2uL: 2	Triggered	Fully close		Yes
1AH/2AH	High superheat	1uH/2uH: 1	Triggered	Operating	Check the system	No
1AP/2AP	Low pressure	1P9/2P9: 1	Triggered	Operating	Check the system for causes of low pressure such as refrigerant loss	No
1AP/2AP blinking		1P9/2P9: 2	Triggered	Operating		Yes
Err	Failed uploading /downloading	–	–	–	Repeat the procedure for uploading/downloading	No

Note:
When multiple alarms occur, the highest priority alarm is displayed until being cleared, then the next highest alarm is displayed until all alarms are cleared. Only then will parameters be shown again.

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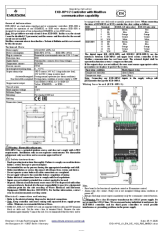
- www.climate.emerson.com/en-gb.

Documents / Resources

	EMERSON EXD-HP1 2 Controller with ModBus Communication Capability [pdf] Instruction Manual EXD-HP1 2 Controller with ModBus Communication Capability, EXD-HP1 2, Controller with ModBus Communication Capability, ModBus Communication Capability, Communication Capability

References

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