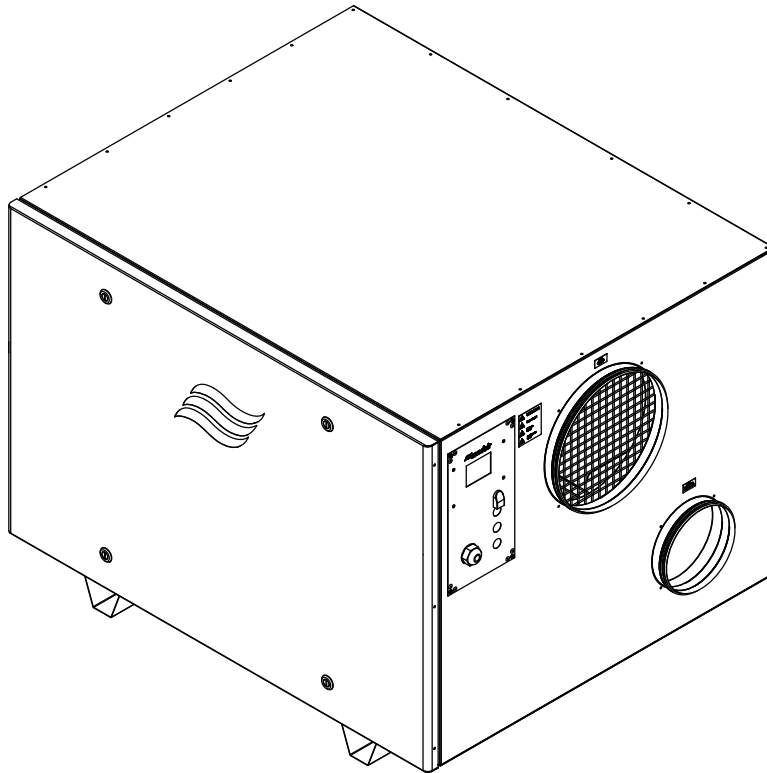


IMPORTANT! Read and save these instructions. This manual to be left with the equipment.

2597586_B_EN_2107_DA_IOM



DA
SERIES



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

Condair DA Series Desiccant Dryer
Condair DA-Series

Thank you for choosing Condair

Installation date (DD / MM / YYYY):

Commissioning date (DD / MM / YYYY):

Site:

Model:

Serial number:

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1 Introduction

1.1 Getting Started

Thank you for purchasing the Condair DA Series Desiccant Dryer.

The Condair DA Series Desiccant Dryer incorporates the latest technical advances and meets recognized safety standards. Improper use of the Condair DA Series Desiccant Dryer may result in danger to the user or third parties, and/or damage to property.

To ensure safe, proper, and efficient operation of the Condair DA Series Desiccant Dryer, please observe and comply with all information and safety instructions contained in this manual, as well as all relevant documentation of components of the installed dehumidification system.

If you have additional questions, please contact your Condair representative. They will be glad to assist you.

1.2 General

1.2.1 Limitations of the Manual

The subject of this manual is the Condair DA Series Desiccant Dryer in its different versions. The various options and accessories that are described in this manual pertain to the proper operation of the equipment. Additional information and instructions are supplied with the options and accessories. It is intended as a supplement to the installation, operation and maintenance manuals.

This manual is restricted to the **installation, operation, and maintenance** of the Condair DA Series Desiccant Dryer. This manual is intended for **competent personnel** suitably qualified for their respective tasks. The specifications are supplemented by various separate items of documentation (such as the parts list). Where necessary, appropriate cross-references are made to these publications in the specification.

1.2.2 Symbols Used in This Manual



CAUTION!

The word "CAUTION" in conjunction with the general caution symbol is used to provide safety instructions that, if neglected, may cause damage or malfunction of the unit, or damage to property.



WARNING!

The word "WARNING" in conjunction with the general warning symbol is used to provide safety instructions that, if neglected, may cause injury to personnel. Other specific warning symbols may also be used in place of the general symbol.



Danger!

The word "DANGER" in conjunction with the general danger symbol is used to provide safety instructions that, if neglected, may cause severe injury to personnel or even death. Other specific danger symbols may also be used in place of the general symbol.

1.2.3 Storage of Manual

Keep this manual in a place where it is safe and readily accessible. If the equipment is moved to another location, please ensure that it remains with the equipment.

If the manual is lost or misplaced, please contact Condair for a replacement.

1.3 Receiving and Storage

1.3.1 Inspection

After receiving the shipment, inspect the goods as follows:

- Inspect the shipping boxes for damage. Report any shipping box damages to the shipping company without delay.
- Check the goods against the packing slip to ensure that all items have been delivered. Report any shortages to your Condair representative within 48 hours of receipt of the goods. Condair does not accept responsibilities for any shortages beyond this period.
- Unpack the parts/components and check for any damage. If parts/components are damaged, notify the shipping company immediately.
- Verify the model type on the specification label to ensure that it is suitable for your installation. Refer to ["Model Designation" on page 14](#).

1.3.2 Storage, Packaging, and Transportation

Storage

Store the Condair DA Series Desiccant Dryer in its original packaging inside a protected area that meets the following requirements until it is installed, or if it needs to be stored for an extended period of time:

- Room temperature: -34 to 104 °F (-30 to 40 °C)
- Room humidity: 0 to 90% RH (non-condensing)

Transportation

For optimum protection always transport the unit and components in their original packaging, and use appropriate lifting/transporting devices (ex. forklift).

Lifting or handling must be carried out by trained and qualified personnel. Ensure that lifting has been fully planned and assessed for possible risks, and that equipment is checked and operated by a skilled operator. It is the customer's responsibility to ensure that operators are fully trained to handle heavy goods and to enforce any applicable lifting regulations.

The unit should be protected from rain and snow, and stand upright.

Avoid placing other goods on top of the unit.

Packaging

Keep the original packaging of the unit/components for later use.

If the packaging needs to be disposed, observe local regulations on waste disposal. Please recycle packaging where possible.

1.4 Safety Precautions

IMPORTANT! Never use the dehumidifier without the filters. The filters help prevent contamination of the desiccant rotor and reduces capacity losses. Missing filters will lead to premature failure of the heaters and desiccant wheel.

The dehumidifier is NOT rated to be installed in rooms that require explosion-proof equipment.

The service panel on the dehumidifier should remain closed at all times, except during servicing. **Disconnect the unit from the supply source before servicing the unit.**

The dehumidifier is designed to meet IEC IP 44 requirements.

Regard all safety precautions described in this manual. Refer to ["For Your Safety" on page 10](#).

1.5 Compliance

Follow all local guidelines and regulations regarding the installation and operation of the unit; this includes (and not limited to) mounting, plumbing, water, gas, ventilation, and electrical connections.

Please consult your local Condair representative to learn more.

2 For Your Safety

General

Every person who is tasked with the installation, operation and/or maintenance of the Condair DA Series Desiccant Dryer must read and understand this manual, as well as any respective installation, operation and/or maintenance manuals before performing any work. Knowing and understanding the contents of these manuals is a basic requirement for protecting personnel against any kind of danger, preventing faulty operation, and operating the unit safely and correctly.

All labels, signs and markings applied to unit must be observed, kept in a readable state, and NOT removed or altered.

Personnel Qualifications

All procedures described in this document must only be performed by personnel who are adequately qualified, familiar with the unit, well trained, and are authorized by the customer.

For safety and warranty reasons, any activity beyond the scope of this manual must only be performed by qualified personnel authorized by Condair.

The unit may not be used by persons (including children) with reduced physical, sensory, or mental abilities, or persons lacking experience and knowledge — unless they are being supervised by a person responsible for their safety, or have received proper instruction on the operation of the system.

All personnel working with the Condair DA Series Desiccant Dryer unit must be familiar with, and comply with the appropriate regulations on workplace safety and prevention of accidents.

Intended Use

The Condair DA Series Desiccant Dryer is intended exclusively for air dehumidification and product drying using Condair-approved parts within specified operating conditions (such as dehumidification of air at atmospheric pressure). Refer to ["Technical Data" on page 17](#) in for details. Any other type of application, without the express written consent of Condair, is considered to be NOT conforming to its intended purpose, and may lead to dangerous operation and will void the warranty.

In order to operate the equipment in the intended manner all information contained in this manual, in particular the safety instructions, must be observed closely.

Safety Precautions that Must be Observed



DANGER!

Risk of electric shock!

The unit is mains powered. Using the On/Off button on the touch screen to shut down the unit will not remove power from the unit. Live parts may be exposed when the access panels or doors are removed. Touching live parts may cause severe injury or even death.

Prevention: Before performing any work inside the dehumidifier, shut down the dehumidifier properly, as described in ["Shutting Down the Unit" on page 39](#). The unit must be connected to the mains only after all mounting, installation, and maintenance work has been completed, checked for correct workmanship, and the access panels/doors are closed and fastened securely. Secure the unit against accidental power-up.

Only qualified personnel should perform maintenance or repairs on the unit.

Follow any lockout procedures when servicing the unit.

**WARNING!****Risk of severe burns from contact with hot vapors!**

The dehumidifier has an internal heater that heats the air to over 248 °F (120 °C), and can dispel wet air with temperatures over 176 °F (80 °C). Contact with hot vapors can result in severe burns.

Prevention: Never perform any work while the dehumidifier is operating. Shut down the dehumidifier and wait for the components to **cool down (at least 15 min)** before working on the system. Wear appropriate personal protective equipment when working near hot vapors. Refer to ["Shutting Down the Unit" on page 39](#) before fixing any leaks in the system.

**WARNING!****Risk of severe burns from contact with hot surfaces!**

The components in the dehumidifier get very hot during operation. Some components in the dehumidifier can be over 248 °F (120 °C). Contact with hot surfaces can result in severe burns.

Prevention: Avoid contact with hot surfaces. Shut down the dehumidifier and allow components to cool down before working on the dehumidifier. Refer to ["Shutting Down the Unit" on page 39](#).

**DANGER!****The unit contains moving parts. Putting objects or body parts into the unit can result in serious injury or damage to equipment!**

The unit contains rotating parts, such as fans and a rotor. The rotor is heated by air with a temperature between 176-248 °F (80-120 °C). Putting objects into the fan or rotor will affect the proper functioning of the unit, causing damage to the object and the equipment, and will become a safety hazard for people in the vicinity of the unit.

Prevention: Avoid placing objects and body parts into the fan, and if work must be performed, ensure that the unit is properly shut down and electrical power is removed.

**CAUTION!**

The desiccant dryer can only be used for dehumidification of air and product drying at atmospheric pressure.

The desiccant dryer must **NEVER** be used without the filters. This is to protect the rotor and heaters, and maintain capacity.

The desiccant dryer must **NOT** be installed in areas where explosion proof equipment is required.

Preventing Unsafe Operation

All personnel working with the Condair DA Series Desiccant Dryer must immediately report to the customer any alterations or changes to the unit that may affect safety, and **secure the unit against accidental power-up**.

If it is suspected that the unit cannot be operated safely for any of the reasons listed below, shut it down immediately.

Alterations and changes that may affect safe operation include:

- damage to the unit
- loose or damaged electrical connections
- improper operation
- leaks in the distribution system

Modifications to the Unit Prohibited

Modifications are NOT permitted on the Condair DA Series Desiccant Dryer without the express written consent of Condair.

3 Product Description

3.1 General Description

The Dehumidifier consists of a solid desiccant wheel containing hygroscopic Silica Gel that absorbs moisture from process air (air to be dried), at atmospheric pressure, with a temperature range between -22 to 104 °F (-30 to 40 °C).

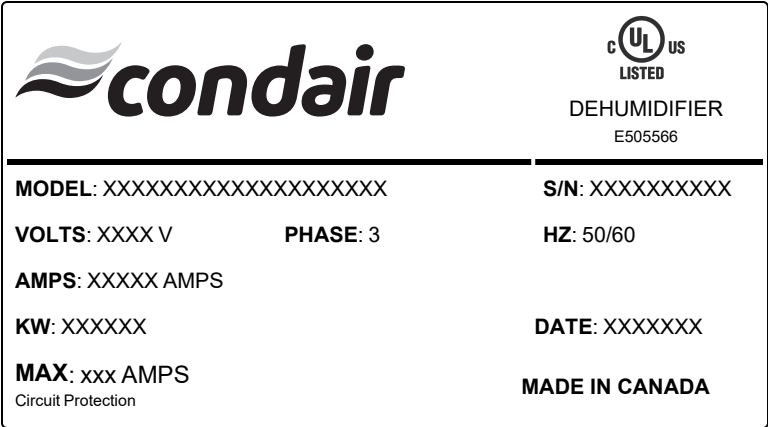
Examples of applications:

- Drying temperature of sensitive products
- Drying after water damage, and during construction
- Controlling humidity in production processes
- Helps protect sensitive equipment from corrosion
- Controlling humidity in museums and archives
- Improving environment in damp areas

The Condair DA series comes in seven model sizes with two different voltages. Refer to ["Technical Data" on page 17](#) for more information.

3.2 Model Designation

The specification label on the side of the Condair DA Desiccant Dryer shows the model type, serial number, and other ratings. Refer to the figure below.



3.3 Functional Description

The Condair DA Series Desiccant Dryer operates with two air streams; a large volume air stream (process air) and a smaller volume air stream (reactivation air) that pass through a desiccant rotor in the unit. The air streams pass through the rotor in opposing directions and are driven by fans at the process air inlet and the reactivation air inlet. These air streams are separated by dividers on the surface of the rotor, and the opposing air streams are ducted separately. Refer to [Figure 1 below](#).

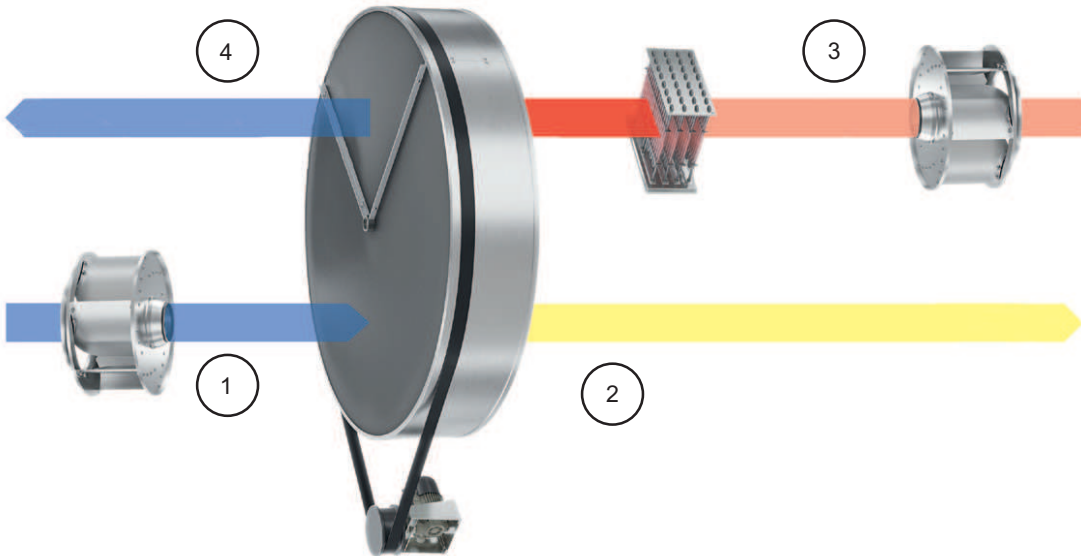


Figure 1 - Dehumidification Process

- 1. Process air
- 2. Dry air
- 3. Reactivation air
- 4. Wet air

The desiccant, embedded in a matrix on axial flutes of the rotor, contains Silica gel, a hygroscopic material, that absorbs water vapor directly from the air. As the water vapor in the process air is absorbed, the air exiting the desiccant becomes warmer and dryer, and the moisture content in the desiccant increases. The dry air leaving the rotor then enters the space that needs dehumidification. **The adsorption process works in temperatures between -22 to 104 °F (-30 to +40 °C).**

IMPORTANT! The adsorption process works in temperatures between -22 to 104 °F (-30 to +40 °C); however, the adsorption process may also be reversed (i.e. the desiccant is reactivated). Heated air, +248 °F (120 °C), can remove moisture from the desiccant.

The smaller air stream (reactivation air) is heated to +248 °F (120 °C) by an internal heater and passes through the rotor, absorbing moisture from the Silica gel, reactivating it. As such, the reactivation air has an increase in humidity. The warm, moist air is then ducted out of the building or space. The warm wet air leaving the rotor can reach +176 °F (80 °C).

Casing

The desiccant dryer is for industrial and commercial use, and can be stacked. Service to the unit can be performed by removing the access panel from the side of the unit.

The resistant double-skin housing consists of AluZinc® and RAL9006 powder coating and is insulated with 1.2 in (30 mm) thick non-combustible mineral wool.

Rotor

Dehumidification is performed by passing air over a desiccant rotor made of desiccant containing Silica Gel housed on heat-resistant sheets. These sheets are placed axially through the rotor, providing a large surface area to volume ratio for which moisture absorption may occur, and can withstand moisture-saturated air without being damaged.

The rotor rotates around a stainless steel shaft and ball bearings to provide consistent performance. A belt drive is tightly wrapped (under tension to prevent slipping) around the rim of the rotor and is driven by a pulley on a geared electric motor.

Note: The rotor will not be damaged even if the fan or the reactivation heater should fail during operation.

Note: The rotor may be used in conjunction with a pre-cooling coil.

Note: The rotor is incombustible and non-flammable, with smoke index of 0.

Rotor Seals

The rotor has two silicone/Teflon seals on the rotor casing to help protect the rotor. There are also four Teflon radial seals.

Rotor Guard

The unit is equipped with an inductive rotor guard. The rotation guard helps ensure that the rotor is rotating quickly enough. A magnet on the rotor passes by a sensor in the unit. If the magnet does not pass the sensor within 45 minutes, an alarm is activated. If the alarm is activated, the rotation guard stops the unit from dehumidifying, and deactivates the reactivation heater if the unit is restarted. If available, the rotor guard can be turned on by going to the Service level page (refer to ["Service Level Settings" on page 36](#)).

Filters

IMPORTANT! Never use the dehumidifier without the filters. Operation without a filter will result in reduced life of the unit and critical failure.

The dehumidifier has two separate panel filters; one for the process air (air to be dried) inlet, and one for the reactivation air inlet. Filters clean the air prior to entering the unit and will extend the use of the rotor.

Fans (Process and Reactivation Air)

The process air and reactivation air fans (radial) are powered by energy efficient electronically commutated (EC) motors. They are accessible for service behind the panels on the dehumidifier.

The reactivation fan in the unit will continue to operate for 6 minutes after the unit is turned off.

Reactivation Heater

The positive temperature coefficient (PTC) type reactivation heater warms air that passes from the reactivation fan to the rotor to remove moisture from the desiccant. The reactivated wet air is then removed from the space.

Rotor Drive Motor

The rotor drive motor has ball bearings that drive the rotor using a drive belt and pulley system. The bearings are designed to last the life of the motor and no maintenance is required.

Electrical Panel

The electrical panel is located behind the service panel, in a separate compartment in the dehumidifier. Switches and indications are located on a touch screen on the unit.

4 Product Specifications

4.1 Technical Data

4.1.1 Capacity

Table 1: Condair DA Series Desiccant Dryer Capacities

Condair DA Unit	Voltage V Ph Hz	Volume Air Moved CFM (m ³ /h)	Regeneration Air Volume CFM (m ³ /h)	Drying Capacity* Moisture Removed lbs/h (kg/h)
Condair DA 300	208 V 3 Phase 50/60 Hz	275 (467.2)	88 (150)	6 (2.7)
Condair DA 300	480 V 3 Phase 50/60 Hz	130 (220.9)	88 (150)	7 (3.2)
Condair DA 400	208 V 3 Phase 50/60 Hz	300 (509.7)	129 (220)	11 (5.0)
Condair DA 400	480 V 3 Phase 50/60 Hz	320 (543.7)	129 (220)	11 (5.0)
Condair DA 600	208 V 3 Phase 50/60 Hz	360 (611.6)	206 (350)	13 (5.9)
Condair DA 600	480 V 3 Phase 50/60 Hz	350 (594.7)	206 (350)	14 (6.4)
Condair DA 800	208 V 3 Phase 50/60 Hz	320 (543.7)	235 (400)	21 (9.5)
Condair DA 800	480 V 3 Phase 50/60 Hz	530 (900.5)	235 (400)	21 (9.5)
Condair DA 1400	208 V 3 Phase 50/60 Hz	430 (730.6)	294 (500)	27 (12.2)
Condair DA 1400	480 V 3 Phase 50/60 Hz	500 (849.5)	294 (500)	27 (12.2)
Condair DA 2000	208 V 3 Phase 50/60 Hz	430 (730.6)	323 (550)	31 (14.1)
* Drying Capacity at 71.6 °F (22 °C), 50% RH				

4.1.2 Weights

Table 2: Condair DA Weights

Condair DA Unit	Weight lb (kg)
Condair DA 300	408 (185)
Condair DA 400	419 (190)
Condair DA 600	419 (190)
Condair DA 800	430 (195)
Condair DA 1400	441 (200)
Condair DA 2000	441 (200)

4.1.3 Dimensions

Table 3: Condair DA Dimensions

	Casing Dimensions Depth x Width x Height in (mm)	Rotor Model	Air Connection Diameters in (mm)			
			Proc- ess	Dry	React- ivation	Wet
Condair DA 300	39 x 48 x 36 (991 x 1199 x 910)	DAN300-600	15.7 (400)	12.4 (315)	7.9 (200)	7.9 (200)
Condair DA 400						
Condair DA 600						
Condair DA 800		DAN800-2000				
Condair DA 1400						
Condair DA 2000						

4.2 Operating Data

4.2.1 Control Signal

Control Signal Type:	
External Control (humidistat)	0-10 VDC; - at 3 V, first heating stage - at 5 V, second heating stage (if applicable) Reactivation air fan speed: full speed or variable, depending on setting
Internal Control	Humidity sensor - Setpoint entered at dehumidifier control interface

4.2.2 Ambient Operating Conditions

Ambient Conditions						
	Condair DA 300	Condair DA 400	Condair DA 600	Condair DA 800	Condair DA 1400	Condair DA 2000
Humidity	0-100 % RH					
Temperature Range	-22 to 104 °F (-30 to 40 °C)					
Pressure	Atmospheric, 1 atm					

4.2.3 Power

For power supply, refer to ["Technical Data" on page 17](#), or see the specification label on the unit.

Power Consumption and Loads:						
	Condair DA 300	Condair DA 400	Condair DA 600	Condair DA 800	Condair DA 1400	Condair DA 2000
Drying Capacity lbs/h (kg/h) (at 208V)	6 (2.7)	11 (5.0)	13 (5.9)	21 (9.5)	27 (12.2)	31 (14.1)
Drying Capacity lbs/h (kg/h) (at 480V)	7 (3.2)	11 (5.0)	14 (6.4)	21 (9.5)	27 (12.2)	—
Voltage Supply	208 V 480 V	208 V 480 V	208 V 480 V	208 V 480 V	208 V 480 V	208 V
Phase Hz	Phase: 3 Hz: 50/60	Phase: 3 Hz: 50/60	Phase: 3 Hz: 50/60	Phase: 3 Hz: 50/60	Phase: 3 Hz: 50/60	Phase: 3 Hz: 50/60
Max. Amps A (at 208 V)	16.0	24.5	33.1	41.0	60.0	61.5
Max. Amps A (at 480 V)	9.5	11.5	15.5	18.8	24.2	—
Max. Power Consumption kW (at 208 V)	5.8	8.8	11.9	14.8	21.6	22.1
Max. Power Consumption kW (at 480 V)	7.9	9.6	12.9	15.6	20.0	—

4.2.4 Nominal Air Pressure and Volume

Filter class process air - G4, MERV 6-8, or equivalent Filter class reactivation air - G4, MERV 6-8, or equivalent Drying capacity at 68 °F (20 °C), 60% RH						
	Condair DA 300	Condair DA 400	Condair DA 600	Condair DA 800	Condair DA 1400	Condair DA 2000
Process Air Pressure inch H ₂ O (Pa)	1.206 (300)	0.804 (200)	1.206 (300)	0.804 (200)	1.206 (300)	0.044 (300)
Reactivation Air Pressure inch H ₂ O (Pa)	1.206 (300)	1.004 (250)	0.804 (200)	1.206 (300)	1.004 (250)	0.804 (200)
Dry Air Volume ft ³ /min (m ³ /h)	294 (499.5)	412 (700.0)	589 (1000.7)	824 (1400.0)	1413 (2400.7)	2001 (3399.7)
Reactivation Air Volume ft ³ /min (m ³ /h)	88 (150)	129 (220)	206 (350)	235 (400)	294 (500)	323 (550)

4.2.5 Sound Level

Maximum Noise Level						
* Approximate						
	Condair DA 300	Condair DA 400	Condair DA 600	Condair DA 800	Condair DA 1400	Condair DA 2000
Noise Level dB	62	62	62	63	68	69

5 Specification Drawings

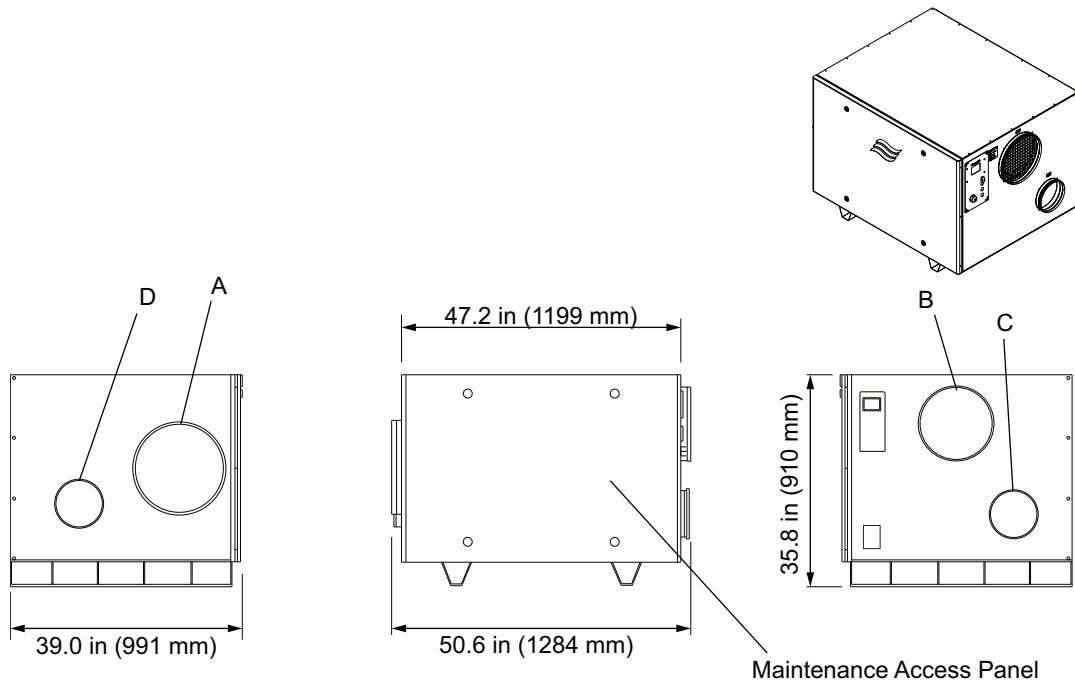


Figure 2 - Specification Drawing

A. Process air inlet:	Ø 15.7 in (400 mm)
B. Dry air outlet:	Ø 12.4 in (315 mm)
C. Reactivation air inlet:	Ø 7.9 in (200 mm)
D. Wet air outlet:	Ø 7.9 in (200 mm)

6 Installation and Planning

6.1 General

Strictly observe and perform all installation tasks including the mounting of the unit and power supplies as described in this manual. Observe and comply with all local and national codes dealing with electrical installations. Condair does not accept any liability for installation of humidification or dehumidification equipment by unqualified personnel, or the use of equipment and parts that are not authorized by Condair.

Personnel Qualifications

All installation work must be performed only by licensed personnel authorized by the customer. It is the customer's responsibility to verify qualifications of the personnel.

Safety

Observe the following safety precautions:



DANGER!

Risk of electric shock!

The unit is mains powered. Using the On/Off button on the touch screen to shut down the unit will not remove power from the unit. Live parts may be exposed when the access panels or doors are removed. Touching live parts may cause severe injury or even death.

Prevention: Before performing any work inside the dehumidifier, shut down the dehumidifier properly, as described in ["Shutting Down the Unit" on page 39](#). The unit must be connected to the mains only after all mounting, installation, and maintenance work has been completed, checked for correct workmanship, and the access panels/doors are closed and fastened securely. Secure the unit against accidental power-up.

Only qualified personnel should perform maintenance or repairs on the unit.

Follow any lockout procedures when servicing the unit.



WARNING!

Risk of severe burns from contact with hot vapors!

The dehumidifier has an internal heater that heats the air to over 248 °F (120 °C), and can dispel wet air with temperatures over 176 °F (80 °C). Contact with hot vapors can result in severe burns.

Prevention: Never perform any work while the dehumidifier is operating. Shut down the dehumidifier and wait for the components to **cool down (at least 15 min)** before working on the system. Wear appropriate personal protective equipment when working near hot vapors. Refer to ["Shutting Down the Unit" on page 39](#) before fixing any leaks in the system.



WARNING!

Risk of severe burns from contact with hot surfaces!

The components in the dehumidifier get very hot during operation. Some components in the dehumidifier can be over 248 °F (120 °C). Contact with hot surfaces can result in severe burns.

Prevention: Avoid contact with hot surfaces. Shut down the dehumidifier and allow components to cool down before working on the dehumidifier. Refer to ["Shutting Down the Unit" on page 39](#).

**DANGER!**

The unit contains moving parts. Putting objects or body parts into the unit can result in serious injury or damage to equipment!

The unit contains rotating parts, such as fans and a rotor. The rotor is heated by air with a temperature between 176-248 °F (80-120 °C). Putting objects into the fan or rotor will affect the proper functioning of the unit, causing damage to the object and the equipment, and will become a safety hazard for people in the vicinity of the unit.

Prevention: Avoid placing objects and body parts into the fan, and if work must be performed, ensure that the unit is properly shut down and electrical power is removed.

**CAUTION!**

The desiccant dryer can only be used for dehumidification of air and product drying at atmospheric pressure.

The desiccant dryer must **NEVER** be used without the filters. This is to protect the rotor and heaters, and maintain capacity.

The desiccant dryer must **NOT** be installed in areas where explosion proof equipment is required.

6.1.1 Installation Overview

The Condair DA Desiccant Dryer is designed for indoor installation and can be installed, with ducts, in the room to be dehumidified or in a separate room. The installation requires a duct to remove wet air from the Condair DA Desiccant Dryer, an air duct for the reactivation air, a duct for the dry air outlet (recommended, especially for distribution), and connection to the mains supply (with disconnect switch).

IMPORTANT! The reactive air supply and exhaust duct needs to be routed outside the space to be dehumidified to prevent negative pressure.

6.2 Location Requirements

The location of the dehumidifier is dependent on the space to be dehumidified and the distance wet and reactivation air must travel to or from the dehumidifier. It is recommended that the wet air duct and reactivation air duct be as short as possible to minimize heat losses in the ducts.

The Condair Condair DA Desiccant Dryer must be placed:

- Indoors.
- In a location that allows it to be inspected and serviced. Refer to ["Clearance Requirements" on the next page](#).
- Horizontally, on its legs, and bolted (recommended) to the floor.

6.3 Clearance Requirements

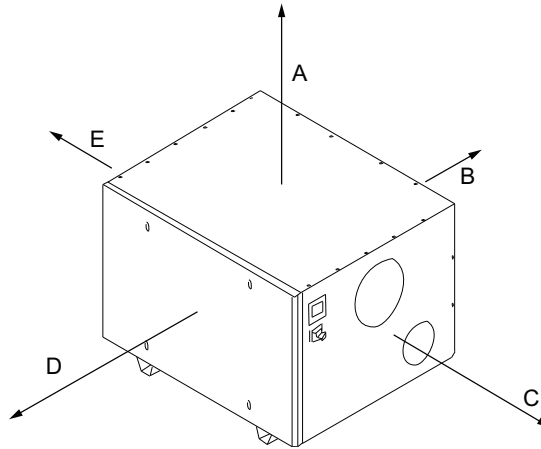


Figure 3 - Clearances

Table 4: Clearances for Condair Condair DA Desiccant Dryer (all units). Refer to [Figure 3 above](#).

A	B	C	D	E
0 in (0 mm)	0 in (0 mm)	15.7 in (400 mm)	39.4 in (1000 mm)	0 in (0 mm)

6.4 Site Requirements

Prepare the Condair DA Series Desiccant Dryer for installation by ensuring the following site requirements are satisfied. Report any discrepancies to your Condair representative.

Ensure that the installation of the Condair DA Series Desiccant Dryer is compliant with all applicable local regulations and codes.

6.4.1 Air Supply Requirements

Filters in the dehumidifier unit help preserve the longevity of the unit and helps prevent dangerous situations. The unit uses a heater for reactivation air and a silica gel rotor, so care must be taken to reduce or prevent contaminants from entering the unit. Such contaminants may include sugar or wood "dust", or flammable vapors. For specific situations and filters, please contact your Condair representative.

6.4.2 Power Supply Requirements

- Mains powered
- Electrical disconnect switch

6.5 Installation

The Condair DA Desiccant Dryer may be installed in the dehumidified room, or in a separate room. To obtain the best performance, equip diffuser to fan outlets.

IMPORTANT! Ensure that the rooms supplying air to the dehumidifier and rooms requiring dry air from the dehumidifier are properly vented to reduce formation of pressure imbalance. Install dampers in the process air duct to correct the dry air volume.

6.5.1 Installing the unit in the room to be dried

In this set-up, the unit is placed in the room needing dehumidification.

- Process air may come from the room itself, or from another source or location. Does not require duct if coming from the room itself. Requires a duct if coming from elsewhere.
- Dry air enters the room from the unit. Does not require duct.
- Wet air leaves the unit to another location or outside. Requires duct out of the room.
- Reactivation air may come from the room itself, or from another location. Does not require duct if coming from the room itself.

IMPORTANT! The intake and exhaust must be at least 6 ft (2 m) apart and installed in a way to prevent exhausted air from being directed into the intake. For example, use 90° hoods oriented away from each other.

6.5.2 Installing the unit in a separate room

In this set-up, the room that is housing the unit and the room needing dry air are separate.

- Process air may come from the room housing the unit, or from another source or location (including the room needing dry air). Does not require duct if coming from the room housing the unit. Requires a duct if coming from elsewhere.
- Dry air is ducted to the desired room. Requires a duct.
- Reactivation may come from the room housing the unit, or from another location (including the room needing dry air). Does not require duct if coming from the room housing the unit. Requires a duct if coming from elsewhere.
- Wet air leaves the unit to another location or outside. Requires duct out of the room housing the unit.

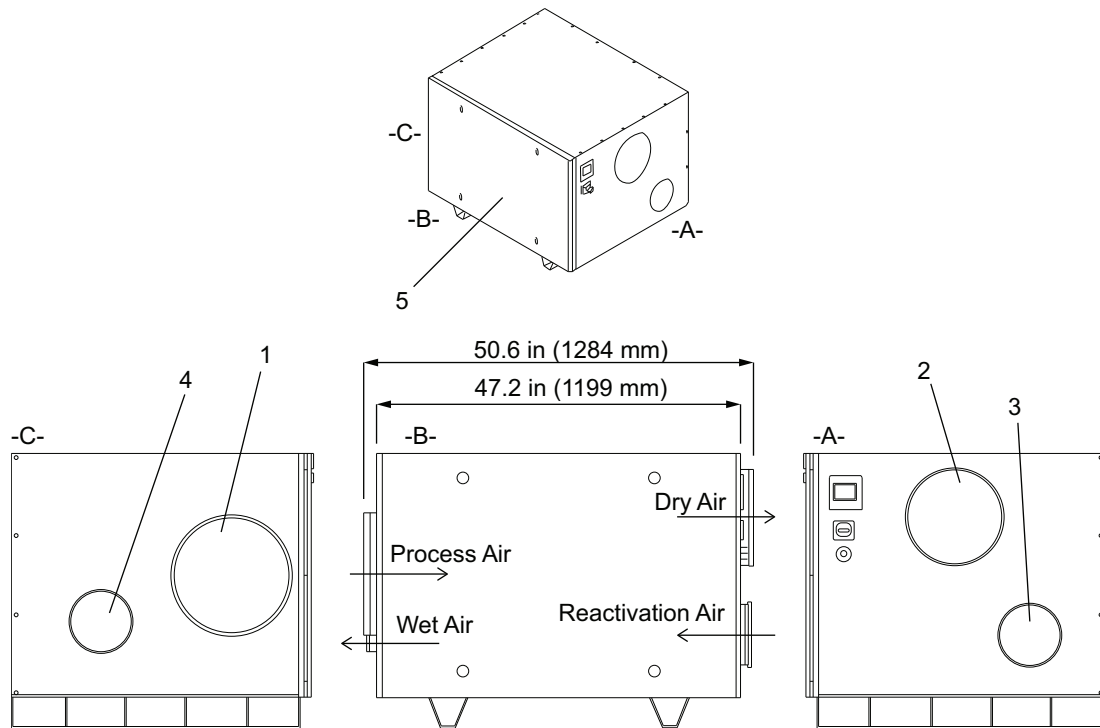


Figure 4 - Connections for the Unit

1. Process air connection ("Connecting the Process Air Duct Inlet" on page 28)
Ø 15.7 in (400 mm)
2. Dry air connection
Ø 12.4 in (315 mm)
3. Reactivation air connection ("Connecting the Reactivation Air Duct Inlet" on page 28)
Ø 7.9 in (200 mm)
4. Wet air connection ("Connecting the Wet Air Duct Outlet" on page 28)
Ø 7.9 in (200 mm)
5. Service panel

6.5.3 Dampers and Air Balancing Schematic

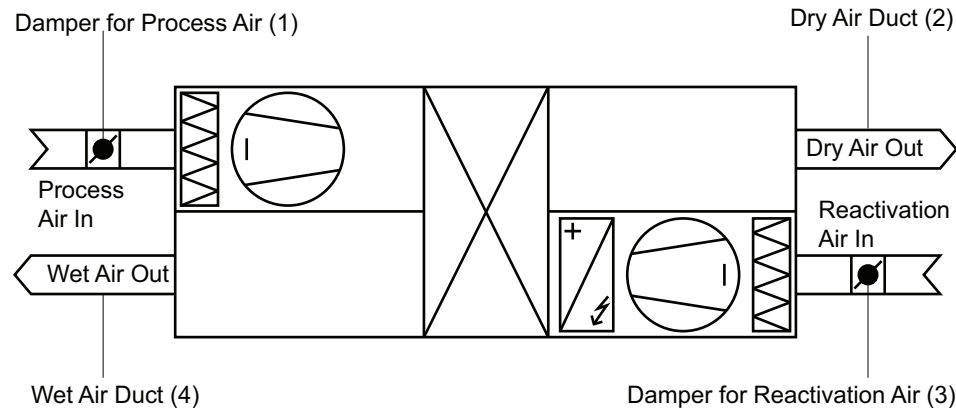


Figure 5 - Example of Damper Locations and Air Balancing setup

- 1. Damper for process air:** To adjust the airflow to the required value during commissioning, the air needs to be adjusted manually with a damper, which is installed at the process air inlet. The process inlet air damper is not required if the system is fitted with fan speed control option.
- 2. Dry air duct:** The ducts should be selected to have the minimum possible pressure drop (check the available external pressure range in the manual), also to prevent unnecessary positive pressure building up in the dry air chamber inside the unit.
- 3. Damper for reactivation air:** To adjust the airflow to the required value during commissioning, the air needs to be adjusted manually to the data sheet-value with a damper.
If the unit is equipped with EC fans, this damper is mandatory and the nominal reactivation airflow needs to be adjusted during commissioning on 100% capacity.
- 4. Wet air duct:** The wet air duct should be insulated and the ducts should be selected to have the minimum possible pressure drop (check available external pressure range in the manual). In this duct, there is a risk of condensation. To prevent a collection of condensate, this duct should slope down in angle of at least $>2^\circ$ or have a condensate drain on its lowest point (drill a hole). If the unit is equipped with full modulating capacity, there is an increased risk of condensate. In this case, we recommend using corrosion resistant ducts.

6.5.4 Safety

Observe all safety precautions and comply with local installation codes. Refer to ["For Your Safety"](#) on page 10.

6.5.5 Mounting the Dehumidifier

Refer to ["Mounting Requirements"](#) for mounting requirements.

The Condair DA Desiccant Dryer comes equipped with legs and is intended to be mounted indoors and on the floor. It is recommended to bolt the legs down to the floor.

Mounting considerations:

- Ensure that there is enough clearance around the unit for ducting and servicing. Refer to ["Clearance Requirements"](#) on page 24.
- Ensure that the unit is horizontal and on a level surface.
- Ensure that the unit is secured (ex. bolted).

6.5.6 Connecting the Process Air Duct Inlet

Typical installations of the Condair DA Desiccant Dryer do not require a process air duct to the unit because the unit is installed in the space needing dehumidification. Instead, air into the dehumidifier is taken from the space directly.

Diameter of the Process Air Connection: 15.7 in (400 mm)

Considerations for the Process Air Connection:

- Units installed in the dehumidified room should be installed with a protection net for the process air inlet.
- Use rivets or mounting screws to ensure that the duct connection is secure.
- For units installed in a separate room, use a duct to supply the unit with process air. Follow local guidelines.

Note: A damper may be installed in the process air duct to allow the correct commissioning of the dry air volume.

6.5.7 Connecting the Reactivation Air Duct Inlet

Reactivation air enters the dehumidifier and passes through a heater. The air is heated and then passes through a section of the rotor, where moisture from the Silica Gel is released into the air stream and removed from the system. Because of the moisture content of the exiting reactivation air, condensation may form and should be removed. Refer to ["Connecting the Wet Air Duct Outlet" below](#).

Typical set-ups, where the Condair DA Desiccant Dryer is installed in the dehumidified room, do not require a duct connection for the reactivation air. In these installations, the air is taken from the space. A coarse wire net is recommended to filter out debris and other small objects from entering the unit.

Diameter of the Reactivation Air connection: 7.9 in (200 mm)

Considerations for the reactivation air duct:

- Ensure that the duct feeding the unit is as short as possible.
- Use rivets or mounting screws to ensure that the duct connection is secure.
- Ensure that a filter (coarse wire net) is used at the inlet to prevent foreign objects from entering the dehumidifier and internal heater.
- The duct may be sloped upwards. Prevent objects from falling into the duct.
- Install a condensate drain at the exit.

6.5.8 Connecting the Wet Air Duct Outlet

Wet air leaving the Condair DA Desiccant Dryer comes from the reactivation air that has passed through the internal heater and desiccant rotor.

IMPORTANT! The reactivation air leaving the desiccant rotor is hot and can reach temperatures of over 176 °F (80 °C).

Diameter of Wet Air Connection: 7.9 in (200 mm)

Considerations for the wet air duct:

- Wet air from the desiccant dryer should be exhausted to the outside.
- A coarse wire net should be installed at the exhaust opening to prevent entry from animals and large debris.
- The duct should be as short as possible.

- Condensate could form in the duct; slope the duct downwards to prevent condensate from returning to the dehumidifier. The downward slope should have an angle of 2° or more.
- Prevent standing water. Condensate could form in the duct if it is long, or slopes upwards. A drainage hole ~0.15-0.25 in (4-6mm) may be drilled at the duct's lowest position. Alternatively, a drain line may be installed in the duct.
Contact your Condair representative for information on proper draining.
- Place warning signs at the outlet, or where applicable. The wet air temperature may reach above 176 °F (80 °C).
- Use rivets or mounting screws to secure the duct connection to the unit.
- Insulate the wet air duct system.

6.5.9 Installing the Electrical Connections

Refer to ["Model Designation" on page 14](#) and ["Power Supply Requirements" on page 24](#) for the electrical requirements. All wiring must be in accordance with local electrical codes.

Safety

The electrical installation work requires removal of the door panels in the humidifier. Observe the following safety precautions:



DANGER!

Risk of electric shock!

The unit is mains powered. Using the On/Off button on the touch screen to shut down the unit will not remove power from the unit. Live parts may be exposed when the access panels or doors are removed. Touching live parts may cause severe injury or even death.

Prevention: Before performing any work inside the dehumidifier, shut down the dehumidifier properly, as described in ["Shutting Down the Unit" on page 39](#). The unit must be connected to the mains only after all mounting, installation, and maintenance work has been completed, checked for correct workmanship, and the access panels/doors are closed and fastened securely. Secure the unit against accidental power-up.

Only qualified personnel should perform maintenance or repairs on the unit.

Follow any lockout procedures when servicing the unit.

- All electrical installation work must be performed only by a licensed electrician authorized by the customer. It is the customer's responsibility to verify qualifications of the personnel.
- The electrical installation must be performed according to the wiring diagrams in this manual, the instructions in this section, as well as applicable national and local codes.
- All cables must lead into the unit, via appropriate cable glands or grommets, and be properly supported.
- Make sure the cables are secured, and do not rub on any components or become a tripping hazard.
- Observe national and local codes for maximum cable length and required wire sizes for cables.

Ensure that the external isolation/disconnect switch is open and the unit is disconnected from mains, and the unit is switched to the Off position before proceeding.

Refer to the wiring diagram on [Appendix: "Wiring Diagram Desiccant Dryer" on page 55](#).

Once the unit is connected to the main power supply, check that all three phases, at terminals L1, L2, and L3, are live, and the unit is on standby (the standby light on the touch screen is lit and the machine is not dehumidifying).

6.5.9.1 Electrical Connections Checklist

- ☐ Power supply meet the voltage and current requirements shown on the specification label? Refer to ["Model Designation" on page 14](#).
- ☐ All cables fastened securely?
- ☐ All electrical connections meet applicable codes?
- ☐ Electrical installation meet the applicable national and local codes?

7 User Interface

7.1 Control Software

The programmable logic controller (PLC) in the Condair DA Desiccant Dryer features a touchscreen, LCD display, that allows you to control the dehumidifier, runtime meters, and alarms. The controller also features functions to protect the rotor from excess rotation, functions to safely cool the internal heater, and functions that control dehumidity through an external 0-10 V humidity sensor or control signal.

7.1.1 Navigation Elements

The graphic interface comprises of several pages that allow you control the unit or navigate to other pages in the software.

To activate the touch screen, simply tap on the display. This will reveal the [Main](#) page. From there, you may access the [Operation](#), [I/O's](#), or [Menu](#) page. The general structure of the software is shown in [Figure 6 below](#).

The display will automatically turn off after 15 minutes. Touch the screen to turn the display on.

Note: The display remains on while an alarm is active.

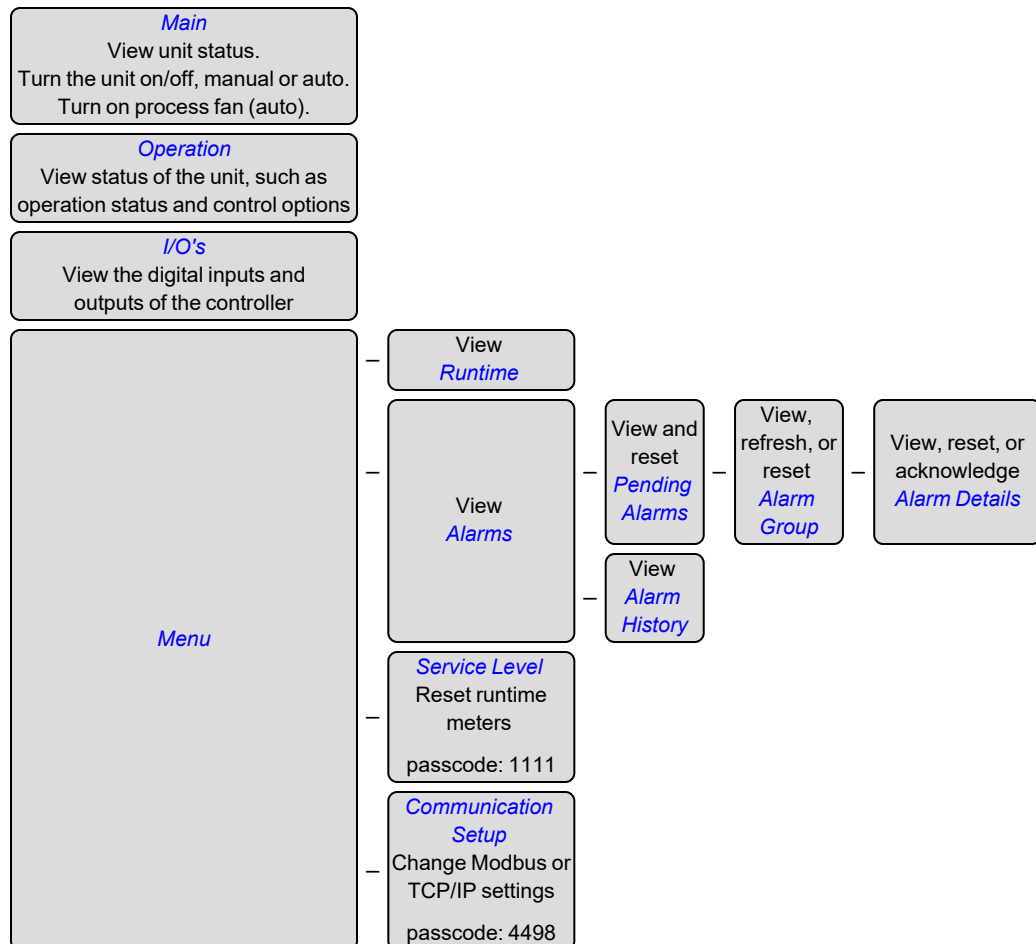


Figure 6 - GUI Layout

7.1.2 Main Page

The Main page shows the unit status and three buttons that allow you to turn the unit on/off, set the unit to manual or automatic mode, and set the process fan to run continuously.

There are three status lights on the Main page:

- **Operation** - turns green when the unit is turned on and the unit is dehumidifying.
- **Stand by** - turns orange while the unit is on, AND the unit is NOT dehumidifying.
- **Alarm** - turns red or yellow while an alarm is active. This light will remain on until the alarm(s) is acknowledged and reset. Refer to ["Resetting Alarms" on page 40](#).



Unit On/Off

Turn the unit **ON** or **OFF**.

Manual/Auto

MANUAL: Run the unit continuously.

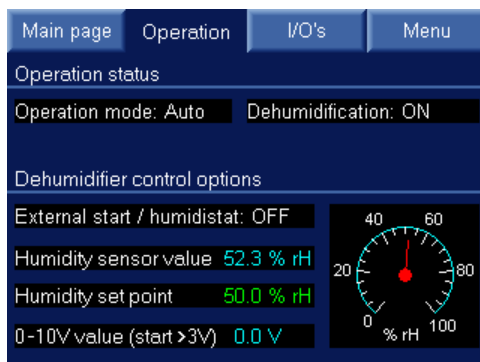
AUTO: Unit is run with a humidity control signal, or an external on/off signal.

Cont. P. A. Fan

Run the process air fan continuously. Allows the air to circulate, even if no dehumidification is required.

7.1.3 Operation Page

The Operation page shows the operational status of the unit and the available control options.



Operation Status

Operation mode shows the unit in AUTO or MANUAL mode. If dehumidification is ON, the unit is operational. If OFF, the unit is in Stand by.

This information can also be seen on the Main page.

Dehumidifier Control Options

If a humidity sensor is connected, the unit starts when the sensed humidity is greater than the setpoint humidity(default setpoint: 50%).

If there is no sensor, the humidity sensor value will read 0%.

If a 0-10 V signal is used to control the humidity, the first heating stage occurs when the control signal exceeds 3 V. At 5 V, the second heating is activated (if applicable). The reactivation fan runs at full speed.

7.1.4 I/O Input Outputs Page

The I/O's page shows the current digital inputs and outputs in the controller.

The inputs and outputs are indicated with 1's and 0's.

- 1 = On (or Auto)
- 0 = Off

Note: These inputs/outputs differ based on the unit size and version.

Main page	Operation	I/O's	Menu
Digital inputs		Digital outputs	
0	Rotation guard	1	React. heater step 1
0	React. heater fault	1	React. heater step 2
0	Process air fan fault	1	Process air fan
0	React. air fan fault	1	React. air fan
0	Drive motor fault	1	Rotor drive motor
0	P.a. fan thermal	0	Ext. alarm indication
0	Filter guard		
0	Ext. start/humidstat		
0	Ext. emergency stop		
0	React. air fan thermal		

Digital Inputs

Rotation Guard	Process Air Fan
Reactivation Heater Fault	Filter Guard
Process Air Fan Fault	External Start/Humidstat
Reactivation Air Fan Fault	External Emergency Stop
Drive Motor Fault	Reactivation Air Fan Thermal

Digital Outputs

Reactivation Heater Step 1	Reactivation Air Fan
Reactivation Heater Step 2	Rotor Drive Motor
Process Air Fan	External Alarm Indication

7.1.5 Menu Page

The Menu page shows the unit's component runtime, alarms, software version, time and date. Accessing the Service level screen and the Communication Setup screen allows you to reset the service timer and set up how the unit communicates

Main page	Operation	I/O's	Menu
		Runtime	
		Alarms	
Service level		Communication setup	
Password (4 digit)		Password (4 digit)	
PLC-35 ver. 18.04.03		17:36:18	16/02/18

Runtime - view how long components in the unit have been on. See "[Runtime](#)" below.

Alarms - view alarm history and details, acknowledge, and reset acknowledged alarms. See "[Alarms](#)" on the next page.

Service Level - (requires password) reset runtime meters. See "[Service Level Settings](#)" on page 36.

Communication Setup - (requires password) communicate via Modbus, TCP/IP, or remotely. See "[Communication Settings](#)" on page 37.

7.1.5.1 Runtime

The Runtime page shows the active time of components in the Condair DA Desiccant Dryer, as well as the total dehumidifier runtime, and hours since maintenance.

Main page	Operation	Runtime	Menu
Runtime in hours			
Dehumidifier runtime		0	
Process air fan runtime		0	
React. air fan runtime		0	
Drive motor runtime		0	
Since process filter change		0	OK
Since react. filter change		0	OK
Since new rotor seals		0	OK

Here, you can find the runtime (in hours) for the:

- Dehumidifier
- Process air fan
- Reactivation air fan
- Drive motor

You can also find out the time (in hours) since maintenance of the following components:

- Process air filter
- Reactivation air filter
- Rotor seals

Note: The runtime meters for maintenance (bottom three) can be reset from the Service Level page. Refer to ["Service Level Settings" on page 36](#).

7.1.5.2 Alarms

Alarms alert you to any complications with the operation of the unit. While an alarm is active, the alarm status light on the Main page will display a red or yellow light, depending the urgency. Urgent alarms are shown with red, and non-urgent alarms are shown with yellow.

Issues causing urgent alarms may cause damage to the unit, so the dehumidifier ceases operation. Non-urgent alarms do not cease operation of the unit.

The unit may be restarted, however, if the cause for the urgent alarm remains present, the component associated with the cause will not function. **Ensure that urgent alarms are resolved.**

To remove the alarm (after resolving the issue), the alarm must first be acknowledged. This is done by accessing the Pending Alarms page and viewing the alarm's details.

Main page	Operation	Alarms	Menu
URGENT ALARM		NON URGENT ALARM	
React. heater		Check proc. air filter	
Process air fan		Check react. air filter	
React. air fan		Check rotor seal	
Drive motor		React. air fan thermal	
Rotor guard		Filter guard	
Proc. air fan thermal			
Pending alarms		Alarm history	

The Alarms page shows Urgent or Non-Urgent alarms, "[Pending Alarms](#)" below, and the "[Alarm History](#)" on the next page.

Urgent alarms indicate an issue with components critical to proper functioning of the unit.

These items include:

- Reactivation air heater
- Process air fan / dry air fan
- Reactivation air fan / wet air fan
- Drive motor
- Process air fan thermal protection
- Reactivation air fan thermal protection (when available)
- High temperature limit (when available)

Non-urgent alarms indicate possible issues that may affect the performance of the unit. These components include:

- Process air filters
- Reactivation air filters
- Rotor seals
- Reactivation air temperature thermostat (stops the reactivation heaters when active)
- Filter guard

Pending Alarms

Access your list of all pending alarms by tapping on the Pending Alarms button on the Alarms page.



On this page, you can see the number of active issues of urgent and non-urgent alarms.

- [Details](#) button - See the alarms in the group. Press the button again to see the specific alarm's details.
- [ESC](#) - Return to the previous page.
- [Reset](#) - Resets all inactive alarms in the group.
- [Refresh](#) - Reloads the page.

Alarms in Group and Alarm Details

You can view the alarms in either urgent or non-urgent groups. The Alarms in Group page shows a brief overview of the alarms in the group.

This information includes the alarm's:

- [ID](#) - Identification number
- [Time On](#) - When the alarm was triggered
- [Ack](#) - Acknowledged: (Y)es or (N)o
- [Alarm Name](#) - Name of the alarm

Pressing the button next to an alarm brings you to the Alarm Details page, where you press [Ack](#) to acknowledge the alarm.

Pressing [Reset](#) will reset the alarm, only if the cause for the alarm is NOT active.

IMPORTANT! Reset an alarm after it has been acknowledged.

Group ID 00
Alarms in Group
ESC

ID	Time On	Ack	Alarm Name	Details
000	23:22:41	N	Fault drive motor	

Refresh
>>
Reset

Priority Low
Alarm Details
ESC

Group 00 Urgent alarms

ID 002 Fault drive motor

Date 29/01/06 23:26

Count 2

Active Y

Ack << >> Reset

Alarm History

Alarm history shows information about old alarms. It shows the time the alarm occurred and was resolved, the time elapsed before acknowledgment and when it was reset. Use the left and right arrows on the touchscreen to go between alarm entries.

Priority Low
Alarm History
ESC

Group 00 Urgent alarms

ID 004 Fault drive motor

Trigger Rise Time	30/01/06 02:45	Duration
Trigger Fall Time	30/01/06 02:50	00:05:00
Ack. Time	30/01/06 03:39	00:52:18
Reset Time	00/00/00 00:00	

<< >>

To clear the alarm history, go to the second service level page (requires password) and press *Clear alarm history*.

7.1.5.3 Service Level Settings

Password: 1111

There are two service level pages. The second service level page is accessed by pressing the arrow button at the bottom of the screen.

Main page
Operation
Service lvl 1
Menu

Runtime in hours

Since proc. filter change 0 Reset

Since react. filter change 0 Reset

Since new rotor seals 0 Reset

Process air fan runtime 0 Reset

React. air fan runtime 0 Reset

Drive motor runtime 0 Reset

Main page
Operation
Service lvl 2
Menu

Intervals in hours

Process filter 2920

React. filter 2920

Rotor seal 8760

PID-controller

P-band (%) 5.0

I-time (sec) 60

PID output 59

Rotation guard OFF

Clear alarm history

The first service level page shows the runtime meters and runtime reset buttons for the following components (in hours):

- Time since process air filter was changed.
- Time since reactivation air filter was changed.
- Time since rotor seals were replaced.
- Process air fan runtime.
- Reactivation air fan runtime.
- Drive motor runtime.

The second service level page shows the adjustable interval period for the process air filter, reactivation air filter, and the rotor seal, before an alarm is activated.

If you are using a humidity sensor, the page also shows the PID controller settings:

- *P-band* - range above and below the humidity setpoint.
- *I-time* - controls the speed of the controller.
- *PID output* - displays the dehumidification demand between 0-100 (stop = 0, start = 30).

IMPORTANT! The PID settings should not be changed. Consult your Condair representative.

In addition to this, the second service level page shows buttons that will allow you to clear the alarm history (refer to ["Resetting Alarms" on page 40](#)), and turn on/off the rotor rotation guard (if available).

7.1.5.4 Communication Settings

Password: 4498

The Communication Settings page displays settings for Modbus TCP/IP and RS485 connections, as long as a communication card is installed.

Note: The Modbus data points are located here: ["Communication" on page 57](#).

The screenshot shows the 'Setup level' tab of the communication settings. At the top, there are four tabs: 'Main page', 'Operation', 'Setup level', and 'Menu'. Below the tabs, it says 'RS485 settings if such a card is installed.' and 'Modbus Network ID' with a value of '35'. Under 'RS485 settings (select only one & press save)', there are six buttons: '9600,8,N,1', '19200,8,N,1', '57600,8,N,1', '9600,8,E,1', '19200,8,E,1', and '57600,8,E,1'. A 'SAVE RS485' button is to the right. Below this, 'Modbus TCP/IP settings' are shown with fields for 'IP Address' (192, 168, 0, 150), 'Gateway' (192, 168, 0, 1), and 'Subnet' (255, 255, 255, 0). A 'Save TCP/IP' button is to the right.

Modbus Network ID

Default: 35

RS 485

Choose between six different combinations, then save.

Modbus TCP/IP

Enter the IP Address, Gateway, and Subnet, then save.

8 Operation

8.1 General

Personnel Qualifications

The Condair DA Series Desiccant Dryer must only be operated by personnel who are adequately qualified, competent, and are authorized by the customer.

Safety

Observe the following safety precautions.



DANGER!

Risk of electric shock!

The unit is mains powered. Using the On/Off button on the touch screen to shut down the unit will not remove power from the unit. Live parts may be exposed when the access panels or doors are removed. Touching live parts may cause severe injury or even death.

Prevention: Before performing any work inside the dehumidifier, shut down the dehumidifier properly, as described in ["Shutting Down the Unit" on the next page](#). The unit must be connected to the mains only after all mounting, installation, and maintenance work has been completed, checked for correct workmanship, and the access panels/doors are closed and fastened securely. Secure the unit against accidental power-up.

Only qualified personnel should perform maintenance or repairs on the unit.

Follow any lockout procedures when servicing the unit.



WARNING!

Risk of severe burns from contact with hot vapors!

The dehumidifier has an internal heater that heats the air to over 248 °F (120 °C), and can disperse wet air with temperatures over 176 °F (80 °C). Contact with hot vapors can result in severe burns.

Prevention: Never perform any work while the dehumidifier is operating. Shut down the dehumidifier and wait for the components to **cool down (at least 15 min)** before working on the system. Wear appropriate personal protective equipment when working near hot vapors. Refer to ["Shutting Down the Unit" on the next page](#) before fixing any leaks in the system.



WARNING!

Risk of severe burns from contact with hot surfaces!

The components in the dehumidifier get very hot during operation. Some components in the dehumidifier can be over 248 °F (120 °C). Contact with hot surfaces can result in severe burns.

Prevention: Avoid contact with hot surfaces. Shut down the dehumidifier and allow components to cool down before working on the dehumidifier. Refer to ["Shutting Down the Unit" on the next page](#).

**DANGER!**

The unit contains moving parts. Putting objects or body parts into the unit can result in serious injury or damage to equipment!

The unit contains rotating parts, such as fans and a rotor. The rotor is heated by air with a temperature between 176-248 °F (80-120 °C). Putting objects into the fan or rotor will affect the proper functioning of the unit, causing damage to the object and the equipment, and will become a safety hazard for people in the vicinity of the unit.

Prevention: Avoid placing objects and body parts into the fan, and if work must be performed, ensure that the unit is properly shut down and electrical power is removed.

**CAUTION!**

The desiccant dryer can only be used for dehumidification of air and product drying at atmospheric pressure.

The desiccant dryer must **NEVER** be used without the filters. This is to protect the rotor and heaters, and maintain capacity.

The desiccant dryer must **NOT** be installed in areas where explosion proof equipment is required.

8.2 Starting Up

Ensure that the proper commissioning has been performed, and the Condair DA Desiccant Dryer is connected to the mains power supply. Refer to ["First-time Commissioning" on page 49](#).

To start the Condair DA Desiccant Dryer:

1. Tap on the touchscreen to see the main page. The unit should be on Standby.
2. Under Unit On/Off, tap the switch button to **ON**.
3. Determine if the dehumidifier should run off of a signal, or run continuously.
 - Tap the Manual/Auto switch button to **MAN** or **AUTO**.
 - » **MAN** - (manual) run the dehumidifier continuously.
 - » **AUTO** - (automatic) run the dehumidifier on a control or on/off signal.
4. Determine if the process fan should run continuously (in automatic mode).
 - Tap the Cont. P. A. Fan (Continuous Process Air Fan) switch button to **OFF** or **ON**.
 - » **ON** - the process fan will run continuously while the unit is in Automatic mode.
 - » **OFF** - the process fan energizes only when dehumidification is needed.

8.3 Shutting Down the Unit

IMPORTANT! The Condair DA is mains powered. Disconnect the dehumidifier from the mains power supply before opening any service panels. Ensure that the external disconnect switch has removed the unit from the mains power supply.

To shut down the Condair DA Desiccant Dryer:

1. Touch the LCD screen to display the Main Page of the dehumidifier. On the touch screen, tap the Unit On/Off button to turn the unit OFF.

Note: If the unit has been running, the reactivation air fan will continue to run for 6 minutes to purge excess heat.

8.4 Configuring the Control Software

insert communication modbus table and forward to instructions for write-able settings:

- Analog Setpoint - humidity setpt for hum sensor
- On/Off (see shutting down/starting)
- Turn on cooling fan
- Set unit to automatic or manual
- Allow process fan to run continuously

8.5 Resetting Alarms

Refer to ["Reset Alarms" on page 43](#).

9 Maintenance

9.1 General

Strictly observe all safety precautions, and perform only those maintenance tasks described in this manual. Refer to ["For Your Safety" on page 10](#).

Use only original Condair replacement parts.

All maintenance work must be performed only by licensed personnel authorized by the customer. It is the customer's responsibility to verify qualifications of the personnel.

The maintenance work may require removal of the cover on the unit.

9.2 Maintenance List

The maintenance intervals for the dehumidifier depend on the environment. As such, the maintenance frequency will differ between units, so regular inspections should be performed until a suitable maintenance interval is created. Incorrect service and maintenance may reduce the efficiency of the unit.

Perform the following maintenance tasks at the (suggested) intervals specified in [Table 5 on the next page](#). For the components referenced in the table, refer to ["Spare Parts List: Condair DA" on page 46](#).

Table 5: Maintenance List

Task/Component	Frequency	Description
Filters	Monthly, or as needed	Check the filters for debris and dust, and replace them as necessary. Blockages in the filter may result in pressure drops across the filter. Clogged filters will lead to failure of the heater and desiccant rotor. A service reminder alarm will activate after a set time to check the filters regularly. NEVER operate the unit without the filters. Dust can damage the desiccant rotor and heater, and reduce the efficiency of the unit.
Rotor (and bearings)	annually	Inspect the rotor for damage, dust, or any other debris. Use compressed air to clean the rotor. Direct the compressed air in the opposite direction of process air flow to prevent particles from embedding further into the desiccant rotor. For severe levels of debris and dust, consult your Condair representative, then (optional) use water to wash the rotor. The rotor bearings and rotor surface should also be inspected for any damages. Contact Condair for a replacement if necessary.
Rotor Drive Belt	Bi-annually	Check the tension of the drive belt and readjust the tension as needed. The unit comes with an internal belt tension device so readjustment of the belt is only required bi-annually. Tension: 15° deflection. Note: The belt will stretch over time. Do NOT over tighten the belt. This may cause damage to the drive motor.
Rotor Seals	Bi-annually	Inspect the seals on the rotor for damage and correct positioning. The seals should slide along with the rotation of the rotor. A service reminder alarm will activate after a set time to check the rotor seals regularly.
Heater	Bi-annually	Inspect the heater, including heating elements, for damage.
Motors	annually	Inspect the motor and ball bearings for damage, or any unexpected sounds or vibrations.

9.3 Resetting the Service Reminder

Reset Runtime Hours

The dehumidifier alerts you when a filter or seal need to be changed, or when the interval runtime hours for the fans and motor exceed a factory defined threshold. The threshold values for runtime hours may be changed, but only after consulting your Condair representative. For more information about runtime hours, refer to ["Service Level Settings" on page 36](#).

To reset runtime hours:

[Menu](#) page > [Service Level](#) (password: 1111) > [Reset](#)

Reset Alarms

Only reset applicable alarms after performing maintenance, or when complications are resolved. For more information about alarms, refer to ["Alarms" on page 34](#).

Reset the alarm directly if the cause of the alarm has been fixed.

Acknowledge an alarm to remove it from the pending list, if the cause of the alarm is fixed.

When an issue is acknowledged and reset (provided the cause of the alarm is fixed), the alarm will be removed from the pending alarm list.

To acknowledge an alarm:

[Menu](#) page > [Alarms](#) > [Pending Alarms](#) > Details  > Details  > [Ack](#)

To reset an alarm, tap on the [Reset](#) button when viewing your pending alarms.

10 Troubleshooting

Troubleshooting of the Condair DA Series Desiccant Dryer must only be performed by qualified and competent personnel. Electrical repairs must only be performed by a licensed electrician authorized by the customer, or by Condair service technicians.

Troubleshooting the Condair DA Series Desiccant Dryer may require the user to access the inside of the unit, to the control cabinets, which may expose the user and equipment to hazards described in ["For Your Safety" on page 10](#).

10.1 General Troubleshooting

Most operation warning and fault conditions are caused by improper installation, or by not adhering to the suggested best practices for installation of the dehumidifier and system components. Hence, a full fault diagnosis always requires a thorough examination of the entire system (hose connections, control systems, etc.).

General guidelines for troubleshooting are described below. For detailed troubleshooting of auxiliary system components, refer to their respective manuals.

Nothing happens when the On/Off switch is turned On.
No control circuit, or fuse for the controls is faulty. Check the electrical components, including control and main fuses.
Internal circuit breaker has tripped. Check the internal circuit breaker in the dehumidifier.
Faulty control signal. Check the external signal.
Phase fault. Check main fuses, breaker, and phase sequence.
Rotor is not moving.
Drive belt is damaged, worn, or slipping. Check the belt and ensure there are no damages, and the belt is not worn. Check the tension of the belt, 15° deflection. The drive belt may need to be replaced.
Drive motor is faulty. Replace the gear motor.
Rotor is jammed. Check the rotor and ensure there are no obstructions at the rim of the rotor and rotor shaft. Ensure that the rotor shaft is undamaged.
No dry air, or no wet air volume is produced.
Internal breakers are flipped. Check the internal breakers.

No dry air, or no wet air volume is produced.
Filters or ducts are blocked. Check and clean the filters. Replace them if necessary. Check the dampers and ducts, and remove any obstructions.
Phase fault. Check the main fuses and phase sequence.
Faulty fans. Check the fans, motor, and impeller for any damages or obstructions.
Dehumidification capacity reduced, or at zero.
Airflow is reduced. The airflow could be reduced due to clogged filters, leaks in the unit or seals, or altered air volumes. Ensure that the air volumes are measured correctly, and check dampers, openings, ducts, and filters for blockages. Replace filters if necessary. Reduced airflow lowers the drying capacity for the space. Check the internal and external seals, internal springs, and outside panels for air leakage.
Reactivation or process air fans are not working. Check the fans if they are engaged. Verify contactor operation for heaters and fans.
Electrical heater is faulty, or the reactivation temperature has been changed. Check the reactivation heater and check the fuses.
Rotor is not rotating. Check the rotor shaft and rotor rim for blockages or damage. Check the drive belt for wear and proper tension.
Circuit breaker or fuses are faulty.
Air volume is too large. Check the air volumes and dampers. Correct as necessary.
Faulty fans. Check the fans, motor, and impeller for any damages or obstructions.
Rotor is not rotating. Check the rotor shaft and rotor rim for blockages or damage. Check the drive belt for wear and proper tension, 15° deflection.
Electrical heater is faulty, or the reactivation temperature has been changed. Check the reactivation heater and check the fuses.

11 Spare Parts List: Condair DA

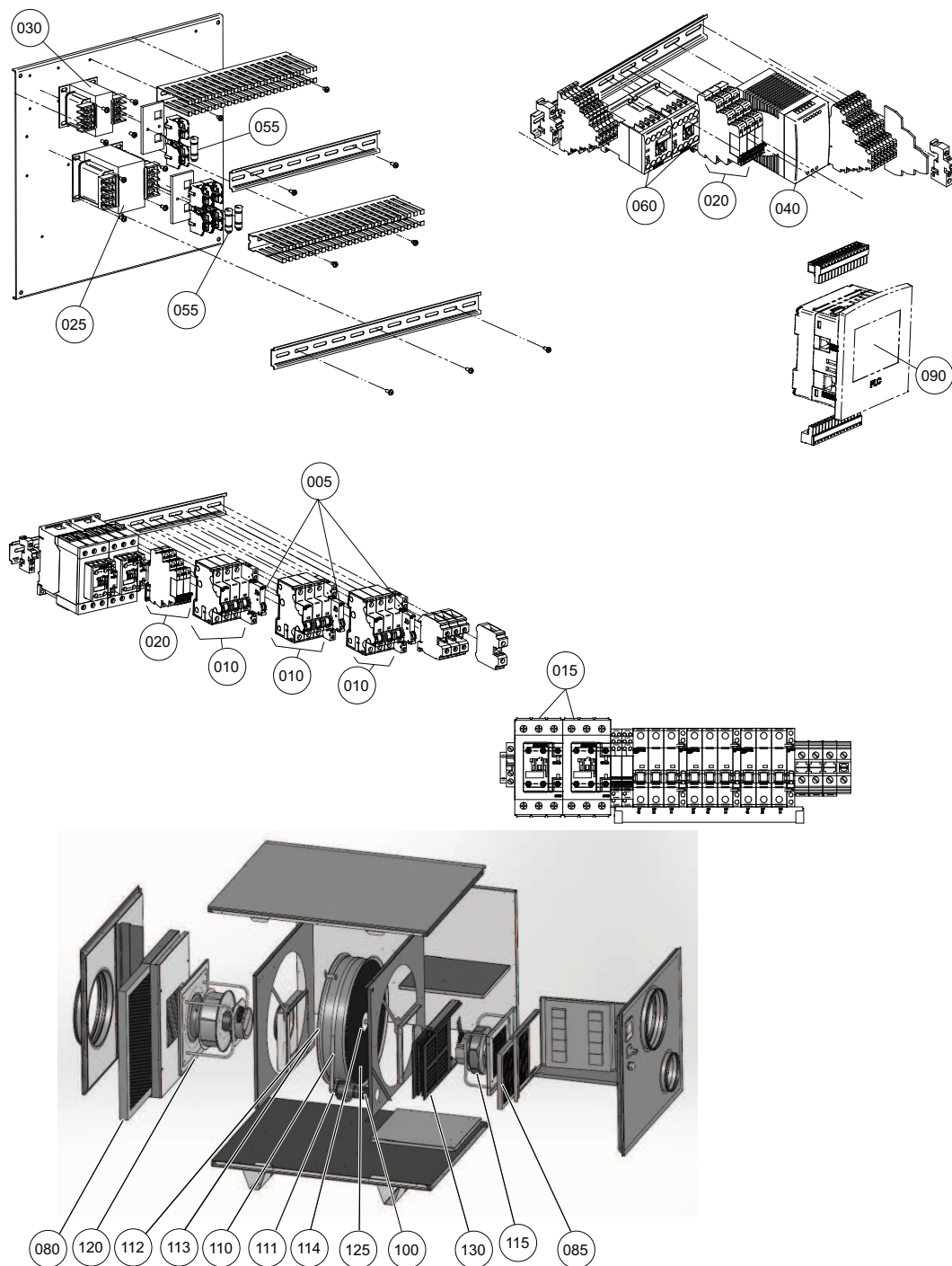


Figure 7 - Spare Parts. Refer to [Table 6 on the next page](#).

Table 6: Condair DA Spare Parts List

Item	Part Number	Description
005	2594702	Auxiliary Switch, MCB DIN Rail
010	2594703	Breaker MCB, DIN rail, 4 Amps
	2594704	Breaker MCB, DIN rail, 13 Amps
	2594705	Breaker MCB, DIN rail, 15 Amps
	2594706	Breaker MCB, DIN rail, 16A
	2594707	Breaker MCB, DIN rail, 20 Amps
	2594708	Breaker MCB, DIN rail, 25 Amps
	2594709	Breaker MCB, DIN rail, 32 Amps
	2594710	Breaker MCB, DIN rail, 63 Amps
	2594732	Breaker MCB, DIN rail, 40A
015	2594733	Contactactor, 80A AC1 DIN, 24VDC coil
	2594712	Contactactor, 40A AC1 DIN, 24VDC coil
020	2594735	Relay module, 24VDC DIN Rail
025	2595352	Transformer, 600/480:240/120VAC 150VA
030	2595400	Transformer, 208/416: 12/24VAC 50VA
	2595403	Transformer, 240/480: 12/24VAC 50VA
040	2595406	Power Supply_AC_DC Converter 24V 96W
	2594734	Power Supply_AC_DC Converter 24V 40W
055	2601283	Fuse kit, dehumidifier
060	2594711	Contactactor, 18A AC1 DIN, 24VDC coil
080	2595407	DA Process Air Filter Kit
085	2594714	DA Reactive Air Filter Kit
090	2594715	DA Series Logic Controller
100	2602554	Drive Motor w Gearbox, Capacitor
N/S	2594742	Capacitor, Drive Motor, Dehum
110	2602555	Drive Belt DA 300/400/600
	2594718	Drive Belt DA 800/1400/2000/2400
111	2595351	Pulley, Belt Drive DA 300/400/600
	2602222	Pulley, Belt Drive DA 800/1400/2000/2400
N/S	2602223	Belt Tensioner, Dehumidifier
112	2602224	Peripheral Seal DA 300/400/600
	2602225	Peripheral Seal DA 800/1400/2000/2400
113	2602226	Clamp for Peripheral Seal 300/400/600
	2602227	Clamp for Peripheral Seal 800/1400/2000/2400
114	2602228	Radial Seal DA 300/400/600
	2602229	Radial Seal DA 800/1400/2000/2400
N/S	2602230	Rotation Guard Sensor with Magnet

Item	Part Number	Description
115	2594740	SP Fan, Reac. Air, DA 2000 208V
	2594719	SP Fan, Reac. Air, DA 1400, 480V
	2601287	SP Fan, Reac. Air, DA 1400 208V
	2601285	SP Fan, Reac. Air, DA 800, 480V
	2601288	SP Fan, Reac. Air, DA 800 208V
	2601286	SP Fan, Reac. Air, DA 600, 480V
	2594741	SP Fan, Reac. Air, DA 600 208V
	2594720	SP Fan, Reac. Air, DA 400, 480V
	2601387	SP Fan, Reac. Air, DA 400 208V
	2594731	SP Fan, Reac. Air, DA 300, 480V
	2601249	SP Fan, Reac. Air, DA 300 208V
120	2601256	SP Fan, Poc. Air, DA 2000 208
	2601250	SP Fan, Poc. Air, DA 1400 480V
	2601257	SP Fan, Poc. Air, DA 1400 208V
	2601251	SP Fan, Poc. Air, DA 800 480V
	2601258	SP Fan, Poc. Air, DA 800 208V
	2601253	SP Fan, Poc. Air, DA 600 480V
	2601259	SP Fan, Poc. Air, DA 600 208V
	2601254	SP Fan, Poc. Air, DA 400 480V
	2601260	SP Fan, Poc. Air, DA 400 208V
	2601255	SP Fan, Poc. Air, DA 300 480V
	2601261	SP Fan, Poc. Air, DA 300 208V
125	2601264	Rotor, Dehumidifier DA 2400
	2601263	Rotor, Dehumidifier DA 800-2000
	2601262	Rotor, Dehumidifier DA 300-600
130	2601282	SP Heater Bank, DA1400-2400, 480V
	2601269	SP Heater Bank, DA 1400-2000, 208V
	2601272	SP Heater Bank, DA600-800, 480V
	2601268	SP Heater Bank, DA 800, 208V
	2601267	SP Heater Bank, DA 600, 208V
	2601271	SP Heater Bank, DA400, 480V
	2601270	SP Heater Bank, DA300, 480V
	2601265	SP Heater Bank, DA 300-400, 208V
N/S = item not shown		

11.1 Obtaining Spare Parts

Obtain additional spare parts from your local Condair Agent, or through www.CondairParts.com.

12 Commissioning

12.1 General

The Condair DA Series Desiccant Dryer must be commissioned and operated only by personnel who are adequately qualified and familiar with the Condair DA Series Desiccant Dryer. It is the customer's responsibility to verify the qualifications of personnel.

12.2 First-time Commissioning

The unit must always be commissioned for the first time by a service technician from your Condair representative, or by personnel who are well trained and authorized by the customer. For this reason, this manual only provides an outline, and not the details of the commissioning protocol.

Outline:

- ☐ Inspect the mounting of the unit.
- ☐ Inspect the ducts for the reactivation air, process air, and wet air.
- ☐ Inspect the electrical installation.
- ☐ Configure the Condair DA Series Desiccant Dryer through the dehumidifier controls.
- ☐ Conduct any applicable performance tests, including controls.
- ☐ Fill out the commissioning protocol documents.

Ensure the following:

- ☐ External disconnect or isolation switch is preventing the mains power supply from powering the unit.
- ☐ The mains supply fuse is appropriately rated.
- ☐ Dampers (in reactivation air and process air ducts) are open.
- ☐ Ducts are clean and unobstructed.
- ☐ There are no foreign objects in the unit (including electrical cabinet).
- ☐ Air filters are clean and installed properly.
- ☐ Fans can rotate freely. Fans can be accessed by removing the safety panels from the fan housing. Ensure that the safety panels are reinstalled.
- ☐ Rotor belt tension is at 15° deflection. The belt will stretch over time, so tension should be adjusted during maintenance.
- ☐ Minimum positive pressure at outlet of process air handling system (running at maximum) is 0.6" WC (150 Pa).

To commission the Condair DA Desiccant Dryer:

- ☐ Close the external disconnect, or isolation switch, to supply power to the unit.
- ☐ Check that the three (power) phases are live by inspecting terminals L1, L2, and L3 in the unit. The main page on the touchscreen should be displayed and the unit is on STAND BY (the unit should remain inactive).
- ☐ Install the main service panel onto the dehumidifier.
- ☐ Wait approximately 1 minute, then
 - ☐ Tap the Unit On/Off button on the touchscreen to the **ON** position.
 - ☐ Tap the Manual/Auto switch to the **MAN** position.

The fans should run and energize to full speed. Ensure that there are no major vibrations during this time.

- ☐ Stop the dehumidifier by tapping the touchscreen and setting the Unit On/Off button to **OFF**. The reactivation air fans will continue to run. Wait 6 minutes for the fans to stop.
- ☐ The dehumidifier is now ready for operation.

13 Decommissioning

13.1 General

If the Condair DA Series Desiccant Dryer needs to be replaced or removed from service for disposal, strictly follow the instructions in this section.

Personnel Qualifications

All decommissioning work must be performed only by a qualified service technician authorized by the customer. It is the customer's responsibility to verify proper qualifications of the personnel.

Safety

Refer to ["For Your Safety" on page 10](#).

13.2 Removing Unit from Service

Remove the unit from service for disposal, or long-term storage, as follows. Use a qualified service technician.

1. Disconnect the humidifier from the power source.
2. Disconnect the control signal inputs (including any power and security loop connections) from the terminal strips in the humidifier.
3. Remove the Condair DA Series Desiccant Dryer from its mounting surface.
4. If the unit is to be disposed, refer to ["Disposing or Recycling the Unit" below](#).

13.3 Disposing or Recycling the Unit

The Condair DA Series Desiccant Dryer and its components must NOT be disposed in domestic waste, and should be brought to an authorized collection point. If required, dispose in accordance with local regulations at authorized collection facilities.

If you have any questions, please contact the appropriate local authorities, or your local Condair representative.

APPENDIX

A

Appendix: Installation Checklist

Mounting

- ☐ Unit installed in a suitable location? Refer to "[Location Requirements](#)" on page 23.
- ☐ Unit installed with suitable clearances? Refer to "[Clearance Requirements](#)" on page 24.
- ☐ Mounting surface is stable and capable of supporting the full operating weight of the unit? Refer to "[Weights](#)" on page 18.
- ☐ Unit is level?
- ☐ Unit is fastened securely?

Electrical Connection

- ☐ Power supply meet the voltage and current requirements shown on the specification label? Refer to "[Model Designation](#)" on page 14.
- ☐ All cables fastened securely?
- ☐ All electrical connections meet applicable codes?
- ☐ Electrical installation meet the applicable national and local codes?

B Appendix: Maintenance Checklist

Follow all safety precautions. Refer to "For Your Safety" on page 10. Shut down the unit before performing maintenance procedures. Refer to "Shutting Down the Unit" on page 39. **Do NOT ignore alarms.** Refer to "Troubleshooting" on page 44.

Refer to "Maintenance List" on page 41 and "Maintenance Procedures" for descriptions on maintenance procedures.

Table 7: Maintenance Log

Component	Frequency	Dates Last Performed (DD/MM/YY) and Initials									
Filters	Monthly or as needed										
Rotor (and bearings)	Annually - contact Condair representative.										
Rotor Drive Belt	Bi-annually										
Rotor Seals	Bi-annually										
Heater	Bi-annually - visually inspect the heater. Replace if necessary. Contact Condair representative.										
Motors	Annually										
Comments:											

C



DA Series Dehumidifier
Wiring Diagram (with modulation)
2595740 Rev. E Feb 25, 2021

D Appendix: Communication

D.1 Modbus

The Condair DA Desiccant Dryer can be ordered with optional Modbus TCP/IP or Modbus RS485 network cards installed in the unit's PLC. Connections can be made with an Ethernet (RJ45) or RJ11 cable.

Note: The Condair DA Desiccant Dryer supports Modbus RTU with RS 232 interfaces.

Table 8: RS 232 Pin Interfaces

Pin #	RS 232 (Port 1)	Notes
1	Not connected	Signals are related to the controller's 0V; the same 0 V is used by the power supply.
2	0V reference	
3	TXD signal	The serial port is not isolated. If the controller is used with a non-isolated external device, avoid potential voltage that exceeds $\pm 10V$.
4	RXD signal	
5	0V reference	Maximum cable length 50 ft (15 m).
6	Not connected	

D.2 RS485 Connection

Connect using RJ11 connector provided (Blue Wire: RS485 A+, White/Blue: RS485 B-).

By default, the RS485 signals are terminated by two wire ferrules coming from the RJ11 connector.

Note: RJ45 connector can be used instead.

Wire	Color	Notes
RS485 A+	Blue	The ground is connected in the shielding of the RJ11 twisted pair connector. Use a shielded twisted pair wire.
RS485 B-	White/Blue	Use a 2-wire splicing connector to connect the two ferrules from RJ11 (or other similar connector) to extend the cables. Maximum cable length 4000 ft (1200 m).

PLC Software Configuration

1. Power up the PLC.
2. Navigate to
Menu > Communication Setup
3. Enter the user level password: **4498**
4. Enter a Modbus slave ID. The default is **35**.
5. Navigate to RS485 settings. Select one of the following serial communication options.
 - 9600 Baud, 8 bits, No Parity, 1 Stop Bit
 - 9600 Baud, 8 bits, Even Parity, 1 Stop Bit
 - 19200 Baud, 8 bits, No Parity, 1 Stop Bit
 - 19200 Baud, 8 bits, Even Parity, 1 Stop Bit
 - 57600 Baud, 8 bits, No Parity, 1 Stop Bit
 - 57600 Baud, 8 bits, Even Parity, 1 Stop Bit
6. Enter the Modbus Network ID (range is 0 to 999).
7. Press **SAVE**

D.3 TCP/IP Network Settings

Connect a CAT V RJ45 Ethernet cable (shielded twisted pair) to Port 2 on the PLC.

1. Power up the PLC
2. Navigate to
Menu > Communication Setup
3. Enter the user level password: **4498**
4. The display will note the installation of an Ethernet card. Navigate to **Modbus TCP/IP settings**.
5. Enter the IP address, default gateway, and subnet mask.
6. Validate the network connection.
 - a. Connect an RJ45 Ethernet cable from the PLC port to a computer.
 - b. Open the command prompt terminal (enter "cmd" from the start menu).
 - c. Enter "ping" and the IP address you created in step 5.
Ex. > **ping 192.168.0.150**
 - d. If there are lost packets, there is no connection. Check the Ethernet connection and IP address and try again.

D.4 Modbus Datapoints

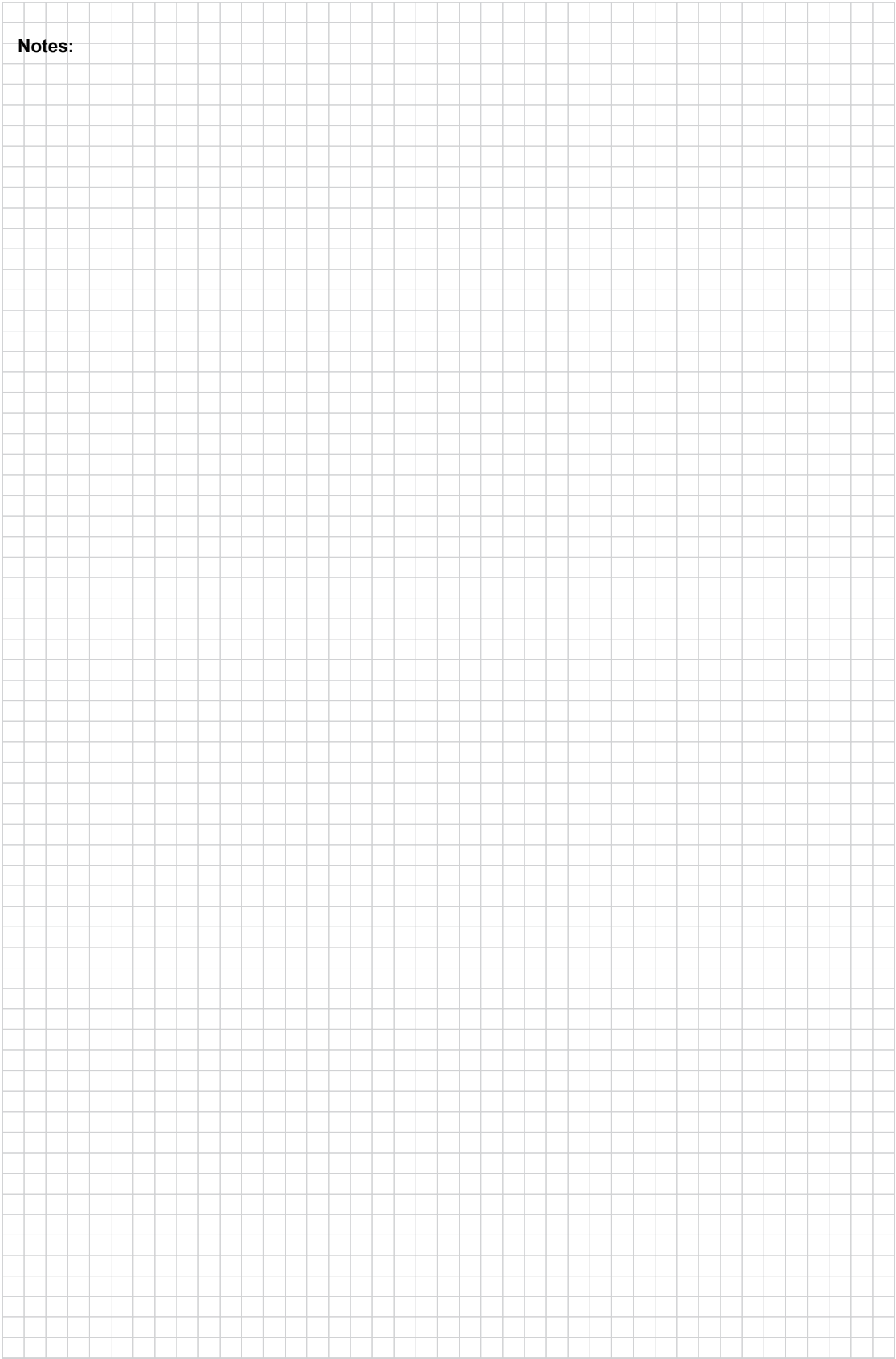
Table 9: Analog and Misc. Datapoints

RS232, ID: 35 Bitude: 9600, Parity: None, Stop bits: 1						MBA	MBE	Format
Holding Register	Coil Status	Read/Write	INFO	Text / Info	Var.			
Analog inputs								
70		R		Humidity sensor	% RH	0	100	##
76		R		0-10V dehumidification control	VDC	0.0	10.0	##.#
Analog setpoint								
9		R/W		Humidity setpoint for humidity sensor	% RH	50	-	##
Misc								
	2	R/W	1=On	Unit on/off	1/0	-	-	-
	3	R	1=On	Urgent alarm	1/0	-	-	-
	4	R	1=On	Non urgent alarm	1/0	-	-	-
	13	R/W	1=On	Cooling time react. Air fan	1/0	-	-	-
	15	R/W	1=Auto	Unit automatic/manual mode	1/0	-	-	-
	27	R/W	1=On	Continuous process air fan	1/0	-	-	-

Table 10: Input and Output Datapoints

RS232, ID: 35 Bitrate: 9600, Parity: None, Stop bits: 1						MBA	MBE	Format
Holding Register	Coil Status	Read/ Write	INFO	Text / Info	Var.			
Digital inputs (Read)								
	24576	R	1=On	Rotation guard sensor	1/0	-	-	-
	24577	R	1=On	Circuit breaker, react. Heater	1/0	-	-	-
	24578	R	1=On	Circuit breaker, process air fan	1/0	-	-	-
	24579	R	1=On	Circuit breaker, react. Air fan/Drive motor	1/0	-	-	-
	24580	R	1=On	Overheating protection OH2	1/0	-	-	-
	24581	R	0=On	Proc. air fan, thermal protection/alarm	1/0	-	-	-
	24582	R	1=On	Filter guard (option)	1/0	-	-	-
	24583	R	1=On	External start/Humidistat	1/0	-	-	-
	24584	R	0=On	External stop/Stop button	1/0	-	-	-
	24585	R	0=On	React. Air fan, thermal protection/alarm	1/0	-	-	-
Digital outputs (Read)								
	16384	R	1=On	React. Heater step 1	1/0	-	-	-
	16385	R	1=On	Process air fan	1/0	-	-	-
	16386	R	1=On	React. Air fan	1/0	-	-	-
	16387	R	1=On	Drive motor	1/0	-	-	-
	16388	R	1=On	Alarm indication	1/0	-	-	-
	16389	R	1=On	React. Heater step 2	1/0	-	-	-
	16390	R	1=On	React. air fan 10V control relay	1/0	-	-	-

Notes:



Warranty

Condair Inc. and/or Condair Ltd. (hereinafter collectively referred to as THE COMPANY), warrant for a period of two years after installation or 30 months from manufacturer's ship date, whichever date is earlier, that THE COMPANY's manufactured and assembled products, not otherwise expressly warranted, are free from defects in material and workmanship. No warranty is made against corrosion, deterioration, or suitability of substituted materials used as a result of compliance with government regulations.

THE COMPANY's obligations and liabilities under this warranty are limited to furnishing replacement parts to the customer, F.O.B. THE COMPANY's factory, providing the defective part(s) is returned freight prepaid by the customer. Parts used for repairs are warranted for the balance of the term of the warranty on the original humidifier or 90 days, whichever is longer.

The warranties set forth herein are in lieu of all other warranties expressed or implied by law. No liability whatsoever shall be attached to THE COMPANY until said products have been paid for in full and then said liability shall be limited to the original purchase price for the product. Any further warranty must be in writing, signed by an officer of THE COMPANY.

THE COMPANY's parts or materials that are considered consumables, including but not limited to: cylinders, filters, nozzles, membranes, media, gaskets, O-rings, etc. are NOT covered by the warranty.

THE COMPANY makes no warranty and assumes no liability unless the equipment is installed in strict accordance with a copy of the catalog and installation manual in effect at the date of purchase and by a contractor approved by THE COMPANY to install such equipment.

THE COMPANY makes no warranty and assumes no liability whatsoever for consequential damage or damage resulting directly from misapplication, incorrect sizing or lack of proper maintenance of the equipment.

THE COMPANY makes no warranty and assumes no liability whatsoever for damage resulting from freezing of the humidifier, supply lines, drain lines, or quality of the water used.

THE COMPANY retains the right to change the design, specification and performance criteria of its products without notice or obligation.

THE COMPANY's limited warranty on accessories, not of the companies manufacture, such as controls, humidistats, pumps, etc. is limited to the warranty of the original equipment manufacturer from date of original shipment of humidifier.

Extended Warranty

Extended warranties are available to purchase under the conditions listed above.

CONSULTING, SALES, AND SERVICE:

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