



**CSD Series**  
Energy Saving Refrigerated Dryers  
800 – 3000 CFM

**NEW**



Engineered to Save

# Energy Saver

## ⇒ Dew Point Stability & Energy Efficiency... what a concept!

For decades, compressed air drying technologies have forced you to choose between pressure dew point stability and energy efficiency. Why? Because until the CSD Series was invented, it was virtually impossible to deliver both at the same time! Dew point stability relies on prompt responses of cooling-energy to the changes in heat load generated by swings in ambient conditions and compressed air flow. Energy savings result from interpreting those very same changes and then controlling the response of the refrigeration compressor.

Advanced Digital Scroll cooling technology holds your dew point steady and starts saving you money the minute you turn it on. Digital Scroll compression uses environmentally friendly R-404a refrigerant and consumes less energy. You benefit with a steady ISO Air Quality Class 4-5 pressure dew point that matches your plant air demand to the second and your drying costs to the penny.

- **Dew Point Stability:** 38°F from 0–100% of rated flow
- **Energy Savings:** up to 91% power reduction
- **Simplicity:** less moving parts for maximum reliability

**Table 1: Energy Consumption of Refrigerated Dryer Technologies**

Refrigerated Dryer Type	Air Load Percentage						38°F Dew Point
	100%	80%	60%	40%	20%	0%	
Digital Scroll	100%	83%	64%	45%	28%	9%	Stable
Non-cycling*	100%	96%	92%	86%	80%	76%	Stable
Cycling Thermal Mass*	100%	100%	100%	77%	50%	9%	Un-stable
Variable Speed*	100%	83%	64%	50%	50%	50%	Stable

\* Dryers correctly designed for 38°F dew points



## ⇒ Air Treatment Systems

Presented with a goal to create a complete energy efficient compressed air treatment system, our engineers conceived and designed the CSD Series. This one package is able to provide you with maximum energy efficiency, clean dry oil-free air, and a single set of connections for easy installation.

CSD Series Digital Scroll Refrigerated Air Dryers combine proven elements to your advantage for:

- **Dew Point Stability:** Unparalleled ISO Quality Class 4-5 dew point stability is maintained under all load conditions up to and including the full capacity rating
- **Water & Particulate Removal:** Grade B Filtration rated 3 micron is included as standard within our Moisture Separator to ensure 99% efficiency as a minimum
- **Oil Removal:** Optional, integral Grade E cold coalescing Filtration is available to provide air quality security with oil removal to 0.008 ppm

# Delivering Increased Profits

## ➔ Digital Scroll: Compression Made Simple

There are less moving parts in the entire Digital Scroll refrigeration circuit. The motor shaft/orbiting lower scroll assembly, the upper scroll, and a solenoid valve tested to 40 million cycles that loads and unloads the hermetically sealed refrigerant circuit. The CSD Series' patented Digital Scroll compression technology benefits you with:

Radial Compliance... the ability to automatically adjust the side-to-side movement of the scroll set to accommodate the presence and removal of non-compressible elements such as liquids or solids in the event of abnormal conditions

Axial Compliance... enables the digital load control solenoid to move the upper scroll up-and-down 4/1000 of an inch, to load and unload the refrigeration compressor.

Less Parts... means greater reliability. Piston compression requires 9 parts per cylinder. Digital Scroll compression is accomplished with only two parts; the upper and lower scroll set.



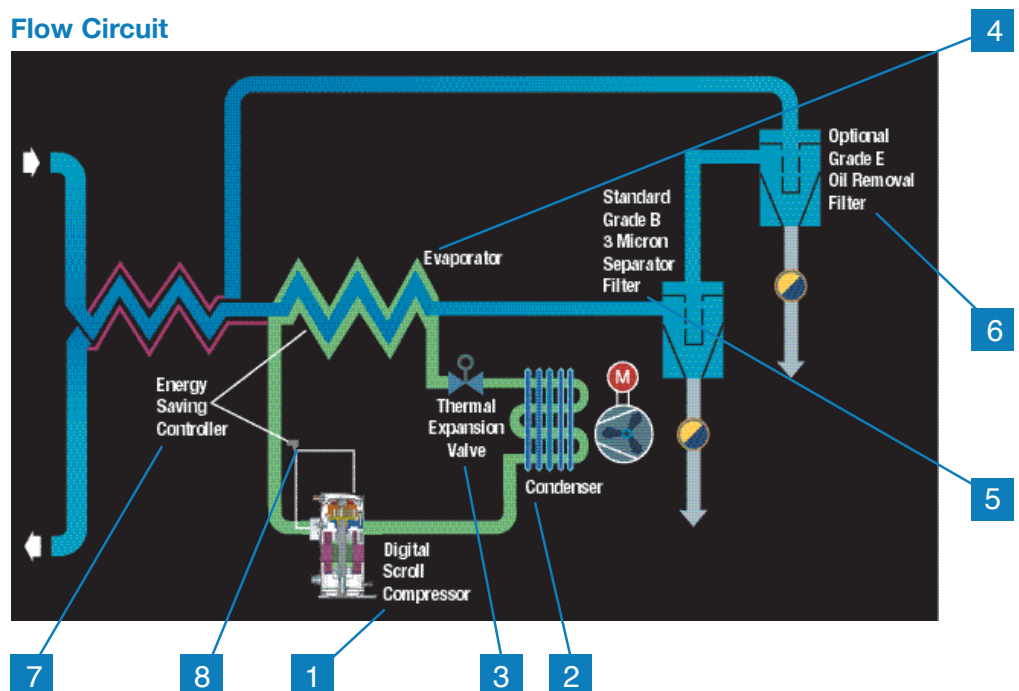
## ➔ Refrigeration Circuit: Simple, Original Cooling

The beauty of the Digital Scroll refrigeration circuit is in its simplicity. Environmentally friendly low-pressure R-404a refrigerant gas is pressurized in the Digital Scroll Compressor **(1)**. Once compressed into a high-pressure gas, it then flows through the condenser **(2)** and changes to a cold 35°F liquid. The thermal expansion valve **(3)** precisely meters the cold liquid refrigerant into the evaporator **(4)** where the work is done. Hot, saturated compressed air enters the evaporator at the end opposite the incoming liquid refrigerant. The compressed air is chilled as they cross paths. Water is condensed out of the cold exiting air and is efficiently removed in the Separator/Filter **(5)**. When ordered, the Grade E cold coalescing filter **(6)** removes oil droplets and aerosols to 0.008 ppm. The warm refrigerant is now a gas and returns to the Digital Scroll Compressor to continue the process.

While the compressor continues to run, the Energy Saving Controller **(7)** automatically energizes and de-energizes the solenoid valve

**(8)** to load and unload the compressor. This precisely controls the flow of the refrigeration circuit to exactly match your load conditions. We maintain a stable 38°F pressure dew point, and provide you with maximum energy savings.

Flow Circuit



# State-of-the-Art Instrumentation

## ESC Controller

The CSD Series' Energy Saving Controller (ESC) combines advanced electronics with globally recognized symbolism for simple at-a-glance operational security that includes an RS-232 communications interface port.

ESC Controls benefit you with:

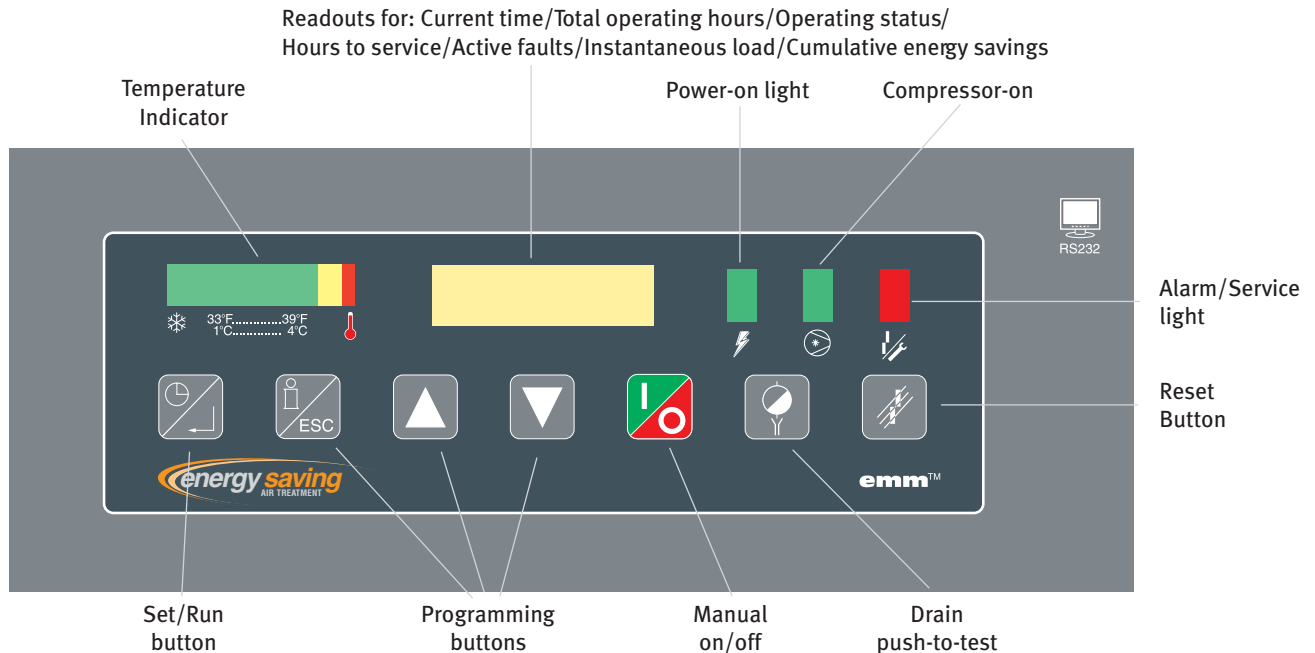
- **Operating Mode:** Digital Scroll mode automatically adjusts to your load. Scheduler mode lets you profit during anticipated shutdowns and restarts (i.e. 2 shift operation, weekends off) with no time lag. Not having to cool down thermal mass storage allows instantaneous savings and your workdays to coexist.



Parts and labor included.

Contact your local distributor for more details.

- **Auto-Restart:** this is one piece of equipment you won't have to worry about restarting after a power glitch. Programming stays in memory, too.
- **Emergency Shutdown:** panel mounted emergency shutdown button on front panel.
- **Dew Point Indicator:** graduated hi-visibility LEDs display drying process temperature status to confirm you're getting what you paid for.
- **Text Display:** vacuum fluorescent text display emits current time, operating mode, hours to service, total operating hours, active faults instantaneous load and cumulative energy savings. Genuine standard text formats include English, Spanish, German, French and Italian. Nine other languages are available to best serve your needs.
- **Remote Monitoring:** RS-232 communication port is standard equipment to allow you to keep track of un-manned equipment in remote installations.



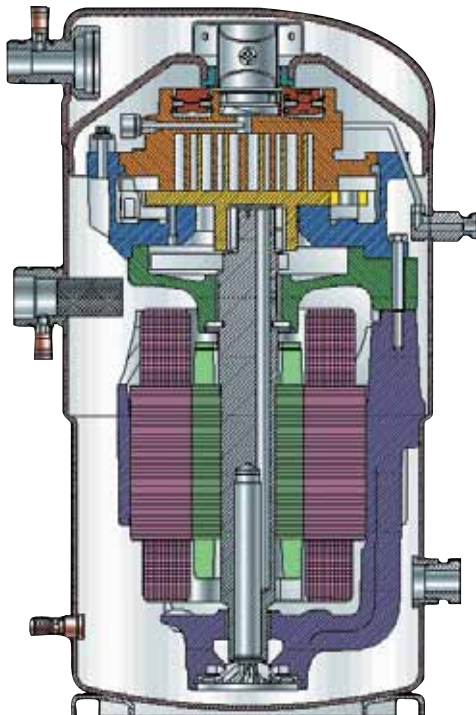
# Premium Design Features

## ➔ Digital Scroll Refrigeration Compressor

- Rugged digital scroll compression improves efficiency, durability and reliability and lowers decibel sound levels.
- Simple reliable operation results from having only two parts, a fixed upper scroll and an orbiting lower scroll.
- Long-life Scroll-set compression sealing surfaces are impregnated to wear-in and improve with time.
- Radial compliance controls the operation of the orbiting scroll set. Axial compliance controls the energy savings. Combined they excel at tolerating abnormal conditions like liquid slugs and solids.

## ➔ Platform/Chassis

- Design allows back-side of dryer to be placed against the wall.
- Connections: compressed air inlet/outlet portals are located through the roof for easy access to interior.
- Cooling air flow: enters one side and exhausts out the top for better ventilation and noise reduction.
- Lift out panels replace the hinged filter access doors for better access to interior.



## ➔ Exclusive Heat Exchanger Design

- Energy efficiency is maximized through the design of our exclusive plate type heat exchangers. Crafted from premium grade 316 stainless steel.
- No Prefiltration is required due to large bore, smooth channels that eliminate places for dirt, rust, and scale to accumulate. Less pressure drop saves you more energy.

## ➔ Integrated Separator/ Filter

- Standard Grade B filter/separator efficiently removes solids and liquids.
- Remove solids down to 3 microns.
- Remove oil down to 5 ppm.

## ➔ Optional Integrated High-Efficiency Oil Removal Filter

- Optional Grade E cold coalescer efficiently removes fine solids and oil aerosols.
- Remove solids down to 0.01 micron.
- Remove oil aerosols in the air down to 0.008 ppm.

## ➔ Dedicated Zero-Air-Loss Demand Drains

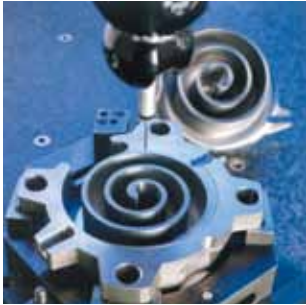
- Electronic energy saving demand drain is standard on Separator/Filter.
- Secondary drain is standard with optional Grade E Cold Coalescer.
- Maximum reliability from large orifice and proven level sensor.
- Intelligent electronics control cycling frequency and discharge duration.

# Precise Energy Savings

## ➔ Compare Technologies

### 1 Digital Scroll

Digital Scroll technology holds a steady dew point while it examines the actual heat load to know precisely when to start and stop the flow of the refrigerant. Maintaining constant motor speed and winding temperature ensures maximum motor lubrication and service life. Revolutionary design matches energy consumption to work load to achieve up to 91% energy savings while in operation. Scheduler mode totally eliminates all intermittent energy consumption during non-working hours without compromising dew point stability when work begins anew.



### 2 Hot Gas Bypass Valves (HGBV)

“Non-cycling” systems use a HGBV and run continuously to control the flow of the refrigerant and maintain a stable dew point. Energy consumption remains fairly constant regardless of air demands. Ideal for a stable pressure dew point at full load conditions.

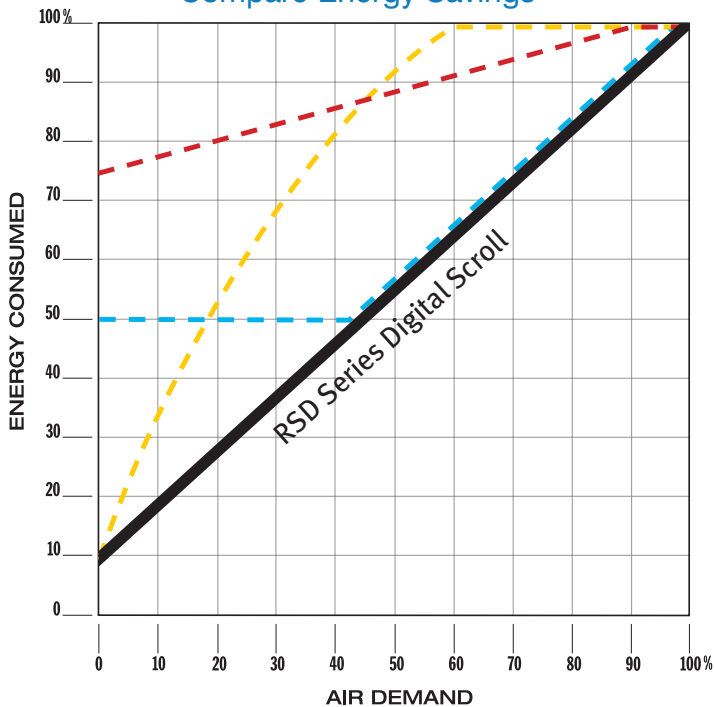
### 3 Thermal Mass Storage

Cycling systems normally use a volume of a chemical called Propylene Glycol or Sand to store cooling energy so the refrigeration compressor can be stopped and started. Energy is saved while the compressor is off. Start/stop temperature differential set points may produce an unsteady dew point. Dew point spikes can allow up to 120% more water vapor to remain than when maintaining a steady 38°F pressure dew point.

### 4 Variable Frequency/Speed Drive (VFD or VSD)

Motor speed is controlled by electronics that manufacture variable AC power. Energy savings maximizes at 50% of speed. Limiting motor speed reductions to 50% minimizes upper motor bearing lubrication losses that increase as compressor speed is reduced. HGBV is included to control dew point when operating below 50% of rated capacity.

Compare Energy Savings



- 1 — Digital Scroll
- 2 - - - Hot Gas Bypass Valves (HGBV)
- 3 - - - Thermal Mass Storage
- 4 - - - Variable Frequency/Speed Drive (VFD or VSD)

# Energy Savings: the Bottom Line

## System Pressure Savings

CSD Series Dryers start saving you money before you even turn them on. Your first line of savings results from being able to reduce your system pressure. Pressure savings result from our exclusive heat exchanger design that doesn't need a Prefilter. You save by not having to purchase and install a prefilter or, pay for the costly pressure drop associated with it. This feature alone saves you 2-5% of the rated brake horsepower of your air compressor.

CSD Series Annual Savings\* without a Prefilter

Air Flow scfm	Air Compressor Motor kW	4 psi Saved (2% power)	10 psi Saved (5% power)
800	119.4	\$2,028	\$5,071
1000	149.2	\$2,536	\$6,339
1250	186.5	\$3,169	\$7,924
1500	223.8	\$3,803	\$9,508
1750	261.1	\$4,437	\$11,093
2000	298.4	\$5,071	\$12,678
2500	373.0	\$6,339	\$15,847
3000	447.6	\$7,607	\$19,017

\* Based on 5 scfm/HP, \$.097/kWh, 8760 hours. Typical prefilter pressure drop is 4 psi. Maximum recommended differential pressure is 10 psi.

## Productivity Savings

Manufacturing productivity averages 81% of available time per shift. The remaining 19% of working hours is comprised of coffee breaks, lunch breaks and shift changes. Air demands may drop sharply due to curtailed usage during those periods. The CSD Series' unrivaled efficiency will match those demand changes and shift the savings to your bottom line.

It is common to have large surges in plant air demand that challenge system capacity for a brief period. This gives you the illusion that you are running your compressors at full capacity. However, many air system audits find continuous changes in demand with 75% of capacity representing a typical average load for first shift operation. Lighter loads on second shift may reduce air demand to less than one-half of capacity, and even less on third shift. Rely on the CSD Series to automatically maximize your bottom line energy savings.

CSD Series Annual Savings Estimator

	Example		Your Savings	
Step 1: Determine Maximum Air Demand	1000	scfm		scfm
Step 2: List Average Air Demands	1st shift	100	100% load	0-100%
	2nd shift	75	75% load	0-100%
	3rd shift	50	50% load	0-100%
	Break periods, shift changes	19	Time Constant	19 Time Constant
Step 3: Totalize shift values	244	Total		Total
Divide by number of entries	4	4 entries		# of entries
Attain average load profile percentage	61	61% load avg.		Percent of load
Step 4: Insert "No Prefilter" savings from table 2	\$2,536	4 psi saved		psi saved
Add closest dollar savings from table 3	\$1,603	75% load		% of load
<b>Conservative Annual Savings Estimate</b>	<b>\$4,139</b>	<b>Model CSD1000</b>		<b>CSD Model</b>

CSD Energy Savings per year by model\*

Average Air Flow %	Energy Consumption %	800	1000	1250	1500	1750	2000	2500	3000
100%	100%								
75	78	\$1,275	\$1,603	\$1,210	\$261	\$1,072	\$803	\$1,065	\$1,408
50	54	\$1,907	\$2,280	\$2,189	\$1,691	\$2,728	\$2,704	\$3,330	\$4,372
25	33	\$2,426	\$2,835	\$3,002	\$2,893	\$4,112	\$4,298	\$5,226	\$6,855
0	9	\$3,058	\$3,512	\$3,981	\$4,332	\$5,768	\$6,200	\$7,491	\$9,800

\* Savings vs. typical non-cycling designs at \$.097 per kWh

## CSD Series Specifications

Model	Rated Flow (1) (scfm)	Voltages (V/ph/Hz)	Power (kW)(2)	Connection (in)(3)	Dimensions (in)			Wt. (lb)	Total Air Treatment System Pressure Drop with Integrated Filtration			
					H	W	D		With Standard 3 Micron CAF Series Grade B Separator/Filter		With Optional 0.008 ppm oil CAF Series Grade E Integrated Filtration	
									psig	bar	psig	bar
CSD800	800	208-230/3/60	4.28	3 NPT	85	49	41	1124	2.4	0.17	5.2	0.30
CSD1000	1000		4.68	3 NPT	85	49	41	1146	3.4	0.23	6.9	0.48
CSD1250	1250	460/3/60	6.34	4 ANSI Flg	85	49	51	1521	3.6	0.25	8.0	0.55
CSD1500	1500		8.68	4 ANSI Flg	85	49	51	1563	4.7	0.32	10.0	0.69
CSD1750	1750	380-420/3/50	10.35	6 ANSI Flg	85	55	60	1940	3.4	0.23	6.5	0.45
CSD2000	2000		11.72	6 ANSI Flg	85	55	60	1997	4.4	0.30	7.9	0.54
CSD2500	2500	575/3/60	14.00	6 ANSI Flg	85	55	60	2315	3.5	0.24	7.9	0.54
CSD3000	3000		18.33	6 ANSI Flg	85	55	60	2646	5.0	0.34	10.3	0.71

**Table 1 - Correction Factors (Multipliers) For Inlet Air Temperature And Pressure**

Inlet Pressure (Psig)	Inlet Temperature					
	80°F	90°F	100°F	110°F	120°F	130°F
	(27°C)	(32°C)	(38°C)	(43°C)	(49°C)	(54°C)
50	1.35	1.05	0.84	0.69	0.56	0.44
80	1.50	1.17	0.95	0.79	0.66	0.52
100	1.55	1.23	1.00	0.82	0.70	0.56
125	1.63	1.31	1.07	0.91	0.74	0.61
150	1.70	1.37	1.13	0.95	0.80	0.64
175	1.75	1.42	1.18	0.99	0.84	0.66
200	1.80	1.47	1.22	1.03	0.89	0.68

**Table 1 - Notes:**

To adjust dryer capacity for conditions other than rated, use Correction Factors (multipliers) from Tables 1, 2 and 3.

**Example:** What is the capacity of a 1,000 scfm model when the compressed air at the inlet to the dryer is 150 psig and 100°F (38°C), and the ambient temperature is 90°F (32°C)?  
**Answer:** 2,000 scfm (rated flow from Specifications Table) x 1.08 (correction factor for inlet temperature and pressure from Table 1) x 1.06 (correction factor for ambient temperature from Table 2) = 2,290 scfm

**CSD Series Specifications - Notes:**

- All models utilize R404a refrigerant with Digital Scroll compressors.
- All models utilize a standard electric demand drain.
- Second electric demand drain is standard when optional integrated Grade E oil removal filter is selected.
- Maximum Operating Pressure 232 psig (14 bar), Maximum inlet temperature: 120°F (49°C).
  - Rated Flow Capacity - Conditions for rating dryers are in accordance with CAGI (Compressed Air and Gas Institute) Standard ADF100 working conditions: inlet air at 100 psig (7 bar) and 100°F (38°C) saturated, ambient air at 100°F (38°C), operating on 60 Hz power supply. At rated conditions, outlet pressure dew point is meets ISO 8573.1 ISO Quality Class 4-5.
  - At 35°F (2°C) evaporator and 100°F (38°C) ambient.
  - BSP connections and DIN flanges available.
  - All models are UL/CSA certified.

**Table 2 - Correction Factors for Ambient Temperature\***

Ambient Temperature	80°F	90°F	100°F	110°F
	(27°C)	(32°C)	(38°C)	(43°C)
Multiplier	1.12	1.06	1.00	0.94

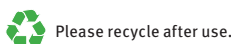
\*Air-cooled models only. For water-cooled use a 1.15 multiplier if cooling water is less than 95°F (35°C)



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