CASCADE17-0342Y3
R134a
48 V DC
VARIABLE SPEED

Brushless DC Variable Speed Compressor Technical Data Sheet

General Information

Compressor Part Number (Stationary)	CASCADE0006	(140 per pallet)
Compressor Part Number (Mobile)	CASCADE1006	(140 per pallet)
Compressor Drawing	DCMX17	
24V Controller Part Number	030F0152	
24V Controller Part Number	030F0189	
48V Controller Part Number	030F0137	
48V Controller Part Number	030F0192	
48V Controller Part Number	030F0175	
Wiring Diagram Drawing	DEMX0028	

Application Information

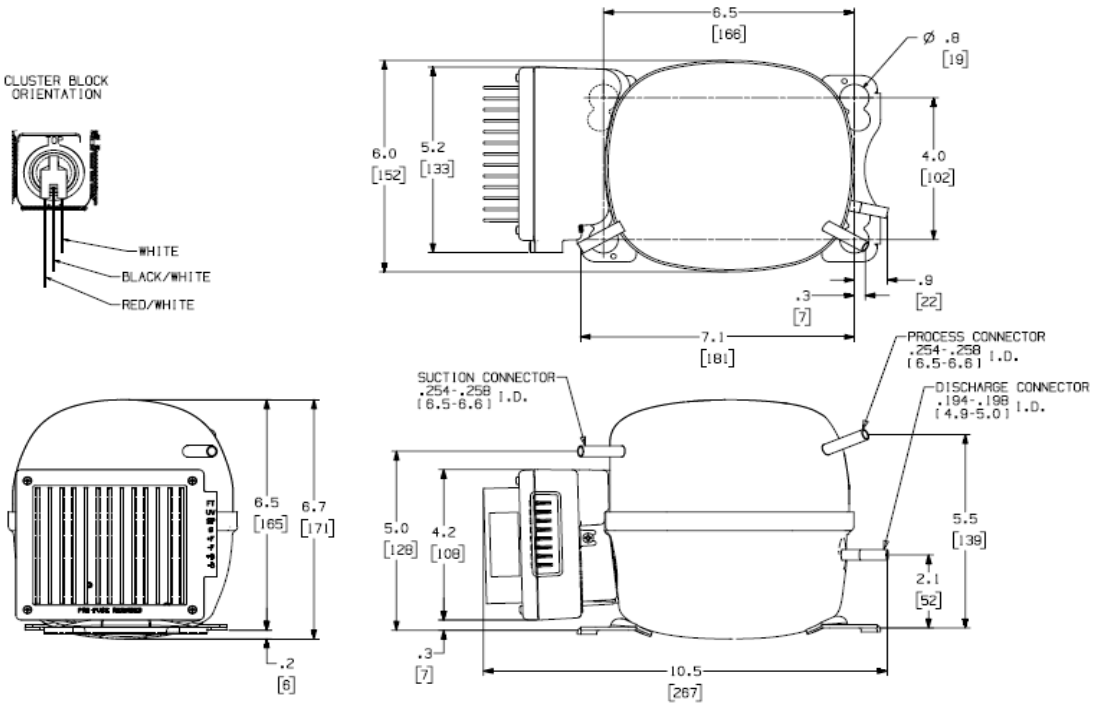
Application	LBP/MBP/HBP
Refrigerant	R134a
Evaporator Temperature Range	-40° F to 59° F (-40° C to 15° C)
Condenser Temperature Range	80° F to 150° F (26.7° C to 65.6° C)

Design

Displacement	5.60 cm^3 (0.342 in^3)
Oil Quantity	270 ml
Oil Type	POE 32cSt
Weight - Compressor/Controller	6.67 kg / 14.7 lb

	24V			48V		
Battery Protection	**Min.**	**Nominal**	**Max.**	**Min.**	**Nominal**	**Max.**
Under Voltage Shutdown	18.0	19.0	20.0	34.0	36.0	37.0
Over Voltage Shutdown	29.0	30.0	31.0	59.0	60.0	61.0

Compressor Dimensions



*ALTERNATE MOUNTING: 6.7" [171] L x 2.8" [70] W, Ø.64" [16]

the Cascade

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Compressor Rating Data

LBP

Specification	ASHRAE	CECOMAF	SPEER
Voltage (VDC)	48	48	48
RPM	4200	4200	4200
Evap. Temp. (°F/°C)	-10°F / -23.3°C	-13°F / -25.0°C	-10°F / -23.3°C
Cond. Temp. (°F/°C)	130°F / 54.4°C	131°F / 55.0°C	105°F / 40.6°C
Ambient Temp. (°F/°C)	90°F / 32.2°C	90°F / 32.2°C	90°F / 32.2°C
Suction Temp. (°F/°C)	90°F / 32.2°C	90°F / 32.2°C	90°F / 32.2°C
Liquid Temp. (°F/°C)	90°F / 32.2°C	131°F / 55.0°C	90°F / 32.2°C
Cooling Capacity (BTU/watt)	621.13 / 182.036	430.25 / 126.094	714.18 / 209.305
Power (watt)	140.80	115.20	124.80
Current (amp)	2.93	2.40	2.60
Efficiency (EER/COP)	4.41 / 1.29	3.73 / 1.09	5.72 / 1.68

MBP

Specification	ASHRAE	ARI
Voltage (VDC)	48	48
RPM	4200	4200
Evap. Temp. (°F/°C)	20°F / -6.7°C	20°F / -6.7°C
Cond. Temp. (°F/°C)	130°F / 54.4°C	120°F / 48.9°C
Ambient Temp. (°F/°C)	95°F / 35.0°C	95°F / 35.0°C
Suction Temp. (°F/°C)	95°F / 35.0°C	40°F / 4.4°C
Liquid Temp. (°F/°C)	115°F / 46.1°C	120°F / 48.9°C
Cooling Capacity (BTU/watt)	1347.69 / 394.969	1286.27 / 376.969
Power (watt)	225.60	220.80
Current (amp)	4.70	4.60
Efficiency (EER/COP)	5.97 / 1.75	5.83 / 1.71

HBP

Specification	ASHRAE	ARI
Voltage (VDC)	48	48
RPM	3850	3850
Evap. Temp. (°F/°C)	45°F / 7.2°C	45°F / 7.2°C
Cond. Temp. (°F/°C)	130°F / 54.4°C	130°F / 54.4°C
Ambient Temp. (°F/°C)	95°F / 35.0°C	95°F / 35.0°C
Suction Temp. (°F/°C)	95°F / 35.0°C	65°F / 18.3°C
Liquid Temp. (°F/°C)	115°F / 46.1°C	115°F / 46.1°C
Cooling Capacity (BTU/watt)	2570.10 / 753.22	2288.94 / 670.82
Power (watt)	288.00	278.40
Current (amp)	6.00	5.80
Efficiency (EER/COP)	8.92 / 2.62	8.22 / 2.41

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Cooling Capacity (24V) - ARI HBP — **BTU/hr (Watt)**

	Evaporator Temperature												
RPM	**20°F**	**(-7°C)**	**30°F**	**(-1°C)**	**35°F**	**(2°C)**	**40°F**	**(4°C)**	**45°F**	**(7°C)**	**50°F**	**(10°C)**	**55°F**	**(13°C)**
1800	663	(194)	766	(224)	861	(252)	970	(284)	1085	(318)	1193	(349)	1284	(376)
2400	879	(257)	1056	(309)	1191	(349)	1343	(393)	1501	(440)	1656	(485)	1796	(526)
3000	1033	(302)	1282	(375)	1456	(426)	1649	(483)	1851	(542)	2052	(601)	2239	(656)
3600	1170	(343)	1489	(436)	1702	(498)	1935	(567)	2180	(638)	2425	(710)	2659	(779)
4200	1337	(391)	1723	(505)	1973	(578)	2246	(658)	2532	(741)	2820	(826)	3100	(908)

Power Consumption (24V) - ARI HBP — **Watt**

	Evaporator Temperature						
RPM	**20°F**	**30°F**	**35°F**	**40°F**	**45°F**	**50°F**	**55°F**
1800	104	124	134	142	150	158	165
2400	126	149	159	169	178	187	195
3000	172	196	207	218	229	239	249
3600	214	240	252	264	276	288	299
4200	226	254	267	280	293	306	319

Current (24V) - ARI HBP — **Amp**

	Evaporator Temperature						
RPM	**20°F**	**30°F**	**35°F**	**40°F**	**45°F**	**50°F**	**55°F**
1800	4.33	5.18	5.57	5.93	6.26	6.57	6.86
2400	5.26	6.19	6.62	7.02	7.41	7.78	8.13
3000	7.17	8.17	8.64	9.09	9.53	9.96	10.37
3600	8.93	10.00	10.52	11.02	11.51	11.99	12.46
4200	9.43	10.57	11.13	11.68	12.22	12.76	13.29

Efficiency (24V) - ARI HBP — **BTU/hr/W (W/W)**

	Evaporator Temperature												
RPM	**20°F**	**(-7°C)**	**30°F**	**(-1°C)**	**35°F**	**(2°C)**	**40°F**	**(4°C)**	**45°F**	**(7°C)**	**50°F**	**(10°C)**	**55°F**	**(13°C)**
1800	6.38	(1.87)	6.16	(1.80)	6.44	(1.89)	6.82	(2.00)	7.22	(2.11)	7.56	(2.21)	7.80	(2.28)
2400	6.96	(2.04)	7.11	(2.08)	7.50	(2.20)	7.97	(2.33)	8.44	(2.47)	8.87	(2.60)	9.21	(2.70)
3000	6.00	(1.76)	6.54	(1.91)	7.02	(2.06)	7.56	(2.21)	8.09	(2.37)	8.59	(2.51)	9.00	(2.64)
3600	5.46	(1.60)	6.20	(1.82)	6.74	(1.97)	7.32	(2.14)	7.89	(2.31)	8.43	(2.47)	8.89	(2.60)
4200	5.90	(1.73)	6.79	(1.99)	7.39	(2.16)	8.01	(2.35)	8.63	(2.53)	9.21	(2.70)	9.72	(2.85)

*** all points are at 35°C (95°F) ambient, 18.33°C (65°F) suction temperature, 8.33°C (15°F) subcooling, 54.4°C (130°F) condenser**

Performance Coefficients (24V) - ARI HBP

Coefficient	Capacity (BTU/Hr)	Power (Watts)	Current (Amperes)	Mass Flow (Lbs/Hr)
C1	-1.592347E+04	1.088217E+03	4.534238E+01	-1.545908E+02
C2	9.498700E+00	-6.717127E-01	-2.798803E-02	1.050577E-01
C3	-7.688808E-04	1.911340E-04	7.963915E-06	-1.030939E-05
C4	3.483050E-08	-2.073188E-08	-8.638281E-10	5.161142E-10
C5	9.373694E+02	-3.911752E+00	-1.629896E-01	1.090514E+01
C6	-4.066662E+00	-8.680358E-02	-3.616817E-03	-5.266672E-02
C7	-1.400403E-02	4.228251E-05	1.761770E-06	-1.568060E-04
C8	1.231457E+02	-1.154928E+01	-4.812201E-01	7.882537E-01
C9	3.819575E-01	5.932875E-02	2.472031E-03	6.723495E-03
C10	-2.966838E-03	-8.533166E-05	-3.555486E-06	-3.261732E-05
C11	4.048536E-03	-2.280483E-05	-9.502010E-07	4.709452E-05
C12	-1.627347E-07	3.704612E-10	1.543587E-11	-2.055891E-09
C13	-1.426063E-05	-9.324866E-08	-3.885364E-09	-1.682211E-07
C14	-8.587879E-06	6.792910E-08	2.830379E-09	-9.258485E-08
C15	-3.711755E-01	1.922667E-03	8.011108E-05	-4.524282E-03
C16	-9.469632E-02	2.865920E-03	1.194133E-04	-9.027043E-04
C17	-1.116009E+01	7.414104E-02	3.089209E-03	-1.223932E-01
C18	2.087117E-05	-5.029278E-08	-2.095531E-09	2.695767E-07
C19	1.924675E-03	1.594406E-05	6.643363E-07	2.400136E-05
C20	3.371079E-06	-7.159817E-08	-2.983257E-09	3.944649E-08
C21	2.302733E-04	-9.144090E-06	-3.810037E-07	1.877364E-06
C22	4.390527E-02	4.817491E-04	2.007289E-05	5.266804E-04
C23	2.632222E-02	-1.816099E-04	-7.567078E-06	2.667196E-04

Performance Equation

$$Y=C_1+C_2X_1+C_3X_1^2+C_4X_1^3+C_5X_2+C_6X_2^2+C_7X_2^3+C_8X_3+C_9X_3^2+C_{10}X_3^3+C_{11}X_1X_2X_3+C_{12}X_1^2X_2X_3+C_{13}X_1X_2^2X_3+C_{14}X_1X_2X_3^2+C_{15}X_1X_2+C_{16}X_1X_3+C_{17}X_2X_3+C_{18}X_1^2X_2+C_{19}X_1X_2^2+C_{20}X_1^2X_3+C_{21}X_1X_3^2+C_{22}X_2^2X_3+C_{23}X_2X_3^2$$

X_1 = RPM

$X_2 = E_t$ (°F)

$X_3 = C_t$ (°F)

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Cooling Capacity (48V) - ARI HBP — **BTU/hr (Watt)**

	Evaporator Temperature												
RPM	**20°F**	**(-7°C)**	**30°F**	**(-1°C)**	**35°F**	**(2°C)**	**40°F**	**(4°C)**	**45°F**	**(7°C)**	**50°F**	**(10°C)**	**55°F**	**(13°C)**
1800	663	(194)	766	(224)	861	(252)	970	(284)	1085	(318)	1193	(349)	1284	(376)
2400	879	(257)	1056	(309)	1191	(349)	1343	(393)	1501	(440)	1656	(485)	1796	(526)
3000	1033	(302)	1282	(375)	1456	(426)	1649	(483)	1851	(542)	2052	(601)	2239	(656)
3600	1170	(343)	1489	(436)	1702	(498)	1935	(567)	2180	(638)	2425	(710)	2659	(779)
4200	1337	(391)	1723	(505)	1973	(578)	2246	(658)	2532	(741)	2820	(826)	3100	(908)

Power Consumption (48V) - ARI HBP — **Watt**

	Evaporator Temperature						
RPM	**20°F**	**30°F**	**35°F**	**40°F**	**45°F**	**50°F**	**55°F**
1800	102	122	131	140	147	155	161
2400	124	146	156	165	174	183	191
3000	169	192	203	214	224	234	244
3600	210	235	248	259	271	282	293
4200	222	249	262	275	288	300	313

Current (48V) - ARI HBP — **Amp**

	Evaporator Temperature						
RPM	**20°F**	**30°F**	**35°F**	**40°F**	**45°F**	**50°F**	**55°F**
1800	2.12	2.54	2.73	2.91	3.07	3.22	3.36
2400	2.58	3.03	3.24	3.44	3.63	3.81	3.98
3000	3.51	4.00	4.24	4.46	4.67	4.88	5.08
3600	4.38	4.90	5.16	5.40	5.64	5.88	6.11
4200	4.62	5.18	5.46	5.73	5.99	6.26	6.52

Efficiency (48V) - ARI HBP — **BTU/hr/W (W/W)**

	Evaporator Temperature												
RPM	**20°F**	**(-7°C)**	**30°F**	**(-1°C)**	**35°F**	**(2°C)**	**40°F**	**(4°C)**	**45°F**	**(7°C)**	**50°F**	**(10°C)**	**55°F**	**(13°C)**
1800	6.51	(1.91)	6.28	(1.84)	6.57	(1.92)	6.96	(2.04)	7.36	(2.15)	7.71	(2.26)	7.96	(2.33)
2400	7.10	(2.08)	7.25	(2.12)	7.65	(2.24)	8.12	(2.38)	8.61	(2.52)	9.05	(2.65)	9.39	(2.75)
3000	6.12	(1.79)	6.67	(1.95)	7.16	(2.10)	7.71	(2.26)	8.25	(2.42)	8.75	(2.56)	9.18	(2.69)
3600	5.57	(1.63)	6.33	(1.85)	6.87	(2.01)	7.46	(2.19)	8.05	(2.36)	8.59	(2.52)	9.07	(2.65)
4200	6.02	(1.76)	6.93	(2.03)	7.53	(2.21)	8.17	(2.39)	8.80	(2.58)	9.39	(2.75)	9.91	(2.90)

*** all points are at 35°C (95°F) ambient, 18.33°C (65°F) suction temperature, 8.33°C (15°F) subcooling, 54.4°C (130°F) condenser**

Performance Coefficients (48V) - ARI HBP

Coefficient	Capacity (BTU/Hr)	Power (Watts)	Current (Amperes)	Mass Flow (Lbs/Hr)
C1	-1.592347E+04	1.067189E+03	2.223310E+01	-1.545908E+02
C2	9.498700E+00	-6.587328E-01	-1.372360E-02	1.050577E-01
C3	-7.688808E-04	1.874406E-04	3.905011E-06	-1.030939E-05
C4	3.483050E-08	-2.033126E-08	-4.235679E-10	5.161142E-10
C5	9.373694E+02	-3.836162E+00	-7.992000E-02	1.090514E+01
C6	-4.066662E+00	-8.512622E-02	-1.773463E-03	-5.266672E-02
C7	-1.400403E-02	4.146546E-05	8.638629E-07	-1.568060E-04
C8	1.231457E+02	-1.132611E+01	-2.359606E-01	7.882537E-01
C9	3.819575E-01	5.818230E-02	1.212131E-03	6.723495E-03
C10	-2.966838E-03	-8.368274E-05	-1.743390E-06	-3.261732E-05
C11	4.048536E-03	-2.236416E-05	-4.659198E-07	4.709452E-05
C12	-1.627347E-07	3.633025E-10	7.568796E-12	-2.055891E-09
C13	-1.426063E-05	-9.144675E-08	-1.905142E-09	-1.682211E-07
C14	-8.587879E-06	6.661646E-08	1.387843E-09	-9.258485E-08
C15	-3.711755E-01	1.885514E-03	3.928152E-05	-4.524282E-03
C16	-9.469632E-02	2.810540E-03	5.855290E-05	-9.027043E-04
C17	-1.116009E+01	7.270837E-02	1.514757E-03	-1.223932E-01
C18	2.087117E-05	-4.932094E-08	-1.027519E-09	2.695767E-07
C19	1.924675E-03	1.563596E-05	3.257494E-07	2.400136E-05
C20	3.371079E-06	-7.021463E-08	-1.462805E-09	3.944649E-08
C21	2.302733E-04	-8.967393E-06	-1.868207E-07	1.877364E-06
C22	4.390527E-02	4.724399E-04	9.842503E-06	5.266804E-04
C23	2.632222E-02	-1.781005E-04	-3.710427E-06	2.667196E-04

Performance Equation

$$Y=C_1+C_2X_1+C_3X_1^2+C_4X_1^3+C_5X_2+C_6X_2^2+C_7X_2^3+C_8X_3+C_9X_3^2+C_{10}X_3^3+C_{11}X_1X_2X_3+C_{12}X_1^2X_2X_3+C_{13}X_1X_2^2X_3+C_{14}X_1X_2X_3^2+C_{15}X_1X_2+C_{16}X_1X_3+C_{17}X_2X_3+C_{18}X_1^2X_2+C_{19}X_1X_2^2+C_{20}X_1^2X_3+C_{21}X_1X_3^2+C_{22}X_2^2X_3+C_{23}X_2X_3^2$$

X_1 = RPM

$X_2 = E_t$ (°F)

$X_3 = C_t$ (°F)

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Cooling Capacity (48V) - ASHRAE LBP — BTU/hr (Watt)

	Evaporator Temperature												
RPM	-40°F	(-40°C)	-30°F	(-34.4°C)	-20°F	(-28.9°C)	-10°F	(-23.3°C)	0°F	(-17.8°C)	5°F	(-15°C)	10°F	(-12.2°C)
1800					213	(62)	286	(84)	380	(111)	439	(129)	510	(149)
2400			181	(53)	268	(78)	372	(109)	510	(150)	597	(175)	698	(205)
3000	131	(38)	221	(65)	325	(95)	461	(135)	644	(189)	758	(222)	890	(261)
3600	161	(47)	256	(75)	379	(111)	547	(160)	775	(227)	916	(269)	1079	(316)
4200	179	(53)	280	(82)	421	(124)	621	(182)	895	(262)	1064	(312)	1258	(369)

Power Consumption (48V) - ASHRAE LBP — Watt

	Evaporator Temperature						
RPM	-40°F	-30°F	-20°F	-10°F	0°F	5°F	10°F
1800			44	53	68	76	86
2400		48	57	71	90	100	110
3000	43	55	72	92	115	126	137
3600	43	64	89	116	142	155	167
4200	45	76	108	141	171	185	198

Current (48V) - ASHRAE LBP — Amp

	Evaporator Temperature						
RPM	-40°F	-30°F	-20°F	-10°F	0°F	5°F	10°F
1800			0.92	1.11	1.41	1.59	1.79
2400		0.99	1.18	1.49	1.87	2.08	2.30
3000	0.90	1.14	1.49	1.93	2.39	2.63	2.86
3600	0.90	1.34	1.86	2.41	2.96	3.22	3.47
4200	0.94	1.58	2.26	2.93	3.57	3.85	4.12

Efficiency (48V) - ASHRAE LBP — BTU/hr/W (W/W)

	Evaporator Temperature												
RPM	-40°F	(-40°C)	-30°F	(-34.4°C)	-20°F	(-28.9°C)	-10°F	(-23.3°C)	0°F	(-17.8°C)	5°F	(-15°C)	10°F	(-12.2°C)
1800					4.79	(1.40)	5.38	(1.58)	5.62	(1.65)	5.75	(1.69)	5.95	(1.74)
2400			3.94	(1.15)	4.72	(1.38)	5.20	(1.53)	5.67	(1.66)	5.97	(1.75)	6.33	(1.85)
3000	3.02	(0.88)	5.09	(1.49)	4.54	(1.33)	4.99	(1.46)	5.61	(1.64)	6.01	(1.76)	6.48	(1.90)
3600	3.73	(1.09)	5.92	(1.74)	4.26	(1.25)	4.73	(1.39)	5.45	(1.60)	5.92	(1.74)	6.48	(1.90)
4200	3.97	(1.16)	6.18	(1.81)	3.89	(1.14)	4.41	(1.29)	5.23	(1.53)	5.75	(1.69)	6.37	(1.87)

*** all points are at 32.2°C (90°F) ambient, 32.2°C (90°F) suction temperature, 22.2°C (40°F) subcooling, 54.4°C (130°F) condenser**

Performance Coefficients (48V) - ASHRAE LBP

Coefficient	Capacity (BTU/Hr)	Power (Watts)	Current (Amperes)	Mass Flow (Lbs/Hr)
C1	4.843117E+03	-3.758131E+01	-7.829440E-01	5.892871E+01
C2	4.844846E-01	-8.199801E-02	-1.708292E-03	1.403603E-03
C3	-1.910217E-05	2.753497E-05	5.736451E-07	2.004940E-09
C4	-5.513570E-09	-2.560112E-10	-5.333567E-12	-8.099637E-11
C5	1.625388E+01	-3.206892E+00	-6.681024E-02	1.583970E-01
C6	5.399586E-01	-1.234511E-01	-2.571897E-03	5.706659E-03
C7	2.664384E-03	-3.171796E-04	-6.607909E-06	3.155425E-05
C8	-1.171677E+02	2.688113E+00	5.600235E-02	-1.379738E+00
C9	9.068263E-01	-1.753444E-02	-3.653008E-04	1.041614E-02
C10	-2.209961E-03	1.611258E-06	3.356789E-08	-2.463993E-05
C11	1.867223E-04	1.535914E-05	3.199821E-07	2.885989E-06
C12	3.727115E-08	-8.739266E-09	-1.820680E-10	3.993256E-10
C13	2.335575E-06	-3.409825E-07	-7.103803E-09	2.897961E-08
C14	-1.722536E-06	1.477160E-07	3.077416E-09	-2.062011E-08
C15	1.318240E-02	-3.934763E-03	-8.197423E-05	8.235952E-05
C16	1.008869E-03	3.443016E-04	7.172950E-06	6.154407E-05
C17	-5.600461E-01	1.209132E-01	2.519025E-03	-5.664703E-03
C18	-4.801705E-06	1.127219E-06	2.348372E-08	-5.184099E-08
C19	-1.921406E-04	2.841572E-05	5.919943E-07	-2.361170E-06
C20	4.907682E-07	-1.703299E-07	-3.548539E-09	5.305765E-09
C21	-3.032504E-05	3.273022E-06	6.818797E-08	-5.059307E-07
C22	-4.303254E-03	1.312686E-03	2.734762E-05	-4.546562E-05
C23	3.094646E-03	-7.000009E-04	-1.458335E-05	3.075653E-05

Performance Equation

$$Y=C_1+C_2X_1+C_3X_1^2+C_4X_1^3+C_5X_2+C_6X_2^2+C_7X_2^3+C_8X_3+C_9X_3^2+C_{10}X_3^3+C_{11}X_1X_2X_3+C_{12}X_1^2X_2X_3+C_{13}X_1X_2^2X_3+C_{14}X_1X_2X_3^2+C_{15}X_1X_2+C_{16}X_1X_3+C_{17}X_2X_3+C_{18}X_1^2X_2+C_{19}X_1X_2^2+C_{20}X_1^2X_3+C_{21}X_1X_3^2+C_{22}X_2^2X_3+C_{23}X_2X_3^2$$

X_1 = RPM

$X_2 = E_t$ (°F)

$X_3 = C_t$ (°F)

CASCADE17-0342Y3

Controller Features

4 pole sensor-less variable speed BLDC motor controller
420W maximum output power
030F0137 & 030F0175: 39 - 60 VDC input range, 030F0152: 19 - 30 VDC input range
1800 – 4200 rpm speed
1.0 - 4.75V analog speed set input (resistor programmable for fixed speed)
030F0137 & 030F0152: 0°C to 45°C operating temperature
030F0175 (LBP/MBP): 0°C to 55°C operating temperature (min. fan cooling / airflow across heatsink is 1.5 m/s)
030F0175 (HBP): 0°C to 46.1°C operating temperature (min. fan cooling / airflow across heatsink is 3 m/s)
Under/Over voltage shutdown (resistor programmable under voltage thresholds)
Locked rotor detection
Thermal shutdown – for power devices
Over current shutdown – for power devices
Low speed shutdown
TTL Fault output
Pulsed Fault output (030F0189 & 030F0192 only)
LED fault indicator
Fan output, +12VDC @ 0.5A with voltage detection
Reverse polarity protection

LED Fault Indicator Output

Motor Fault	1 Flash
Under Voltage	2 Flashes
Over Voltage	3 Flashes
Over Temperature	4 Flashes
Over Current/Power	5 Flashes
Fan Voltage Error	6 Flashes
General Hardware Error	7 Flashes
System Integrity Fault	8 Flashes

Use the formula below to find the resistor value needed to achieve a specific speed for the controller.

$$\frac{934960 - 806 * Speed\_Desired}{Speed\_Desired - 4360}$$

Optional Fixed Resistor Speed Chart

Resistor Value OHMS	Motor Speed [RPM]	
0	3000	48V ONLY
200	1800	
242	1900	
287	2000	
388	2200	
510	2400	
659	2600	
847	2800	
1090	3000	
1.4k	3200	
1.88k	3400	
2.58k	3600	
3.8k	3800	
6.36k	4000	
15.3k	4200