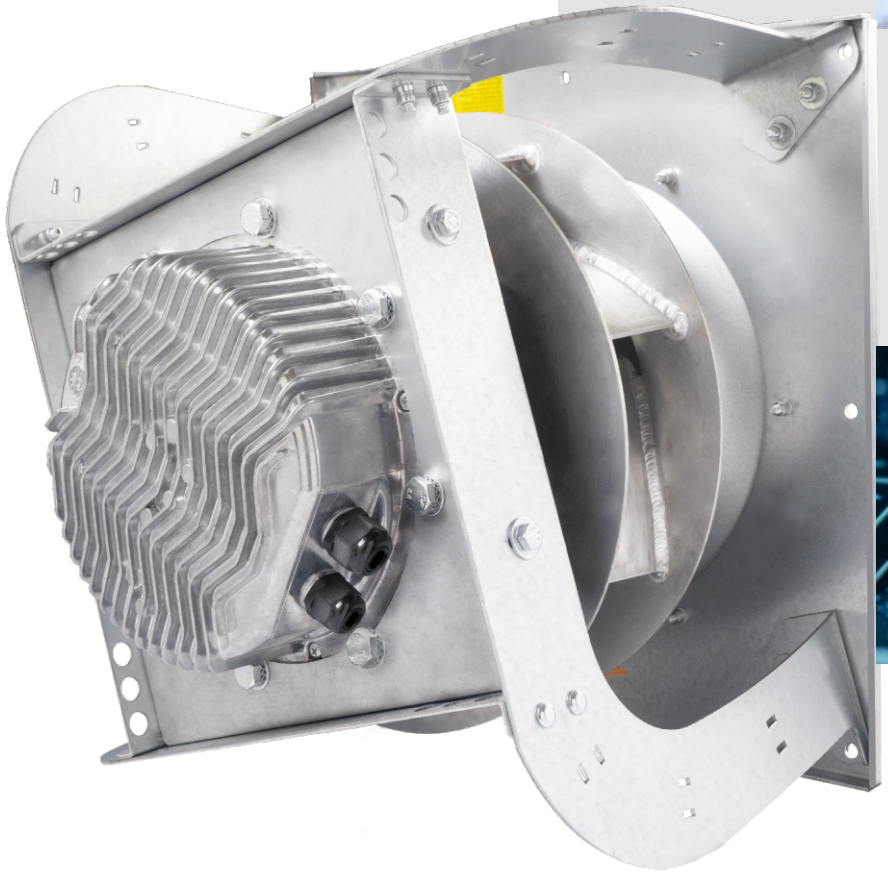
KRUGER

eBNC Ecowatt

EC Plenum Fan Series

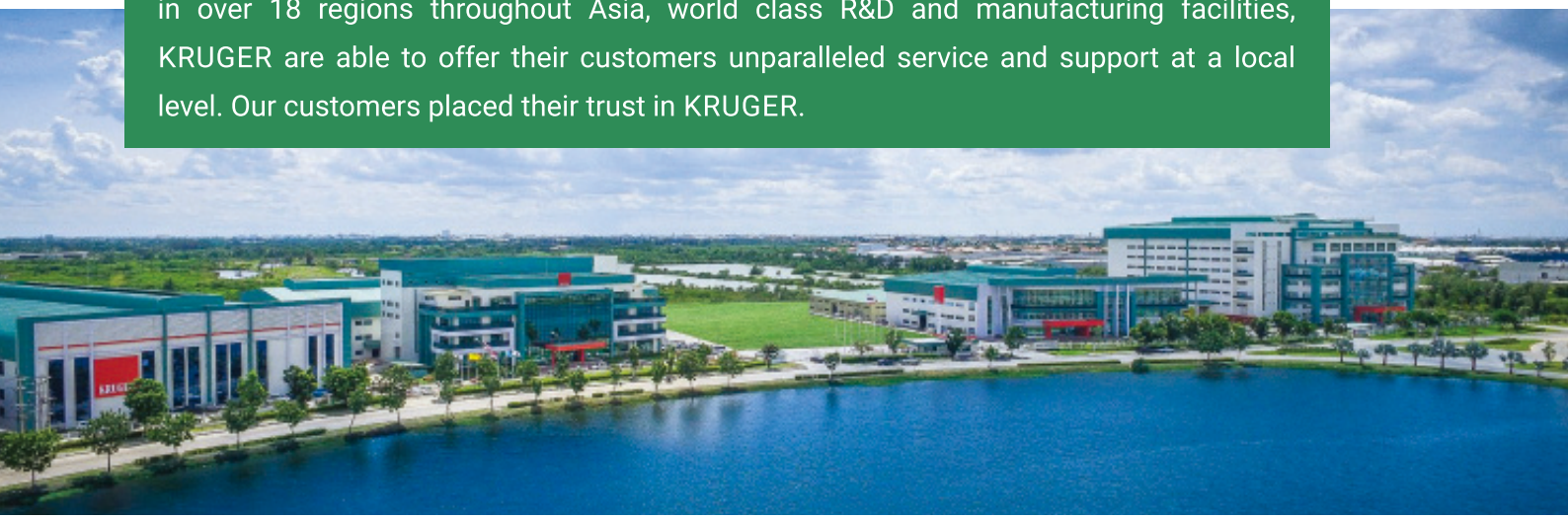
Ecowatt®



Energy (W) Efficient **Powerful** **Low Noise**

Why KRUGER?

KRUGER has been a leading innovator and manufacturer of residential, commercial and industrial fan application solutions across Asia since 1985. Today with a direct presence in over 18 regions throughout Asia, world class R&D and manufacturing facilities, KRUGER are able to offer their customers unparalleled service and support at a local level. Our customers placed their trust in KRUGER.

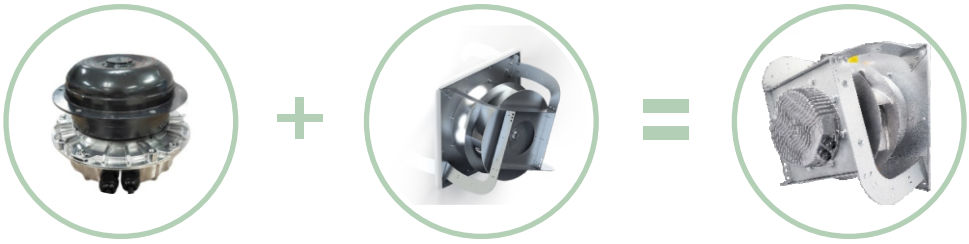


What is KRUGER eBNC Ecowatt EC Plenum Fan?

The eBNC Ecowatt plenum fan series is a newly developed, compact and highly efficient EC fan solution for air handling units.

Aluminium Impeller

3rd generation aerodynamically optimized plenum fan impeller made of aluminium material for its light weight and excellent matched up with an EC motor integrated with an electronically controlled internal driver motor (ECM) that was carefully selected and rigorously tested that provides an optimized system efficiency.

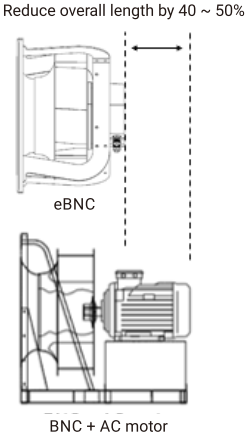


Efficient EC PM Motor

Integrated with a 3-phase controller vector EC motor that is significantly more efficient than conventional fan with AC motors. The permanent magnet increases the electrical efficiency of the motor while eliminates rotor copper and rotor slip losses and the electronic commutation eliminates mechanical wear of the carbon brushes. The end outcome is a far efficient motor.

Compact & Versatile

With the flow optimized "Boomerang" motor support aerodynamic design and integrated fan and drive assembly, it is a key advantage over conventional fans as it saves 40-50% in fan section length compared to equivalent plenum fan with AC motor. It is lightweight and lesser components makes it a versatile installation for AHU.



Speed Control

There are 3 simple wiring methods to control motor speed as shown below:

a. Manual speed control 0-10V via Potentiometer.
b. Automatic control signal 0-10Vdc or 4-20mA from Demand Controlled Ventilation (DCV) or Building Management System (BMS).
c. Automatic control by Modbus RTU program that is connected via RS485 interface.

Full control wiring schematic is available in wiring section.

REB-ECOWATT

Pressure/Airflow Control

Why Use a KRUGER eBNC Ecowatt EC Plenum Fan?

- The efficient vector motor allows energy saving over the full and part load operating spectrum while keeping system efficiency at optimum level.
- Reliable and optimized fan system where the entire fan, EC motor and control system is installed and tested as a complete system.
- Boomerang brackets allow for optimized aerodynamic airflow across the fan outlet.
- Low sound level due to good EC motor efficiency plus a light aluminium impeller ensures a low power consumption that leads to reduction in sound levels.
- Simple, easy to handle, light and compact.

It is a.....
SOLUTION
for TOTAL
FAN SYSTEM
EFFICIENCY
in AHU at
OPTIMUM
POINT of well
above 60%

Applications

Data Centre

Ideally suited for both new AHU equipment, retrofit applications and VAV systems. Highly efficient, versatile, clean and compact, it is recommended for applications and installation in data centres, clean rooms and other commercial buildings and general industrial applications where a low energy input is required.

The eBNC Ecowatt EC plenum fan is available in a ready-to-install design with aerodynamic "boomerang" spider bracket and a square mounting plate for mounting to AHU support panel or a fan wall.

It is designed for air handling application where the fan wheel operates without a housing but inside a plenum. The fan wheel pressurizes the entire plenum in which the fan is installed. This allows for air ducts to be directly connected from any direction within the plenum. Spider mounting brackets are used for mounting to the AHU.

Fan Wall Installation

The eBNC Ecowatt EC plenum fan system is also suited for fan wall technology design approach whereby multiple small fans are mounted together in a fan wall. It can be used as a replacement for single large AC fan or even multiples of AC fans. It derives extensive benefits such as footprint savings, lower energy cost over the full and part load spectrum, lower noise, increased reliability and redundancy and lower maintenance cost.

Summary of Key Specifications

A

Nominal fan diameter ranges from 315mm to 630mm with data at optimum efficiency point below.

Data at Optimum Efficiency Point							
eBNC Ecowatt Model	Airflow (cms)	Static Pressure (Pa)	Motor Input Power Pwr(kW)	SFP w/m³/s	Amp (A)	Speed (RPM)	LwA dB(A)
315 LP S5	0.71	768	0.91	1426	1.45	2595	86
315 HP S2	1.06	1764	3.18	2997	4.69	3920	94
355 LP S5	1.03	994	1.73	1669	2.48	2610	86
355 HP S2	1.19	1318	2.66	2230	3.87	3007	93
400 LP S2	1.22	982	2.02	1652	2.98	2230	87
450 LP W3	1.53	758	1.81	1179	2.96	1802	81
500 LP W3	2.13	962	3.18	1494	3.30	1800	88
560 LP W5	2.40	827	3.03	1262	5.19	1500	85
630 LP W5	3.20	636	3.10	968	5.32	1227	83

Nominal Voltage: 380-480VAC, Frequency 50/60 Hz. Performance certified is for installation type A-Free Inlet, Free Outlet. Performance ratings do not include the effects of appurtenances (accessories). The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for outlet Lwo A sound power levels for installation type A-Free Inlet, Free Outlet.

B

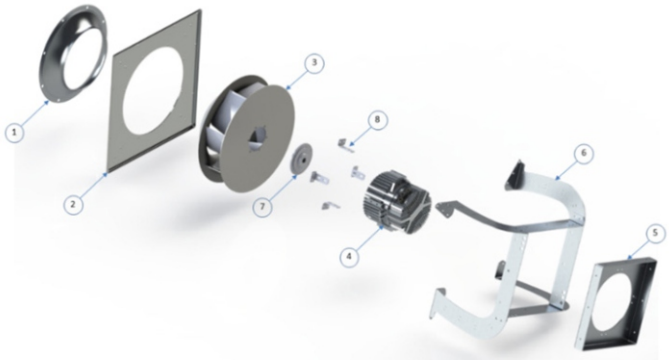
EC Motor Technical Specifications
The EC motor information and technical details

EC Motor Information						
Motor Technology	EC/PM	Motor Model	EC112D-L1HL01	EC112D-L1HL03	EM13210A412A4	EM13210A412B2
Efficiency	IE4	eBNC Model	315/355	315/355/400	450/500	560/630
Insulation Class	Class F	Max RPM	2650	4000	1800	1500
Poles	10	Max Input Power (kW)	1.85	3.25	3.30	3.30
Electrical Characteristic	3 phase AC/380-480V/50/60 Hz	Max Input Amp (A)	2.85	6	5.5	5.5
Speed Control	PWM Speed Regulation	Motor Designation	S5	S2	W3	W5
	0-10V Speed Regulation	Enclosure Class	IP 54	IP 54	IP 55	IP 55
	4-20mA Speed Regulation	Bearing	Maintenance Free Ball Bearings			
	Via MODBUS over RS485 Serial Connection	Electronic Enclosure	Aluminium Diecast			
Perm Amb Temp °C	-25 to 50	Weight (kg)	11.2	11.2	30.0	30.0
Motor Rotation	CW (viewed towards the rotor)	Rotor	External	External	Internal	Internal

C

Impeller Design & Specification

Fan Information		
No	Component	Material
1	Inlet Cone	Galvanized Steel
2	Inlet Cone Frame	Galvanized Steel
3	Wheel	Aluminium
4	Motor	EC Type Motor
5	Motor Support	Galvanized Steel
6	Spider Bracket	Galvanized Steel
7	Hub	Aluminium
8	Bracket	Galvanized Steel
9	Number of Blades	7
10	Fan Weight (casing + wheel + motor)	eBNC 315 = 23.2 kg eBNC 355 = 25.8 kg eBNC 400 = 28.2 kg eBNC 450 = 58.0 kg eBNC 500 = 63.0 kg eBNC 560 = 63.7 kg eBNC 630 = 71.5 kg



To optimize it for EC motor operations, the wheel of the eBNC Ecowatt is specially made from lightweight aluminium material and with its 7 backwards curved continuously welded and profile blade, it delivers strong static pressure with good efficiency and economical operation.

D

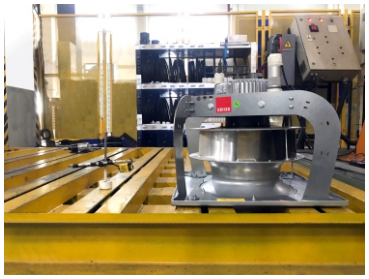
Certification

Kruger Ventilation Industries Asia Co. Ltd certifies that the eBNC Ecowatt series shown herein is licensed to bear the AMCA seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

E

High Balancing Quality

Motor impeller is statically and dynamically balanced to ISO 14694:2003 and AMCA 204 - G2.5 Standard. G1.0 Standard is avaiable upon request.



Flow Measurement (Option)

Fan volume flow rate could be estimated through the measurement of differential pressure at the fan inlet. The differential pressure compares the static pressure at the fan inlet cone (narrowest ID) and the static pressure of suction chamber/duct (right before the fan intet). This measurement is based on the Bernouili Principle and Continuity Equation, where volume flow rate through a converging cone could be calculated by the static pressure drop across the cone. There are 4 pressure taps installed on the fan inlet cone and these pressure taps are connected to the differential pressure transmitter by pressure tubes as Figure 1.

The volume flow rate of BNC fan can be calculated using the following formula:

$$Q = \frac{K x \sqrt{\frac{\rho 1}{\rho 2}} x \triangle P}{3600}$$

Where :
Q = Volume flow rate (CMS)
K = K-factor
ΔP = Measured static pressure difference (Pa) between the fan inlet and the suction chamber
ρ_1 = Standard air density 1.2 kg/m^3
ρ_2 = Actual air density (kg/m^3)

K-factor of BNC Series

Models	K-Factor
eBNC 315	125
eBNC 355	135
eBNC 400	157
eBNC 450	205
eBNC 500	256
eBNC 560	325
eBNC 630	403

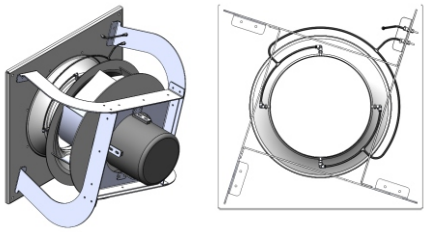
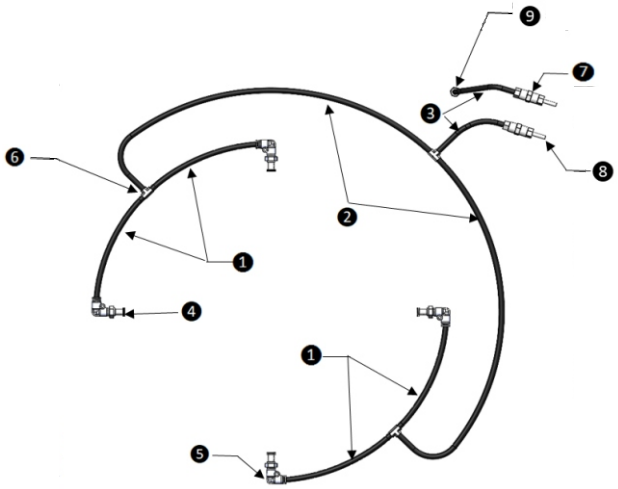
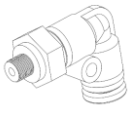


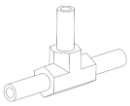
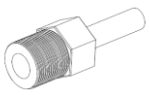
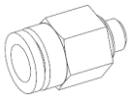
Figure 1

Note: Volume flow rate calculated through the measurement of differential pressure at fan inlet are not licensed by AMCA

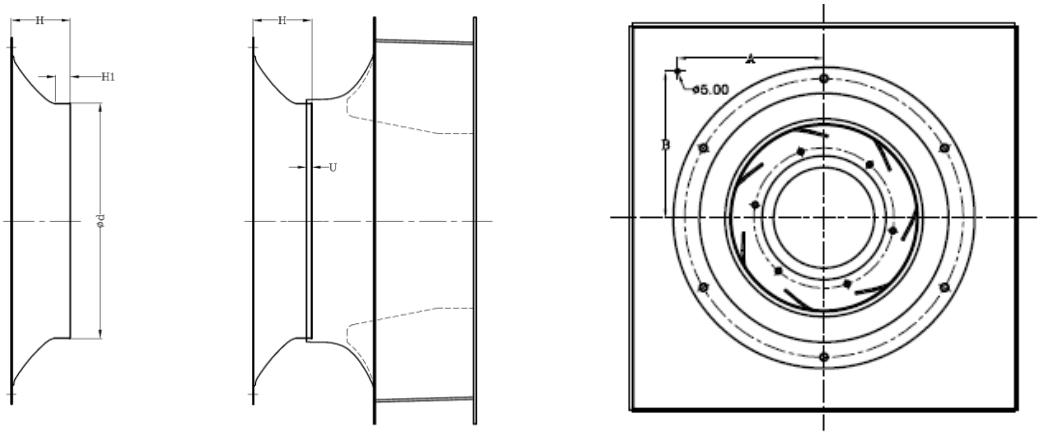
Flow Measurement Items Description



No.	Part	Descriptions	Quantity
1		Polyurethane (PU) Tube Black Color Size: O.D. 6 mm. I.D 4 mm. (4x6 mm.). Remark: length must be the same	4
2		Polyurethane (PU) Tube Black Color Size: O.D. 6 mm. I.D 4 mm. (4x6 mm.). Remark: length must be the same	2
3		Polyurethane (PU) Tube Black Color Size: O.D. 6 mm. I.D 4 mm. (4x6 mm.). Remark: length must be the same	2
4		Nutsert Size: M5	5
5		One-Touch Couplings - Male Elbows Size: One-Touch Couplings O.D 6 mm., I.D 4 mm., Male Elbows 4.85 mm.	4

No.	Part	Descriptions	Quantity
6		Fitting, barbed Size: 5.80 x 5.80 x 5.80 mm.	3
7		Coupling Size : Famale Thread O.D. 11.53 mm., I.D. 8 mm.	2
8		Hose Barb Fitting – Straight Size: Famale Thread 9.36 mm., Hose Barb 4.30 mm.	4
9		One-Touch Couplings - Male Thread Fittings Size: One-Touch Couplings O.D 6 mm., I.D 4 mm., Male Thread 4.85 mm.	1

Dimension of Installation Pressure Taps



Model	Size	H		H1		d(OD)		U		A	B
	(D)	mm.	ratio(H/D)	mm.	ratio(H1/D)	mm.	ratio(d/D)	mm.	ratio(U/D)	mm.	mm.
eBNC	315	49.5	0.16	13.0	0.04	221.0	0.7	4.0	0.013	150	190
	355	55.5	0.16	13.0	0.04	234.0	0.66	5.0	0.014	175	215
	400	69.4	0.17	13.0	0.03	266.0	0.67	5.0	0.013	190	240
	450	81.0	0.18	15.0	0.03	300.0	0.67	5.0	0.011	200	250
	500	82.1	0.16	15.0	0.03	331.0	0.66	5.0	0.011	220	270
	560	89.5	0.16	15.0	0.03	376.0	0.67	6.0	0.011	250	310
	630	103.1	0.16	22.0	0.03	420.0	0.67	5.0	0.008	290	350

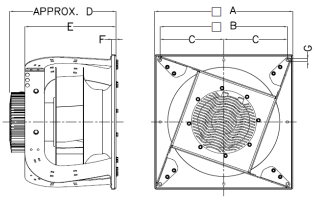
Nomenclature

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
E	X	X	X	X	X	X	X	X	X	-	X	X	-	X	X

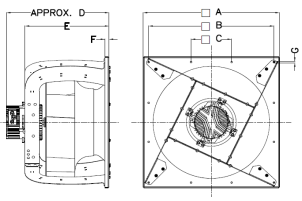
Digit1	Product Category	Digit 10	Motor Frame Size
'E'	Plenum Fan	"A"	3.25kW/400/3/50-60(EC112D-LHL03)-S2
Digit 2,3	Fan Series	"B"	1.85kW/400/3/50-60(EC112D-LHL01)-S5
"NC"	BNC	"C"	3.00kW/380/3/50-60(EM13210A412A4)-W3
Digit 4	Fan Drive Type	"D"	3.00kW/380/3/50-60(EM13210A412B2)-W5
"D"	Motor Drive Type	"E"	NA
Digit 5,6	Pressure Range	"F"	NA
"P1"	Type P(L)	"G"	NA
"P2"	Type P(M)	"H"	NA
"P3"	Type P(H)	Digit 11	None
"R1"	Type R(L)	Digit 12/13	Revision
"R2"	Type R(M)	Digit 14	None
"R3"	Type R(H)	Digit 15,16	Configuration/Others
"Q1"	Type Q(L)	Digit 00	None
"Q2"	Type Q(M)		
"Q3"	Type Q(H)		
Digit 7,8,9	Fan Model		

"031"	315	Example
"035"	355	ENCD P1031A-00-00 - Plenum Fan EBNC-P-315DL(S2)
"040"	400	ENCD P3031B-00-00 - Plenum Fan EBNC-P-315DH(S5)
"045"	450	ENCD P1050C-00-00 - Plenum Fan EBNC-P-500DL(W3)
"050"	500	ENCD P3056D-00-00 - Plenum Fan EBNC-P-560DL(W5)
"056"	560	
"063"	630	

Drawings & Dimensions (eBNC 315-630)



Models 315-400

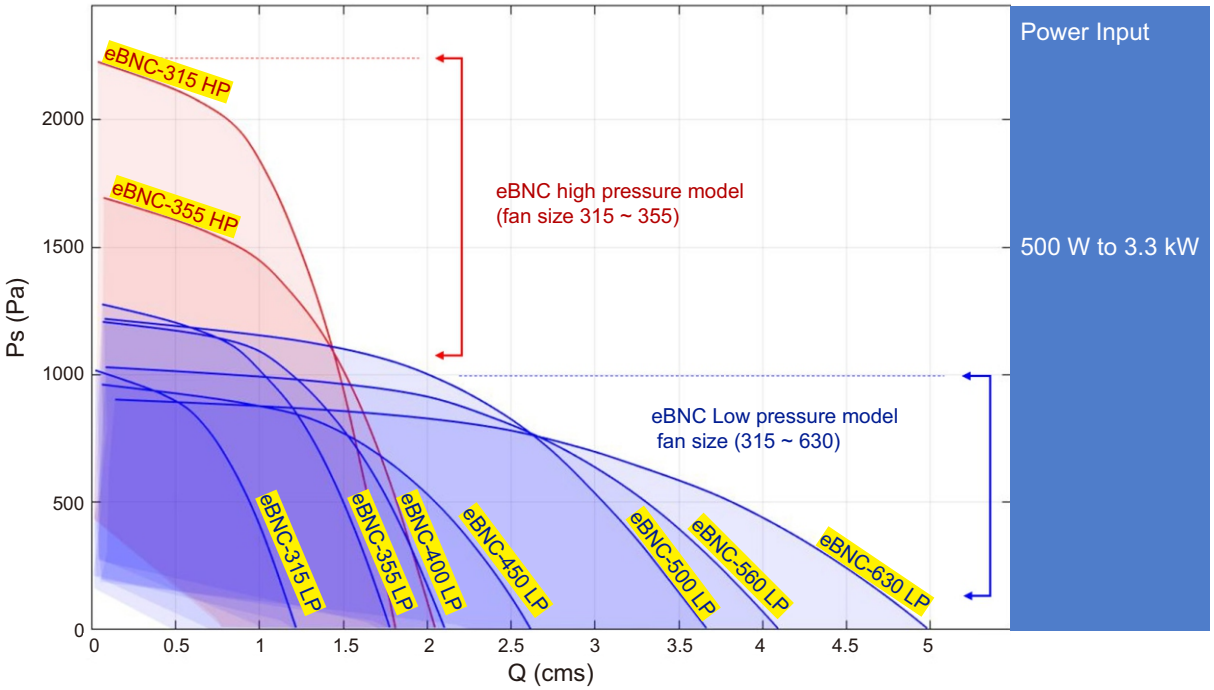


Models 450-630

Models	A	B	C	D	E	F	G
315	450	411	205.5	360	305	15	9
355	500	461	230.5	385	330	15	9
400	550	512	256	415	367	15	9
450	600	562	250	520	416	15	9
500	670	622	250	555	453	25	11
560	730	662	250	590	485	25	11
630	840	772	250	630	516	25	11

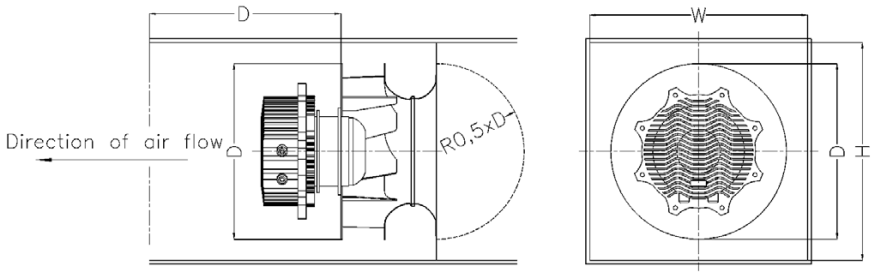
Ecowatt eBNC Fan Performance Curves

The graph below shows an overview of the maximum air performance for all the models measured in a chamber test rig. The motor power input ranges from 0.5 kW to 3.3 kW. High performance high-pressure motor is available for models eBNC 315/355.



Effect of Installation Space

Installation in a square box may cause a reduction in air performance.

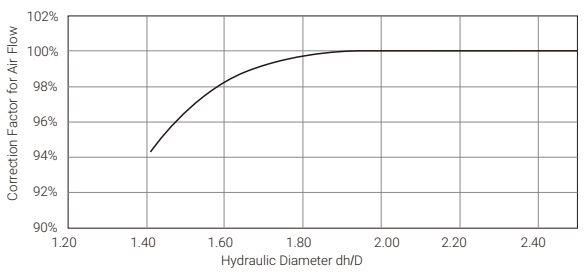


d_h = Hydraulic diameter
Formula:d_h=2xWxH/(W+H)
W = Width of the box
H = Height of the box
D = Outside diameter of the fan

For square cross sections that are greater than 1.9x the impeller diameter, no deduction has to be applied to the catalogue curves. Refer to curve below for appropriate correction factor when dh/D is lower than 1.9. Below is an example of square cross sections and respective impeller diameter. Where 1.9D is equal or smaller than cross sectional area of W*H divided by (W+H), no correction factor is required. Apply the appropriate correction factor as defined in the graph if dh/D is smaller than 1.9.

D	w(m)	H(m)	dh/D	dh=(WxH)/(W+H)	1.9*D≤dh
315	1	1	3.17	1.00	0.60
355	1	1	2.82	1.00	0.67
400	1	1	2.50	1.00	0.76
450	1	1	2.22	1.00	0.86
500	1	1	2.00	1.00	0.95
560	1	1	1.79	1.00	1.06
630	1	1	1.59	1.00	1.20

Correction Factor Values For Airflow Fan Size eBNC 315-630

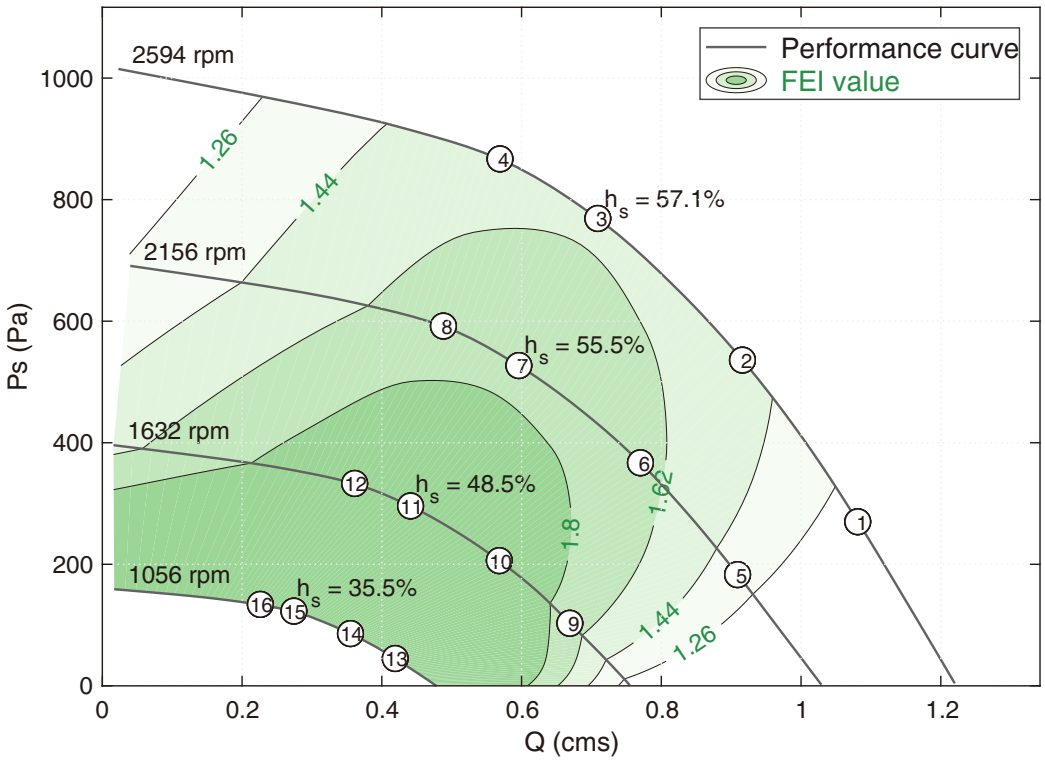


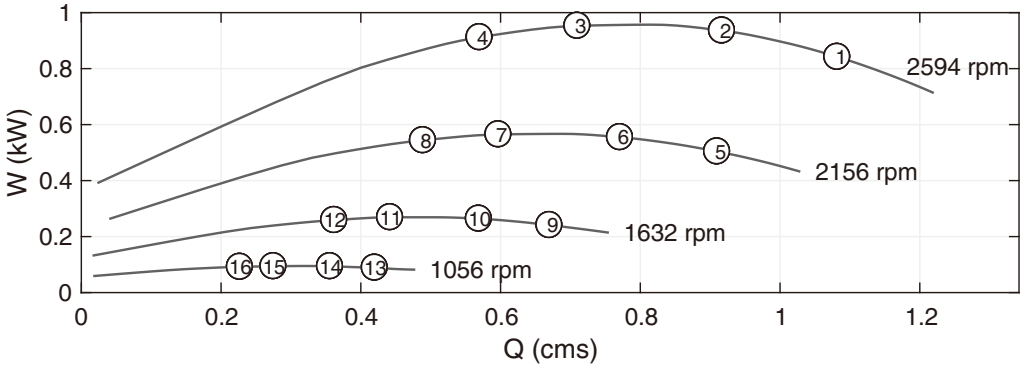
Note: The Correction Factor for Airflow due to Effect of Installation Space are not licensed by AMCA.

Characteristic Curve

Fan curves at the maximum speed and 3 different partial speeds with FEI curves are available with corresponding curves for power input and fan system static efficiency.

Characteristic Curve (eBNC 315-LP S5)

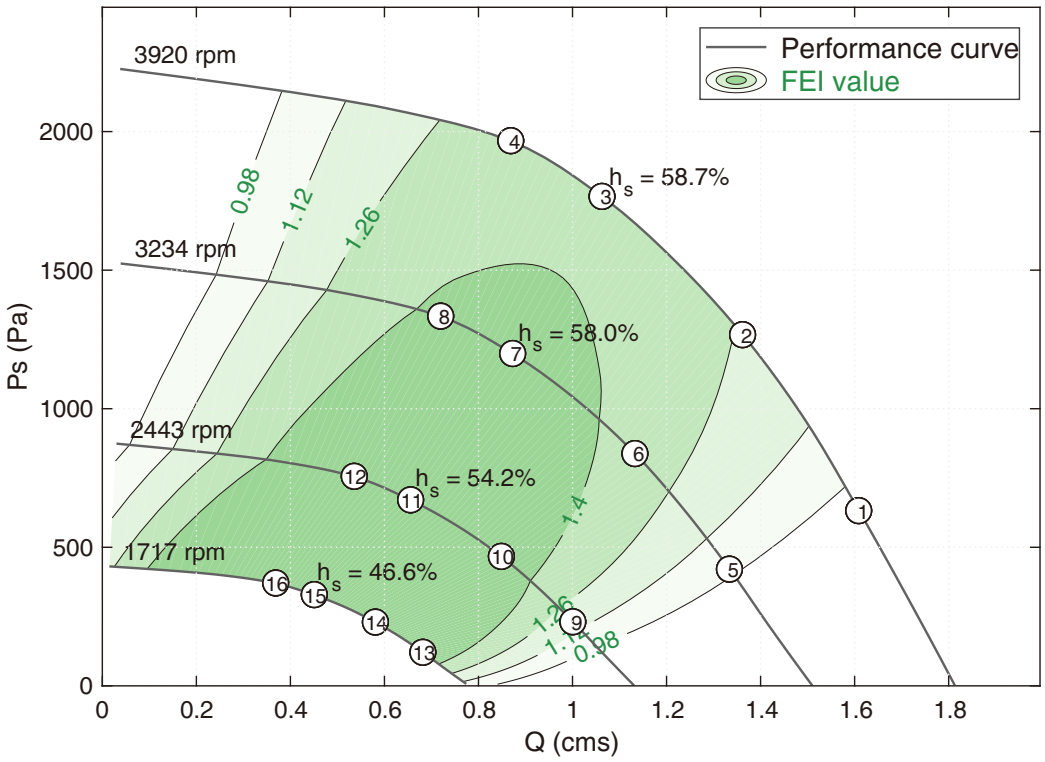


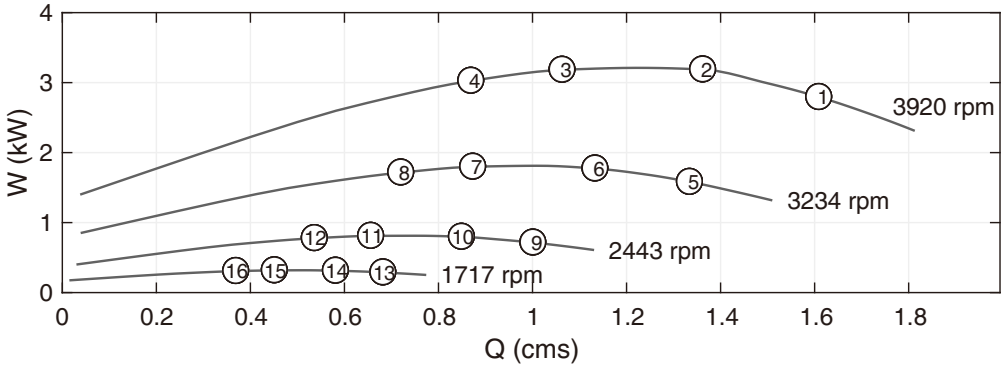


Point	Nominal Vol(VAC)	Freq (Hz)	Nominal Speed(rpm)	Ps(Pa)	Q(cms)	W(kW)	Hs(%)	I(A)	LwA
1	380-480	50/60	2595	269	1.082	0.84	34.5	1.30	88
2	380-480	50/60	2595	535	0.917	0.93	52.3	1.42	87
3	380-480	50/60	2594	768	0.710	0.95	57.1	1.45	86
4	380-480	50/60	2595	866	0.570	0.91	54.0	1.39	87
5	380-480	50/60	2156	182	0.910	0.50	32.9	0.84	85
6	380-480	50/60	2157	366	0.770	0.55	50.8	0.91	83
7	380-480	50/60	2156	526	0.597	0.57	55.5	0.92	82
8	380-480	50/60	2156	591	0.489	0.54	53.1	0.88	83
9	380-480	50/60	1632	102	0.670	0.24	28.5	0.47	80
10	380-480	50/60	1632	205	0.569	0.26	44.1	0.51	78
11	380-480	50/60	1632	295	0.442	0.27	48.5	0.53	77
12	380-480	50/60	1632	332	0.362	0.26	46.5	0.51	76
13	380-480	50/60	1056	44	0.420	0.09	20.6	0.28	74
14	380-480	50/60	1056	85	0.356	0.09	32.4	0.29	71
15	380-480	50/60	1056	122	0.275	0.09	35.5	0.29	69
16	380-480	50/60	1056	133	0.227	0.09	32.9	0.28	69

Speed (RPM) shown is nominal.
Performance is based on actual speed of test.
Ps is static pressure, Q is airflow, W is power input measured, Hs is fan static efficiency, A is input current, LwO(A) is A-weighted sound power.
Performance certified is for installation type A-Free Inlet, Free Outlet.
Performance ratings do not include the effects of appurtenances (accessories).
FEIs values are calculated in accordance with ANSI/AMCA Standard 208 and are based on wire-to-air measurement, AMCA 211 ratings.
FEIs values for fans with specific motors will vary slightly from those shown.
The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.
Values shown are for outlet Lwo A sound power levels for installation type A-Free Inlet, Free Outlet.

Characteristic Curve (eBNC 315-HP S2)

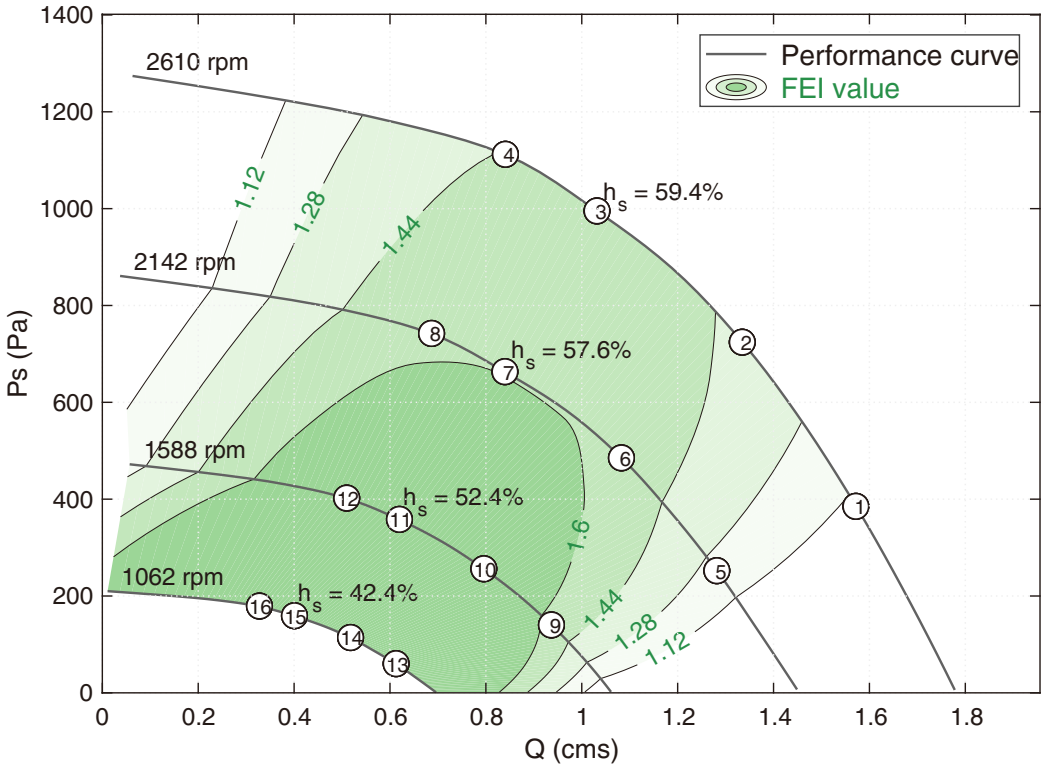


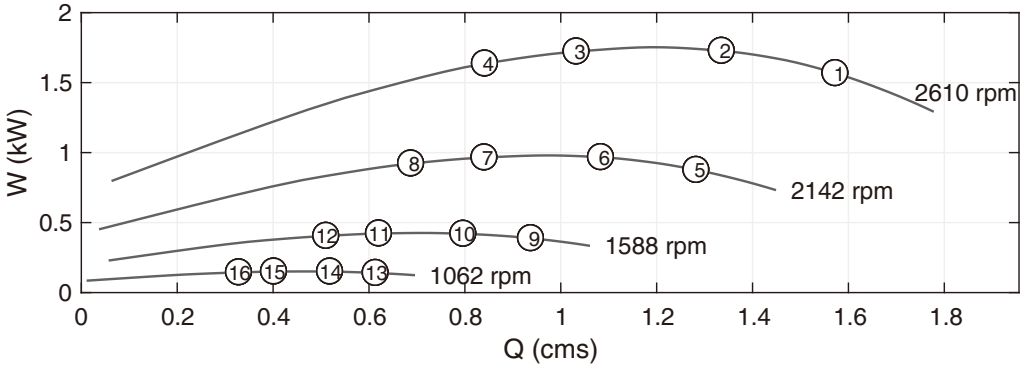


Point	Nominal Voltage(VAC)	Freq (Hz)	Nominal Speed(rpm)	Ps(Pa)	Q(cms)	W(kW)	Hs(%)	I(A)	LwA
1	380-480	50/60	3920	630	1.610	2.79	36.3	4.15	99
2	380-480	50/60	3920	1265	1.363	3.19	53.9	4.71	96
3	380-480	50/60	3920	1764	1.064	3.18	58.7	4.69	95
4	380-480	50/60	3920	1965	0.870	3.02	56.2	4.47	96
5	380-480	50/60	3234	419	1.335	1.58	35.4	2.44	94
6	380-480	50/60	3234	836	1.134	1.77	53.3	2.72	91
7	380-480	50/60	3234	1197	0.874	1.80	58.0	2.71	91
8	380-480	50/60	3234	1332	0.721	1.71	55.8	2.60	91
9	380-480	50/60	2444	229	1.002	0.71	32.1	1.26	88
10	380-480	50/60	2444	465	0.850	0.80	49.5	1.39	86
11	380-480	50/60	2443	669	0.657	0.81	54.2	1.40	85
12	380-480	50/60	2444	754	0.537	0.78	52.0	1.35	86
13	380-480	50/60	1717	119	0.683	0.29	28.3	0.67	80
14	380-480	50/60	1717	228	0.582	0.31	42.5	0.70	79
15	380-480	50/60	1717	327	0.452	0.32	46.6	0.74	78
16	380-480	50/60	1717	369	0.370	0.31	44.5	0.78	79

Speed (RPM) shown is nominal.
Performance is based on actual speed of test.
Ps is static pressure, Q is airflow, W is power input measured, Hs is fan static efficiency, A is input current, LwO(A) is A-weighted sound power.
Performance certified is for installation type A-Free Inlet, Free Outlet.
Performance ratings do not include the effects of appurtenances (accessories).
FEIs values are calculated in accordance with ANSI/AMCA Standard 208 and are based on wire-to-air measurement, AMCA 211 ratings.
FEIs values for fans with specific motors will vary slightly from those shown.
The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.
Values shown are for outlet Lwo A sound power levels for installation type A-Free Inlet, Free Outlet.

Characteristic Curve (eBNC 355-LP S5)

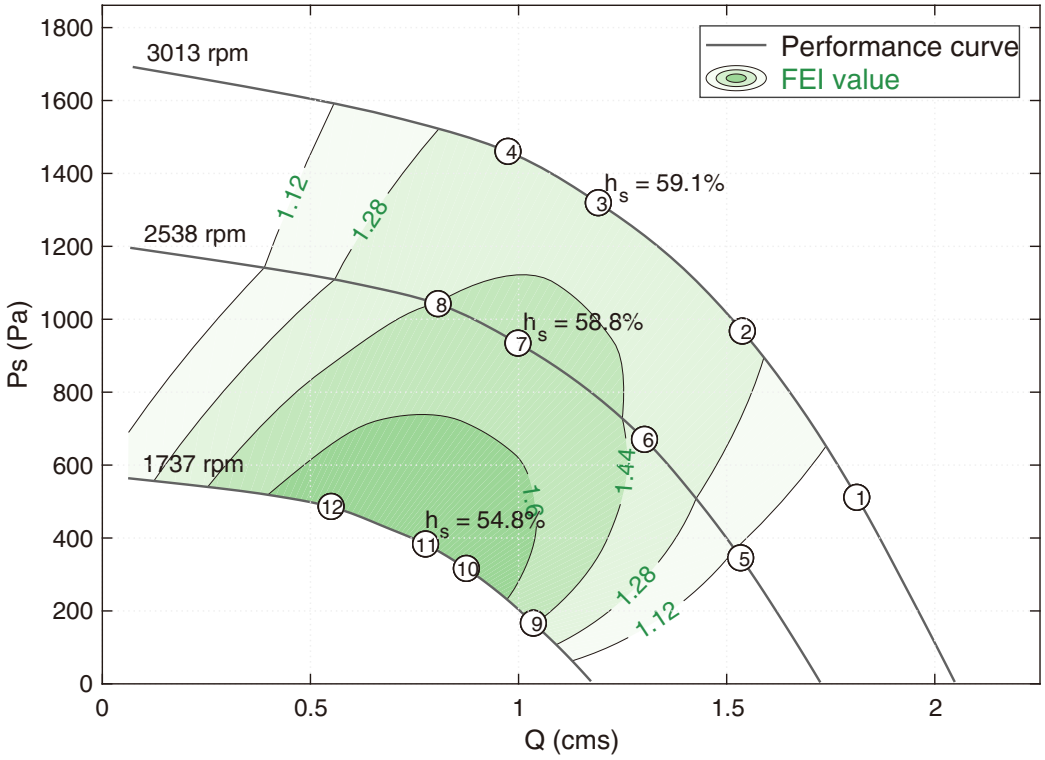


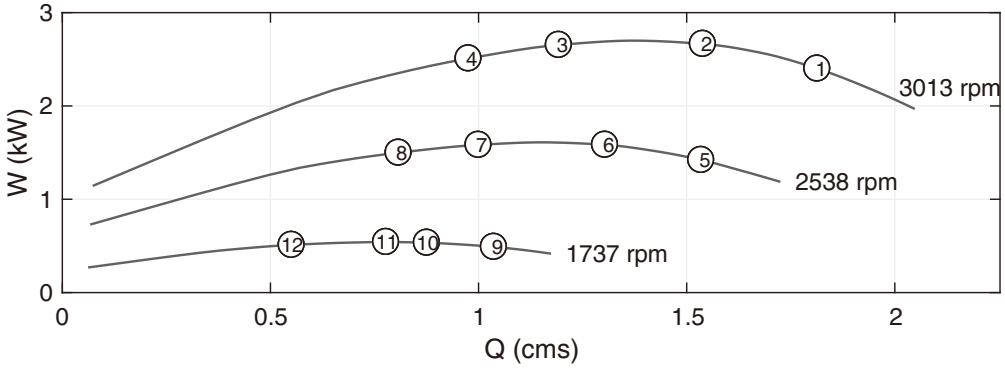


Point	Nominal Voltage(VAC)	Freq (Hz)	Nominal Speed(rpm)	Ps(Pa)	Q(cms)	W(kW)	Hs(%)	I(A)	LwA
1	380-480	50/60	2610	384	1.573	1.57	38.5	2.26	91
2	380-480	50/60	2611	723	1.336	1.73	55.8	2.48	88
3	380-480	50/60	2610	994	1.033	1.72	59.4	2.48	88
4	380-480	50/60	2610	1111	0.842	1.64	57.0	2.36	93
5	380-480	50/60	2142	251	1.283	0.87	36.7	1.29	86
6	380-480	50/60	2142	484	1.084	0.97	54.1	1.42	84
7	380-480	50/60	2141	662	0.841	0.97	57.6	1.41	83
8	380-480	50/60	2141	741	0.688	0.92	55.2	1.35	84
9	380-480	50/60	1588	139	0.938	0.39	33.5	0.66	80
10	380-480	50/60	1587	255	0.797	0.42	48.5	0.71	77
11	380-480	50/60	1589	357	0.621	0.42	52.4	0.72	76
12	380-480	50/60	1587	401	0.511	0.41	50.7	0.69	76
13	380-480	50/60	1062	59	0.614	0.14	25.9	0.34	70
14	380-480	50/60	1062	113	0.519	0.15	39.2	0.35	67
15	380-480	50/60	1062	158	0.402	0.15	42.4	0.35	68
16	380-480	50/60	1062	178	0.329	0.14	40.6	0.33	68

Speed (RPM) shown is nominal.
Performance is based on actual speed of test.
Ps is static pressure, Q is airflow, W is power input measured, Hs is fan static efficiency, A is input current, LwO(A) is A-weighted sound power.
Performance certified is for installation type A-Free Inlet, Free Outlet.
Performance ratings do not include the effects of appurtenances (accessories).
FEIs values are calculated in accordance with ANSI/AMCA Standard 208 and are based on wire-to-air measurement, AMCA 211 ratings.
FEIs values for fans with specific motors will vary slightly from those shown.
The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.
Values shown are for outlet Lwo A sound power levels for installation type A-Free Inlet, Free Outlet.

Characteristic Curve (eBNC 355-HP S2)

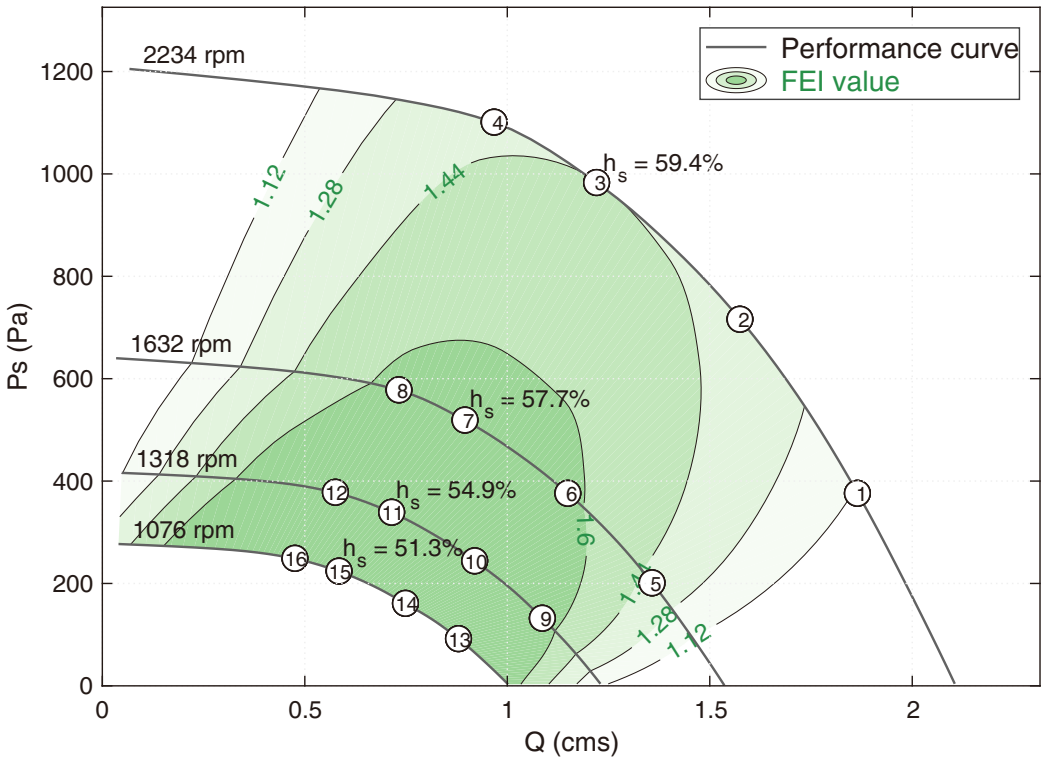


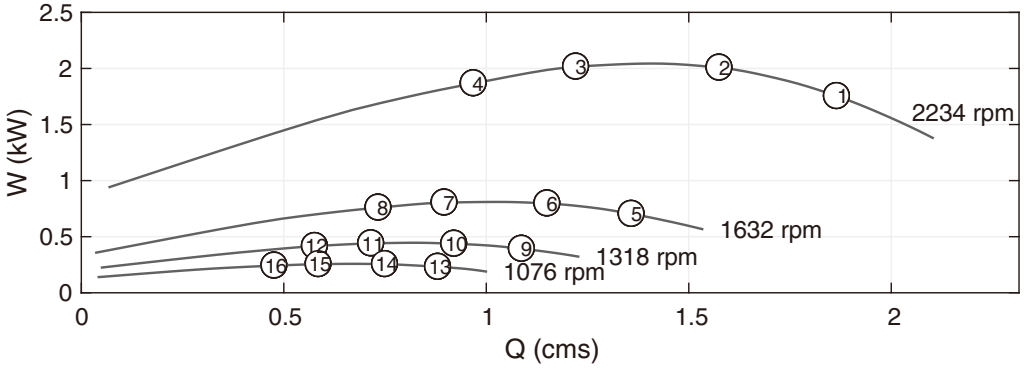


Point	Nominal Voltage(VAC)	Freq (Hz)	Nominal Speed(rpm)	Ps(Pa)	Q(cms)	W(kW)	Hs(%)	I(A)	LwA
1	380-480	50/60	3013	510	1.814	2.40	38.5	3.54	95
2	380-480	50/60	3013	966	1.539	2.67	55.6	3.91	92
3	380-480	50/60	3013	1318	1.193	2.65	59.1	3.87	91
4	380-480	50/60	3013	1459	0.976	2.51	56.6	3.66	96
5	380-480	50/60	2539	344	1.535	1.42	37.1	2.17	91
6	380-480	50/60	2539	669	1.304	1.58	55.0	2.38	88
7	380-480	50/60	2538	933	1.000	1.58	58.8	2.37	87
8	380-480	50/60	2537	1099	0.603	1.37	48.4	2.06	88
9	380-480	50/60	1737	165	1.037	0.49	34.8	0.95	82
10	380-480	50/60	1737	315	0.876	0.53	51.6	1.02	79
11	380-480	50/60	1740	382	0.778	0.54	54.8	1.04	79
12	380-480	50/60	1738	518	0.401	0.46	45.1	0.93	80

Speed (RPM) shown is nominal.
Performance is based on actual speed of test.
Ps is static pressure, Q is airflow, W is power input measured, Hs is fan static efficiency, A is input current, LwO(A) is A-weighted sound power.
Performance certified is for installation type A-Free Inlet, Free Outlet.
Performance ratings do not include the effects of appurtenances (accessories).
FEIs values are calculated in accordance with ANSI/AMCA Standard 208 and are based on wire-to-air measurement, AMCA 211 ratings.
FEIs values for fans with specific motors will vary slightly from those shown.
The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.
Values shown are for outlet Lwo A sound power levels for installation type A-Free Inlet, Free Outlet.

Characteristic Curve (eBNC 400-LP S2)

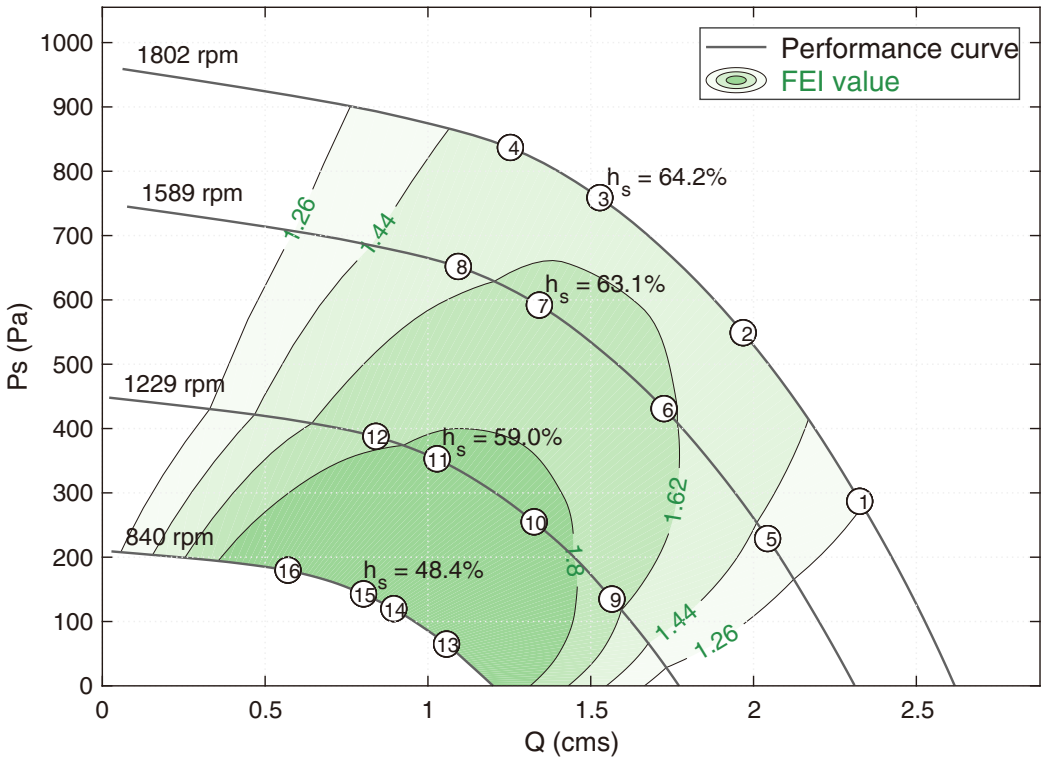


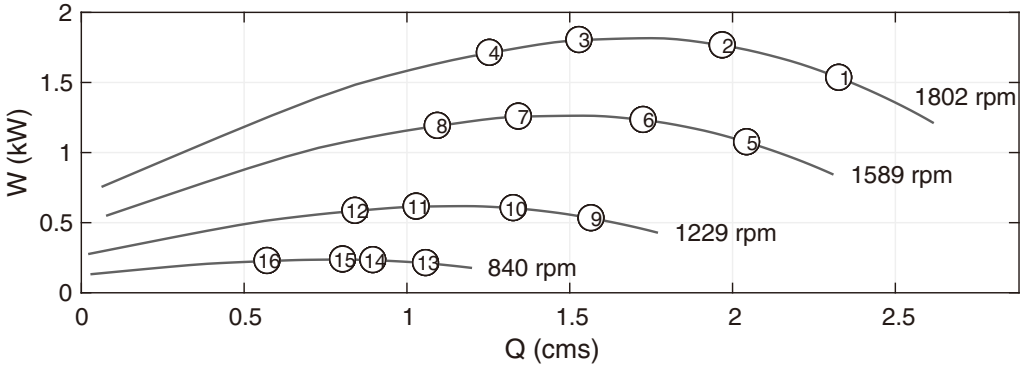


Point	Nominal Voltage(VAC)	Freq (Hz)	Nominal Speed(rpm)	Ps(Pa)	Q(cms)	W(kW)	Hs(%)	I(A)	LwA
1	380-480	50/60	2233	375	1.866	1.75	39.9	2.63	89
2	380-480	50/60	2234	715	1.576	2.01	56.0	2.98	86
3	380-480	50/60	2234	982	1.222	2.02	59.4	2.98	87
4	380-480	50/60	2232	1100	0.969	1.87	56.9	2.77	92
5	380-480	50/60	1631	200	1.359	0.70	38.7	1.29	81
6	380-480	50/60	1632	375	1.151	0.80	54.1	1.38	78
7	380-480	50/60	1632	518	0.897	0.80	57.7	1.38	78
8	380-480	50/60	1633	577	0.734	0.76	55.7	1.33	80
9	380-480	50/60	1318	131	1.088	0.39	36.4	0.88	77
10	380-480	50/60	1318	243	0.921	0.44	51.3	0.95	74
11	380-480	50/60	1318	338	0.716	0.44	54.9	0.97	73
12	380-480	50/60	1318	377	0.577	0.41	52.2	0.94	74
13	380-480	50/60	1077	91	0.881	0.23	34.5	0.65	71
14	380-480	50/60	1076	160	0.750	0.26	47.2	0.70	68
15	380-480	50/60	1076	223	0.586	0.26	51.3	0.70	67
16	380-480	50/60	1076	248	0.477	0.24	48.9	0.67	68

Speed (RPM) shown is nominal.
Performance is based on actual speed of test.
Ps is static pressure, Q is airflow, W is power input measured, Hs is fan static efficiency, A is input current, LwO(A) is A-weighted sound power.
Performance certified is for installation type A-Free Inlet, Free Outlet.
Performance ratings do not include the effects of appurtenances (accessories).
FEIs values are calculated in accordance with ANSI/AMCA Standard 208 and are based on wire-to-air measurement, AMCA 211 ratings.
FEIs values for fans with specific motors will vary slightly from those shown.
The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.
Values shown are for outlet Lwo A sound power levels for installation type A-Free Inlet, Free Outlet.

Characteristic Curve (eBNC 450-LP W3)

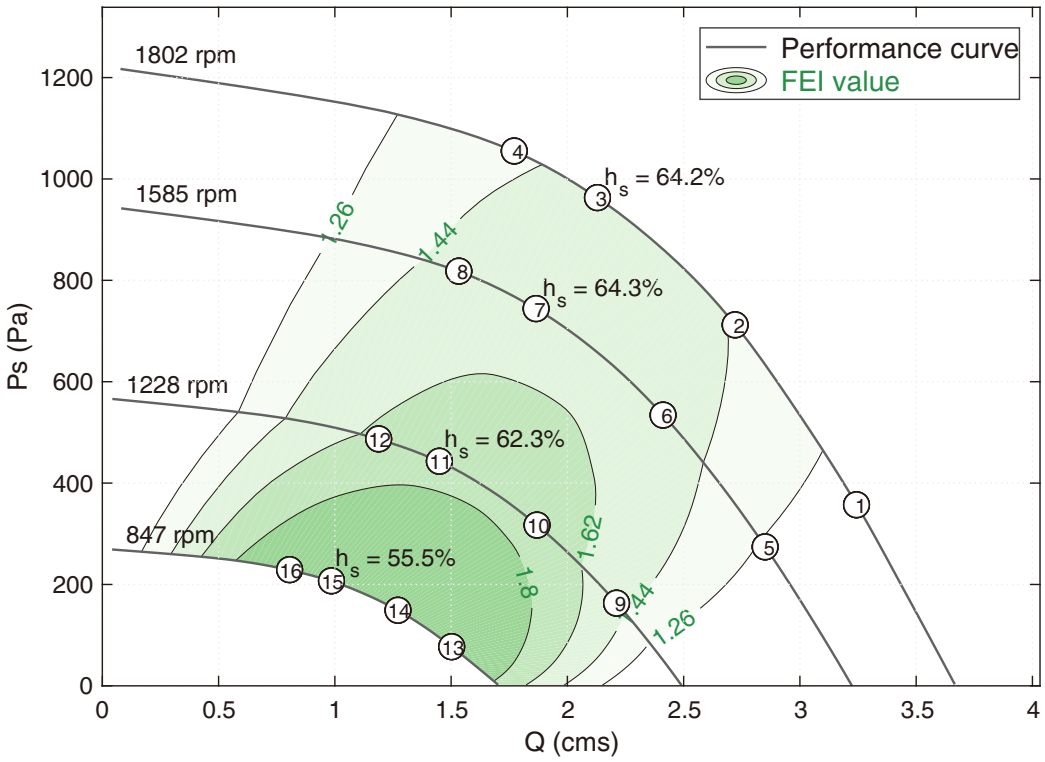


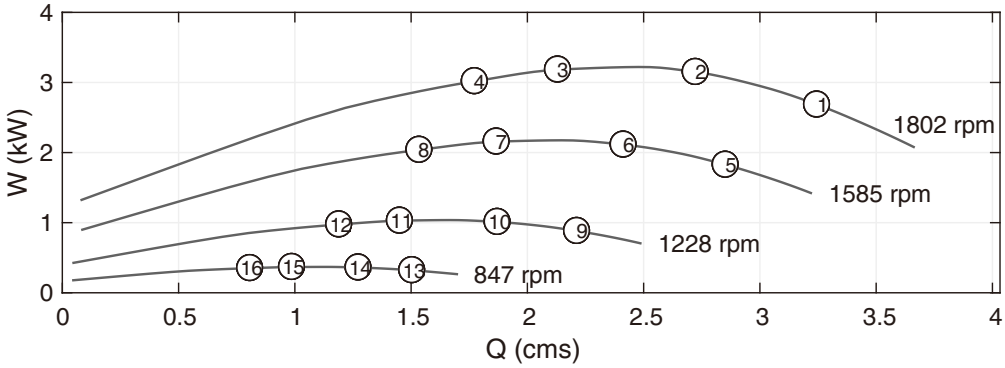


Point	Nominal Voltage(VAC)	Freq (Hz)	Nominal Speed(rpm)	Ps(Pa)	Q(cms)	W(kW)	Hs(%)	I(A)	LwA
1	380-480	50/60	1802	286	2.328	1.53	43.4	2.56	87
2	380-480	50/60	1802	548	1.970	1.76	61.0	2.92	84
3	380-480	50/60	1802	758	1.530	1.80	64.2	2.96	83
4	380-480	50/60	1802	836	1.255	1.71	61.2	2.82	86
5	380-480	50/60	1588	228	2.040	1.073	43.3	1.86	84
6	380-480	50/60	1589	430	1.727	1.23	60.2	2.08	82
7	380-480	50/60	1589	591	1.344	1.26	63.1	2.14	82
8	380-480	50/60	1589	651	1.095	1.19	59.8	2.05	83
9	380-480	50/60	1229	134	1.567	0.53	39.6	0.99	77
10	380-480	50/60	1229	254	1.328	0.60	56.0	1.10	75
11	380-480	50/60	1229	352	1.030	0.61	59.0	1.12	74
12	380-480	50/60	1229	387	0.842	0.58	55.8	1.07	76
13	380-480	50/60	840	64	1.059	0.21	32.0	0.43	70
14	380-480	50/60	840	119	0.897	0.23	45.9	0.46	68
15	380-480	50/60	840	142	0.804	0.24	48.4	0.47	67
16	380-480	50/60	840	179	0.572	0.23	45.3	0.46	67

Speed (RPM) shown is nominal.
Performance is based on actual speed of test.
Ps is static pressure, Q is airflow, W is power input measured, Hs is fan static efficiency, A is input current, LwO(A) is A-weighted sound power.
Performance certified is for installation type A-Free Inlet, Free Outlet.
Performance ratings do not include the effects of appurtenances (accessories).
FEIs values are calculated in accordance with ANSI/AMCA Standard 208 and are based on wire-to-air measurement, AMCA 211 ratings.
FEIs values for fans with specific motors will vary slightly from those shown.
The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.
Values shown are for outlet Lwo A sound power levels for installation type A-Free Inlet, Free Outlet.

Characteristic Curve (eBNC 500-LP W3)

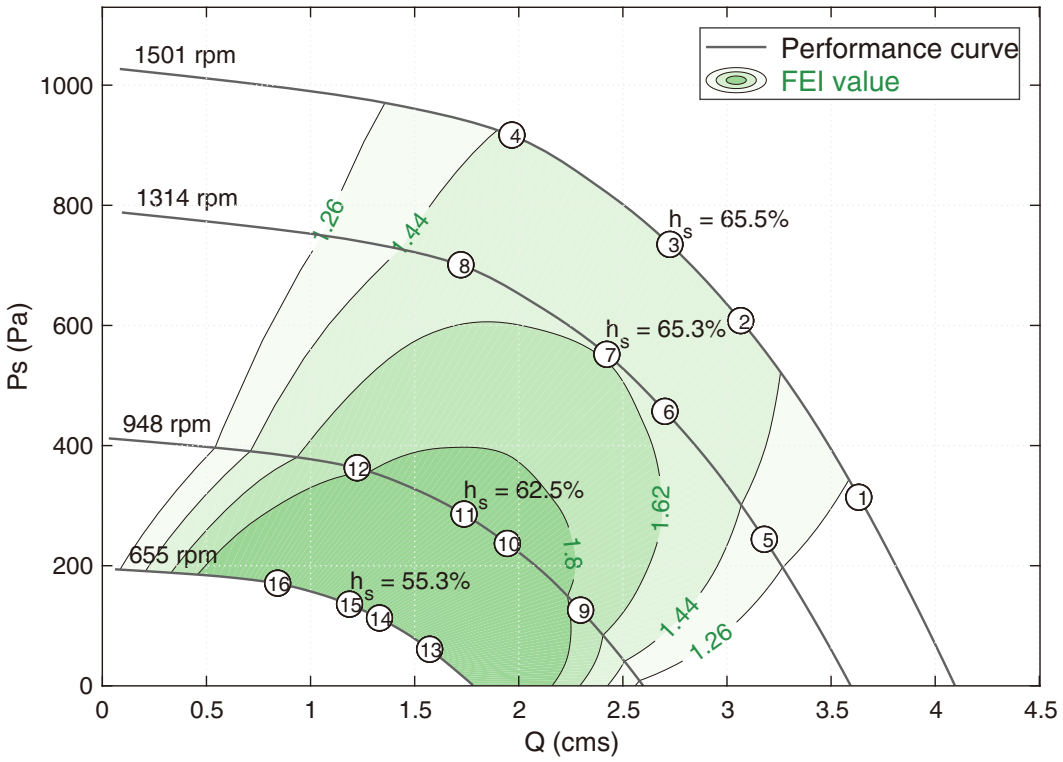


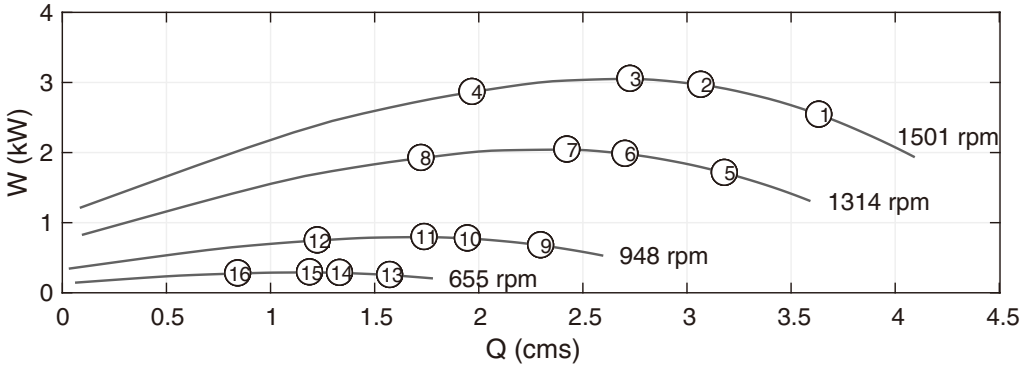


Point	Nominal Voltage(VAC)	Freq (Hz)	Nominal Speed(rpm)	Ps(Pa)	Q(cms)	W(kW)	Hs(%)	I(A)	LwA
1	380-480	50/60	1802	356	3.246	2.68	43.0	4.36	94
2	380-480	50/60	1802	711	2.724	3.15	61.3	5.19	89
3	380-480	50/60	1802	962	2.132	3.18	64.2	5.20	89
4	380-480	50/60	1802	1054	1.774	3.01	61.8	4.92	92
5	380-480	50/60	1585	273	2.853	1.83	42.6	3.02	90
6	380-480	50/60	1585	533	2.414	2.11	60.7	3.48	86
7	380-480	50/60	1585	743	1.868	2.16	64.3	3.54	85
8	380-480	50/60	1585	817	1.536	2.04	61.4	3.36	87
9	380-480	50/60	1228	162	2.214	0.88	40.7	1.53	84
10	380-480	50/60	1228	316	1.872	1.01	58.5	1.76	80
11	380-480	50/60	1228	442	1.452	1.03	62.3	1.81	79
12	380-480	50/60	1228	486	1.191	0.97	59.3	1.70	80
13	380-480	50/60	847	76	1.505	0.32	35.7	0.62	77
14	380-480	50/60	847	148	1.274	0.36	55.3	0.69	75
15	380-480	50/60	847	206	0.988	0.37	55.5	0.71	73
16	380-480	50/60	847	228	0.808	0.35	52.6	0.68	72

Speed (RPM) shown is nominal.
Performance is based on actual speed of test.
Ps is static pressure, Q is airflow, W is power input measured, Hs is fan static efficiency, A is input current, LwO(A) is A-weighted sound power.
Performance certified is for installation type A-Free Inlet, Free Outlet.
Performance ratings do not include the effects of appurtenances (accessories).
FEIs values are calculated in accordance with ANSI/AMCA Standard 208 and are based on wire-to-air measurement, AMCA 211 ratings.
FEIs values for fans with specific motors will vary slightly from those shown.
The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.
Values shown are for outlet Lwo A sound power levels for installation type A-Free Inlet, Free Outlet.

Characteristic Curve (eBNC 560-LP W5)

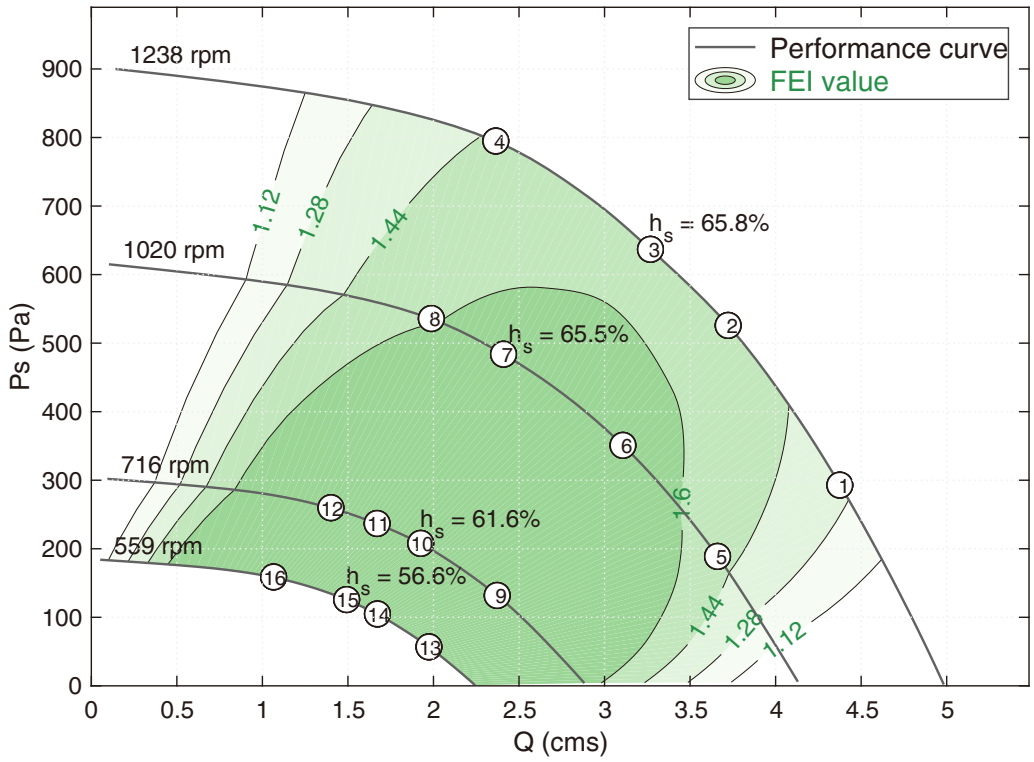


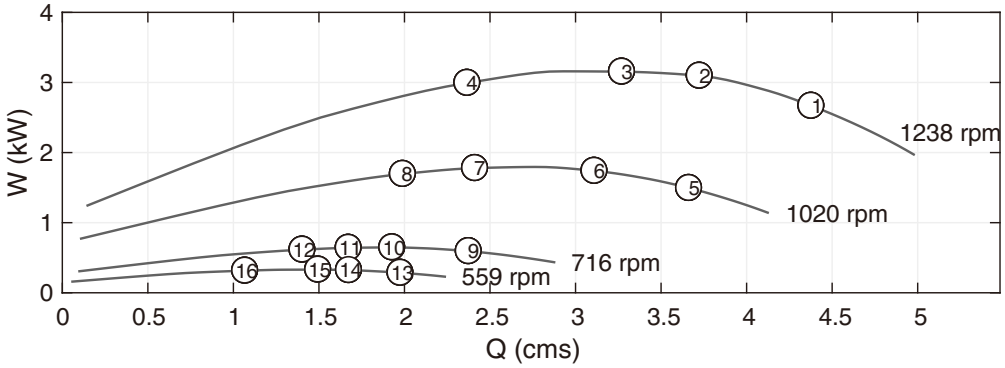


Point	Nominal Voltage(VAC)	Freq (Hz)	Nominal Speed(rpm)	Ps(Pa)	Q(cms)	W(kW)	Hs(%)	I(A)	LwA
1	380-480	50/60	1501	313	3.636	2.54	44.8	4.17	90
2	380-480	50/60	1501	607	3.069	2.97	62.7	4.95	87
3	380-480	50/60	1501	734	2.729	3.05	65.5	5.08	87
4	380-480	50/60	1501	916	1.970	2.86	62.8	4.72	89
5	380-480	50/60	1314	243	3.182	1.71	45.2	2.89	86
6	380-480	50/60	1314	456	2.705	1.98	62.2	3.30	82
7	380-480	50/60	1314	551	2.426	2.04	65.3	3.41	82
8	380-480	50/60	1314	700	1.725	1.92	62.7	3.08	86
9	380-480	50/60	948	125	2.300	0.68	42.5	1.19	77
10	380-480	50/60	948	236	1.948	0.77	59.5	1.35	74
11	380-480	50/60	948	285	1.740	0.79	62.5	1.39	74
12	380-480	50/60	948	362	1.227	0.74	59.5	1.31	76
13	380-480	50/60	656	60	1.575	0.25	37.4	0.50	69
14	380-480	50/60	655	112	1.334	0.28	52.5	0.54	67
15	380-480	50/60	655	135	1.190	0.29	55.3	0.56	67
16	380-480	50/60	655	170	0.845	0.27	52.2	0.54	67

Speed (RPM) shown is nominal.
Performance is based on actual speed of test.
Ps is static pressure, Q is airflow, W is power input measured, Hs is fan static efficiency, A is input current, LwO(A) is A-weighted sound power.
Performance certified is for installation type A-Free Inlet, Free Outlet.
Performance ratings do not include the effects of appurtenances (accessories).
FEIs values are calculated in accordance with ANSI/AMCA Standard 208 and are based on wire-to-air measurement, AMCA 211 ratings.
FEIs values for fans with specific motors will vary slightly from those shown.
The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.
Values shown are for outlet Lwo A sound power levels for installation type A-Free Inlet, Free Outlet.

Characteristic Curve (eBNC 630-LP W5)





Point	Nominal Voltage(VAC)	Freq (Hz)	Nominal Speed(rpm)	Ps(Pa)	Q(cms)	W(kW)	Hs(%)	I(A)	LwA
1	380-480	50/60	1238	292	4.379	2.67	47.9	4.42	89
2	380-480	50/60	1238	525	3.726	3.10	63.1	5.26	86
3	380-480	50/60	1234	636	3.272	3.15	65.8	5.35	85
4	380-480	50/60	1238	794	2.368	2.99	62.7	5.01	86
5	380-480	50/60	1020	188	3.664	1.49	46.1	2.44	85
6	380-480	50/60	1020	350	3.111	1.74	62.5	2.83	81
7	380-480	50/60	1020	483	2.413	1.78	65.5	2.90	81
8	380-480	50/60	1020	535	1.991	1.70	62.8	2.76	83
9	380-480	50/60	716	131	2.376	0.59	52.6	1.06	76
10	380-480	50/60	715	207	1.929	0.65	61.6	1.16	73
11	380-480	50/60	716	236	1.674	0.64	61.6	1.14	73
12	380-480	50/60	716	259	1.404	0.61	59.1	1.10	74
13	380-480	50/60	559	56	1.977	0.28	38.5	0.55	72
14	380-480	50/60	559	81	1.830	0.31	48.2	0.59	69
15	380-480	50/60	559	125	1.496	0.33	56.6	0.63	68
16	380-480	50/60	559	158	1.069	0.31	53.5	0.61	66

Speed (RPM) shown is nominal.
Performance is based on actual speed of test.
Ps is static pressure, Q is airflow, W is power input measured, Hs is fan static efficiency, A is input current, LwO(A) is A-weighted sound power.
Performance certified is for installation type A-Free Inlet, Free Outlet.
Performance ratings do not include the effects of appurtenances (accessories).
FEIs values are calculated in accordance with ANSI/AMCA Standard 208 and are based on wire-to-air measurement, AMCA 211 ratings.
FEIs values for fans with specific motors will vary slightly from those shown.
The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.
Values shown are for outlet Lwo A sound power levels for installation type A-Free Inlet, Free Outlet.

Tender Specifications Data Sheet

Technical Data	Result	Unit
Fan Type/Model		
Airflow		cms
Static Pressure		Pa
Stat Overall Effciency, Ps %		%
Operating Speed, n		rpm
Motor Type	EC Motor	
Type of Control	10-100% Speed Control	
Motor Efficiency Class	IE4	
Total Power Input (kW)		kW
Specific Fan Power (w/cms)		w/cms
Nominal Voltage Range (V)	380-480	V
Line Frequency	50/60	Hz
Nominal Current		A
Degree of Protection (IP)		
Sound Power Level, Lin (Lw0/Lwi)		dB
Sound Power Level, Lw0 (A)		dB (A)
Sound Pressure Level (Lp0 (A)@1.5m)		dB (A)
Permissible Amb Temperature		°C
Weight of Fan		kg

Power and Control Wiring

The following section shows the terminal layouts and wiring method for eBNC Ecowatt plug fans.
eBNC fan has various speed control functions are available as follows:

1. Manual speed control by using of Potentiometer: Analog signal 0–10Vdc.
2. Automatic speed control by using of Demand Controlled Ventilation (DCV) or Building Management System (BMS): Analog signal 0–10Vdc or 4–20mA.
3. Automatic speed control by using of eBNC Modbus RTU interface PC program: RS485 digital port.

Please contact Kruger to get a training about eBNC Modbus RTU interface PC program and configurations method.

Power Wiring

- Use the appropriate cable size for each motor model by referring to power wiring section.
- Shielded cables are not required for use on power cables.
- Where multiple fans are installed in one AHU, individual circuit breakers must be installed for each fan.
- Three-phase main power must be connected, do not use the output from a variable speed drive to power an eBNC Ecowatt plenum fan.

Control Wiring

- Ensure that the RSA, RSB, 0-10V input, +10V output and ground of each fan are accessible at an external location away from the three phase power supply connections.
- Where MODBUS over RS485 is used, appropriate shielded cables should be used.

Ecowatt eBNC 315, 355 & 400

Three-phase fan eBNC 315, 355 & 400 wiring Diagram consists of 2 parts: power and control wiring terminals are shown in Fig. 1.

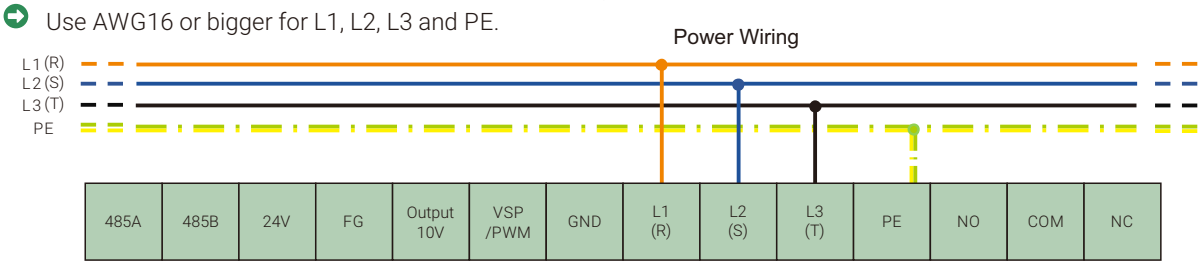
Fig. 1. eBNC 315, 355 & 400 Wiring Diagram

Color	Wiring	Function	Description
Brown	Control	485A	RS485 data +, 485 communication interface
Black	Control	485B	RS485 data -, 485 communication interface
Green	Control	24V	24Vdc output
White	Control	FG	Speed output 2 pulses per revolution
Red	Control	10V	10Vdc, 10mA max
Yellow	Control	VSP/PWM	Analog Input 0-10V or 4-20mA
Blue	Control	GND	Signal ground
Brown	Power	L1(R)	Power input phase1
Blue	Power	L2(S)	Power input phase2
Black	Power	L3(T)	Power input phase3
Yellow/Green	Power	PE	Protective Earth
Orange	Relay	NO	Output relay N.O. contact
Gray	Relay	COM	Output relay common contact
Red	Relay	NC	Output relay N.C. contact

Noted: There are 2 spec of wire harness length (1.2m for Single fan and 3.5m for Multi fan)

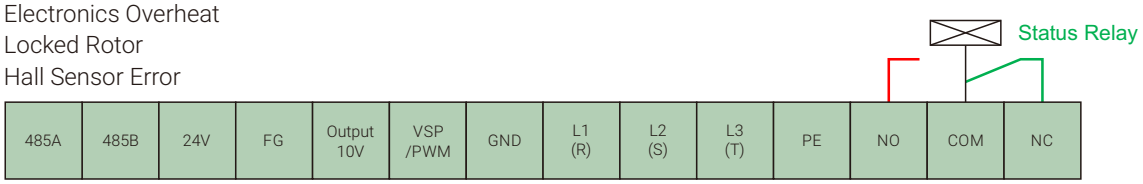
Power Wiring

- Power wiring (L1, L2 and L3) connections to the 3PH 380V 50/60Hz power supply (R ,S, T).
- PE wire is the protective earth terminal like below diagram.
- Use AWG16 or bigger for L1, L2, L3 and PE.



Status Relay

- Status relay should be connected to show the status of Fan motor operation.
- When normal operation the NC–COM will be short circuit.
- When fan faults as below conditions, NO–COM will be short circuit.
  - Motor Overheat
  - Electronics Overheat
  - Locked Rotor
  - Hall Sensor Error



Control Wiring

There are 3 wiring simple connection methods for control motor speed as shown below.

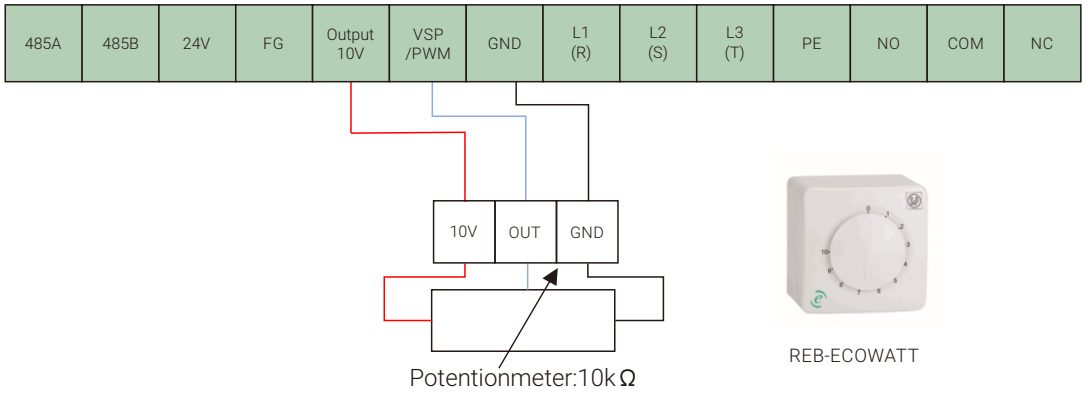
1.Manual speed control by using of Potentiometer: Analog signal 0–10Vdc.

2.Automatic speed control by using of Demand Controlled Ventilation (DCV) or Building Management System (BMS): Analog signal 0–10Vdc or 4–20mA.

3.Automatic speed control by using of eBNC Modbus RTU interface PC program: RS485 digital port.

Please contact Kruger to get a training about eBNC Modbus RTU interface PC program and configurations method.

a.1 Manual speed control by using of Potentiometer (Analog signal 0-10Vdc)



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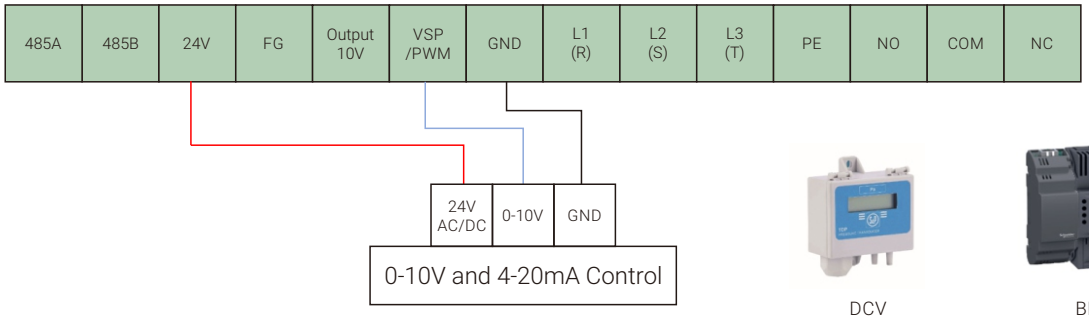
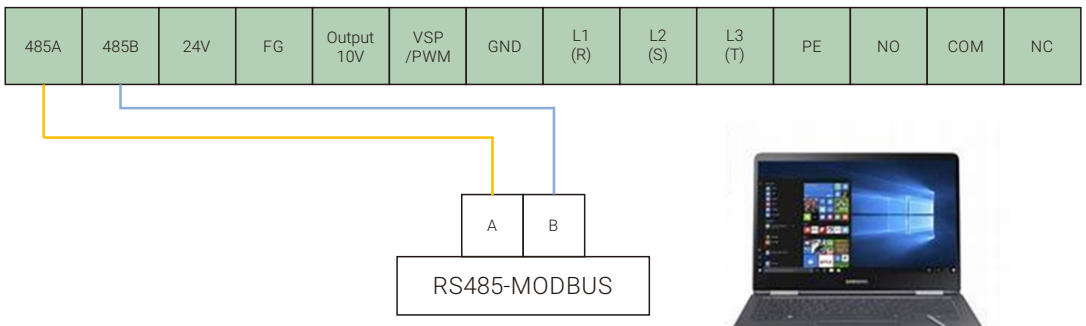
b.1 Automatic speed control by using of DCV or BMS (Analog signal 0-10Vdc and 4-20mA)



DCV
Pressure/Airflow Control

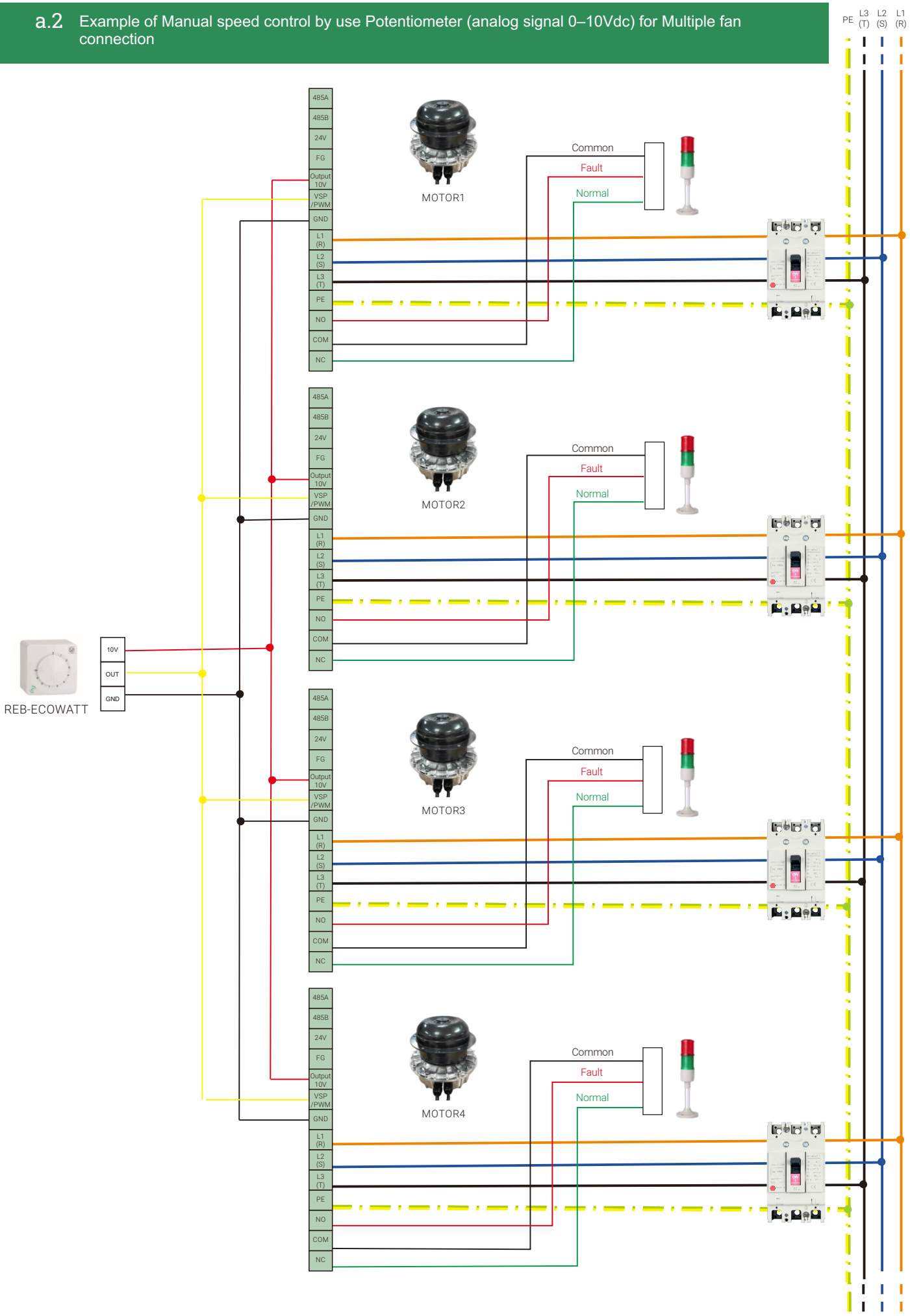
BMS
Direct Digital Controller

c.1 Automatic speed control by using of Modbus RTU interface PC program (RS485 digital port)

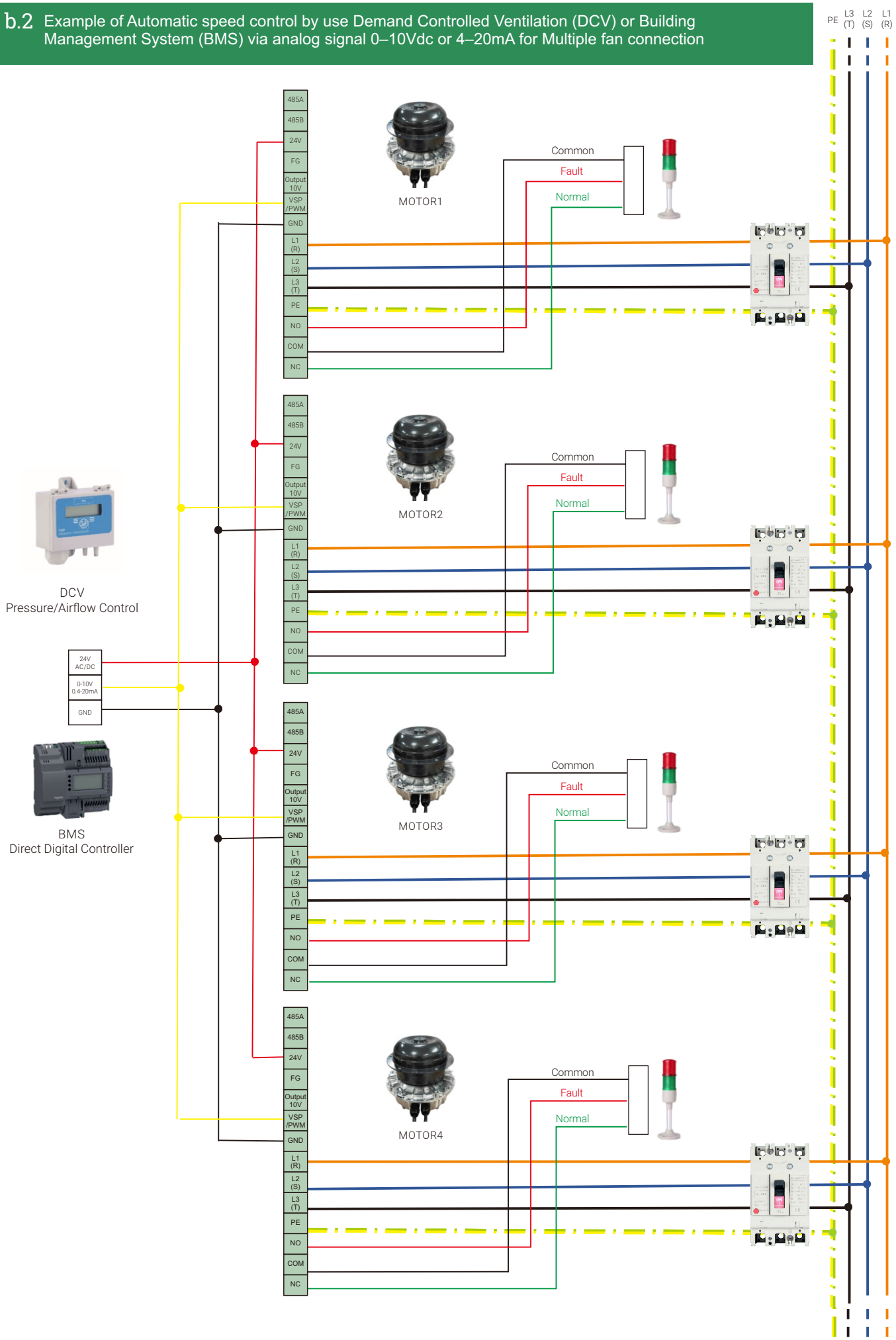


Modbus RTU interface PC program

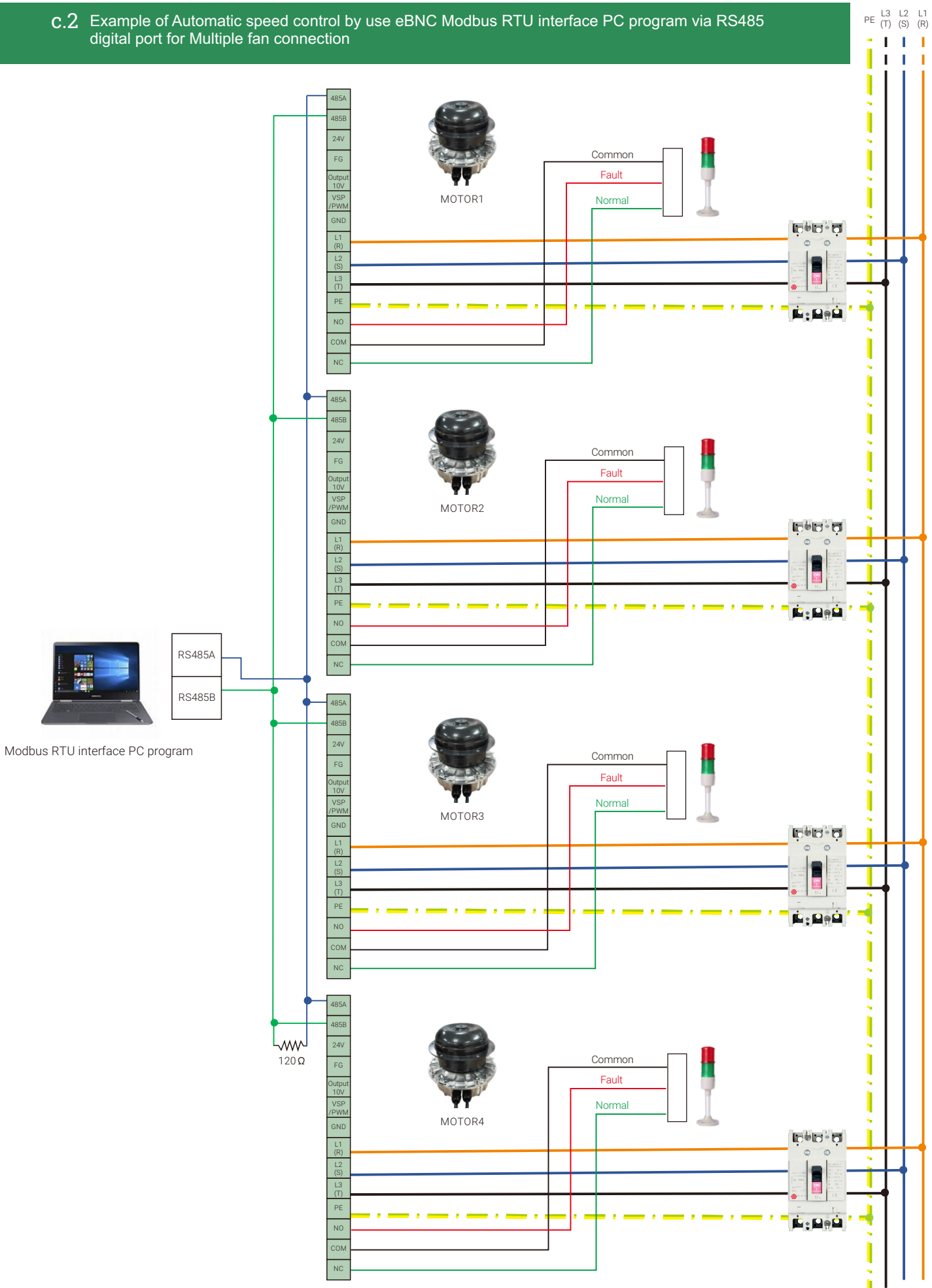
a.2 Example of Manual speed control by use Potentiometer (analog signal 0–10Vdc) for Multiple fan connection



b.2 Example of Automatic speed control by use Demand Controlled Ventilation (DCV) or Building Management System (BMS) via analog signal 0–10Vdc or 4–20mA for Multiple fan connection



c.2 Example of Automatic speed control by use eBNC Modbus RTU interface PC program via RS485 digital port for Multiple fan connection



Recommends for RS485 connection
- To prevents an interference from electromagnetic fields, please always using the Shielded twisted pair cable.
- To keep the stability of the control signal, please adding 120 Ohm, 0.5W resistor at the end of control line.

Ecowatt eBNC 450, 500, 560 & 630

Three-phase fan eBNC 450, 500, 560 & 630 wiring Diagram consists of 2 parts: power and control wiring terminals are shown in Figure.2 below.

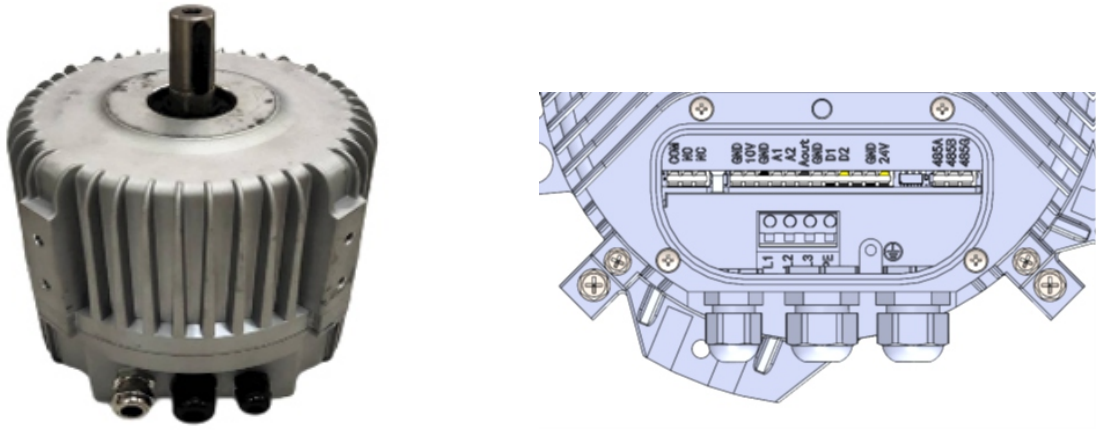
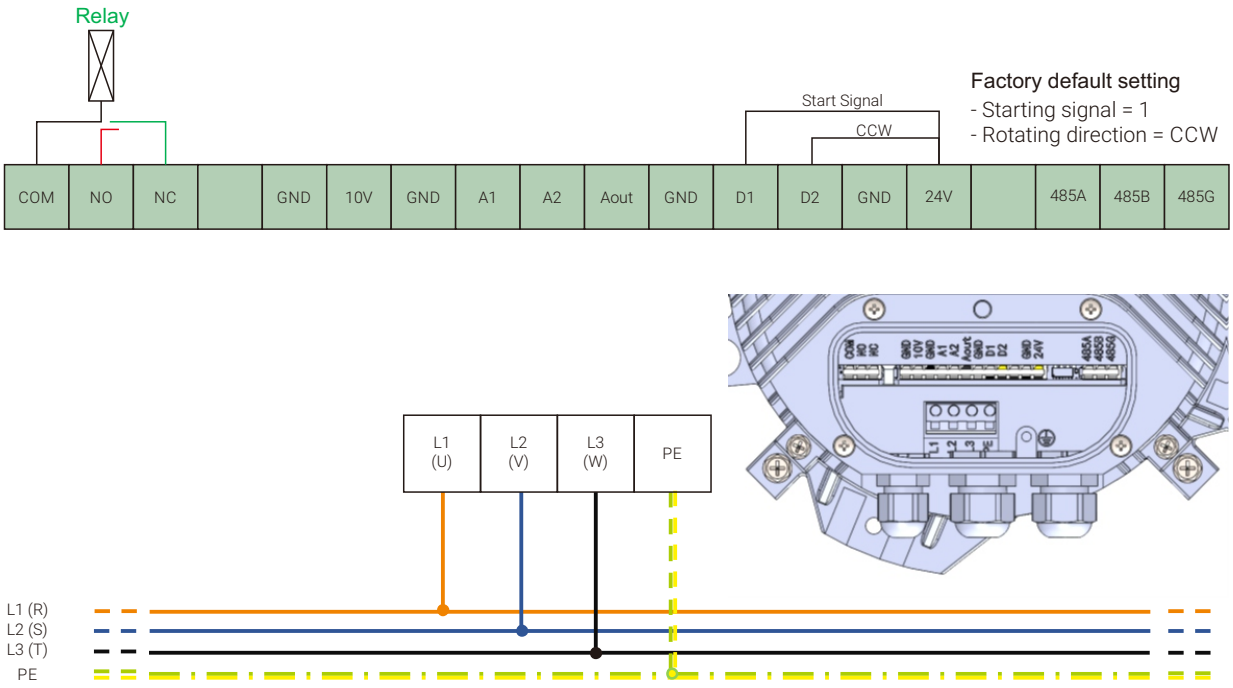


Fig. 2. eBNC 450, 500, 560 & 630 Wiring Diagram

Terminal	Wiring	Connection	Function
TL1	Power	L1(U)	Power input phase 1
	Power	L2(V)	Power input phase 2
	Power	L3(W)	Power input phase 3
	Power	PE	Protective Earth
TL2	Relay	COM	Output Relay common contact
	Relay	NO	Output relay N.O. contact
	Relay	NC	Output relay N.C. contact
TL3	Control	GND	Signal ground
	Control	10V	10Vdc, 10mA max
	Control	GND	Signal ground
	Control	A1	Analog Input 1, 0-10 V
	Control	A2	Analog Input 2, 4-20 mA
	Control	Aout	Analog Output, Programmable output
	Control	GND	Signal ground
	Control	D1	Digital Input 1, Motor start enable signal, 0V: Start Disable, 10V/24V: Start Enable
	Control	D2	Digital Input 2, Motor rotation direction control signal, 0V: CW, 10/24V: CCW
TL4	Supply	GND	Supply ground
	Supply	24V	+24 VDC supply, 50mA max
TL5	Control	485A	RS 485 data+, 485 communication interface
	Control	485B	RS 485 data-, 485 communication interface
	Control	485G	RS 485 ground, 485 communication interface

Power Wiring

- Power wiring (L1, L2 and L3) connections to the 3PH 380V 50/60Hz power supply (R ,S, T).
- PE wire is the protective earth terminal like below diagram.
- Use AWG14 or bigger for L1, L2, L3 and PE



Status Relay

- Status relay should be connected to show the status of Fan motor operation.
- When normal operation the NC–COM will be short circuit.
- When fan faults as below conditions, NO–COM will be short circuit.
  - Motor Overheat
  - Electronics Overheat
  - Locked Rotor
  - Hall Sensor Error

Start Signal

- Start signal D1 terminal must be always connected to 24V terminal as Factory default.

Rotating Direction Signal

- Rotating direction signal D2 terminal must be always connected to 24V terminal as Factory default.

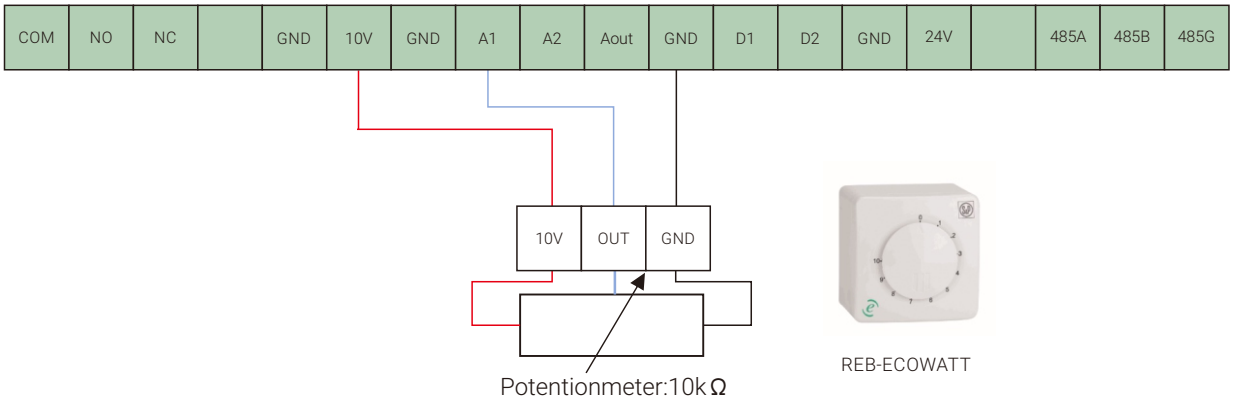
Control Wiring

There are 3 wiring simple connection methods for control motor speed as shown below.

1. Manual speed control by using of Potentiometer: Analog signal 0–10Vdc.
2. Automatic speed control by using of Demand Controlled Ventilation (DCV) or Building Management System (BMS): Analog signal 0–10Vdc or 4–20mA
3. Automatic speed control by using of eBNC Modbus RTU interface PC program: RS485 digital port.

Please contact Kruger to get a training about eBNC Modbus RTU interface PC program and configurations method.

a.1 Manual speed control by using of Potentiometer (Analog signal 0-10Vdc)



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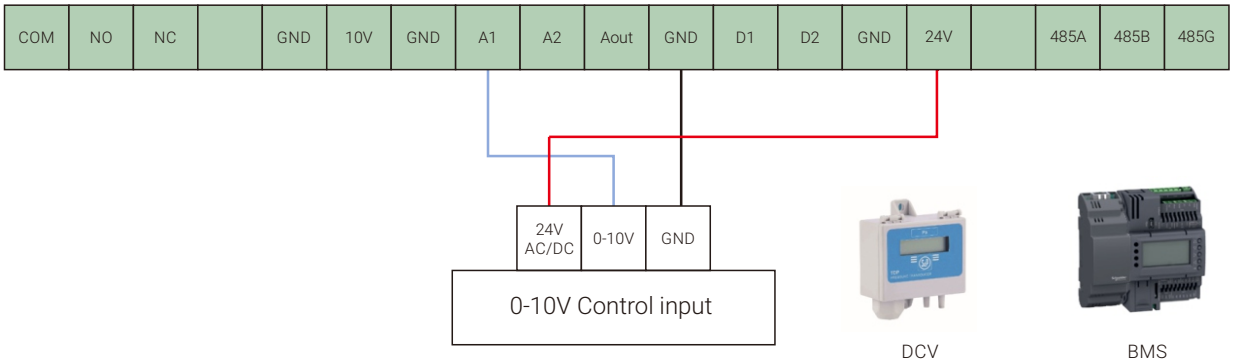
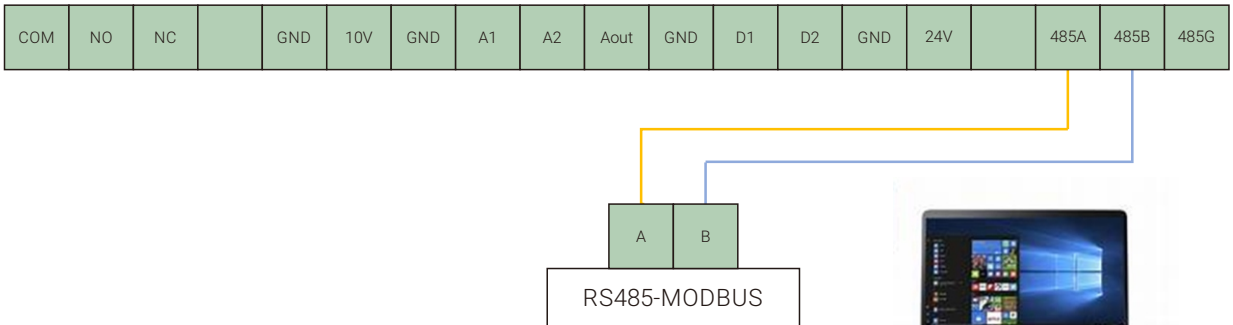
b.1 Automatic speed control by using of DCV or BMS (Analog signal 0-10Vdc and 4-20mA)



DCV
Pressure/Airflow Control

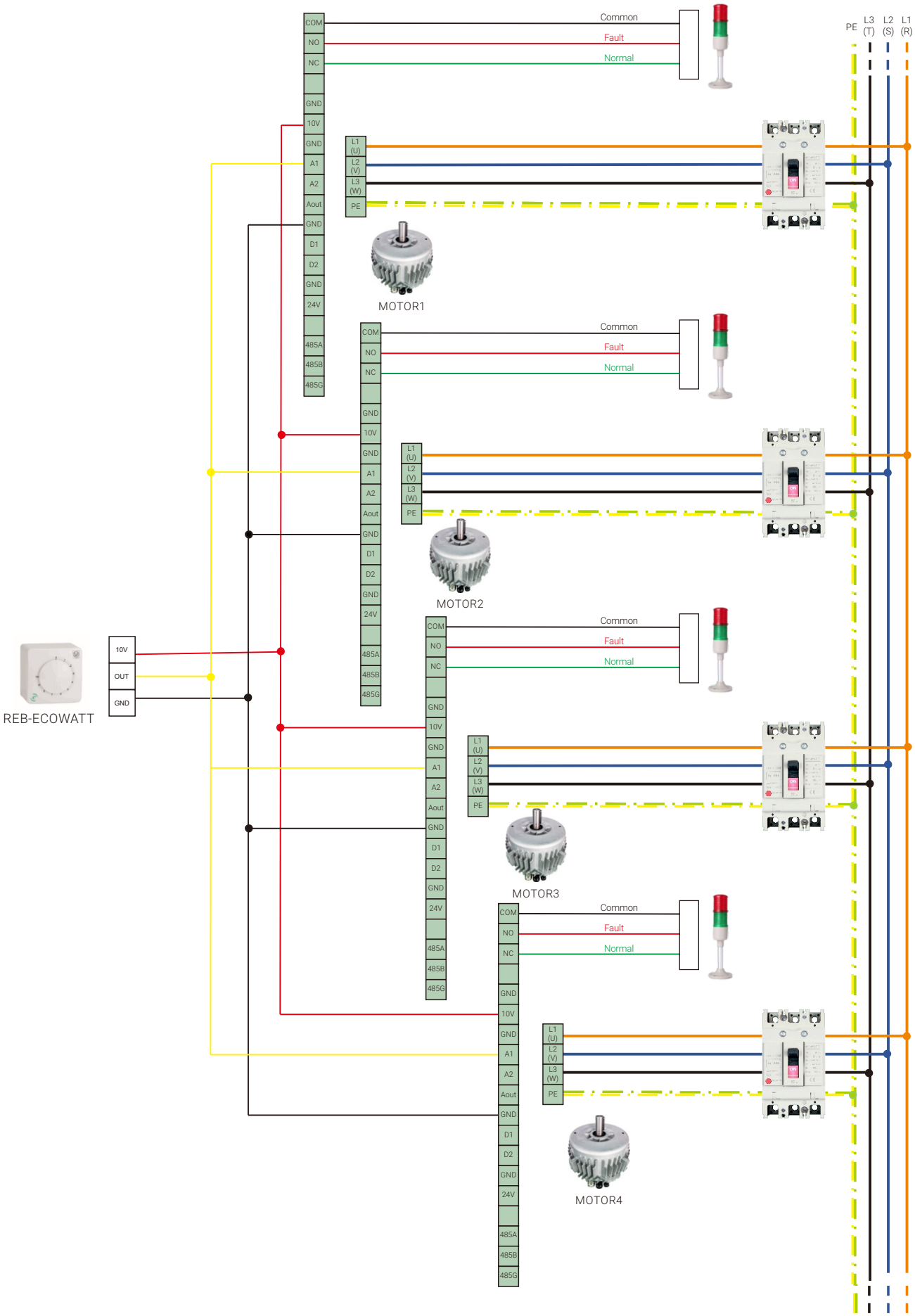
BMS
Direct Digital Controller

c.1 Automatic speed control by using of Modbus RTU interface PC program (RS485 digital port)

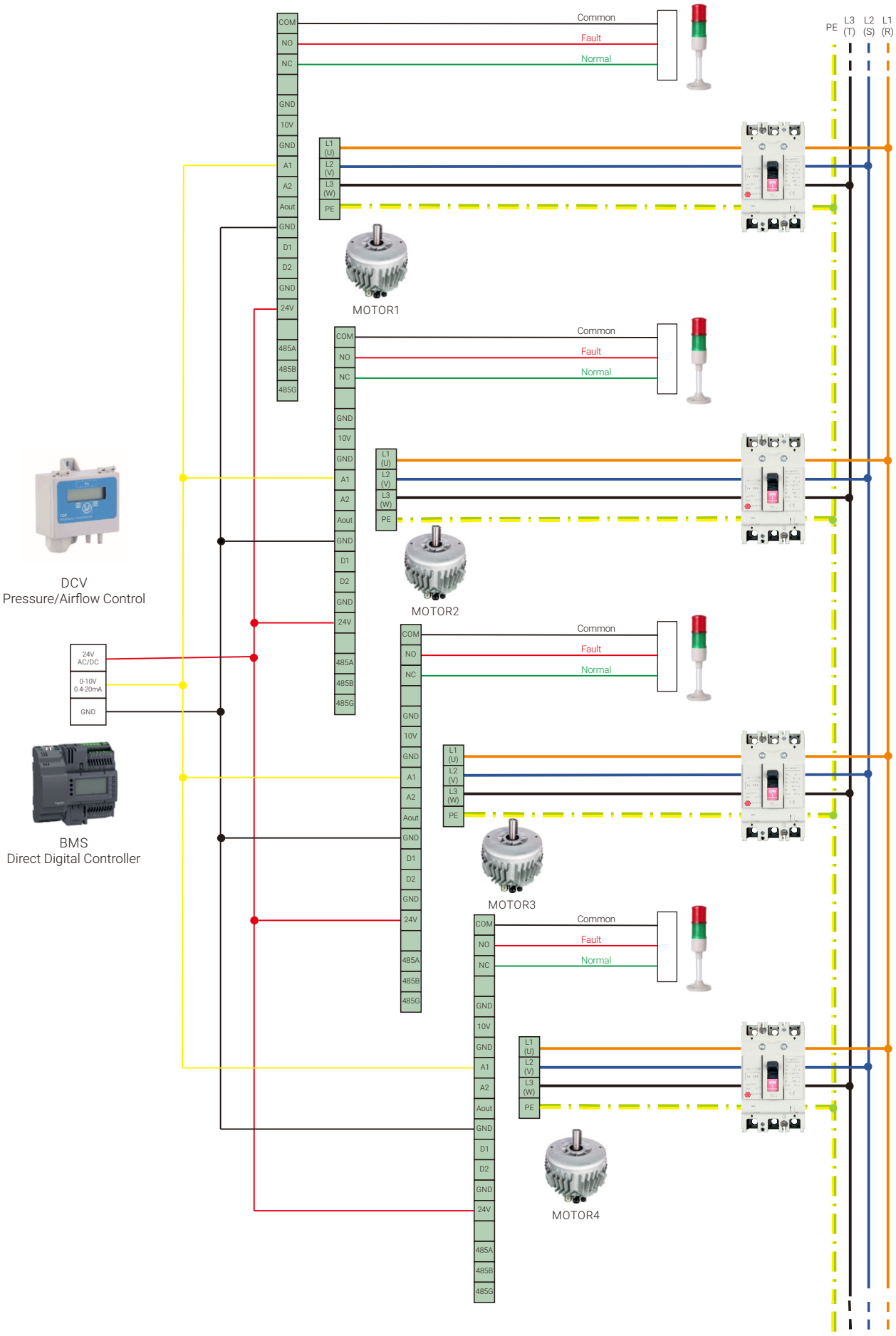


Modbus RTU interface PC program

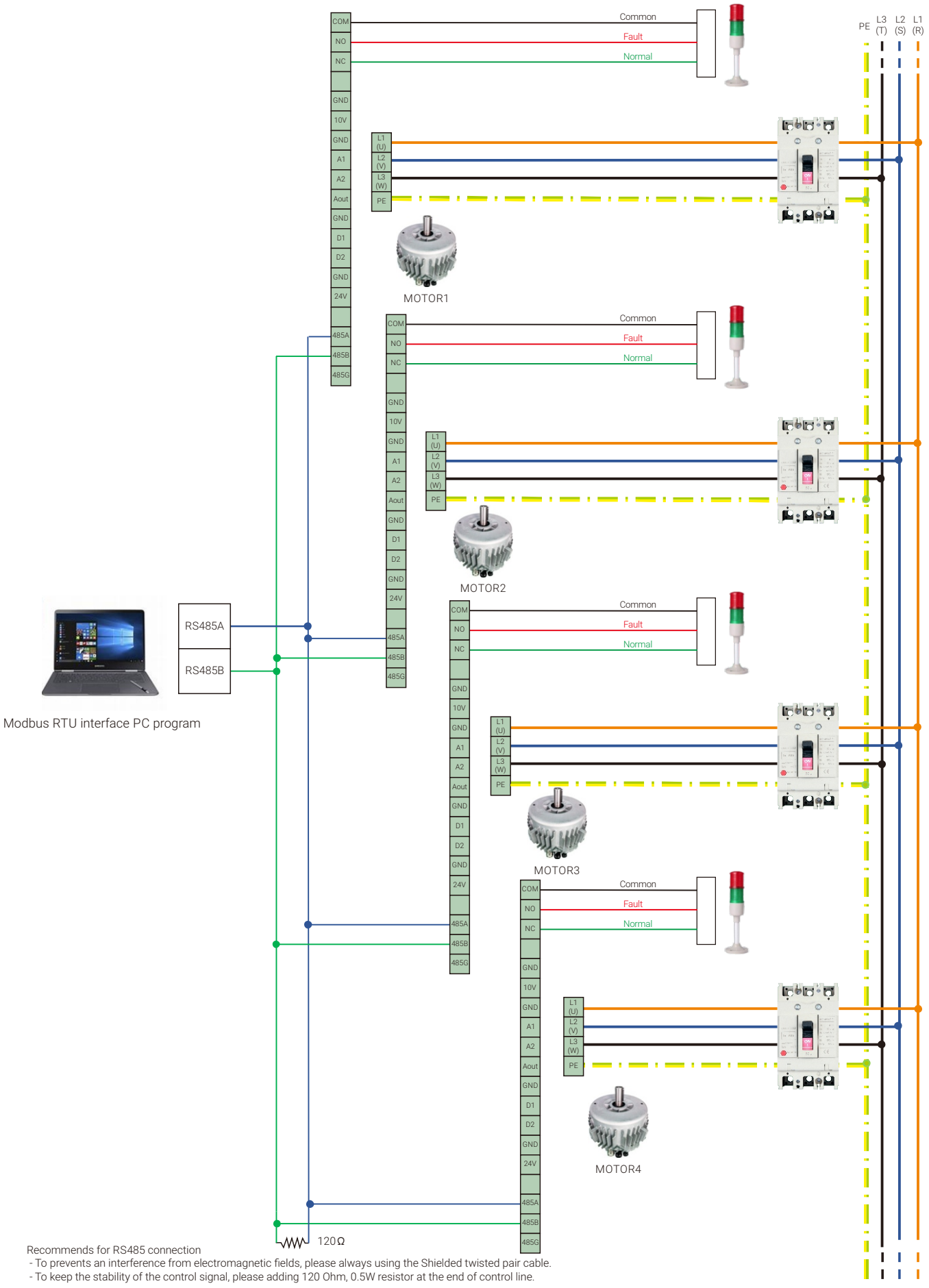
a.2 Example of Manual speed control by use of Potentiometer (analog signal 0–10Vdc) for Multiple fan connection



b.2 Example of Automatic speed control by use Demand Controlled Ventilation (DCV) or Building Management System (BMS) via analog signal 0–10Vdc or 4–20mA for Multiple fan connection



c.2 Example of Automatic speed control by use eBNC Modbus RTU interface PC program via RS485 digital port for Multiple fan connection



Recommends for RS485 connection
- To prevents an interference from electromagnetic fields, please always using the Shielded twisted pair cable.
- To keep the stability of the control signal, please adding 120 Ohm, 0.5W resistor at the end of control line.

KRUGER

KRUGER Ventilation Group

THAILAND (Regional HQ)
KRUGER VENTILATION INDUSTRIES ASIA CO., LTD.
30/159 Moo 1, Sinsakorn Industrial Estate,
Chetsadawithi Road, Khok Kham Mueng, Samuthsakorn 74000, Thailand
Tel: +662 1054298 Fax: +662 0248256-9
Website: www.krugerfan.com

THAILAND
KRUGER VENTILATION IND. (THAILAND) CO., LTD.
30/105 Moo 1, Sinsakorn Industrial Estate,
Chetsadawithi Road, Khok Kham Mueng, Samuthsakorn 74000, Thailand
Tel: +662 1050399 Fax: +662 1050370-2
Email: mktg@kruger.co.th

AUSTRALIA
S&P KRUGER AUSTRALIA PTY. LTD.
2 Cunningham St, Moorebank N.S.W. 2170
Tel: +61 2-98227747
Fax: +61 2-98227757
Email: info@sandpkruger.com.au

INDIA
KRUGER VENTILATION INDUSTRIES (INDIA) PVT. LTD.
Kruger Centre, Mumbai-Nasik Highway,
Kalamgaon, Shahapur, Thane 421601, Maharashtra, India
Tel: +91 9960558899/9975577211
Email: sales@krugerindia.com

INDIA (NORTH)
KRUGER VENTILATION INDUSTRIES (NORTH INDIA) PVT. LTD.
Village Rohad, Tehsil Bahadurgarh, Jhajjar, Haryana-124507
Tel. +91-9958991652/9958991660/8586966303
Fax +91-1276-278096
Email: sales.kni@krugerindia.com , service@krugerindia.com

INDONESIA
P.T. KRUGER VENTILATION INDONESIA.
JL. Teuku Umar No.20,
Karawaci - Tangerang 15115, Indonesia
Tel: +62 21-5512288/5513557 Fax: +62 21-5513502
Email: mktg@krugerindo.co.id

KOREA
NEOMATE CO., LTD.
2-1010, Ace High Tech City B/D, 775 Gyeongin-ro,
Yeongdeungpo-gu, Seoul, Korea. Postal Code 07299
Tel: +82-2-2679-2052 Fax: +82-2-2679-2174
Email: y7890@neomate.co.kr

MALAYSIA
KRUVENT INDUSTRIES (M) SDN. BHD.
Lot 850, Jalan Subang 7, Taman Perindustrian Subang,
47500, Subang Jaya, Selangor D.E.
Tel: +603 80743399 Fax: +603 80743388
Email: mktg@kruger.com.my

MYANMAR
KRUGER VENTILATION (MYANMAR) CO., LTD.
Room No. F21, Thiri Yadanar Whole Sale Market, (Htawunbe)
Toe Chae Ward, North Okkalapa Township, Yangon.
Tel: +959 763141081/2/3
Email: htoon@krugermm.com

HONG KONG
KRUGER VENTILATION (HONG KONG) LIMITED.
Flat C, 9/F, Yeung Yiu Chung (No.8) Industrial Building,
20 Wang Hoi Road, Kowloon Bay, Kowloon, Hong Kong
Tel: +852 22469182 Fax: +852 22469187
Email: info@kruger.com.hk

GUANGZHOU
GUANGZHOU KRUGER VENTILATION CO., LTD.
No. 9 Huahui Road, Huashan, Huadu,
Guangzhou, P.R. China 510880
Tel: +86 20-66356635 Fax: +86 20-86786001/86786500
Email: gzkruger@krugergz.com

TAIPEI
KRUGER VENTILATION (TAIWAN) CO., LTD.
No. 157, Ping-an Rd, Hengfeng Village,
Dayuan Shiang Taoyuan County 337, Taiwan
Tel: +886 3-3859119 Fax: +886 3-3859118
Email: sales@krugertwn.com.tw

TIANJIN
TIANJIN KRUGER VENTILATION CO., LTD.
Jingjin Science and Technology Park
Wuqing District, Tianjin, China
Tel: +86 22-22143480/3481 Fax: +86 22-22143482
Email: krugertj@krugertj.com

SHANGHAI
SHANGHAI KRUGER VENTILATION CO., LTD.
No.500 Yuanguo Road, Anting,Jiading District,
Shanghai 201814, P.R. China
Tel: +86 21-69573266 Fax: +86 21-69573296
Email: shkruger@krugerchina.com

WUHAN
WUHAN KRUGER VENTILATION CO., LTD.
No. 805, Huian Ave, Dongxihu District, Wuhan, Hubei, P.R. China 430040
Tel: +86 27- 83248840/83060522/83097505
Fax: +86 27- 83261886
Email: whkruger@krugerwh.com

PHILIPPINES
KRUGER M & E INDUSTRIES CORPORATION.
B3 Welborne Industrial Park Bancal Carmona Cavite 4116, Philippines
Tel: +63-2-7 6223260 * +63-46 4129652
HP: +63 925 8018444
Email: mktg@krugerph.net

SINGAPORE
KRUGER ENGINEERING PTE. LTD.
2 Venture Drive #20-23, Vision Exchange,
Singapore 608526.
Tel: +65 68631191 Fax: +65 68631151
Email: mktg@krugerfan.com

VIETNAM
KRUGER VENTILATION INDUSTRIES (VIETNAM) CO., LTD.
Lot A7. 2-4, C2 Road, Thanh Thanh Cong IZ,
Trang Bang Dist. Tay Ninh Province, Vietnam
Tel: +84-276 3585200/01/02 Fax: +84-276 3585199
Email: mktg@krugervn.com

Kruger Ventilation Industries Asia Co., Ltd.

30/159 Moo 1, Sinsakorn Industrial Estate
Chetsadawithi Road, Khok Kham Mueng,
Samuthsakorn 74000, Thailand
Tel: +662 1054298 Fax: +662 0248256-9
Website: www.krugerfan.com

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Soler&Palau Ventilation Group