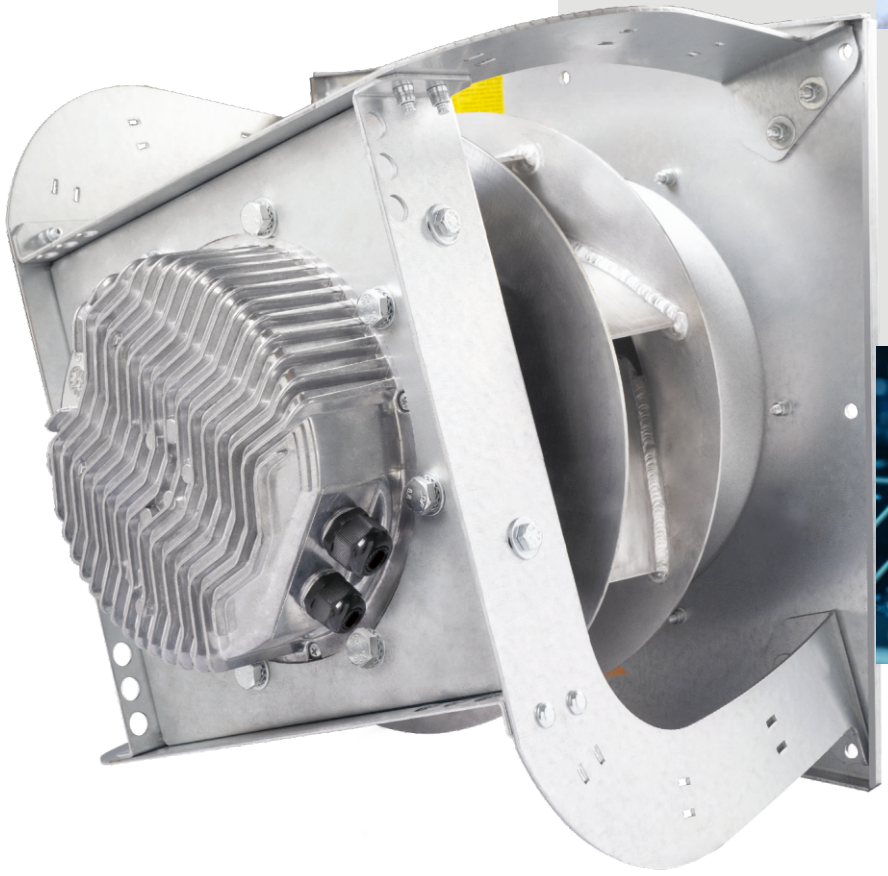
KRUGER

eBNC Ecowatt

EC Plenum Fan Series

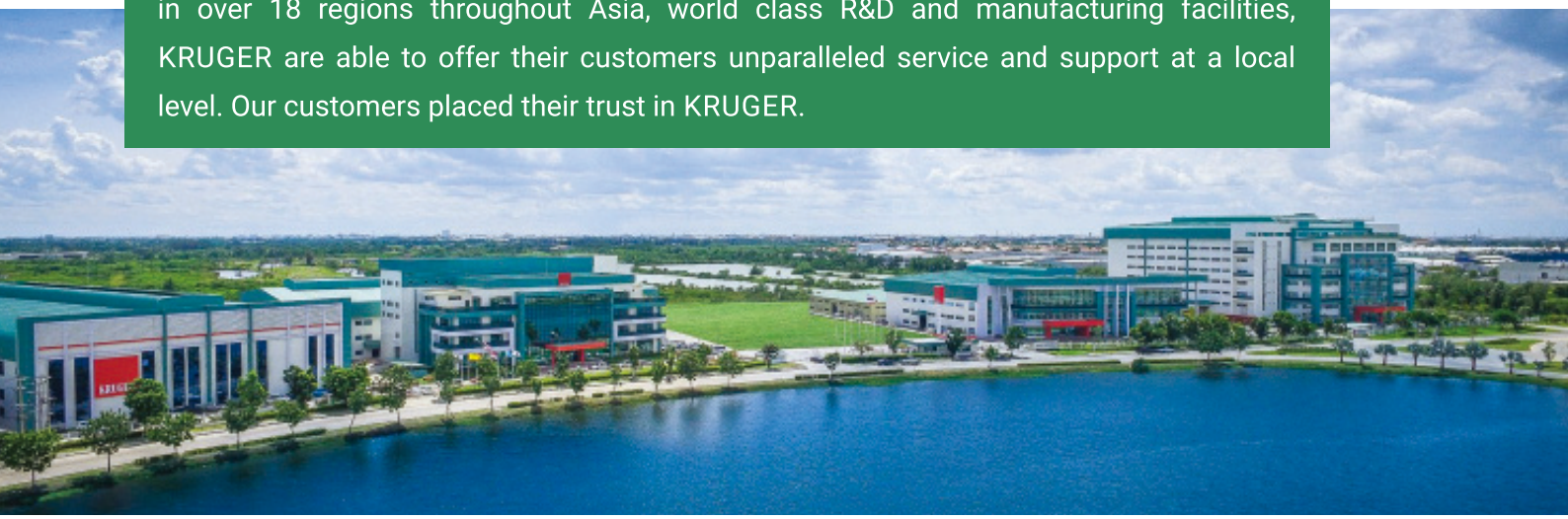
Ecowatt®



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.

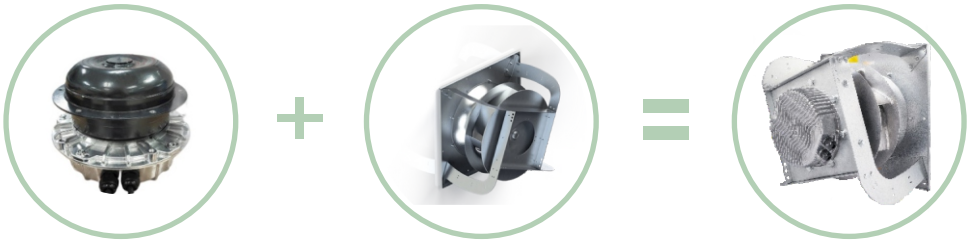


What is KRUGER eBNC Ecowatt EC Plenum Fan?

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.

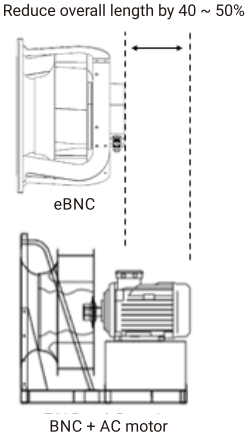


Efficient EC PM Motor

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:

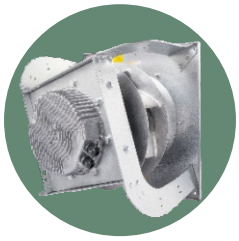
a. Manual speed control 0-10V via Potentiometer.
b. Automatic control signal 0-10Vdc or 4-20mA from Demand Controlled Ventilation (DCV) or Building Management System (BMS).
c. Automatic control by Modbus RTU program that is connected via RS485 interface.

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 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

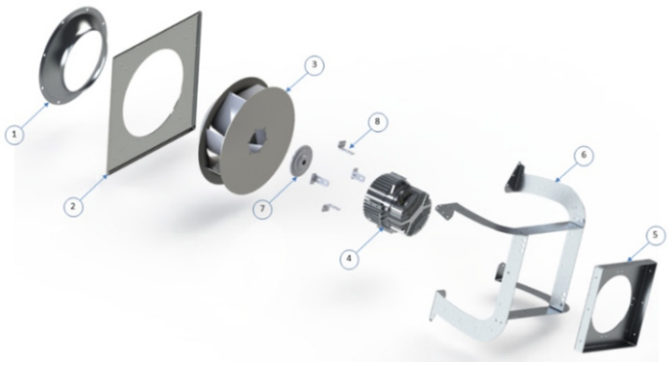
EC Motor Technical Specifications
The EC motor information and technical details

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

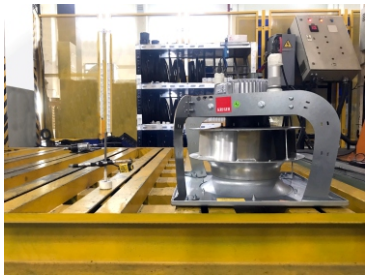
Certification

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

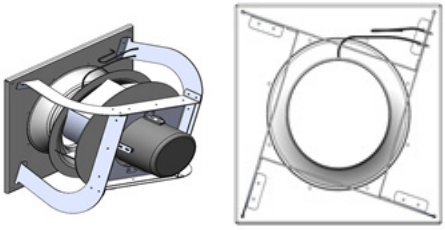


Figure 1

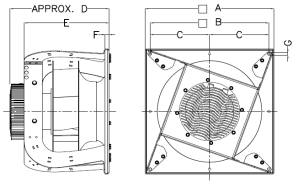
Note: Volume flow rate calculated through the measurement of differential pressure at fan inlet are not licensed by AMCA

Nomenclature

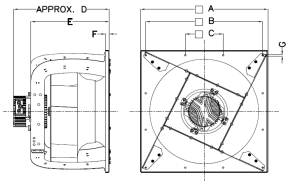
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
E	X	X	X	X	X	X	X	X	X	-	X	X	-	X	X

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

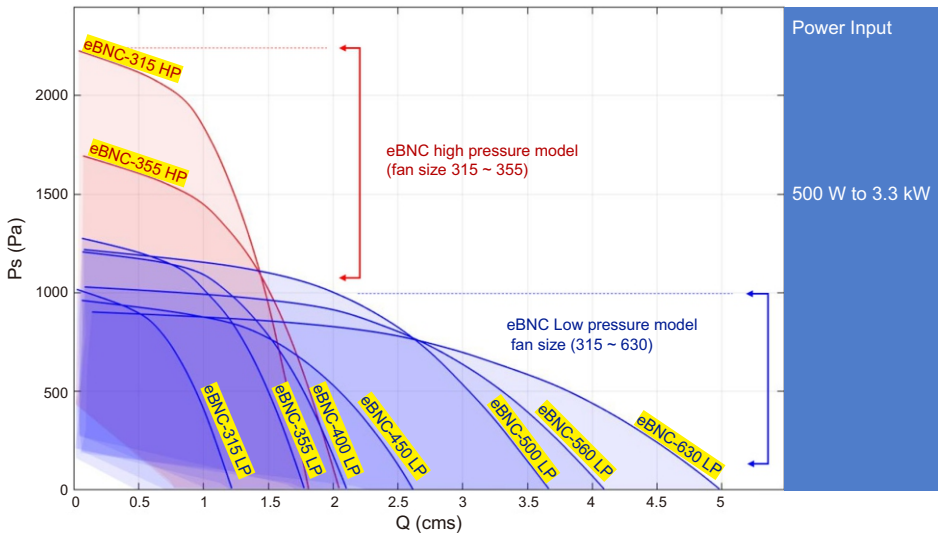


Models 450-630

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

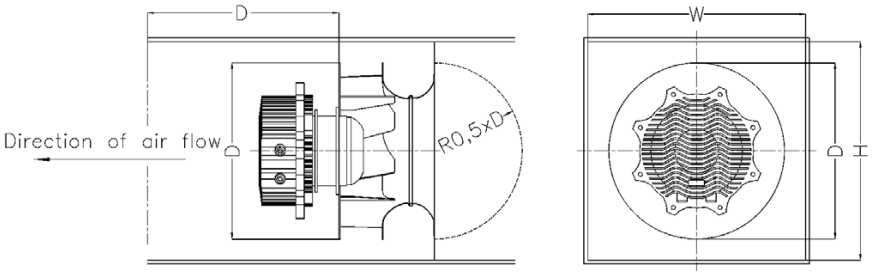
Ecowatt eBNC Fan Performance Curves

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.

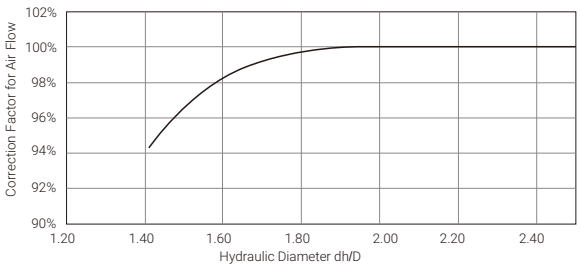


d_h = Hydraulic diameter
Formula:d_h=2xWxH/(W+H)
W = Width of the box
H = Height of the box
D = Outside diameter of the fan

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.

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.

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