SINKO

TCR series FAN COIL UNIT

With 4-wire 3-speed EC MOTOR

Energy saving

Environment-friendly

High efficiency and high power factor

ECM to EN61000

Low noise level

100% compatible with 3-speed thermostat

Convertible to 7-speed

with special digital thermostat

Love our Earth

Save our Environment by

Reducing carbon emission

Choice of FCU motor

1. Permanent split capacitor motor
2. Brushless DC motor (BLDC)
3. Permanent magnet synchronous motor or EC motor or advance DC motor

Permanent Split Capacitor Motor

Permanent split capacitor motor is an AC induction motor. It has a wounded iron stator as the outer core, and a squirrel cage iron rotor as the inner core which is bonded to motor shaft.

Alternating current feed into the stator flowing through copper winding creates a rotating magnetic field. Capacitor is used to create phase shift to start and run the motor. Magnetic field generated in stator induces an alternating current in rotor squirrel cage conductors. This induced rotor current in turn creates a magnetic field. The two magnetic fields interact and the rotor field attempts to align with the rotating stator field, resulting in rotation of the squirrel cage rotor. If there were no mechanical motor torque load, no bearing, windage, or other losses, the rotor would rotate at the synchronous speed. However, the slip between the rotor and the synchronous speed stator field develops torque. It is the magnetic flux cutting the rotor conductors as it slips which develops torque. Thus, a loaded motor will slip in proportion to the mechanical load. If the rotor were to run at synchronous speed, there would be no stator flux cutting the rotor, no current induced in the rotor, and no torque.

Brushless DC Motor (BLDC)

Brushless DC motor is a traditional DC motor but brush and slip ring are replaced by electronic commutator to feed power into stator winding, thus the name brushless. It consists of a DC motor body and an electronic controller. Better performance with respect to AC permanent split capacitor is due to permanent magnet on the rotor. This provides a situation that there is no need to feed extra current to stator for producing induced current in rotor squirrel cage, and stator current is only consumed for producing electromagnetic field to drive the permanent magnet rotor.

For general domestic and commercial application where DC power grid is usually absent, brushless DC motor is powered by AC supply. AC power is rectified to DC

power by the controller. It is then converted to square wave or trapezium wave power to simulate brush and slip ring supply power to drive the DC motor body. It still has the same ripple torque problem inherent from DC motor.

Permanent Magnet Synchronous Motor or EC or Advance DC Motor

Permanent magnet synchronous motor is very similar in structure to brushless DC motor. Earlier version of permanent magnet synchronous motor for FCU uses distributed winding embedded in slots of the stator to generate rotating magnet filed to drive the permanent magnet rotor. With more advanced electronic and software developed in recent years, it is now possible to replace distributed winding stator by DC motor salient pole stator. This has an advantage of less copper winding for the same power. Salient pole stator also allows winding of stator 100% fully automatic.

Same as brushless DC motor, AC is first rectified to DC, and then inverted using pulse width modulation (PWM) to provide a 3-phase source. The modulated voltages provide a variable amplitude and frequency sinusoidal power source for the motor.

Permanent Magnet Synchronous Motor has better dynamic performance, and higher efficiency compared to brushless DC motor. It is due to better performance of three phase sine wave power used. Torque ripple is also eliminated.

Typical three phase voltage used in EC motor is 360V, current flowing through copper winding is very small and thus heat generated is very small. Temperature sensor is no longer built inside the copper winding as it is not the critical heat generating component. Sensors are built on the controller electronic PCB. With help of software, over temperature, over load, over current, over voltage, locked rotor protection, etc can be added.

As this new type of permanent magnet synchronous motor's stator is quite different from traditional AC design, it is now commonly grouped under DC motor or BLDC motor. To distinguish it from traditional brushless DC motor, a new name EC motor is adopted to name this motor.

Product Characteristics

SINKO 3-speed DC motor fan coil units use brushless electronically commutated permanent magnet synchronous EC motors which provide low noise, low vibration, high torque, high power factor, and high efficiency operation. It is the best motor for fan coil units for reduction in carbon dioxide emission.

A．Application

Suitable everywhere, especially for high class hotels, hospitals, department stores, restaurants, offices and government buildings.

B．Runs smoothly with very low noise and nearly no vibration

Our EC motor uses sinusoidal wave power to drive the rotor, more advanced than ordinary BLDC motor which uses square wave power. Sinusoidal wave results in low electrical noise and low vibration during operation.

C．High efficiency and energy saving

Average motor efficiency at full load is over 75%. Average power factor at full load is 90% by means of active power factor correction IC in the controller. Compared to traditional AC motors, under the same air volume of external static pressure, energy saving at low speed could be up to 70%. More saving can be achieved by lowering to below 3-speed AC motor's low speed.

D．Easy and simple to operate

It can be used with any conventional 3-speed thermostat, or DDC controller.

E．Convenient installation

Motor controller box is built onto the motor. Wiring is exactly like conventional 3-speed AC motor FCU. There is no need to install another controller box, thus eliminated the need of another access door on the ceiling to service the controller box.

F．Stable quality with high reliability

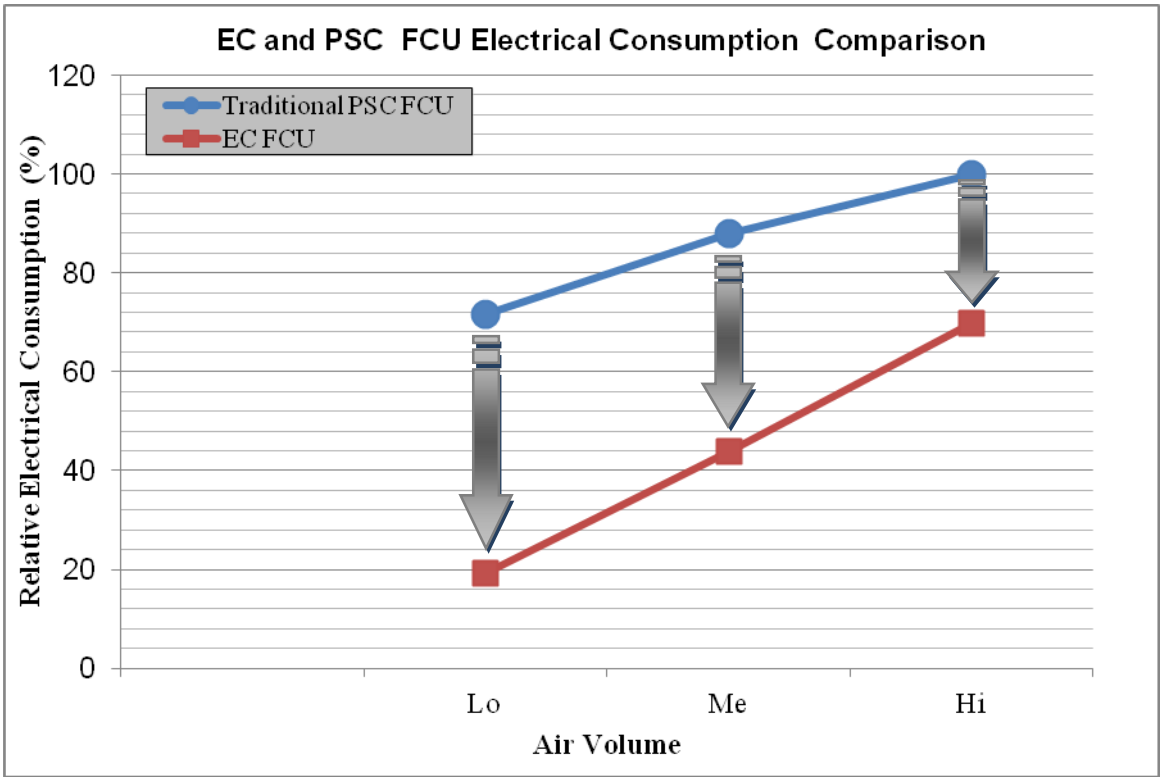
The main body of our EC motor is without electronic parts. All electronics are located in the controller. Hall position sensors are not necessary because the position of the magnet rotor is calculated by high power MPUs in the controller. The controller has multiple protection functions like over load, over heat, over current , over voltage and locked rotor, etc

G．Interchangeability of parts

There only two motor bodies, one double shaft and one single shaft, for the entire series of TCR fan coil unit. Power and speed of our motors can be adjusted to suit whole range of air flow and static pressure by adjusting the output from our motor controller (AS models) or changing the controller (standard TS models).

Energy saving advantages

Under the same external static pressure and air volume, EC motor can save up to 70% in power consumption at speed equivalent to the low speed of traditional 3-speed PSC motor. Moreover, the low speed of EC motors can be reduced farther making energy saving of up to 80% being possible.



Power consumption comparison between EC motor and traditional PSC motor

Check List when choosing DC Motor for FCU

1. EC motor is an advanced BLDC motor and preferred over traditional BLDC motor.
2. No torque ripples
3. Motor controller attached to motor body is preferred over motor with a separate controller. Same access door is used to service fan, motor and motor controller.
4. Motor controller can be easily removed and replaced without the need of taking down the motor and fan together
5. Active PFC to be built-in to achieve power factor above 0.9 at rated power output.
6. Harmonic filter must be built-in to reduce disturbance to power supply.
7. Electro Magnetic Compliance to EN61000.
8. Efficiency to be min 75% at optimal output and speed.
9. Auto-voltage for 200-240V/50 +/-10% power supply.
10. With over load, power current, over temperature, over voltage, locked rotor protection.
11. Operate from high to low speed without resonant vibration or electric noise.
12. Minimum no. of motor models to reduce spare parts.
13. Motor compatible with FCU manufacturer's thermostat or 3rd party thermostat.
14. Motor is designed to work as 4-wire 3-speed compatible with standard new or old AC 3-speed thermostat. And convertible to 7-speed if applied with FCU manufacturer's digital thermostat (AS models only).

Nomenclature

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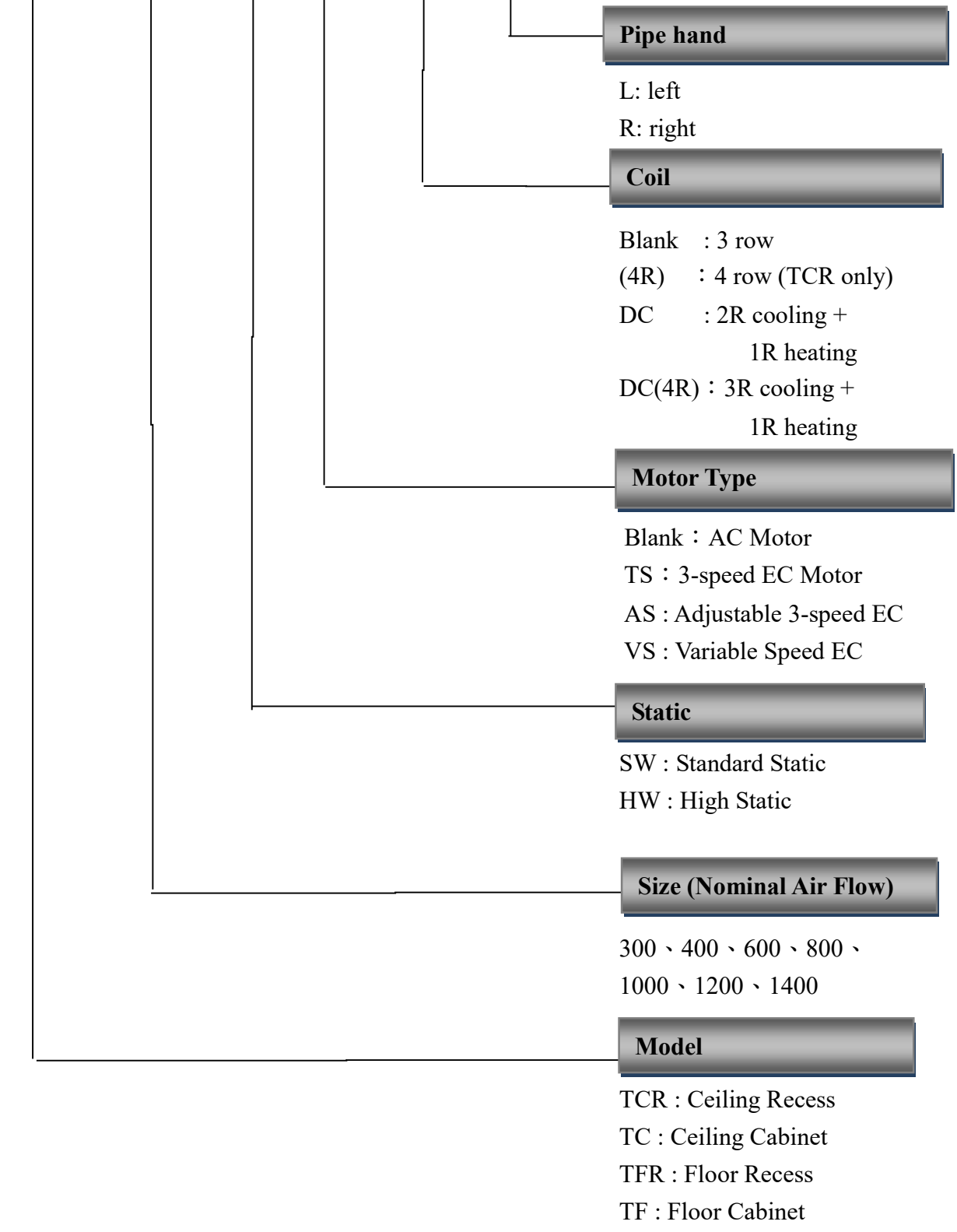


Specification

Type		Ceiling recess and cabinet type fan coil unit						
Model		TCR-SW, TCR-HW, TC-SW						
Size		300	400	600	800	1000	1200	1400
Fan	Type	Forward-curved DIDW centrifugal fan						
	Number	1	2	2	2	3	4	4
Motor	Type	Electronic commutated, sensorless, brushless DC motor, also called permanent magnet synchronous motor. With 32-bit MPU and power factor correction controller						
	Operating Range	3-speed from 500 to 1200rpm						
	Speed Control Signal	Compatible with conventional 3-speed thermostat						
	Power supply	AC 100 ~ 240V (+/-10%) 50 / 60Hz						
	Number	1	1	1	1	2	2	2
Coil	Type	Aluminum fins mechanically bonded to copper tube, complete with water in/out sockets, manual air vent and drain plug.						
	Row/ FPI	3 or 4 - row / 12 fpi						
	Operating pressure	1700kPa (250psig) maximum, unless otherwise specified						
Piping	Inlet / Outlet	3/4” FPT						
	Drain	3/4” MPT						
Insulation for drain pan		6mm thick elastomeric BS476 Class 0 material						
Weight (kg)		16	20	24	28	36	42	45

Please refer to separate FCU schedule submission for capacities and power consumptions.

Sound Power Level

Model TCR-SW

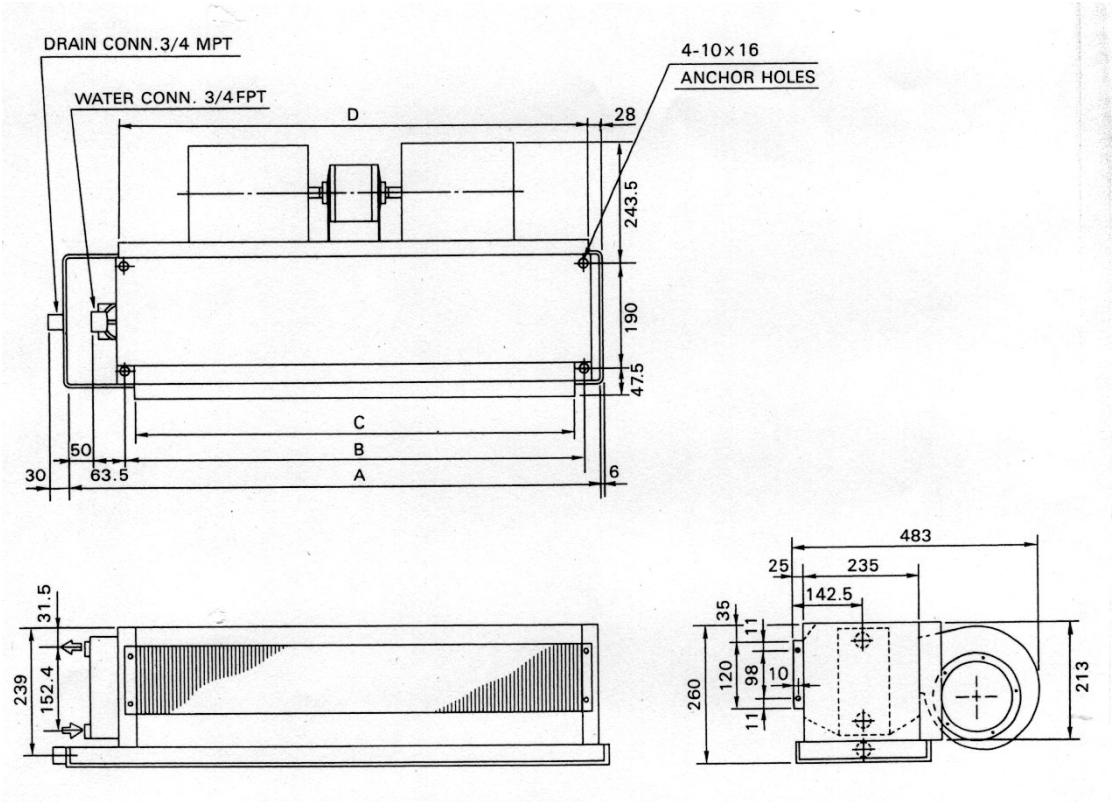
Fan Speed	Unit Size	Octave Band Frequencies, Hz (dB at 30Pa Ext. S.P.)							
		63	125	250	500	1000	2000	4000	8000
H	300SW	34	46	41	43	43	38	34	23
	400SW	35	47	45	46	44	39	31	26
	600SW	38	50	45	46	45	41	32	25
	800SW	40	52	47	49	48	44	36	31
	1000SW	38	51	46	48	47	42	33	27
	1200SW	40	52	46	49	47	42	36	30
	1400SW	42	54	49	52	51	48	39	34
M	300SW	34	44	36	37	37	30	22	<20
	400SW	31	42	39	40	39	33	24	<20
	600SW	31	44	39	41	39	34	25	<20
	800SW	34	47	43	45	41	37	26	22
	1000SW	35	46	42	44	42	36	27	21
	1200SW	37	48	43	46	42	37	28	23
	1400SW	38	51	46	48	44	40	31	26

Model TCR-HW

Fan Speed	Unit Size	Octave Band Frequencies, Hz (dB at 50Pa Ext. S.P.)							
		63	125	250	500	1000	2000	4000	8000
H	300HW	38	52	47	49	48	44	36	30
	400HW	38	50	46	48	48	43	35	30
	600HW	40	53	49	52	50	47	38	31
	800HW	43	57	53	55	53	50	41	34
	1000HW	42	55	51	54	52	48	39	34
	1200HW	45	57	53	55	53	50	42	34
	1400HW	47	59	55	57	55	52	43	38
M	300HW	34	46	41	43	43	38	34	23
	400HW	35	47	45	46	44	39	31	26
	600HW	38	50	45	46	45	41	32	25
	800HW	40	52	47	49	48	44	36	31
	1000HW	38	51	46	48	47	42	33	27
	1200HW	40	52	46	49	47	42	36	30
	1400HW	42	54	49	52	51	48	39	34

Dimension

2-pipe ceiling TCR (300 ~1400)



Model / Size	Dimension (mm)			
	A	B	C	D
TCR-300	635	500	462	510
TCR-400	885	750	712	760
TCR-600	1020	885	847	890
TCR-800	1305	1170	1132	1180
TCR-1000	1490	1340	1302	1350
TCR-1200	1740	1590	1552	1600
TCR-1400	1920	1770	1732	1780

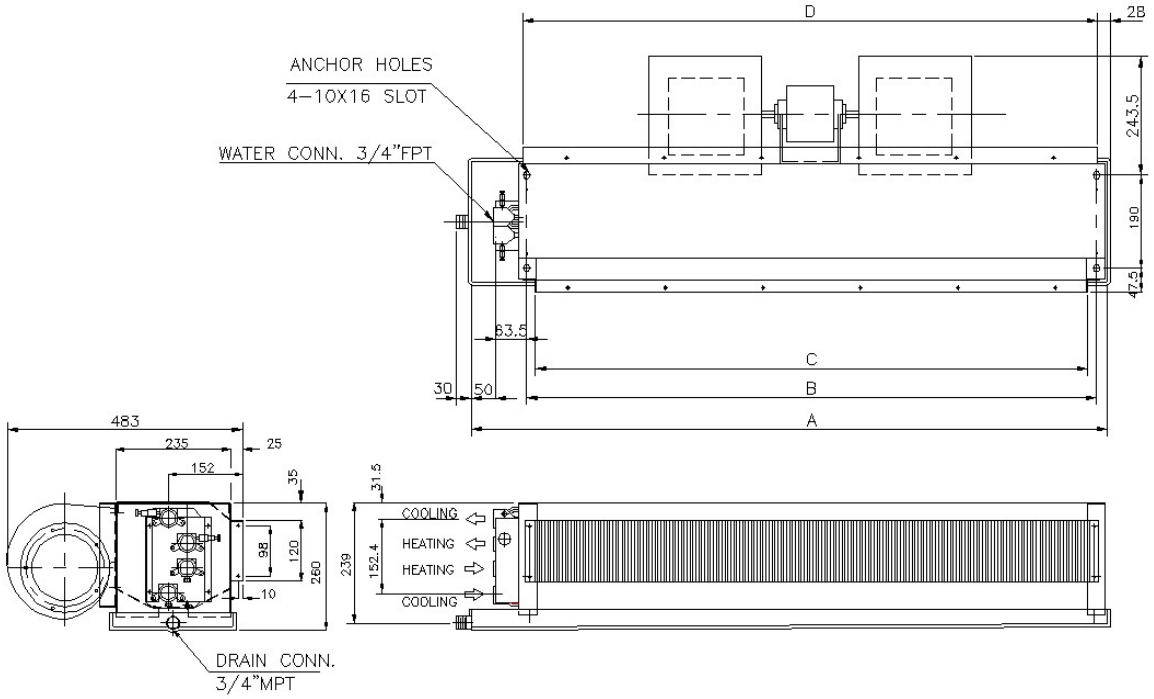
Remarks: 1. The pipe connection method is identified by facing the air outlet, if the water in/out pipe is on the left side, the connection is on the left.

2. Add 240mm to A for extended drain pan.

3. Special anti-corrosion aluminum fin water coil can be ordered upon request

Dimension

4-pipe ceiling recess TCR- (300 ~1400) DC(4R)



Model / Size	Dimension (mm)			
	A	B	C	D
TCR-300DC(4R)	635	500	462	510
TCR-400DC(4R)	885	750	712	760
TCR-600DC(4R)	1020	885	847	890
TCR-800DC(4R)	1305	1170	1132	1180
TCR1000DC(4R)	1490	1340	1302	1350
TCR1200DC(4R)	1740	1590	1552	1600
TCR1400DC(4R)	1920	1770	1732	1780

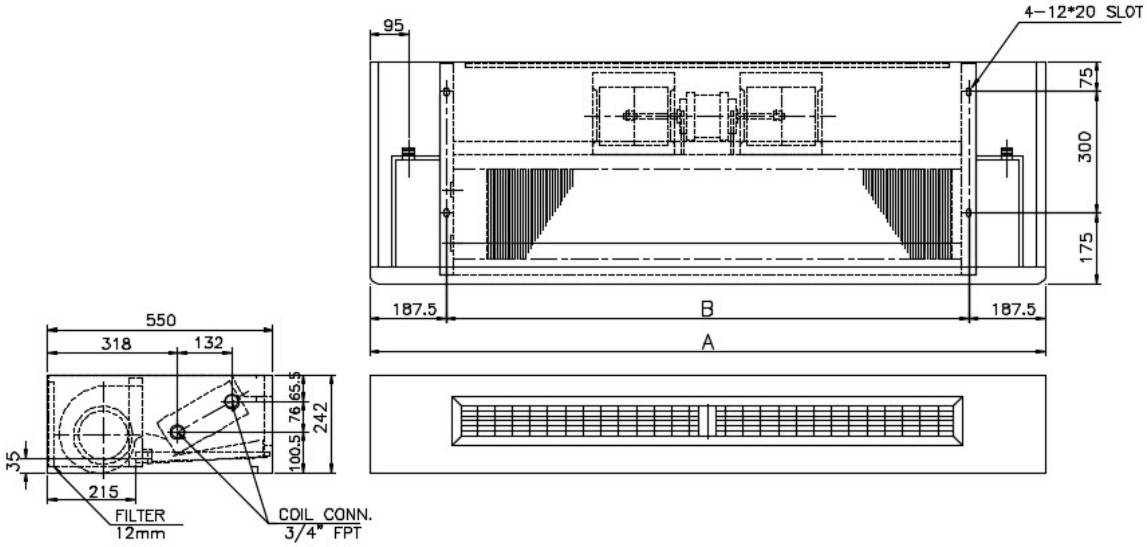
Remarks: 1. The pipe connection method is identified by facing the air outlet, if the water in/out pipe is on the left side, the connection is on the left.

2. Add 240mm to A for extended drain pan.

3. Special anti-corrosion aluminum fin water coil can be ordered upon request

Dimension

2-pipe ceiling cabinet TC- (300 ~1400)



Model / Size	Dimension (mm)	
	A	B
TC-300	980	605
TC-400	1230	855
TC-600	1365	990
TC-800	1650	1275
TC-1000	1845	1470
TC-1200	2095	1720
TC-1400	2275	1900

Remarks: 1. The pipe connection method is identified by facing the air outlet, if the water in/out pipe is on the left side, the connection is on the left.

2. Extended drain pan not available for ceiling expose model.

3. Special anti-corrosion aluminum fin water coil can be ordered upon request

- **Wiring Diagram**