Instructions for the TBCW Control Equipment
The TBCW Control equipment is intended for the Swegon Power roof ventilator, Sky Wing.

1. General

The Sky Wing is a power roof ventilator with Swegon's patented WING fan impeller. The power roof ventilator is intended for outdoor installation on a roof duct or chimney and is designed for use as an extract air fan in mechanical ventilation systems, where the air has low dust content. The fan design provides a low level of fan-generated sound and energy-efficient performance.
The fan is direct driven and equipped with flange motor. It is supplied in three physical sizes. Several impeller and motor options are available for each size. The control and regulation equipment for the roof fan is also available with several different functions, from the simplest variant with a starter for starting up and stopping the fan, to the most sophisticated solution with outdoor temperature-compensated pressure control. Depending on function and the fan size, the control equipment can either be delivered installed inside the fan or supplied separately for external installation.

Descriptions

A number of optional control solutions are available for the Sky Wing power roof ventilator:

Equipment Package Q2

Control system with frequency inverter, programmed for one constant speed or two constant speeds (high and low speed).

Equipment Package Q3

Control system with frequency inverter, programmed for variable fan speed in response to a 0-10 V signal or by means of an external potentiometer.

Equipment Package Q4

Control system with frequency inverter programmed for pressure control.

Equipment Package Q5

Control system with frequency inverter, programmed for outdoor temperature-compensated pressure control.

2. Specification

Control System

Control equipment **TBCW-12-a-bb-c-dd**
For controlling the fan speed

Control function
Q2 = 2
Q3 = 3
Q4 = 4
Q5 = 5

Max. permissible motor output
0,37 kW = 03
0,75 kW = 07
1,1 kW = 11
1,5 kW = 15
2,2 kW = 22
3,0 kW = 30
7,5 kW = 75

Frequency inverter
unmounted = 0
mounted =1
(not applicable to LTCW-040)

Pressure control
No pressure control = 00
(applicable to Q2 and Q3 only)
0- 300 Pa = 03
0- 500 Pa = 05
0-1000 Pa = 10
0-1600 Pa = 16

Frequency inverter 0.37-1.5 kW 1x230 V in, 3x230 V out
Frequency inverter 2.2-7.5 kW 3x400 V

Accessories for the Control System

Control panel **KPA-1-200**

Timer, 0-2 hours **TBLZ-1-406-a**
Surface-mounted =1
Flush-mounted=2

Safety switch **ELQZ-1-401-01**

3. Safety and norms

3.1 Measures for your safety

The inverter drives can be commissioned quickly and safely. For your own safety and for safe machine operation, pay careful attention to the following warnings and instructions:
First read the installation instructions!
l Pay attention to the safety precautions!
When carrying out work on electrical drive systems, always be aware of the following dangers:
Electrical voltages > 230 V/460 V:
l Even 10 min. after isolating the mains power supply, harmful voltage may remain. It is therefore advisable to test whether the voltage has dropped to zero!
l Rotating parts
l Hot surfaces
Your skills:
lTopreventpersonalinjuryanddamagetoelectricalcomponentsortheventilator,only persons with sufficient skills in electrical engineering shall be allowed to carry out work on the unit.
lThequalifiedpersonmustfirstfamiliarizehimselfwiththeinstallation instructions (compare IEC364, DIN VDE 0100).
Knowledge of National Regulations
Observe the following while installing equipment:
l Follow the conditions for wiring and technical particulars thoroughly.

l Electrical installation standards shall be observed, i.e. the cross-sectional area of conductors, grounding conductors and earth connections.
Don'ttouchelectroniccomponentsandcontacts(Staticdischargefromhandsmaydestroy electronic components).

3.2 Norms

CE The CDA3000 Frequency inverter conforms to the Low Voltage Directive 73/23/EWG.
EMC Compliance with the installation instructions is a prerequisite for compliance with the
following basic standards:
EN50081-1 and EN50081-2 (Conductor-borne disturbances and disturbing radiation) IEC 1000-4-2 to 5/ EN61000-4-2 to 5 (inverter module immunity to disturbance)
Use of the frequency inverter in special applications i.e. potentially explosive environments requires compliance with special standards (e.g. EX environment EN 50014 "General Conditions" and EN 50018 "Air-tight Enclosures").
Repair may only be carried out by authorized service shops. Unauthorized and unwarranted modification may cause damage to property and bodily injury. Swegon does not assume liability for the above.

4. Incorporating the Frequency Inverter/Installation

The TBCW Control system has a frequency inverter of Cold Plate design (installation and cooling variant). If the TBCW control system is supplied in unmounted condition, the frequency inverter shall be incorporated into the system as follows

Important!

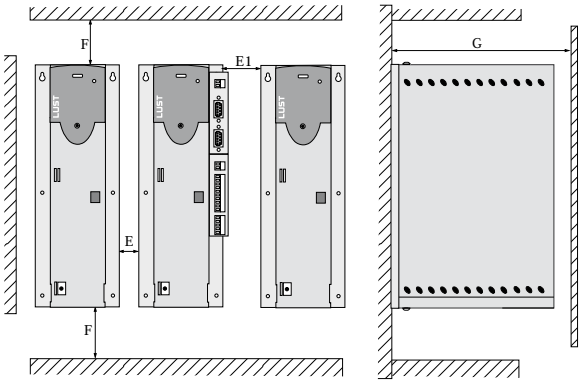
Do the following to protect the frequency inverter!

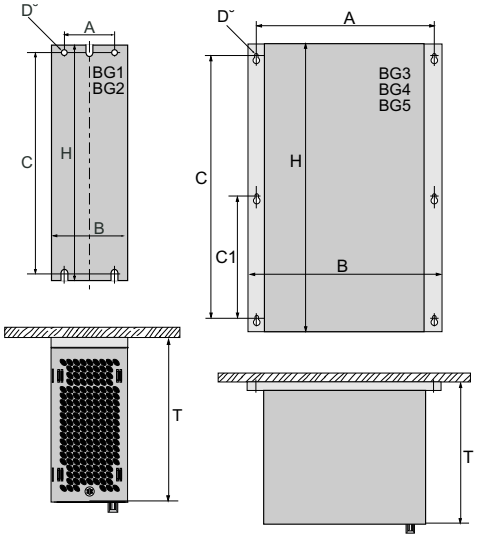
- Prevent moist air from entering the frequency inverter.
- Make sure that the ambient air doesn't contain aggressive or volatile substances
- Prevent drilling cuttings, screws or foreign objects from falling into the frequency inverter
- Keep the cooling air openings free from obstruction.

4.1 Installation

Step	Influence
1	Draw the position for the mounting holes on the mounting plate or cooler. Drill a hole for each mounting screw.
2	The best result for EMC-correct installation can be achieved by using a chromized or galvanized mounting plate. If a painted mounting plate is used, the paint layer must be removed to obtain a proper metallic contact surface!
3	Fit the inverter module vertically onto the mounting plate. Tighten all the screws with the same torque.
4	Mount the other components such as the mains filter, smoothing choke, etc on the mounting plate.
5	The mounting plate must be earthed.

4.2 Dimensions





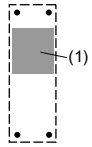
Control system **Frequency inverter, size**	**TBCW-12X-03X-** **TBCW-12X-07X-** **BG1**	**TBCW-12X-11X-** **TBCW-12X-15X-** **TBCW-12X-22X-** **BG2**	**TBCW-12X-30x-** **BG3**	**TBCW-12X-75X-** **BG4**
Weight, kg	1,6	2,3	3,2	5,2
B (Width) mm	70	70	100	150
H (Height) mm	215	240	300	300
T (Depth) mm	120	145	150	150
A mm	50	50	85	135
C mm	205	230	200	200
C1 mm	-	-	100	100
D mm	4,8	4,8	5,5	5,5
Screws	4xM4	4xM4	6xM5	6xM5
E mm	0	0	0	0
E1 (with module) mm	35	35	5	5
F mm	100[1)]	100[1)]	100[1)]	100[1)]
G mm	> 300	> 300	> 300	> 300

[1)] Make sure that sufficient free space is provided for cable bends!

4.3 Necessary Cooling on Installing the Frequency Inverter.

Pay careful attention to the following:

- Adequate cooling can be obtained either by fitting a mounting plate that is large enough (see Table 4.3.1) or by fitting a cooling flange. The cooling flange must be mounted centrally below the hottest area of the frequency inverter (1).
- The temperature on the back side of the inverter module must not exceed 85.0°C. If the temperature is higher than 85° C the inverter will switch itself off. Reclosing is only possible after the frequency inverter has cooled down.
- The contact surface should have a surface smoothness of 0.05 mm; the maximum porosity on the contact surface should be = RZ 6.3.



4.3.1 Table

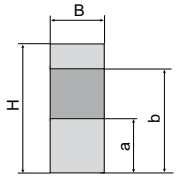
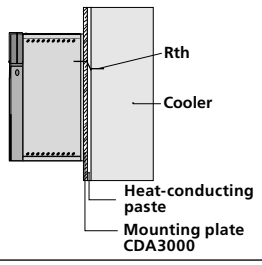
Construction size	Output (kW)	P_v 1) (W)	R_{thk} 3) (K/W)	Mounting plate (unpainted steel) min permissible cooling surface.	Ambient temp. °C
BG1	0,375	25	0,05	-	45 °C
	0,75	45	0,05	650x100 mm=0,065 m^2	45 1), 40 2)
BG2	1,1	75	0,05	650x460 m m=0,3 m^2	45 1), 40 2)
	1,5	95	0,05	650x460 mm=0,3 m^2	45 1), 40 2)
	2,2	100	0,05	A fitted cooling flange is necessary for adequate cooling.	
BG3	3	120	0,03		
BG4	7,5	225	0,02		

1) For a final stage frequency of 4 kHz

2) For a final stage frequency of 8 kHz

3) Thermal resistance between active cooling surface and cooling flange

4.3.2 Sizing Instructions for "Cold Plate"

<table>
<tr><th>Subject</th><th colspan="5">Planning instructions</th></tr>
<tr><td>Thermal connection with the cooling surface</td><td colspan="5">1 The contact surface regularity = 0.05 mm.
The contact surface irregularity = Irregularity factor 6.3
1 The contact surface between inverter module ("Cold Plate" mounting plate) and cooling flange treated with heat-conducting paste. (Coating thickness: 30-70µ)
1 The temperature in the centre of the inverter's mounting plate must not exceed 85 °C .</td></tr>
<tr><td rowspan="2">Distribution of loss effect</td><td>Size</td><td>Output</td><td colspan="2">Cooling flange</td><td>Enclosure</td></tr>
<tr><td>BG 1/2
BG 3
BG 4</td><td>0,37 to 2,2 kW
3 to 4 kW
5,5 to 7,5 kW</td><td colspan="2">about 65%
about 70%
about 75%</td><td>about 35%
about 30%
about 25%</td></tr>
<tr><td rowspan="2">Active cooling surface
 
</td><td>Size</td><td>Output
[kW]</td><td colspan="2">Component surface[mm]
B H</td><td colspan="2">Active cooling surface [mm]
a b</td></tr>
<tr><td>BG 1
BG 2
BG 3
BG 4</td><td>0,37 to 0,75
1,1 to 2,2
3 to 4
5,5 to 7,5</td><td>70
70
100
150</td><td>193
218
303
303</td><td>50
90
120
65</td><td>165
200
260
215</td></tr>
<tr><td rowspan="2">Thermal resistance
 
</td><td>Size</td><td>Output
[kW]</td><td colspan="4">Thermal resistance between active cooling surface and cooler
Rth [K/W]</td></tr>
<tr><td>BG 1
BG 2
BG 3
BG 4</td><td>0,37 to 0,75 kW
1,1 to 2,2 kW
3 to 4 kW
5,5 to 7,5 kW</td><td colspan="4">0,05
0,05
0,03
0,03</td></tr>
</table>

5. Electrical connections

Electrical connections, such as the connection of sensors, etc, should be carried out in accordance with the wiring diagram for each control equipment package.
NB:
A type of cable with double copper surface with 60 - 70% coverage must be used for all the shielded connections.

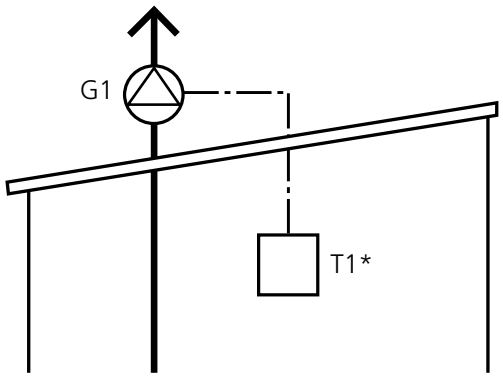
- The protective conductor should be star-coupled in order to meet the EMC standards.
- The mounting plate must be properly earthed.
- The motor cable, mains power cable and control cable should be run sufficiently distant from one another.
- Prevent slack in the wiring and run the wire the shortest possible way.
- The leakage current while the unit operates is > 3.5 mA.
- Arrange predominantly earthed cables to the control connections.
- The control cables should be arranged at a sufficient distance from mains power and motor cables.
- You'llfindparticularsofthepresetoperatingmodesintheUsers Manual for the CDA3000.

5.1 Control Equipment Q2

Control system with frequency inverter*, programmed for constant speed (1 or 2-speed operation)

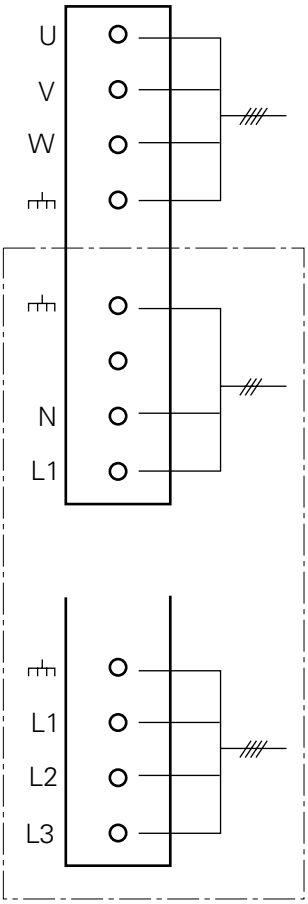
Operation

G1 = Extract air fan
T1 = Frequency inverter
Extract air fan G1 is started and stopped via frequency inverter T1*.
Required speed(s) are set from the KP-1-200 control panel.
One or two constant speeds.
Start via closure between 7-8 and 7-9.
Speed 1: 7-10 open.
Speed 2: 7-10 closed.
Alarms can be reset by isolating the power supply to the fan or by opening the circuit at 7-8.
Provision is available for the transmission of alarms.



Electrical connections

Power supply (terminal block X1)



Power supply to fan motor

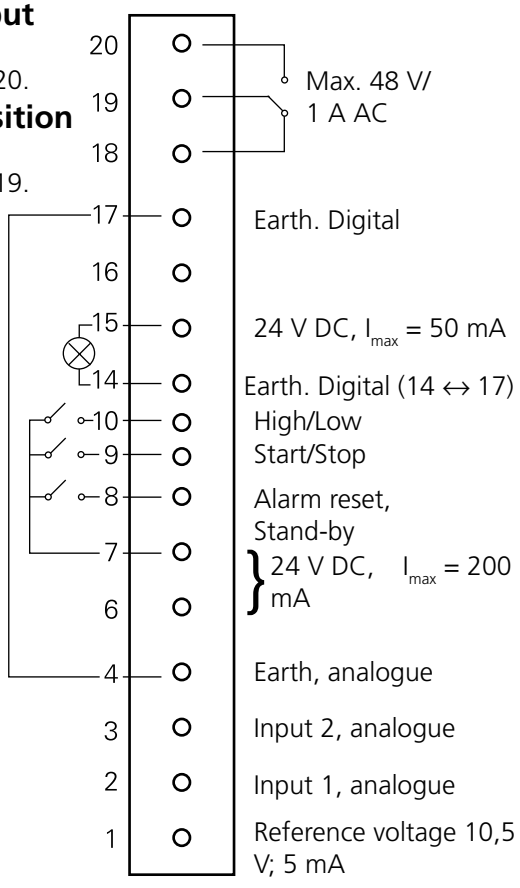
Option 1: 1-phase
Incoming
power supply: 1 x 230 V
(0.25-1.5 kW motors)

Option 2: 3-phase
Incoming
power supply: 3 x 400 V
(2.2-7.5 kW motors)

Control functions (terminal block X2)

Alarm output
Active alarm:
Closure at 19-20.
Normal position
No alarm:
Closure at 18-19.

In-operation indication



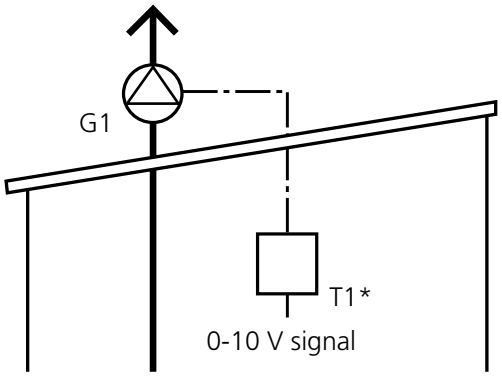
** As an option, the frequency inverter can be supplied mounted inside the fan casing (size 060 and 090 units) or separate for indoor installation. NB! A shielded cable should be used between T1 and G1 if the unit is installed indoors. The electrical connections should not be wired if the temperature is below -10° C to avoid damaging the terminals of the frequency inverter.*

5.2 Control Equipment Q3

Control system with frequency inverter*, programmed for variable speed in response to 0-10 V signals or by means of external potentiometer

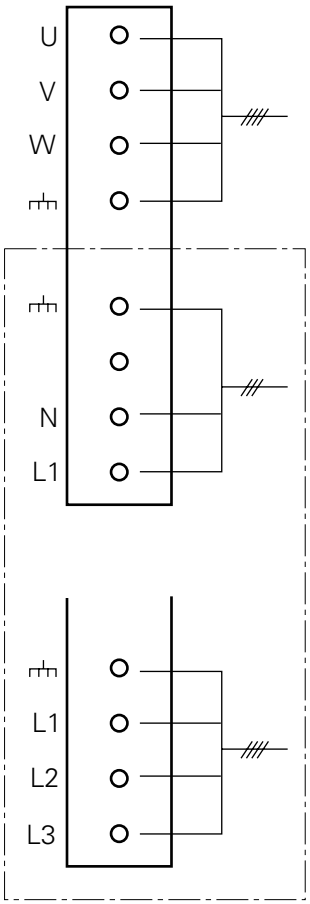
Function

G1 = Extract air fan
T1 = Frequency inverter
Exhaust air fan G1 is controlled between 0 and max speed by means of an external 0-10 V signal, G0 connected on terminal 4 and signals on terminal 2.
Start via closure between 7-8 and 7-9. Alarms can be reset by isolating the power supply to the fan or by opening the circuit at 7-8.
Provision is available for the transmission of alarms.



Electrical connections

Power supply (terminal block X1)



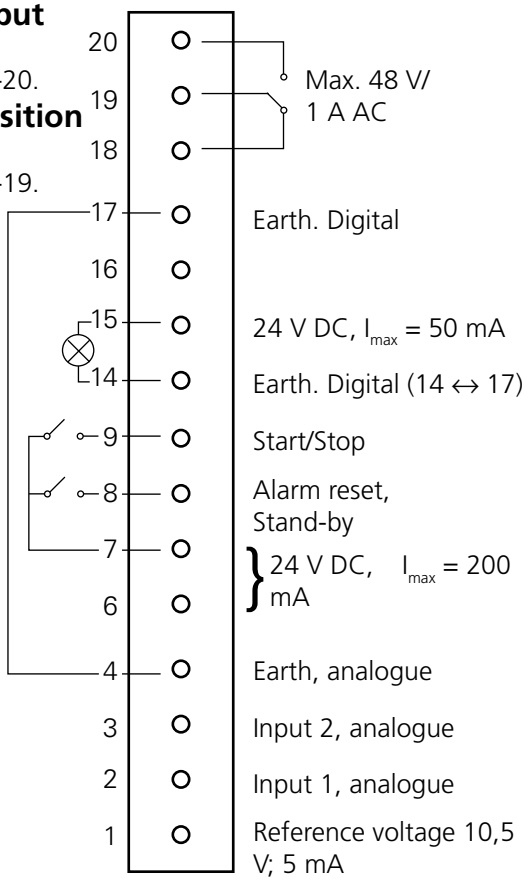
Power supply to fan motor

Option 1: 1-phase
Incoming
power supply: 1 x 230 V
(0.25-1.5 kW motors)

Option 2: 3-phase
Incoming
power supply: 3 x 400 V
(2.2-7.5 kW motors)

Control functions (terminal block X2)

Alarm output
Active alarm:
Closure at 19-20.
Normal position
No alarm:
Closure at 18-19.



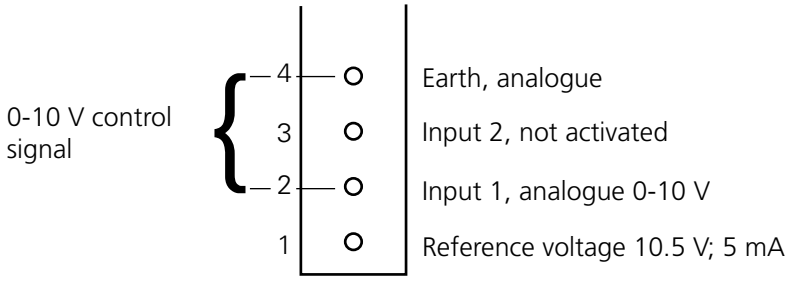
In-operation indication

** As an option, the frequency inverter can be supplied mounted inside the fan casing (size 060 and 090 units) or separate for indoor installation.*
NB! A shielded cable should be used between T1 and G1 if the unit is installed indoors. The electrical connections should not be wired if the temperature is below -10° C to avoid damaging the terminals of the frequency inverter.

Q3 Continued, Options

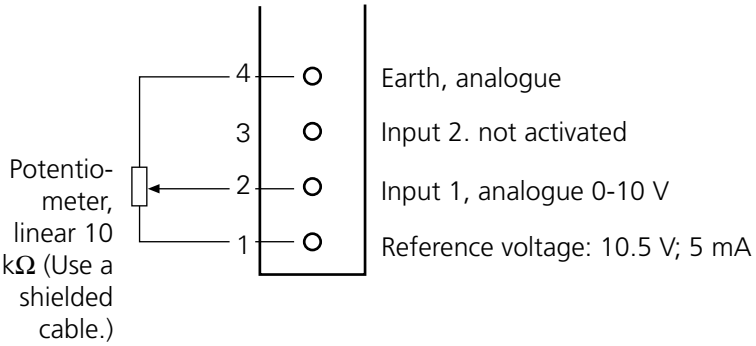
Option 1

0-10 V control signal



Option 2

Control via potentiometer



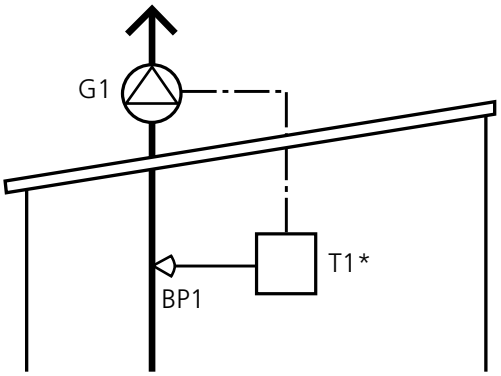
5.3 Control Equipment Q4

Control system with frequency inverter*, programmed for pressure control

Function

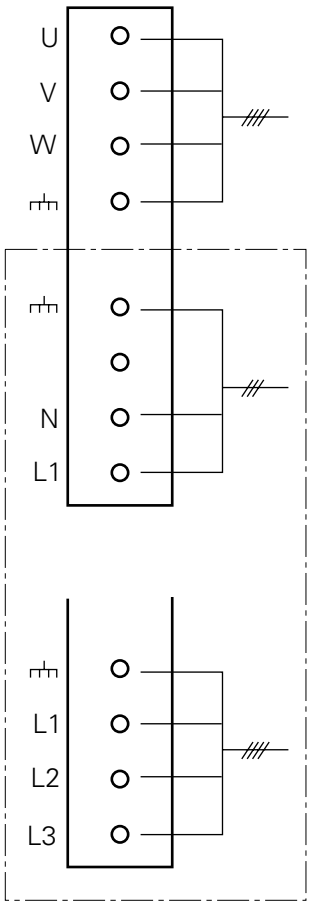
G1 = Extract air fan
T1 = Frequency inverter
BP1 = Pressure sensor
The speed of extract air fan G1 is regulated by means of 4-10 mA signals from active pressure sensor BP1, connected to terminals 6 and 2.

Start via closure between 7-8 and 7-9.
Alarms can be reset by isolating the power supply to the fan or by opening the circuit at 7-8.
Provision is available for the transmission of alarms.



Electrical connections

Power supply (terminal block X1)



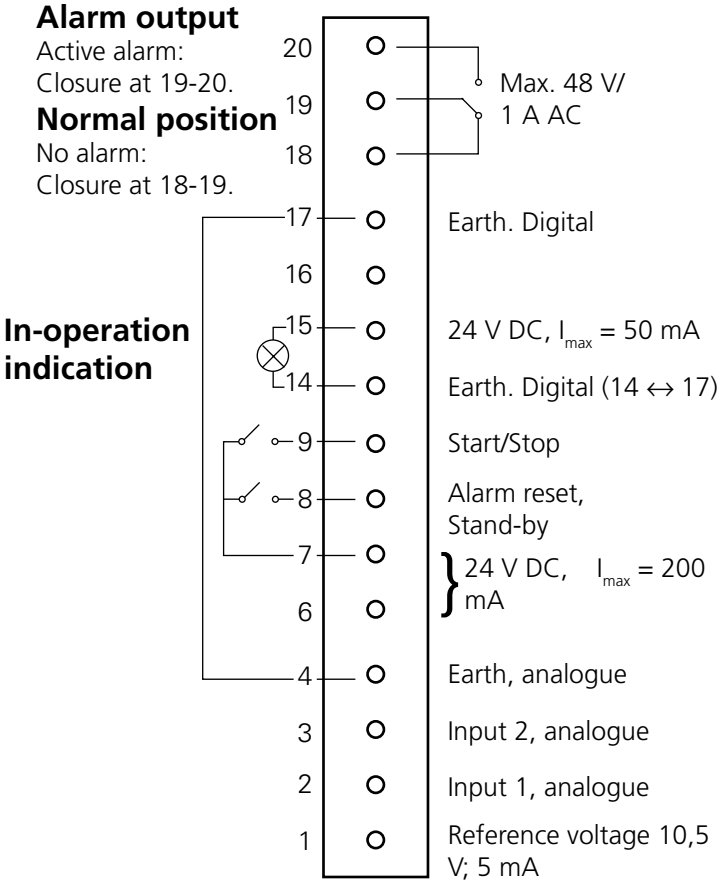
Power supply to fan motor

Option 1: 1-phase
Incoming
power supply: 1 x 230 V
(0.25-1.5 kW motors)

Option 2: 3-phase
Incoming
power supply: 3 x 400 V
(2.2-7.5 kW motors)

Control functions (terminal block X2)

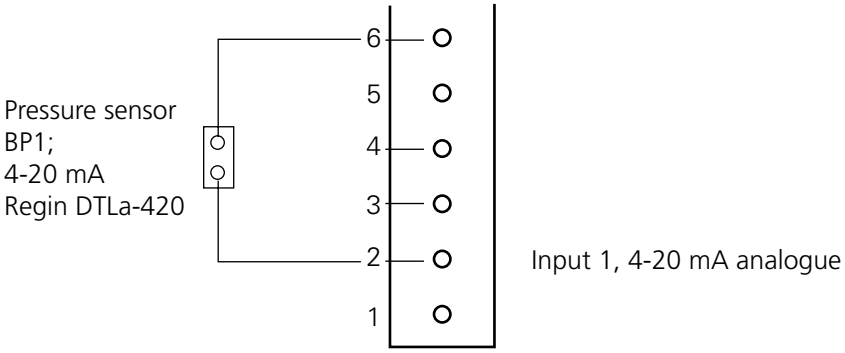
Alarm output
Active alarm:
Closure at 19-20.
Normal position
No alarm:
Closure at 18-19.



** As an option, the frequency inverter can be supplied mounted inside the fan casing (size 060 and 090 units) or separate for indoor installation. NB! A shielded cable should be used between T1 and G1 if the unit is installed indoors. The electrical connections should not be wired if the temperature is below -10° C to avoid damaging the terminals of the frequency inverter.*

Q4 Continued, Option

Control via external pressure sensor



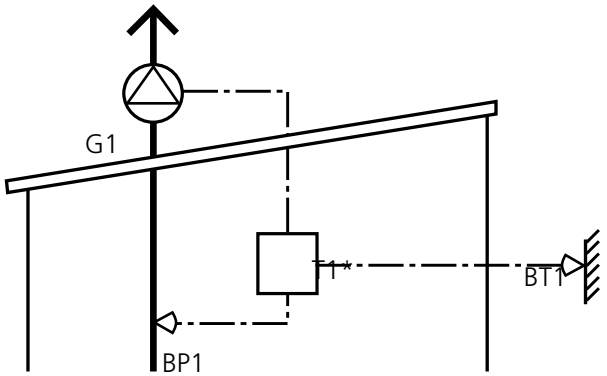
The analogue input 1 can be re-programmed with parameter 180 to 0-10 V or 0-20 mA if a different pressure sensor is used.

5.4 Control Equipment Q5

Control system with frequency inverter*, programmed for outdoor temperature compensated pressure control

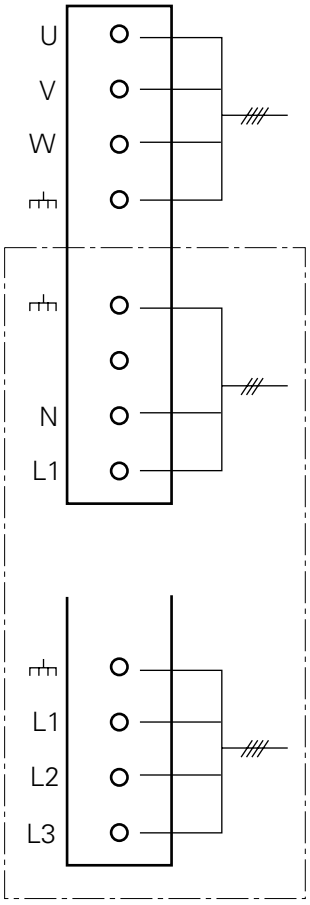
Function

G1 = Extract air fan
T1 = Frequency inverter
BP1 = Pressure sensor
BT1 = Outdoor temperature sensor
The speed for extract air fan G1 is regulated by means of 4-10 mA signals from active pressure sensor BP1, connected to terminals 6 and 2.
The pressure set point is compensated for outdoor temperatures between -25°C and + 25°
Outdoor temperature sensor BT1 is connected to terminals 6, 4 and 3.
Start via closure between 7-8 and 7-9.
Alarms can be reset by isolating the power supply to the fan or by opening the circuit at 7-8.
Provision is available for the transmission of alarms.



Electrical connections

Power supply (terminal block X1)

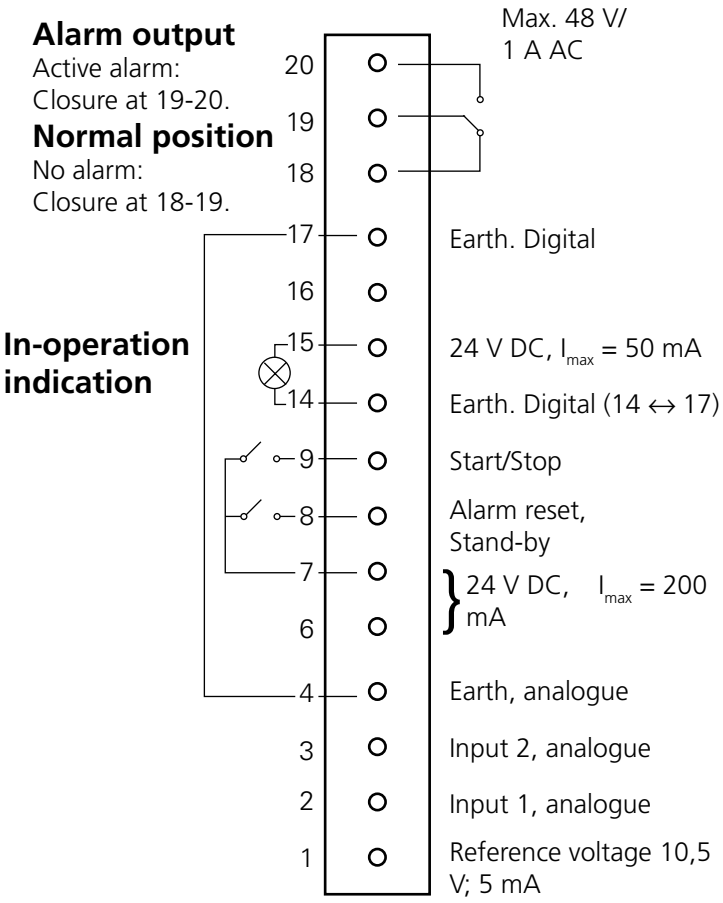


Power supply to fan motor

Option 1: 1-phase
Incoming
power supply: 1 x 230 V
(0.25-1.5 kW motors)

Option 2: 3-phase
Incoming
power supply: 3 x 400 V
(2.2-7.5 kW motors)

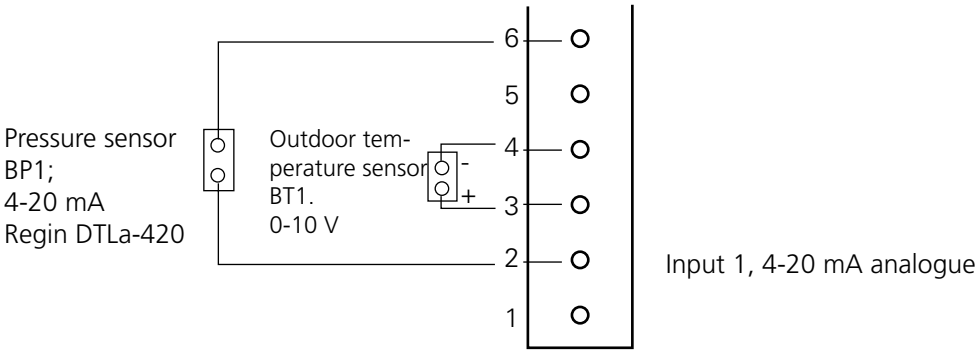
Control functions (terminal block X2)



** As an option, the frequency inverter can be supplied mounted inside the fan casing (size 060 and 090 units) or separate for indoor installation. NB! A shielded cable should be used between T1 and G1 if the unit is installed indoors. The electrical connections should not be wired if the temperature is below -10° C to avoid damaging the terminals of the frequency inverter.*

Q5 Continued, Option

Control via external pressure sensor.
Outdoor temperature compensation of pressure set point.

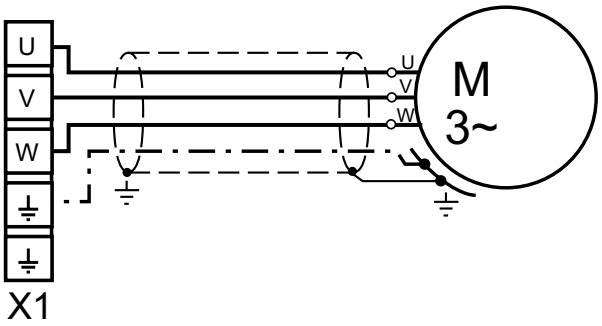


The analogue input 1 can be re-programmed with parameter 180 to 0-10 V or 0-20 mA if a different pressure sensor is used.

5.5 Motor Connections

The CDA3000 frequency inverters are short-circuit-proof between phases and between phase and earth while they operate. In the event of a short circuit or earth fault in the motor or motor cable, the final stage will be disabled and the operator will receive a failure message.

1. Connect the U. V. W. motor phases in shielded cable and connect the motor to earth at X1/⏚ The shield prevents disturbing radiation; shield earthed at both ends.
2. Locate the PTC temperature sensor (if fitted) with a separate shielded cable. The shield prevents disturbing radiation; shield earthed at both ends.



Max possible conductor cross-sectional area and recommended mains fuse

Control equipment	Component output, kVA	Terminal's max conductor cross-sectional area mm2	Rec. mains fuse, A
TBCW-12X-03X-	1,0	2,5	1x10
TBCW-12X-07X-	1,7		
TBCW-12X-11X-	2,3		1x16
TBCW-12X-15X-	3,0		
TBCW-12X-22X-	4,2		3x10
TBCW-12X-30X-	5,7		
TBCW-12X-75X-	12,4	4,0	3x25

The electrical connections should not be wired if the temperature is below -10° C to avoid damaging the terminals of the frequency inverter.

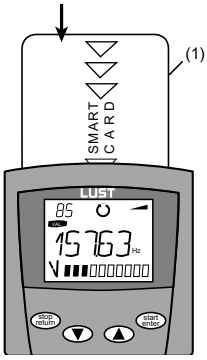
6. Commissioning

On delivery, the Q2-Q5 control equipment packages are pre-programmed for the type of control specified on the purchase order. The set points – and in some cases the P band and I time – must however be adjusted afterwards. This can be done from the KPA-1-200 control panel. To make commissioning easier, these are quick-selection settings in Menu Group _11UA.

6. 1 Settings using the KP-1-200 Control Panel

The KeyPad can be directly connected to the inverter module (X4) .

KP200 KeyPad Overview



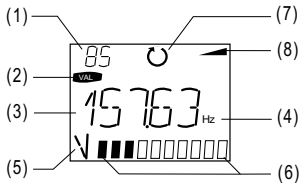
(1) ❍ SmartCard for saving and transmitting settings to other control systems

start enter
- ❍ For calling menu area or parameters
- ❍ Save changes
- ❍ Start, on controlling the motor

stop return
- ❍ Leave menu area
- ❍ Cancel changes
- ❍ Stop, on controlling the motor

▲
- ❍ Select menu, menu area or parameter
- ❍ Increase setting

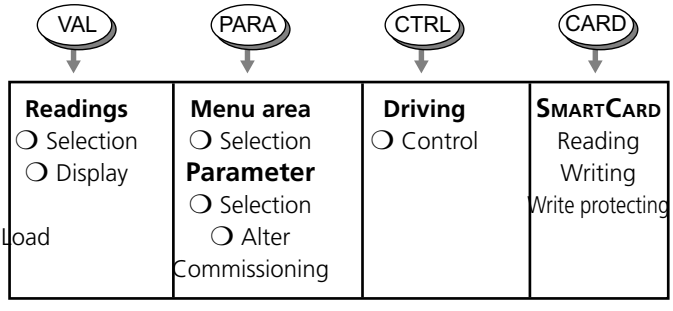
▼
- ❍ Select menu, menu area or parameter
- ❍ Decrease setting



(1) 3-digit display, e.g. parameter number.
(2) Current menu
(3) 5-digit display, parameter designation and value
(4) Physical unit for item (3)
(5) Topic of the bar graph
(6) Bar graph, 10 places.
(7) Direction of rotation indicator
(8) Acceleration and brake ramp

6.2 Menu structure

The KP200 KeyPad has a menu structure for overall operation. It is identical with the menu structure of the KP100 for the VF1000 inverter SmartDrive and the MasterControl servo-amplifier.



6.3 Parameters

Control Equipment Q2

Parameter 270 specifies the duty point of the fan in Hz. (20 Hz).
If the value is outside the min and max permissible fan speed, the value closest to it is used. If the max frequency for the fan is 96 Hz and required value is set to 100 Hz, for instance, the fan will run at 96 Hz. The following parameters can also be read:

600 Speed 1
601 Speed 2
590 Ramp time up
592 Ramp time down

Control Equipment Q3

590 Ramp time up
592 Ramp time down

The 0-10 V input signal here corresponds to the whole operating range of the fan.

Control Equipment Q4

270 Set point for pressure control. Set the appropriate pressure in Pa.
590 Ramp time up
592 Ramp time down
822 Amplification (p-band)
823 I-time

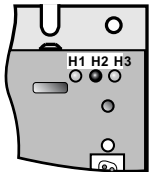
Control Equipment Q5

186 Set point for pressure control, max pressure, warm outdoors.
Set the appropriate pressure in Pa.
187 Set point for pressure control, mini pressure, cold outdoors.
Set the appropriate pressure in Pa.
590 Ramp time up
592 Ramp time down
822 Amplification (p-band)
823 I-time

After you've altered the values or parameters, you'll have to save them. Return to the main menu "MENU" and press both arrow buttons at the same time for a few seconds until "SAVE" is shown. Then you can release the buttons. All the altered values will then be saved in the frequency inverter's long-term memory. If they are not saved in this way, the values will revert to earlier preset values in the event of a power failure. After you've saved the changes, you should either switch off the fan for 30 seconds, or the jumper between 7 and 8 should be opened to make the changes effective.

6.4 Diagnosis and Fault Messages

6.4.1 Light Emitting Diodes



At the upper right-hand side of the frequency inverter, there are 3 LEDs coloured RED
(H1), YELLOW (H2) and GREEN (H3) for displaying the status.

Operating Conditions	**RED LED (H1)**	**YELLOW LED (H2)**	**GREEN LED (H3)**
Mains connected	-	-	●
Operational	❍	●	-
In operation/auto tuning active	❍	✳	-
Warning	●	●/✳	-
Fault	✳(Blink	❍	-
❍ LED off, ● LED on, ✳ LED flashing			

6.4.2 Reaction to Faults

In the event of a malfunction, the inverter will react by initiating a predetermined functional sequence. In the "Fault signal" table
The various functional sequences are assigned a reaction number as tabulated in the "Fault Signal" Table below.

Reaction No.	**Function**
1	Fault signal, the final stage is disabled
3	Fault signal, the final stage is disabled, inhibited against automatic restart.
5	Fault signal, the final stage is disabled, software reset after remedying fault

6.4.3 Fault signals

If a fault arises while the component is operating, the following will be displayed on the screen while the red LED, H1, will flash on the inverter. The code indicates the type of fault. If the KP200 is connected, type of fault with an explanation will be shown.

Flashing code for red LED, H1	KeyPad Display	Reaction No.	Explanation	Cause/Remedial Measure
1x	E-CPU	5	Fault in CPU (Processor)	Switch off the power supply, then switch it back on again. Contact Swegon if the fault recurs.
2x	E-OFF	1	Under-current, switches out	Check the mains power. Also occurs briefly on normally opening the circuit.
3x	E-OC	3	Over-current, switches out	Short circuiting, earth fault. Check power cables, motor windings, zero conductor and earth. Faulty Component Setting: Check the parameters of the control circuits, and the ramp settings.
4x	E-OV	3	Over voltage, switches out	Over voltage in the mains: Check the mains voltage and restart. Over voltage due to feedback from the motor (generator operation): Prolong brake ramps – connect braking resistance when this is not possible.
5x	E-OLM	3	Motor protection switches out	verloaded motor (or I x t-monitoring): Prolong the process cycle if possible, Check for correct motor sizing.
6x	E-OLI	3	Component protection	Overloaded inverter: Check for correct sizing, switches out, a larger inverter may have to be used.
7x	E-OTM	3	Motor temperature too high	Motor PTC correctly connected?: Is the MOPTC Parameter (Set for motor PTC evaluation) correctly set? Motor overloaded? Let the motor cool off, check for correct sizing.
8x	E-OTI	3	Over temperature, inverter	The ambient temperature is too high: Improve the cooling in the cubicle. Too high load during operation/braking: Check for correct sizing, new braking resistance can be connected, if necessary.

6.4.4 KeyPad--Service Faults

Fault	Cause	Remedial Action
ATT1	The parameter cannot be changed at this users level or is not accessible.	Select user level 1-MODE higher.
ATT2	The motor must not be controlled via CTRL-Menu.	Remove the start signal from another control station.
ATT3	The motor must not be controlled via CTRL-Menu due to a fault condition.	Remedy the fault and reset.
ATT4	New parameter value is not permitted	Change the value.
ATT5	New parameter value is too large	Decrease the value.
ATT6	New parameter value is too small	Increase the value.
ATT7	KCard in its present state does not permit readings.	Reset the start signal.
ERROR	Invalid pass code	Enter the correct pass code.

6.4.5 Faulty Mains Connection

Fault	Cause	Remedial Action
Connection to mains established. The inverter module shows no reaction (LEDs don't light up), to mains power.	If the component is switched on/off too often, the control system will protect itself by switching out if the resistance is high.	Allow the inverter to rest for a few minutes. After that it will be operational again.

For further information about the KP-1-200 control panel see www.Swegon.se