FORTIS
WIND ENERGY
GREAT IN SMALL TURBINES

Fortis Wind Energy

Brake Switch

Instruction Manual

Type: 5000/12
Valid for serial numbers: 0361207xxx

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1. Introduction

Thank you for choosing FORTIS energy systems. Your choice means tried and tested reliability, no maintenance costs and the convenience of a quiet, independent power supply. FORTIS wind turbines are in operation all over the world and can withstand almost every environment imaginable. Even Arctic expeditions have benefited from the reliable power the FORTIS wind turbine produces. FORTIS tests their systems under the worst possible weather conditions. FORTIS turbines should only be installed by trained and approved installers. A FORTIS-system is almost always composed of various components: the wind turbine itself is only one component of this system. We can supply controllers for battery charging and for grid connection. For hybrid systems, controllers are available to couple a photovoltaic solar generator or to a diesel or petrol generator together to a FORTIS Wind turbine. In other words, the possibilities with an FORTIS wind turbine are endless in the sense that they can be adapted to suit almost every conceivable application.

1.1 Health and Safety Information

Please refer installation and servicing to qualified service personnel only. High currents and forces are produced by this wind turbine system and incorrect installation or use may result in

- risk of electric shock or fire
- mechanical damage
- injury or death

Health and Safety means having a positive and caring attitude and this should be foremost in your mind in everything you do. The prevention of accidents, injury and damage is a top priority.

Health and Safety work is not a matter to be left to someone else to deal with. Everyone has a duty to other colleagues, the public and customers.

Important security notice

This Instruction Manual contains important operational guidelines and security considerations that require your attention. Before installation, it is essential that the user first studies this user's manual in detail and keeps in mind the safety matters that need attention. During user installation and operation one must refer to this handbook's documentation. If you are unfamiliar with installation as shown below, DO NOT CONTINUE and let a qualified Technical Engineer proceed with correct installation. Failure to comply with the guidelines and instructions will void your warranty.

Electric risk symbol

This electric risk symbol is a sign of High Voltage.

2. Safety precautions

Please read this manual prior starting with the installation or commissioning.
This brake switch can only be used for the FORTIS-Montana wind turbine with the 400V generator and 5 kW rated power.

The system for safe operation comprises of:

1. the Fortis Montana wind turbine,
2. this brake switch,
3. the load or grid tie converter with its ballast resistor properly connected.

Under no circumstances operate the wind turbine without this brake switch properly connected.
Wrongly dimensioned cables, improper connections, etc. bear a high risk of sparks and fire, injuries, or damage of the wind turbine!
Please read this manual and the installation and operation manual of the wind turbine before starting the installation.
The rated current is 20A, the rated DC voltage is 400V, please use appropriate cables.

3. Overview of functions

The brake switch has three main functions:

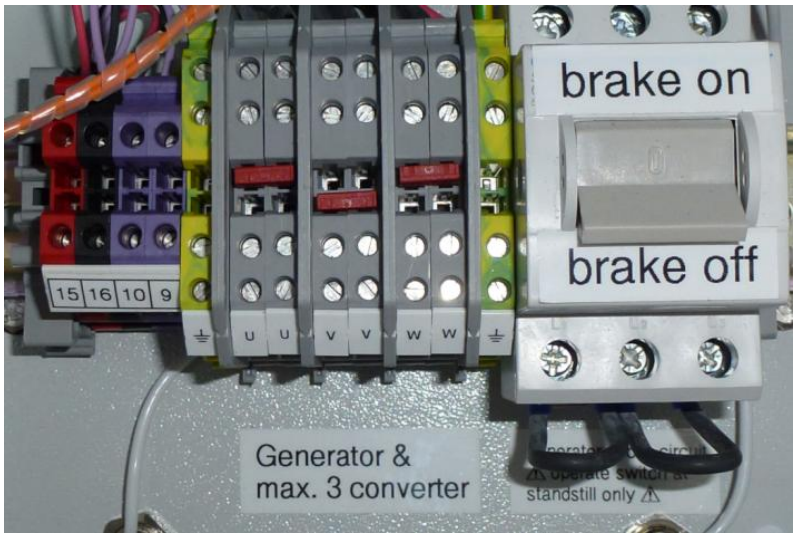
1] Main STOP button for the wind turbine initiating 2step shutdown with braking resistance and short circuit

2] Overvoltage protection for the load or grid tie converter

3] Service switch inside housing (direct short-circuit of generator windings for service)

4. Installation

The brake switch is designed for indoor and outdoor wall mounting only. Screws and dowels are supplied with the unit.
Please use all 4 screws. For sufficient cooling the outside air temperature has to stay below 40°C and the controller is not exposed to direct sunlight. The casing is for indoor and outdoor installation (IP 44). The cable connections must be on the bottom side! Keep a minimum distance of 0.8 m above the unit and 0.3 m to each side. Do not install the unit on a wooden or easy inflammable surface. At the bottom there are 5 cable connections and a protective vent.

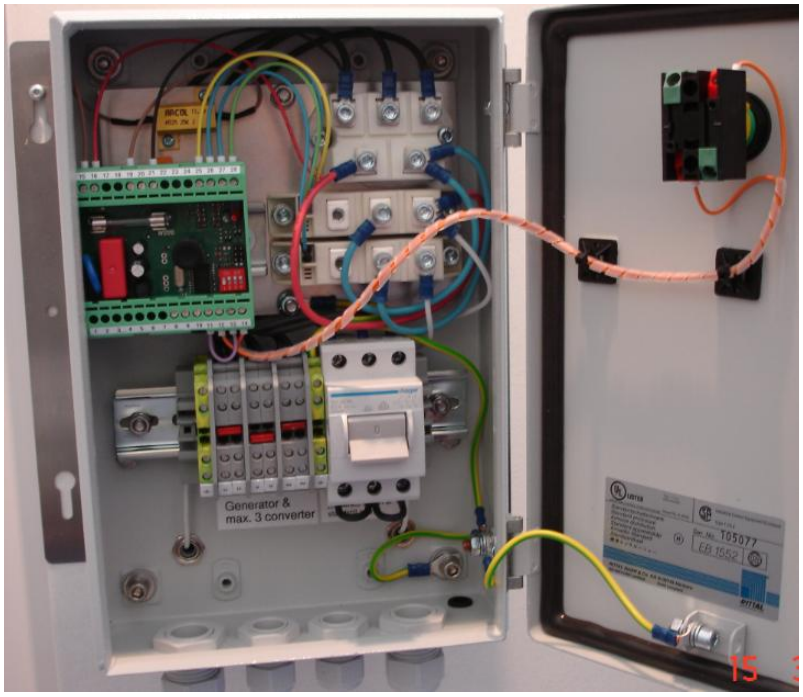


- Cable from the wind turbine generator
- 3 cables for up to 3 loads or grid tie converters / additional grounding
- Install a bridge from terminal 10 to 9 if no external stop signal via normally closed contact will be Installed
- One cable connection may be used for additional grounding

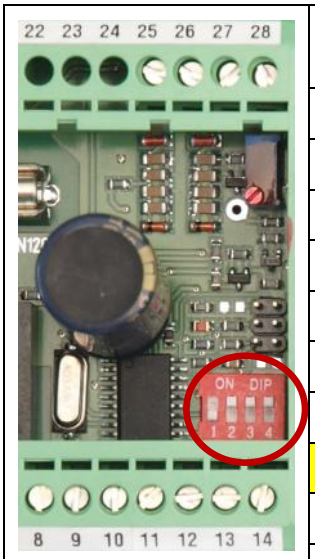
The rubber in the cable connections can be separated into 2 pieces to fit for larger cables.
The minimum cable cross section is 2.5 mm².

- Connect the metal casing to ground, 1 free “PE” terminal is available.
- Connect the 3 phases and ground of the generator to the terminals “u”, “v”, “w”, “PE”
- Connect the 3 phases and PE of the loads or grid-tie converters to the additional terminals “u”, “v”, “w”, “PE”

5. Voltage settings



The DIP-switch on the PCB allows programming of shut-down and switch-over voltage.

	1 | 2 | 3 | 4 DIP		Rectified voltage
	0 | 0 | 0 | x	370 V	Shut-down voltage
	1 | 0 | 0 | x	390 V	
	0 | 1 | 0 | x	410 V	
	1 | 1 | 0 | x	430 V	
	0 | 0 | 1 | x	450 V	
	1 | 0 | 1 | x	470 V	
	0 | 1 | 1 | x	490 V	
	1 | 1 | 1 | x	**510 V**	
	x | x | x | 0	90 V	Switch-over voltage
	x | x | x | 1	**180 V**	

510 V = Factory pre-set

6. Wiring Diagram

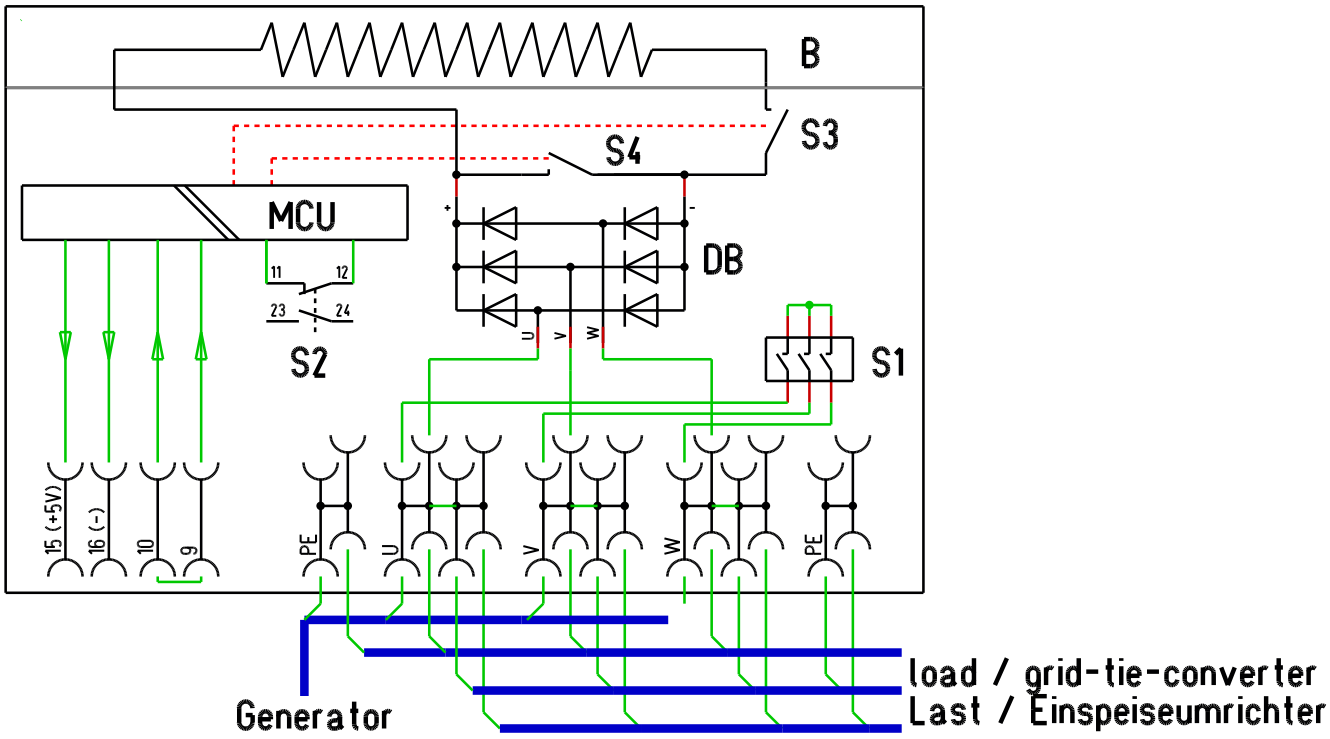


Figure: 1

Figure 1: Internal schematic and external connections. S1 is internal service and maintenance switch, S2 is red/yellow stop switch for the wind turbine. The Microcontroller MCU handles the braking procedure if triggered by over voltage or the red button with the 2 internal semiconductor switches S3 and S4. If no external normally closed contact switch is connected, a bride from terminal 10 to 9 has to be installed. Terminals 9, 10, 15, 16 are galvanically isolated.

7. Operation and maintenance

The brake switch operates fully automatically and stops the wind turbine if the rectified generator voltage is above the preset shut-down voltage. As long as the stop switch is activated, the rotor will be kept at low rotor speed.

After stop triggered by over voltage, the rotor is released automatically when it has come to a complete **stand still for 30 seconds**. If the rotor restarts within this time, the wind turbine will be kept at low rotor speed.
To stop the wind turbine manually, please operate the STOP switch. Controlled by a microcontroller, the wind turbine is stopped most efficiently first with the brake resistor, in a second step with direct short circuit.

To prevent overheating of the brake resistor, short-circuit is activated after 20 s power on the brake resistor.

For service and maintenance there is a switch inside the housing. To stop the wind turbine, operate the STOP switch and wait until the rotor has come to a complete stand still or very low rotor speed. Finally, open the door of the housing and turn on the short-circuit brake. In this position the generator is mechanically short circuited and there should be no voltage at the terminals. Please check the voltage at the terminals before working at the load or grid tie converter.

For connection of an external emergency stop switch or a stop-signal, the bridge between terminals 10 and 9 can be replaced by a switch or a relay contact. Braking is initiated when the connection is open and one second after the rectified generator voltage has reached more the 70 V. The input is isolated and can be connected with an external controller. Maximum cable length 100 m.

Do not use the service switch for stopping the rotor when turning at high speed.

Do not switch from “ON” to “OFF” while the rotor is turning. High inductive voltage peaks can destroy the switch and the Brake Switch.

8. Specification

Rated generator power	5000W
Rated generator voltage, rectified	300 … 400VDC
Rated current, rectified	20ADC
Maximum short term current (up to 20 s)	35ADC
Voltage range for automatic shutdown procedure	370; 390; 410; 430; 450; 470; 510*) VDC
Voltage range for switching from braking resistor to direct short circuit	90; 180*) VDC
Generator current at change over voltage	7.5; 15 ADC
2nd braking stage voltage (direct short circuit if automatic shutdown procedure should fail)	530 VDC
Internal protection	IP44
Dimensions (width x height x depth)	280 x 335 x 227 mm³
Weight	8.0 kg
Dimensions of packing (width x height x depth)	330 x 410 x 310 mm³
Total weight, incl. packing	9.8 kg

*) factory preset