

INSTALLATION MANUAL
FOR
DC5000 DOOR CONTROLLER

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WARNING

**This equipment must be installed by a qualified and registered electrician
Incorrect installation could lead to severe electrical shock and death.**

INTRODUCTION

- The **DC5000** is a dedicated microcontroller that is designed to operate roller doors, gates, and similar motorised equipment. An **AUTO/MANUAL** keyswitch on the front enables the controller to be run in either a fully Automatic mode, when pushing the **OPEN (▲)** button initiates a complete automatic cycle of opening and closing the door with all limit switches and safety devices (beamsets etc) processed by the controller, or a Manual mode, when the **OPEN (▲)** and **CLOSE (▼)** buttons need to be held in to move the door (Inching control). All run times and delays are software-derived and are programmable by the installer. The controller has been designed for flexibility, allowing it to be used in a stand-alone mode, or in conjunction with any security system. All facets of its operation are easy to set up at the time of installation to suit virtually any situation.
1. If the motor is on a gate, it may not use any limit switches - it may be designed to stall at the fully-open or closed positions, or have a slipping clutch arrangement with the motor running in each direction for a defined amount of time. The **DC5000** controller is also ideal for this type of installation.
 2. Normally a door motor will run until a limit switch is reached. If the door becomes physically jammed the limit switch may never be reached, and the motor will keep running until the thermal overload trips out. The **DC5000** uses motor-run timers in addition to the limit switches and thermal overload. These should be programmed to a run time about ten percent more than the usual operating time of the door. If this time expires before the door reaches its limit switches, the motor will stop. This reduces the requirement for the thermal overload to be the main protective device if the door becomes stuck because the timer should expire well before the overload trips out.

FEATURES

Simple to wire up and programme. For most roller door installations the factory-default setup programme will be perfect.

A special "Watchdog circuit" will reset Controller in the unlikely event of a problem such as a power surge or hardware lock-up.

Unregulated 12vdc (nominal) power is available for safety beamsets and locks. The **LOCK** output is switched by the controller to unlock the door or gate when required. Both fail-secure and fail-safe locks are catered for. If a different voltage lock is required, the **LOCK** output may be used to drive a 12vdc relay. It is also possible to use the **LOCK** output to drive a courtesy light.

All programming information is held in non-volatile memory and will not be lost even on complete power failure. The unit can be programmed in the workshop before installing at the site if desired.

Dipswitches are provided on the circuit board for on-site programming of Run Times, Delays etc. without any additional equipment being required. This makes life easier for service staff who do not need to carry any special programming tools.

Solid-state relays provide electrically interlocked single-phase 230v outputs to drive the **OPEN** and **CLOSE** contactors. The contactors are also mechanically interlocked. Each output has a light emitting diode (LED) to indicate its status.

7 inputs are provided for safety beamsets, pushbuttons, limit switches, radio transmitters, cardreaders, keypads etc. All inputs have noise filtering and are software debounced for maximum reliability. Each input has a light emitting diode (LED) to indicate its status.

SPECIFICATIONS

Power Input

400Vac Mains. A transformer is connected to the RED and YELLOW Phases. Secondary windings are 230VAC and 12VAC. Do **NOT** short-circuit the secondary windings, as this will destroy the transformer. Check that the wires cannot touch anything before connecting to the mains.

Transformer Secondary Fuse: 2 Amp 1¼" x ¼" glass type (in inline fuse holder) - 230vac supply from Red and Yellow Phases for Controls.

Printed Circuit Board Fuse: 2 Amp 20x5mm glass type (F1 - 12VDC Supply)

Power Output

+12V, -VE: Auxiliary 12vdc (nominal) power used to supply safety beamsets, keypads etc. 2 Amp maximum power output. Actually closer to 16vdc, unregulated.

LOCK+, LOCK-: Output for 12vdc lock or relay to control any other locking device. Switched on and off by the controller

+12V: Common for all the input terminals.

Signal Inputs

Seven independent inputs as labeled. These each have an LED to indicate input status. Safety Beam and Limit Switch inputs may be activated by normally-open or normally-closed switches as determined by programming. All inputs require 12vdc to operate them, from the **+12V** common terminals, with a wiring resistance of less than 100 Ohms. Any high-resistance wiring to the switches may cause the input signal to be ignored, because the noise-rejection circuitry on each input pin requires sufficient current to flow before it is considered to be a valid signal.

Outputs

Two electrically-interlocked Solid State Relays supply the 230v signals to drive the **OPEN** and **CLOSE** contactors, which are also mechanically interlocked. LEDs show the status of the output signals for ease of fault finding.

Watchdog Timer

This is a hardware timer on the circuit board which is designed to reset the microprocessor every one second or so unless the software sends out an instruction to prevent this from occurring. These software commands are written into the main loop of the door program to ensure the controller will reset itself if there is any form of software or hardware lock-up. The installer need not worry about this - it is just a special feature of the electronic design.

Operating Temperature Range

0 degrees C to +50 degrees C (32 to 122 degrees F) inside the enclosure. 95% Relative Humidity maximum but not condensing.

INSTALLATION

Select a suitable location to mount the controller. The location should be dry, the ambient temperature must be between 0 and 50 degrees C, it should be near to the door to be controlled, and close to a switched 3-phase source with Earth. It is important to ensure that the switches on the front of the box are accessible.

Attach the cabinet to the wall using the Mounting Template provided. Pull all cables into the cabinet and prepare them for connection.

Do not run extra-low voltage wiring (for the limit switches, beamsets, locks etc) in the same conduits or through the same bushes or glands as the higher voltage wiring for the motor and incoming power.

Terminate the extra-low voltage control cables to the labeled 12-way connector on the gear-plate. Terminate the motor cables to the 4-way connector on the gear-plate. Terminate the incoming three-phase power cables to the bottom of the 3-Pole Isolator mounted on the gear-plate, and the incoming Earth wire to the 4-way connector on the gear-plate.

CABLING REQUIREMENTS

Inputs - Each of the inputs (or as many as are used) requires two wires to make a switch closure to the **+12V** terminal. These wires should be at least 0.2 mm² multi-stranded for cable runs of up to 100 meters. Under extremely adverse conditions or for very long runs, screened cable may be used. If using screened cable, ensure the screen is earthed only at the controller end. Connect the input cables to the input connector, according to the wiring diagram supplied. Note that the inputs are labeled on the circuit board and gear-plate.

AC Power – This must be run in accordance with Electrical Wiring Regulations. Proper 230V or 400V rated TPS cable or flex must be used. The metal enclosure must be earthed – an earth terminal is provided for this purpose. Connect the incoming three phases to the bottom of the 3-Pole Isolator. Do not switch on the power until all the cables are properly terminated and have been checked.

Motor Wiring – Connect the 3-phase power and Earth cable to the motor from the 4 way connector on the gear-plate. **Do not wire the Motor until the Power-up and Testing of the DC5000 is complete.**

POWER-UP AND TESTING

Before wiring the Motor, and ensuring the unit is free of swarf etc. Switch the 3 Pole Isolator **ON**. Check that the red **+12V** LED at the top of the input connector is illuminated. This indicates that the circuit-board has power. Check that the Program link CN5 is in the **RUN** position, and that the LED on the left of the circuit board is flashing at a fast rate.

Operate each limit switch by using the hand chain to move the door to its upper and lower positions and check that the corresponding input LEDs change state when each limit switch is operated. If the LED is **ON** until the door reaches the limit switch, it is defined as a **normally-closed** limit. This is the factory default type, because any breakage in the cabling will make the controller think it has reached its limit, and the door will stop.

Make sure that the keyswitch is in the **MANUAL** position and then push and hold the **OPEN (▲)** push button on the box, and check that the left-hand contactor operates. Release the **OPEN (▲)** button and check that the contactor releases. Move the keyswitch to the **AUTO** position, then push and release the **OPEN (▲)** pushbutton. Check that the left-hand contactor operates, but this time wait for the opening time to expire and check that the contactor automatically releases at the end of this time.

The beam set (**SAFETY**) LED on the circuit board should come on and go off when the beam is obstructed and cleared. Check this to ensure that the beamset is correctly aligned. If the LED is **ON** when the beam is clear, and goes **OFF** when the beam is obstructed, this is defined as a **normally-closed** safety circuit. This is the factory default type because it is safer. Faulty beamset wiring will fool the controller into thinking that it is obstructed, so the door will not close.

Set the Trip current on the thermal overload to 1.8A (Fully Anti-Clockwise). This is suitable for a 0.5kW motor. If using a 0.75kW motor, the Trip current may need to be adjusted up to prevent the overload operating when the motor starts (check the motor specifications). Set the toggle switch to the “**A**” position, this makes the thermal overload self-resetting. If the left in the “**H**” position, the thermal overload will latch any trip.

Switch **OFF** the 3-Pole Isolator. Connect 3 phase motor power and Earth cables to the 4-way connector. Carefully remove the fuse (F1 – 12VDC Supply) from the Printed Circuit Board. This will ensure the controller has no power and will not be able to operate the contactors while the motor wiring is being tested. Move the door to the mid-way position by using the hand chain, and then remove the hand chain. Turn the power back on. Manually operate the left-hand contactor briefly by sliding the small lever on the contactor from the “**O**” position to the “**I**” position. This should cause the door to open. If it closes, reverse two of the phases to the motor and try again. Operating the right-hand contactor should cause the door to close. Turn off the power and replace the fuse on the circuit board.

If the controller has already been programmed, the installation is now completed. Turn the power back on and check all facets of operation. It is recommended that you stay near the Controller and main switch for the first few cycles in case a mistake has been made.

PROGRAMMING

All programming is done by setting a value onto the small 4-way dipswitches in the centre of the circuit board. Note that to the right of the switches there are labels for **+1**, **+2**, **+4** and **+8**. These switches should normally all be left in the **OFF** position, which is to the left. The **PROG/RUN** link (**CN5**) near the top of the circuit board should be left in the **RUN** position (right hand side) unless you are actually doing some programming.

It is recommended that you fill out the Programming Sheet and work from it if you are unfamiliar with the programming of the **DC5000**. A copy of this sheet could be left onsite if desired.

To program the controller, first fit a short piece of wire into the +12V terminal on the right hand side of the circuit board that can be momentarily touched to the **OPEN**, **STOP** or **CLOSE** terminals as required. The keyswitch on the front door of the controller cabinet must be in the **AUTO** position.

Alternatively, use the **OPEN (▲)** button for **OPEN**, the **CLOSE (▼)** button for **CLOSE**, and switch the AUTO/MANUAL keyswitch momentarily to the MANUAL for **STOP**.

With the power on, first move the **PROG/RUN** link to the **PROG** position.

The watchdog LED on the left of the circuit board will stop flashing to indicate that the controller is waiting for the address of the parameter to be programmed.

Next, set the address of the parameter you are about to change onto the dipswitches. If you are working on Parameter 1 then turn **ON** the switch labeled **+1**, or if you are working on Parameter 7 then turn **ON** the switches labeled **+4**, **+2** and **+1**. Touch the wire to the **OPEN** terminal to enter the parameter address value. The LED will start flashing fast to indicate that the controller is waiting for the first digit of the value that you want to change that parameter to.

Set the value of the first digit onto the dipswitches. If it is a zero, all switches will be **OFF**, or if it is a six the switches labeled **+4** and **+2** will be **ON** etc. Touch the wire to the **STOP** terminal to enter the first digit value. The LED will now flash slowly to indicate that the controller is waiting for the second digit of the value.

Set the value of the second digit onto the dipswitches, and touch the wire to the **CLOSE** terminal to enter it. You have now programmed a two-digit value into the address you selected. The LED will stop flashing to indicate that another parameter address may be selected if desired, or you can return to **RUN** mode of finished.

You can exit programming at any time before touching the wire to the **CLOSE** terminal by returning the **PROG/RUN** link to the **RUN** position, and the parameter you were working on will not be changed. Once the second digit has been entered and the wire has been touched to the **CLOSE** terminal it is permanently stored in non-volatile memory.

When you have finished programming, you should leave all the dipswitches in the OFF position.

RETURNING TO THE FACTORY DEFAULT PROGRAMME

Fit the **PROG/RUN** link in the **PROG** position. Note that the LED stops flashing.

Turn **ON** all four dipswitches.

Touch the wire to the **OPEN** terminal and note that the LED flashes fast.

Touch the wire to the **STOP** terminal note that the LED flashes slowly.

Touch the wire to the **CLOSE** terminal and note that the LED stops flashing. Factory default values are now loaded.

Turn **OFF** all four dipswitches and return the **PROG/RUN** link to the **RUN** position.

Parameter Address 1. (SETUP INFORMATION)

First digit

Dipswitch **+1** **OFF** if the door is to wait for the **HOLD TIME** after reversing (because the safety device operated while it was closing) and then close after the **HOLD TIME** expires. **ON** if the door is not to close after the **HOLD TIME** expires, but must wait for a **CLOSE** signal after reversing. **Factory default is OFF.**

Dipswitch **+2** **OFF** if the door is to wait for an **OPEN** or **CLOSE** signal when the controller first powers up. **ON** if the door is to automatically go to an open or closed position when the controller first powers up. **Factory default is OFF.**

Dipswitch **+4** **OFF** if the door is to automatically go to the open position when it first powers up. **ON** if the door is to automatically go to the closed position when it first powers up. **Factory default is OFF.**

Dipswitch **+8** **OFF** if the controller is to ignore any **CLOSE** signal unless the safety device is clear. **ON** if the controller is to remember that it received a **CLOSE** signal, and start to do a closing sequence once the safety device becomes clear. **Factory default is OFF.**

Second digit

Dipswitch **+1** **OFF** if the open limit switch is normally-open, **ON** if it is normally-closed. **Factory default is ON.**

Dipswitch **+2** **OFF** if the close limit switch is normally-open, **ON** if it is normally-closed. **Factory default is ON.**

Dipswitch **+4** **OFF** if the safety device is normally-open, **ON** if it is normally-closed. **Factory default is ON.**

Dipswitch **+8** **OFF** if the lock is fail-secure, **ON** if it is failsafe (power to lock). **Factory default is OFF.**

Parameter Address 2. (OPENING RUN TIME)

The maximum time in seconds that the motor may run in the open direction if the limit switch doesn't stop it first. Two digits. **Factory default is 20 seconds.**

Parameter Address 3. (CLOSING RUN TIME)

The maximum time in seconds that the motor may run in the closing direction if the limit switch doesn't stop it first. Two digits. **Factory default is 20 seconds.**

Parameter Address 4. (HOLD OPEN TIME)

The time in seconds the door will wait in the open position before automatically closing. It will close earlier than this if a close signal is received before this number of seconds has expired. It will not close if the safety device is operated. If it is necessary for the door to wait for a **CLOSE** signal rather than timing out, a value of "**F**" (all four dipswitches **ON**) must be programmed for both the first and second digits. **Factory default is 15 seconds.**

Parameter Address 5. (REVERSING RUN TIME)

The maximum time in seconds that the motor may run in the open direction if the safety device operated while it was closing, if the limit switch doesn't stop it first. Two digits. **Factory default is 20 seconds.**

Parameter Address 6. (UNLOCK OPERATING TIME)

The time **in tenths of a second** that the lock will operate for, at the start of an opening sequence. Two digits. **Factory default is 30 (3 seconds)**.

Parameter Address 7. (UNLOCKING DELAY)

The time **in tenths of a second** after the lock starts to operate before the door commences moving in the open direction. This allows the lock to fully operate without any load on it. Two digits. **Factory default is 01 (no significant delay)**.

Parameter Address 8. (REVERSING DELAY)

The time **in tenths of a second** in which the door remains stopped between running in the close direction and running in the open direction. Two digits. **Factory default is 10 (1 second)**.

Parameter Address 9. (BEAMCLEAR TIME)

The time **in tenths of a second** for which the safety device must be unoperated before the controller decides that it is safe to close. This gives protection against closing a roller door into the gap between a slow-moving truck and its trailer, for example. Two digits. **Factory default is 50 (5 seconds)**.

FAULT- FINDING GUIDE

Controller is completely “dead”

- Check mains power (all three phases)
- Check that the mains isolator is switched on
- Check that the overload has not tripped out
- Check the inline fuse on the Transformer secondary is O.K.
- Check the 12VDC fuse on the Printed Circuit Board is O.K.
- Measure the transformer secondary voltage at the XFMR terminals on the circuit board

Door won't open/close

- Check the **PROG/RUN** switch is in the **RUN** position
- Check the safety device (e.g. beamset) for alignment
- Check limit switches are correctly wired and properly adjusted
- Check that the **OPEN (▲)** and **CLOSE (▼)** buttons are working
- Test the batteries in any radio remote used to control the door
- Look for any shorts or loose wiring at the terminals of the circuit board
- Observe the LEDs to confirm all input wiring is correct
- Check that the open and close contactors operate under control of the circuit board
- Check that all limit switch and safety device polarities are correctly programmed

Door travels past its limits

- Check limit switches are correctly wired and properly adjusted
- Look for any shorts or loose wiring at the terminals of the circuit board

Motor runs in wrong direction

- Check that the left-hand contactor opens the door and right-hand closes it
- Reverse any two phases (three-phase motors only)
- Reverse the open and close wires (single-phase motor)

Motor won't run or runs slowly

- Check that the three-phase supply has not lost one phase
- Check that the overload feeds all three phases to the motor when it should be running
- Check the motor and wiring for faults

PROGRAMMING SHEET

Parameter	FIRST DIGIT				SECOND DIGIT			
	+8	+4	+2	+1	+8	+4	+2	+1
1 SETUPS OFF	Ignore CLOSE signal if beam set is obstructed (default)	Automatic OPEN on power up (default)	No automatic OPEN or CLOSE on power up (default)	Timeout and CLOSE after reversing (default)	FAIL SECURE LOCK (default)	Normally-open SAFETY DEVICE	Normally-open CLOSE LIMIT SWITCH	Normally-open OPEN LIMIT SWITCH
1 SETUPS ON	Remember & CLOSE once the beam set comes clear	Automatic CLOSE on power up	Automatic OPEN or CLOSE on power up	Wait for CLOSE signal after reversing	FAIL SAFE LOCK (Power to lock)	Normally-closed SAFETY DEVICE (default)	Normally-closed CLOSE LIMIT SWITCH (default)	Normally-closed OPEN LIMIT SWITCH (default)
ACTUAL:								
2 OPEN RUN TIME (SECS)	Two Digits. Default 20 seconds							
ACTUAL:								
3 CLOSE RUN TIME (SECS)	Two Digits. Default 20 seconds							
ACTUAL:								
4 HOLD OPEN TIME (SECS) (Set all switches on for both digits to wait for CLOSE)	Two Digits. Default 15 seconds							
ACTUAL:								
5 REVERSING RUN TIME (SECS)	Two Digits. Default 20 seconds							
ACTUAL:								
6 UNLOCK OPERATE TIME (10th SECS)	Two Digits. Default 30 (3 seconds)							
ACTUAL:								
7 UNLOCK DELAY (10th SECS)	Two Digits. Default 01 (No significant delay)							
ACTUAL:								
8 REVERSE DELAY (10th SECS)	Two Digits. Default 10 (1 second)							
ACTUAL:								
9 BEAM CLEAR TIME (10th SECS)	Two Digits. Default 50 (5 seconds)							
ACTUAL:								

METALBILT DC5000 LOGIC CONTROLLER - EXTERNAL/SECURITY SYSTEM INTERFACING

This Technical Instruction describes how to connect external equipment to the DC5000 Logic Controller to achieve extended functions not (yet) fully described in the installation manual. It also covers miscellaneous technical issues encountered by field installers, and helpful hints.

1. The standard (Auto mode) operation is for a momentary press of the **OPEN** (^) button to initiate a door opening, with an automatic closure after the *hold open* time (programmable parameter #4, default 15 seconds).
2. A simple security/building management system interface can easily be achieved by wiring a clean contact relay output to bridge the **OPEN** and **+12V** inputs (yellow/orange wires on the top rear of the OPEN button on the door). Provided the DC5000 system is in Auto mode (key), the door will open and stay open for as long as the relay contacts are held closed. When the contacts are released the door will automatically close after the *hold open* time (programmable parameter #4, default 15 seconds).
3. The wiring arrangement of 2 above will also work for a momentary relay closure (e.g. from magnetic swipe or ground loop sensor) - a single door open/close cycle will be initiated as in 1 above.
4. Remote control/Radio (or on/off auto reversing) control can be achieved by using a clean contact relay output to momentarily bridge the **RADIO** and **+12V** inputs on the logic circuit board. Operation (in Auto mode) is cyclical as follows:

Initial pulse	- Initiates a door opening cycle as in 1 above
Subsequent pulses	- Will stop the door opening (if still in upward transit) - door closure will occur automatically after the <i>hold open</i> time. - Will cause an immediate door closure (if door fully open). - Will stop the door closing (if still in downward transit). - Initiate a door opening cycle as in 1 above (if door fully closed)

etc...(in cycle)

To stop the door automatically closing (so operation is the same as a domestic garage door remote control) program the "hold open" time (parameter #4) to all switches on (i.e. door waits in the open position until it receives a close signal from the remote control).

5. A DC5000 circuit board on its own (ordering code PA0984) can be incorporated into non-standard equipment installations to provide the necessary logic control (e.g., for a single phase motor with variable speed controller). The circuit board requires a 12V ac power supply, and provides outputs of solid-state (100-240Vac, 100mA minimum, 2A maximum rated) triac-style ac relays for **OPEN** and **CLOSE** "Control" outputs. These solid-state relays are not suitable for driving a motor directly - they are only compatible with ac inputs (75V minimum) on third-party control equipment. If dc inputs are all that is available, two interposing 230Vac-coil relays must be installed between the DC5000 circuit board's outputs and the other control equipment's dc inputs.
6. Please note that the default settings for parameter address 1 are +0 +7, not +0 +0. If you accidentally get this wrong when you alter the programming, it will set all the safety and limit switches to be normally open (instead of the fail-safe default of normally closed) so nothing will appear to work.

7. For secure carpark applications, it is sometimes necessary to rewire the Pushbuttons and keyswitch so that inching manual control is available when the keyswitch is in "Manual", and automatic (remote) control only is available in "Auto". The simplest way to do this is to desolder the existing orange wire connection from pin 6 of the keyswitch and move it to the right hand NC terminal on the "down" switch (where the brown wire from pin 5 of the keyswitch already connects). Then disconnect the orange +12V circuit board feed wire from the top left NO terminal of the "Up" switch and solder it to the recently vacated pin 6 of the keyswitch.

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