DEsc MOTOR CONTROLLER

The *DEsc Motor Controller is designed for any application where automatic speed control is needed, and a slow time response is enough.* Therefore, this DEsc Motor Controller is very suitable as part of the pipe cutting systems in the oil industry. *Using it, the cut will be uniform and cleaner, the pipe easier to be prepared for the next step – this will save a lot of time, and therefore money*.

DEsc Motor Controller Features (firmware versions 6):

1) Dual and very wide input voltage ranges: 35VAC-220VAC or 35VDC-310VDC. The accessible fuse can be 1A-3A, depending on the internal heat sink and the application
2) Output current max 3A (depending on internal heat sink size)
3) PWM output
4) Three digits display for speed indicator (potentiometer position), for automatic speed control, and for more information
5) Overload protection, "**oL**" displayed and the red LED flashing (Stop Button)
6) Short circuit protection, "**Sc**" or "**Sc.**" displayed and the red LED flashing (Stop Button)
7) Overheating protection, "**hot**" displayed and the red LED flashing (Stop Button)
8) Burned fuse indicator, "**FUS**" displayed and the red LED flashing (Stop Button)
9) Automatic speed control* to compensate (counterbalance) load variation (such as gravity or mechanical system problems), "**c**" displayed
10) Automatic speed control* to compensate (counterbalance) input voltage variation (such as powered by a power generator that may have voltage fluctuations)), "**c**" displayed
11) Real-time warning indicator for speed deviation, if for some reason the speed has decreased or exceeded certain limits during operating in speed control mode , "**c**" displayed and flashing, and 1, 2 or 3 dots displayed
12) Adjustable level of the warning indicator for speed deviation, (useful especially for checking and/or adjusting the mechanical system), "c" displayed and flashing, and 1, 2 or 3 dots displayed
13) Display the running time (hours, minutes, seconds) for the last run, or for the last group of runs, or for all runs beginning from power ON
14) Display the maximum speed deviation (in percents) for the last run, or for the last group of runs, or for all runs beginning from power ON
15) Fast and very fast forward-reverse-forward switching response, the response time is automatically adjusted according to the mechanical system response (its inertia)
16) Fine adjusting and locking the selected speed to prevent accidental speed modification during speed control mode
17) Flashing LED speed indicators (flashing frequency proportional to the selected speed) for forward and reverse run
18) Four speed curves

Notes: * The automatic speed control works well if the load variation or the input voltage variation does not exceed the limits (+, - 20%).

If the application needs higher power, or if a portable battery powered device is needed, or different housing etc, the controller can be customized accordingly.

Details about the controller

- ### *At power up, the following sequence will appear on the display:*

1. "**8.8.8.**" *and all 3 buttons' LEDs will be ON*...................... (all will be ON for visual test)
2. "**dE.6**"*and all 3 buttons' LEDs will be ON*......................... (dE.6 is the firmware version)
3. "**C2**" *and just the Stop button's LED will remain ON*.......... (can be "C1", "C2", "C3" or "C4" according to the selected speed curve)
4. "**1**"-"**99**" , *and just the Stop button's LED will be ON* ....("1"-"99" is a number between 1 and 99 according to the potentiometer position)

- ### *How to use the Controller*

1. By turning the potentiometer, the display will show numbers from 1 to 99, and they represent the selected speed. These numbers depend on the potentiometer position and the chosen speed curve, so the response is not linear.

2. By pressing the Forward or Reverse button the controller will start running and the corresponding LED will blink slower or faster according to the speed (to the potentiometer position).

3. By pressing the Stop button the controller will stop and the corresponding LED (red) will be ON.

4. *By pressing the Reverse button when the controller runs forward (or vice versa) the controller will change the direction of rotation (clockwise or counter clockwise). The forward-reverse-forward switching time is automatically adjusted according to the inertia of the mechanical system.*

5. *If an overload occurs during operation or an over current occurs, the controller will cut off the output power to avoid damage, and the stop button LED (red) will flash once. If the problem does not persist, the controller will continue to run. If the problem persists, the controller will turn off, "oL" or "Sc" will be displayed, and the stop button's LED (red) will flash continuously until any button is pressed.*

6. *If at the start there is a short circuit between the output lines, the controller will stop immediately, "**Sc.**" will be displayed and the stop button's LED (red) will flash continuously until any button is pressed.*

*7. If for some reason the board temperature will exceed 176 Fahrenheit / 80 Celsius the controller will stop immediately, "**hot**" will be displayed and the stop button's LED (red) will flash continuously until any button is pressed.*

- ### *Speed Control Mode*

By pressing the Forward or the Reverse button, the controller will start and the corresponding LED will flash slower or faster according to the speed.

By pressing the same button again (when the motor is running) the momentary speed will be set (memorized), and the controller will go in Speed Control Mode (like a car running in cruise control). On the display there will be a "**c**" in front of the numbers (**cXX**) which indicates the set speed. *In this mode the potentiometer will be ignored to prevent accidental speed modifications during cutting.*

If the same button is pressed again the controller will exit from Speed Control Mode and the speed can be controlled again by the potentiometer. If another button is pressed the controller will take the new command.

When the controller enters the speed control mode again, if the potentiometer will be in the same position as when previously entered the speed control mode, the controller will maintain the speed at the set value even when the direction is changed.

While cutting the pipe in speed control mode, the controller will keep the speed at the set value or very close to it, whether the tool is running from 12 o'clock to 6 o'clock (when gravity decreases the load) or from 6 o'clock to 12 o'clock (when gravity increases the load).

Also, in speed control mode, the controller will keep the speed at the set value or very close to it, even if the input voltage has some slow variation in an acceptable range (e.g. when an unstable power generator is used).

Useful information especially for the maintenance workshop

- ### *Speed deviation warning indicator*

During speed control mode ("cXX" on display) the "c" may blink and some dots may appear. This is the speed deviation warning indicator. This means that at that moment the speed was not quite close to the set value. *This can happen for various reasons: e.g. when a crawler wheel is hardly turning (happening once, or intermittently), or there is a dent in the rail, then an extra load will be created. If*

*extra load is too great and cannot be compensated, the **"c" will blink and some dots will appear.***

The 3 dots indicate the percent deviation rate [%] as follows:

o *-**last dot (right one) ON**: the speed has a deviation of [6-10]%,*
o *-**middle dot ON**: the speed has a deviation of [11-15]%,*
o *-**first dot (left one) ON**: the speed has a deviation of [16-20]%,*
o *-**all 3 dots are ON** (at the same time): the speed has a deviation higher than 20% from the set value.*

✓ ***Changing the level of the warning indicator to a lower level***

To change the warning indicator to a lower level, the Stop button must be pressed when the controller is connected to power. Before the power up sequence, for a short time "**to2**" will be on the display as confirmation. *The controller will run in this mode (warning indicator at the lower level) until it will be disconnected from power.*

When the level of the warning indicator is set at the lower level, *the 3 dots indicate the percent deviation rate [%] as follows:*

o *-**last dot (right one) ON**: the speed has a deviation of [3-4]%,*
o *-**middle dot ON**: the speed has a deviation of [5-6]%,*
o *-**first dot (left one) ON**: the speed has a deviation of [7-8]%,*
o *-**all 3 dots are ON** (at the same time): the speed has a deviation higher than 8% from the set value.*

✓ ***Why is the speed deviation warning indicator useful?***

The speed deviation warning indicator (controller in speed control mode) shows how well the mechanical system works.

It is also useful when the system is set up, to check that the mechanical parts are correctly adjusted and everything is running well.

✓ ***Visualizing the maximum speed deviation and the running time***

The speed deviation warning indicator (blinking "**c**" and some dots "..." ON) *will be shown on the display in real time*, and the maximum speed deviation will be memorized and can be visualized at the end *by holding the stop button for one second after the controller has stopped.* Then the running time will first appear on the display, as the following sequence: "**H.XX**","**M.XX**" and "**S.XX**", where XX are numbers representing hours, minutes, seconds. Next, *the maximum speed*

*deviation "**d.XX**" will be displayed. The XX are numbers representing the maximum percentage [%] of speed deviation.* All this information is for the last run, or for the last group of runs, or for all runs beginning from the last power ON. This information will *be erased* every time when the Forward or Reverse button is pressed *if that information was visualized before*.

So this information represents the running time and the maximum speed deviation, starting from the previous visualization (or for all runs after the last power ON).

✓ *__Why is it useful to visualize the maximum speed deviation?__*

If a cut is not uniform and clean enough, it means that something did not go well, e.g. the cutting speed was not constant, or the cutting flame had variations in intensity or distance. To find out what the problem was, the maximum speed deviation has to be checked.

If the maximum speed deviation was too high (e.g. higher than 10%), then the mechanical parts need to be verified. If not, the flame cutting system must be tested (for variations in intensity or distance).

• *__Continuous automatic direction change mode__*

When the controller is stopped, if the Stop button is pressed and held and both Forward and Reverse buttons are pressed immediately, the display will show "F.r.F.".

Now you need to press the Forward or Reverse button and after a wanted time press the button for the opposite direction. The controller will go into a routine where the direction will change automatically. The time interval between two successive automatic changes will be equal to the wanted time above.

During this mode the direction can be also manually changed any time.

In this way, the system can be left running for a long time to be tested for reliability.

At the first time when the Stop button is pressed, the controller will exit from this routine.

- ***Speed Deviation Test Mode***

If the Forward and Stop buttons are pressed when the controller is connecting to power, before the start-up sequence, for a short period of time "d. " will appear on the display as confirmation. It means that the controller will go into a routine where it will display the percentage of speed deviation.

In this mode, no compensation is made for the variation of the load or input voltage.

After start (forward and reverse) the display will show the potentiometer position (as usual), and the speed will be accordingly with it. Pressing the same button a second time, after a few seconds the display will show "d. 0" (means the speed deviation percentage at that time is 0). At this stage, the momentary speed is memorized, the potentiometer will be ignored, and from now on the display will show the speed deviation percentage "d.xx", by comparing the actual speed with the memorized speed.

Therefore, using this feature, the entire system can be tested to see how well it works.

To exit from this mode, need to restart the controller.

- ***Changing the speed curve.***

The output power of the controller, which determines the speed of the motor, depends on the position of the potentiometer and the selected speed curve. C2 is the default curve.

If the Stop and Reverse buttons are pressed when the controller is connecting to the power, before the start sequence, the display will sequentially show C1, C2, C3 and C4, which are the 4 curves that determine the speed. By pressing the Forward button, the currently displayed curve is selected and stored in non-volatile memory, so the controller will use the selected curve until it is changed again.

Troubleshooting

A. *If the motor is running but the direction of rotation cannot be changed, the controller needs to be sent for repair.*

B. *If the motor doesn't run or runs abnormally, go through the following steps to figure out if the controller works properly or not:*

1. *-disconnect the controller from power*
2. *-check/replace the fuse (1A.)*
3. *-connect the motor to the controller*
4. *-connect the controller to power and check if **the controller goes through the power up sequence described above** (under "Details about the controller").*
5. *-turn the potentiometer from minimum to maximum and check if **the numbers increase from 1 to 99 on the display**. (The numbers will depend on the position of the potentiometer and the preselected speed curve).*
6. *-adjust the potentiometer to minimum so that **the number "1" is on the display***
7. *-start the controller by pressing the Forward button (or the Reverse button). The corresponding **LED needs to start blinking** (slowly).*
8. *-put the controller in speed control mode by pressing the same button again.*

   a) *Then **"c 1" must appear** on the display.*
   b) *After a few seconds **the letter "c" must start blinking and some dots will be ON.***

9. *-stop the controller by pressing the Stop button, adjust the potentiometer to have **the number "40" (or around that) on the display***
10. *-start the controller by pressing the Forward button (or the Reverse button). **The corresponding LED needs to start blinking** (faster than before).*
11. *-put the controller in speed control mode by pressing the same button again. Then **"c40" must appear** on the display.*

   a) *While "c" is displayed, turn the potentiometer and check if **the displayed number is frozen**. As long as "c" is displayed, the displayed number must not change when turning the potentiometer.*
   b) ***The letter "c" must be continuously ON (solid)** on the display until any button is pressed.*

   12. *-stop the controller by pressing the Stop button. Now **the letter "c" must disappear** and the displayed number need to be according to the potentiometer position.*

If the controller responds correctly to all these steps, this means the controller is working properly (except for faults that occur only sometimes).

The problem may be: the connectors, the cables or the motor.

For more details, please call Digiem Electronic at 1-780-690-7386 or 1-780-428-0884.