

Antenna rotation – Modes

F1EHN – May 2008

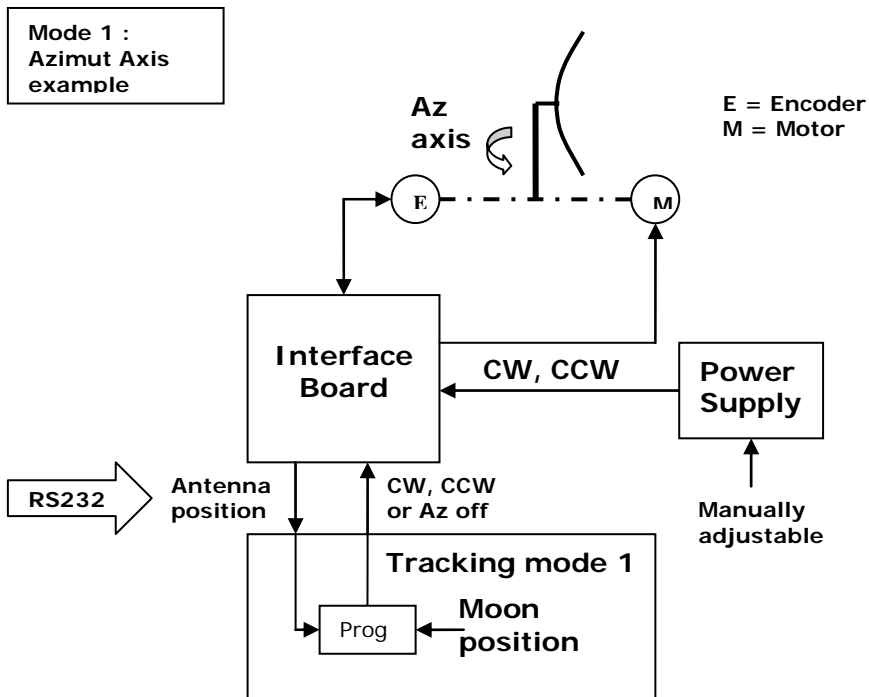
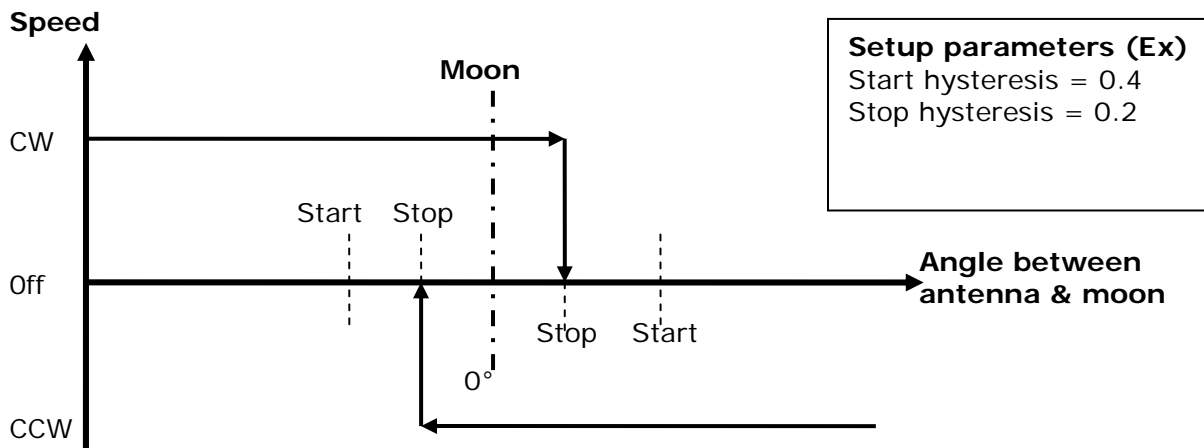
The interface board includes 4 relays to manage the antenna rotation. With the SETUP module, the operator is able to select the running mode of the TRACKING module according to the antenna design.

1 Mode 1 (Normal track)

The azimuth (cw, ccw) and elevation (up, down) relays control the rotation and the direction of the antenna. The speed (drive or motor supply) is fixed or manually adjusted.

The hysteresis allows reducing the time when the antenna is rotating to reach the source position with stopping the rotation after the source position.

The antenna rotates if the angle between antenna and moon (ex) is greater than “start” value. The antenna stops if the angle between antenna and moon (ex) is greater than “stop” value over the source position.

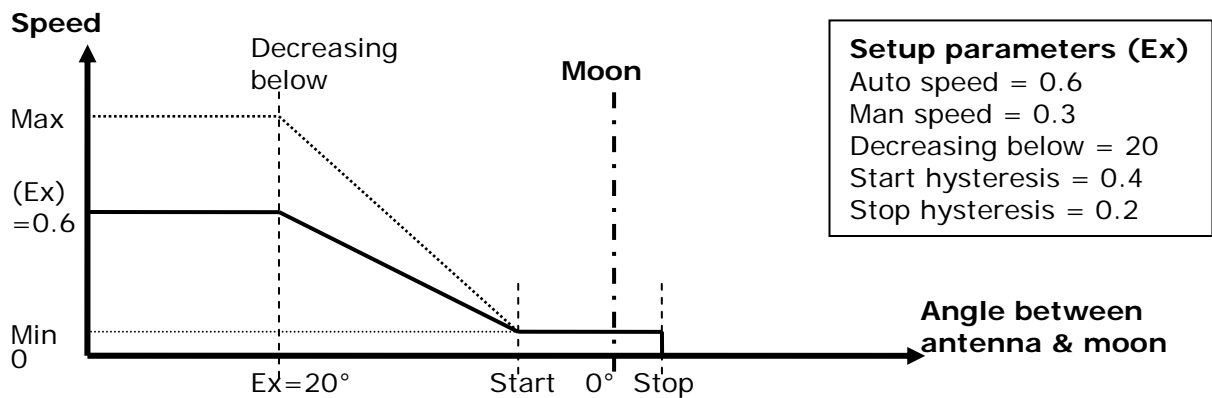


2 Mode 2 (normal track with rotation speed control)

Runs like the mode 1. Moreover the interface supplies an error word on 2 different formats :

- On the Rx Bus outputs, a 7 bits binary error corresponding to the offset between the antenna and the tracked source (ex : moon). The error is coded from 5 (min) to 127 (max).
- On an analog output, a voltage error corresponding to the offset between the antenna and the tracked source. The voltage is automatically set from 0.16 (min) to 4.096 V (max)

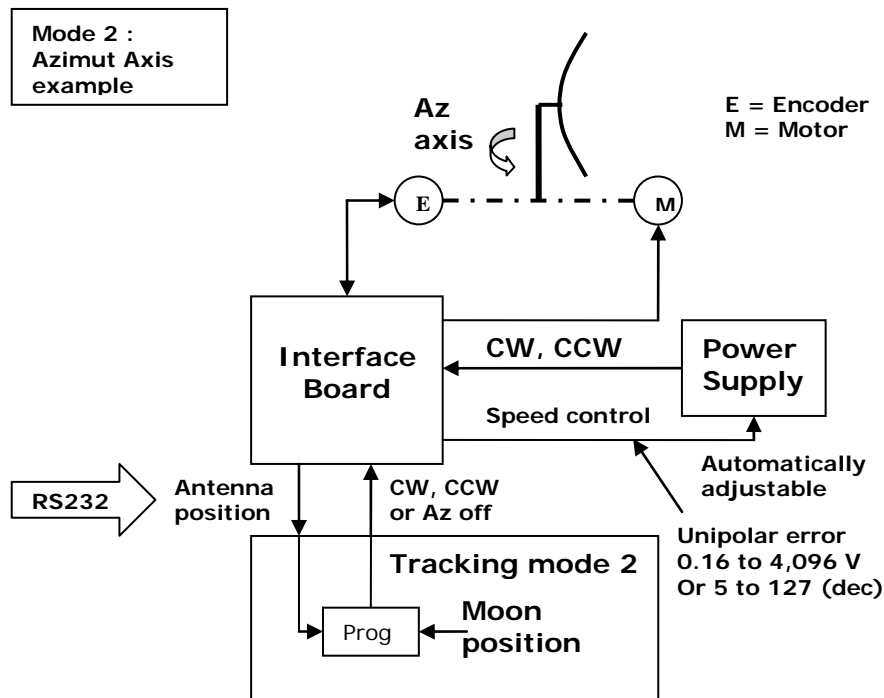
Then the speed (drive or motor supply) can be automatically adjusted.



Max = 127 (4.096V), Min = 5 (0.16V)

In automatic tracking, the speed is automatically adjustable according to the graphic above. In manual positioning (Kbd arrow key), the rotation speed is equal to :

Max speed * Man speed, that is to say : $127 * 0.3$ (Ex) = 38 (decimal) => 1.21 V



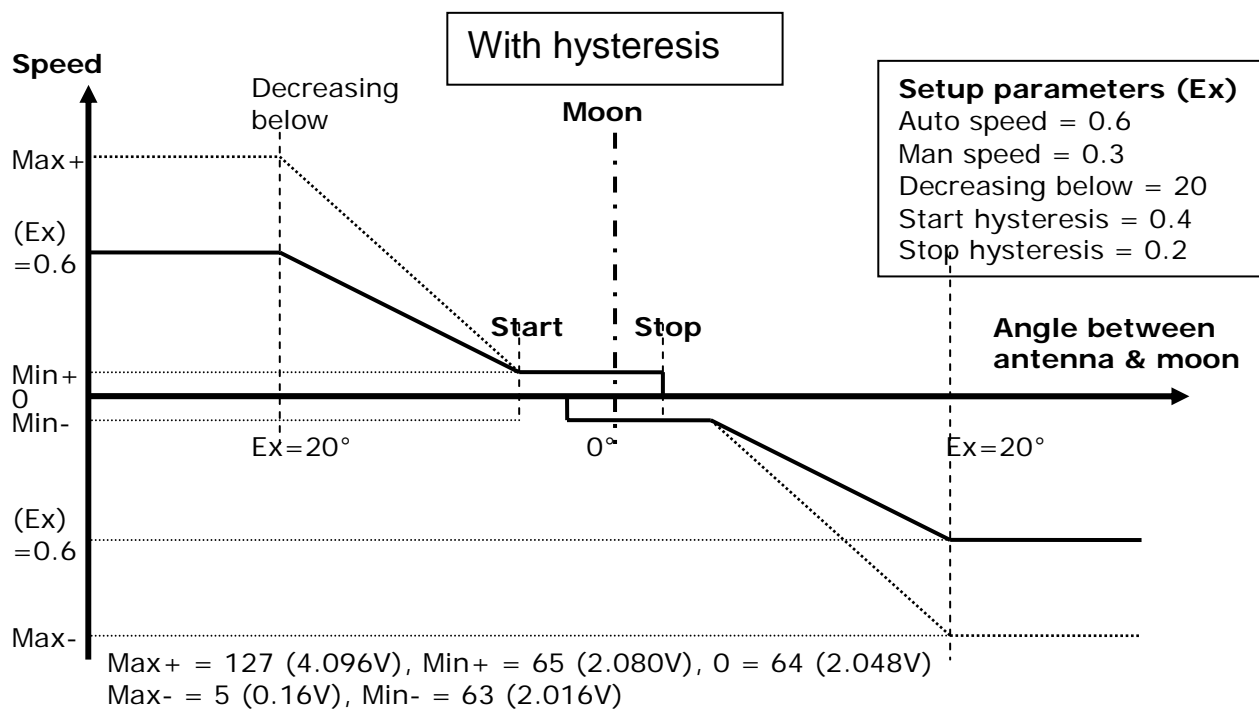
3 Mode 3 (automatic speed control)

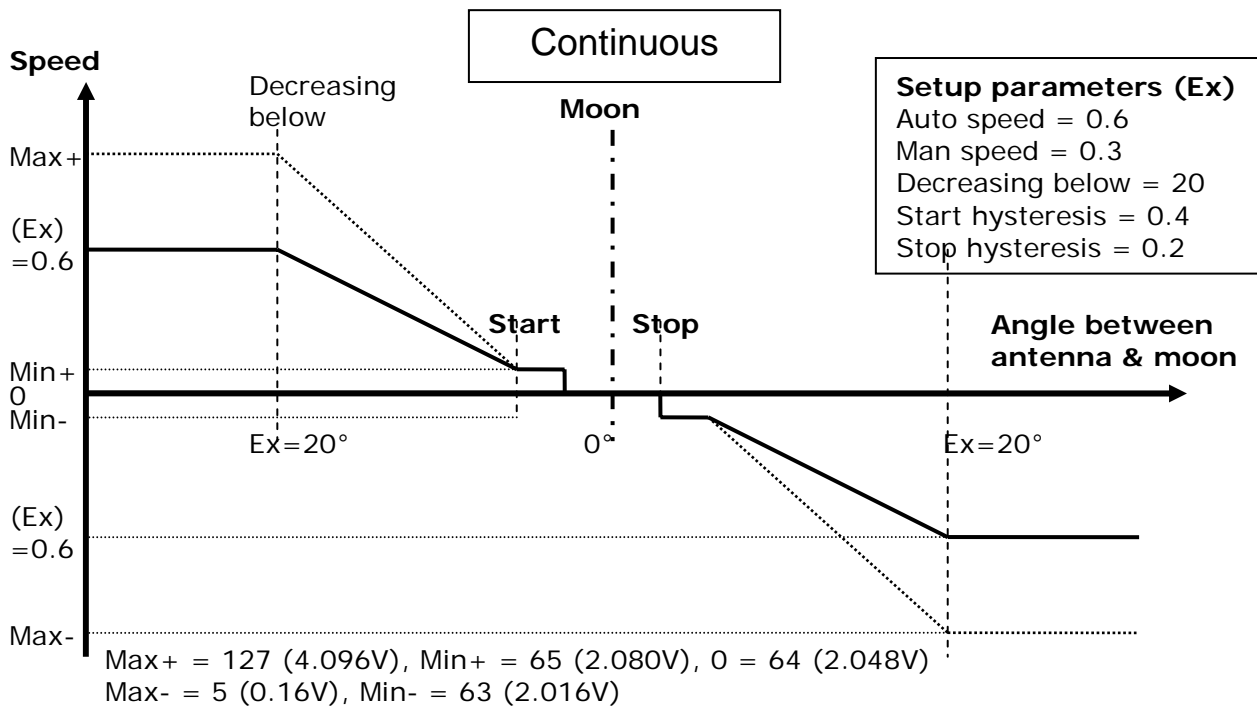
In the mode 3, the rotation, direction and speed of the antenna can be automatically adjusted.

The interface supplies a bipolar error word on 2 different formats :

- On the Rx bus outputs, a 7 bits bipolar binary error corresponding to the offset between the antenna and the tracked source (ex : moon). The error is coded from 5 (max negative error) to 127 (max positive error). For a null error, the interface displays the "64" decimal value.
- On an analog output, a voltage error corresponding to the offset between the antenna and the tracked source. The supplied voltage is centered on 2.048 v and varies of +/- 2.048 V from that (0 to 4.096V). With an external operational amplifier, the voltage can be easily shifted so that +2.048V error value gives 0V and the output is now bipolar +/-2.048V (or more) to pilot a servo-control of position.

In this mode 3, the relays of the board are used by the Tracking module to switch on or off the servo-control. The direction of rotation of the antenna is only controlled by the voltage or error word of control speed. 2 running are available with hysteresis and continuous (selectable with EME Setup into the mode 3).



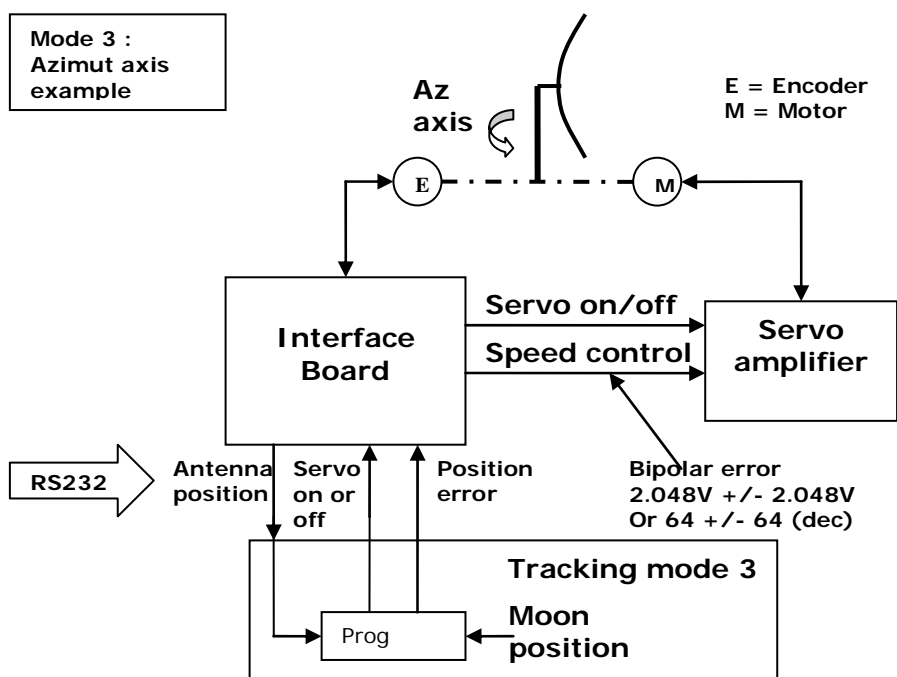


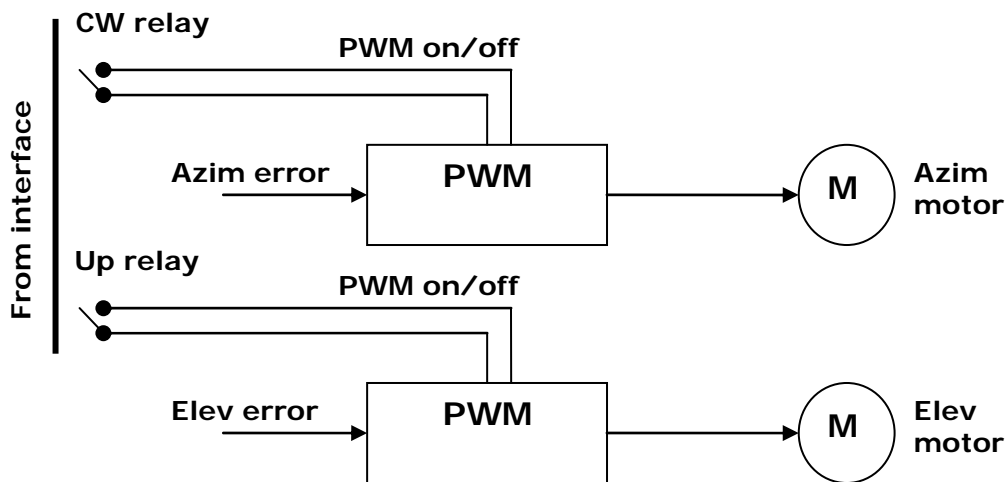
In automatic tracking, the speed is automatically adjustable according to the graphics above.

Compared to mode 2, Mode 3 in manual positioning (direction key), is a continuous mode. The drive is on. The error word is set to 64 because the antenna position is equal to the designation position. When the operator press an arrow key, tracking increases (or decreases, depends on the key) the error word and the antenna rotates to the next antenna position equal to previous position + angular increment set with the emesetup. If the operator maintains the key pressed the antenna rotates continuously. When the operator releases the key, the antenna stops. The angular increment is equal to :

$$\text{Start HysteresisValue} * 10 * \text{Man Speed}, \text{ that is to say } 0.4^\circ * 10 * 0.3 = 1.2^\circ.$$

The increment is depending of the start value defined in the hysteresis setup.

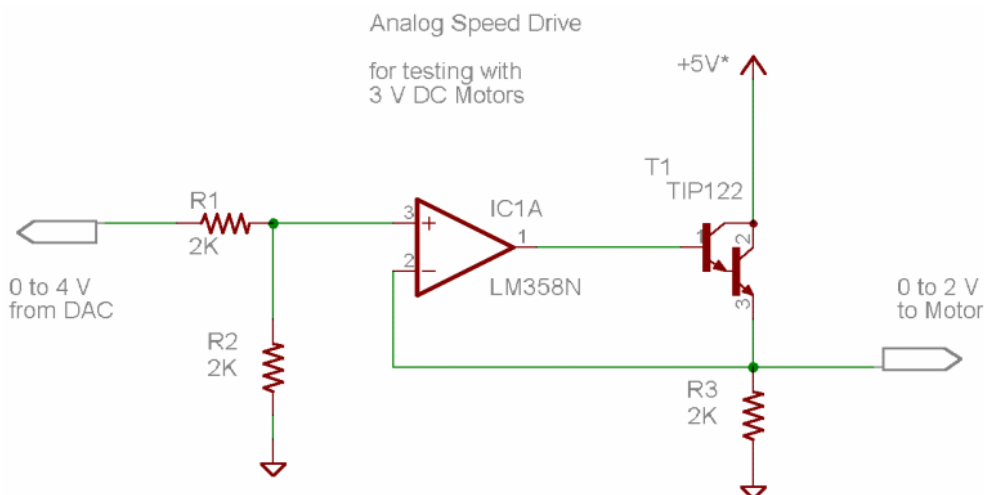




4 Interface for speed control (Mode 2 or 3)

- Using analog outputs (Az_V & EI_V)

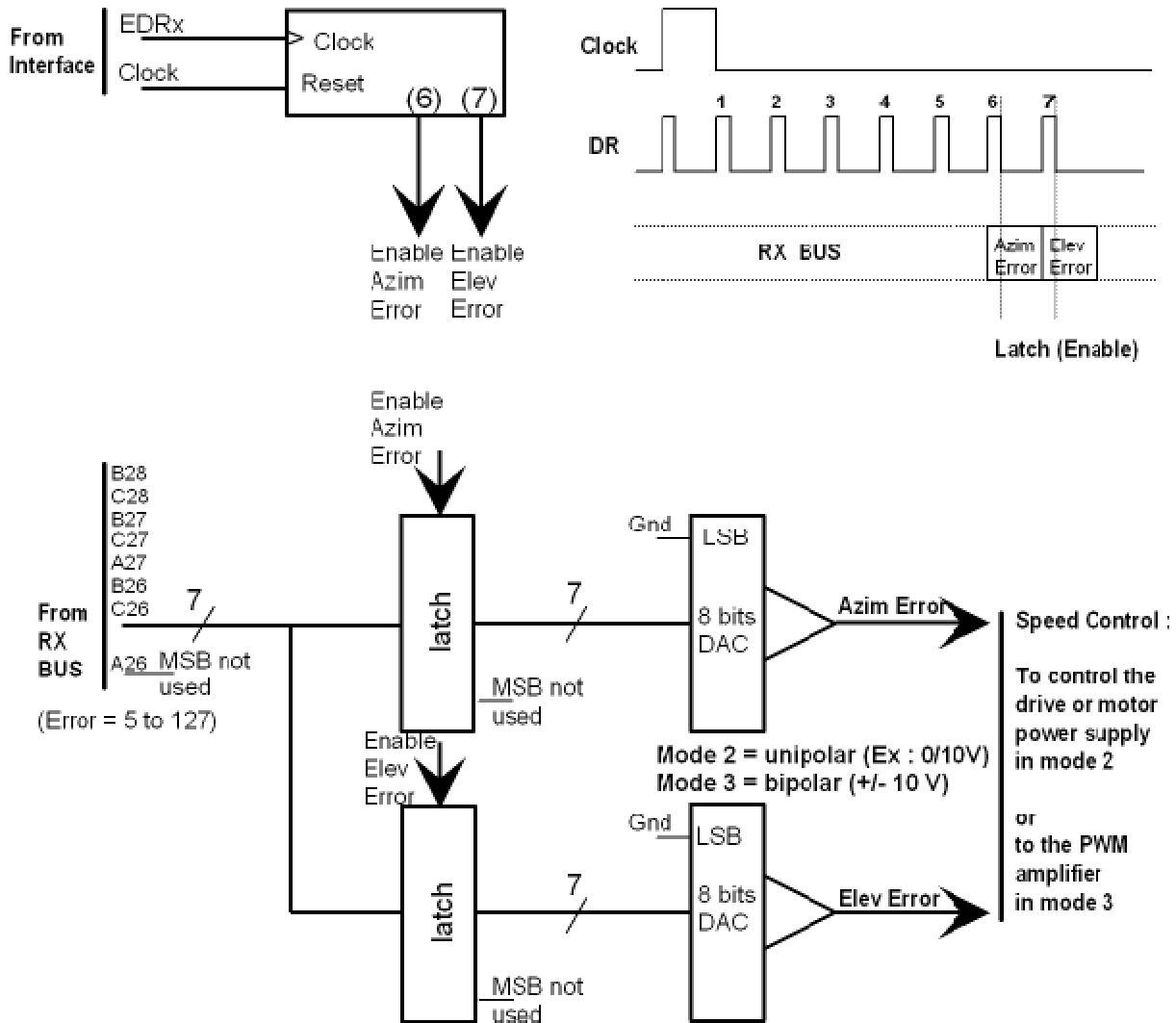
As a simple example of how the DC motor drive from the DAC speed output can be implemented, Rex KK6MK is providing the schematic of the circuit he used for the tests. An op amp is used to scale the voltage output from the DAC to the voltage required by the motor. The darlington transistor in the output provides (more than) the required current for the motor. This is a trivial example, but with high voltage MOSFETs in the output, and a suitable feedback divider, this should be scalable up to a level that can drive larger high-voltage DC motors. Here is the simple circuit.



Remark : These analog outputs are only available on the new MK-EHN board

- Using Rx bus interface

TRACKING SPEED CONTROL Mode 2 or 3



Remark : The RX bus is available on both, the previous F1EHN board and the new MK-EHN board.