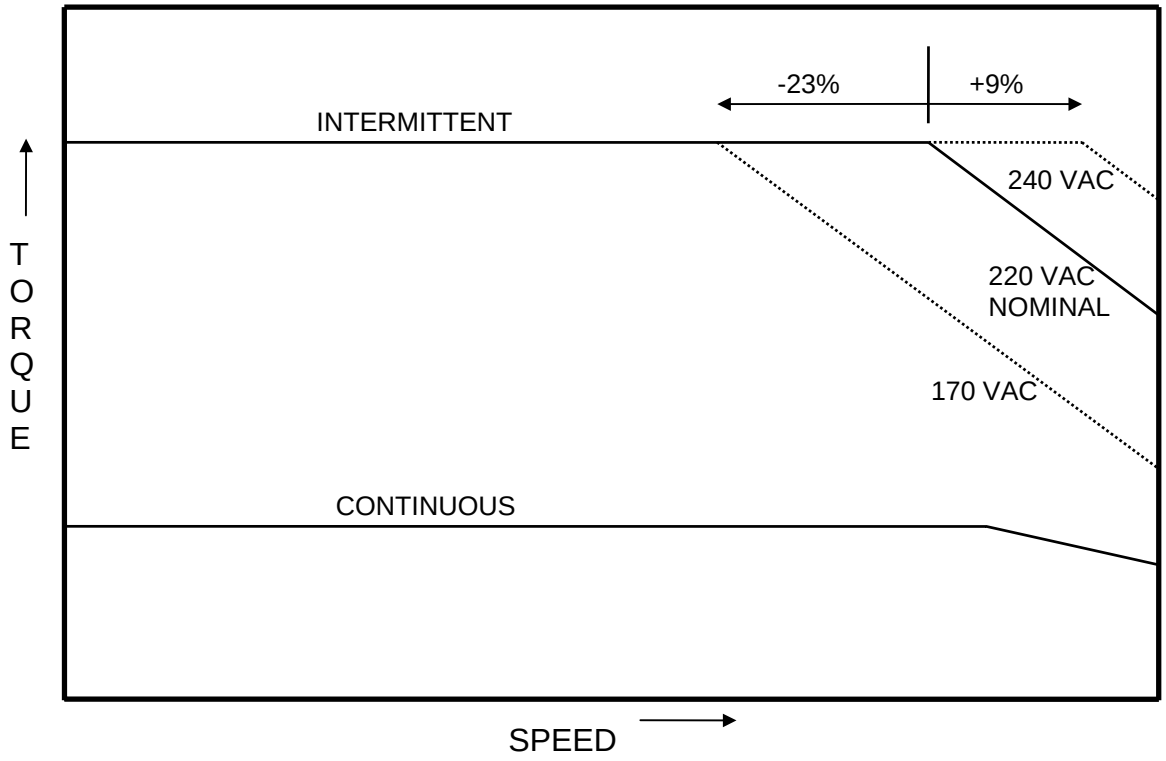
SECTION 14 - APPLICATION NOTES

14.1 SPEED TORQUE CURVES

The Delta S Driver speed/torque curves are shown with a nominal 115 VAC and 220 VAC, 50/60Hz incoming line voltage. The Delta S Drivers however are rated at 85-126 VAC for the "B" models and 170-264 VAC for the "A" models. The intermittent torque rating at the high speed is nearly linearly related to the line voltage. Motor winding resistance, winding inductance and motor losses also play a role in rolling off the peak torque and higher speeds.



As the servo motor speed goes up, the counter EMF or generator action of the motor increases the voltage across the motor windings. The driver must provide a voltage greater than the motor voltage to produce current in the winding and therefore torque at the motor shaft. The intermittent torque curve rolls off when the motor voltage reaches the driver's internal DC bus voltage. The internal DC bus voltage is directly related to the incoming line voltage.

The roll off in the continuous torque curve is caused by motor heating due to internal losses in the motor, not line voltage.

Note that the speed/torque curves shown in the specifications represent the speed and torque being applied in the same direction, as is the case when the motor is driving the load.

When the speed and torque are in opposite directions, as is the case when the motor is braking the load, the motor is putting the load's mechanical energy back into the driver in the form of electrical energy. The result is that the driver internal voltage DC bus is pumped up rather than drained down, as is the case when the motor is driving the load. The driver has a higher bus voltage in this braking mode; therefore the intermittent zone of speed/torque curve is higher. This means that there is more high-speed torque available for braking/deceleration than there is for accelerating a load.

14.1 SPEED TORQUE CURVES (cont'd)

When the driver is braking the load it is absorbing the mechanical energy of the load and pumping up the internal voltage bus. If the energy absorption is great enough, the driver switches in a regeneration resistor to dump some of the energy as heat. Repetitive or excessive absorption can overheat the regeneration resistor resulting in a fault condition. Absorption energy and the use of an internal or external regeneration resistor are discussed in detail in the Delta S Driver Technical manual Section 10.

When reviewing a particular application, consideration of the line voltage fluctuation can be an important issue. Generally speaking, applications in the more developed countries in the world can be more aggressively sized because a stable 220 VAC line is readily available. In emerging countries the line voltage is not likely to be stable, so more conservative sizing is necessary. It may even be necessary to move up a size rating to be sure the application will run properly when the line voltage dips. This could be of particular concern for Original Equipment Manufacturers that ship machines around the globe.

**** CAUTION ****

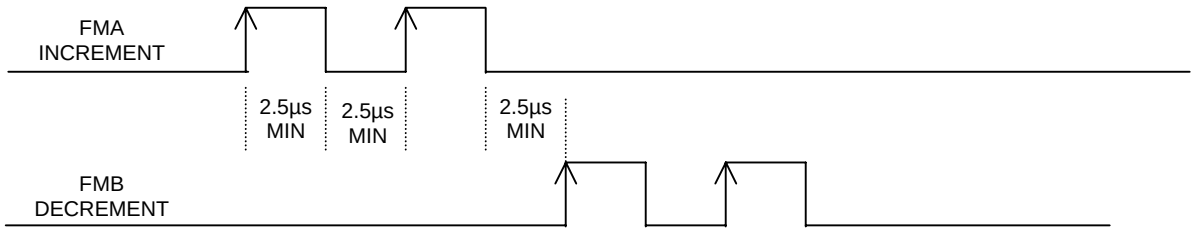
It might appear tempting to simply use a transformer to raise the nominal line voltage to 240-250 VAC to avoid the low line problem. Raising the nominal line voltage poses the risk of overheating the driver's regeneration resistor in the case of heavy motor braking or in the case of a rise in the line voltage.

14.2 PULSE INPUT & OUTPUT

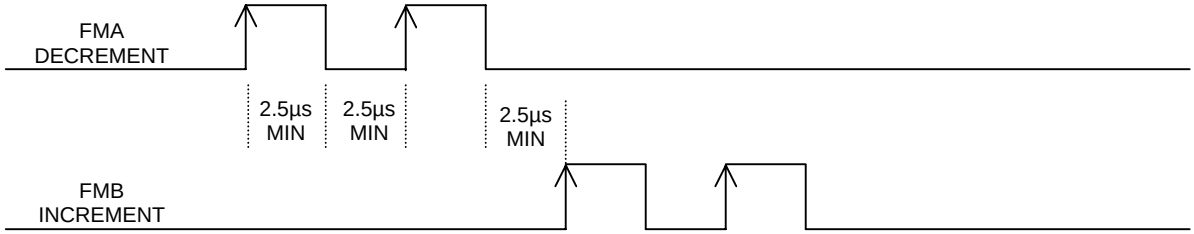
14.2.1 AUXILIARY ENCODER PULSE INPUTS FMA & FMB

An auxiliary position feedback to the Delta S driver is provided by pulse inputs from an external source. The Delta S driver, depending on the settings in UP-18, can configure the pulse inputs, FMA and FMB, in one of six ways. In the following descriptions an up arrow ↑ and down arrow ↓ indicates a pulse.

PULSE-PULSE DECODING (UP-18 = 00) where FMA increments the command position and FMB decrements the encoder position. Maximum frequency of FMA and FMB is 200 KHZ.

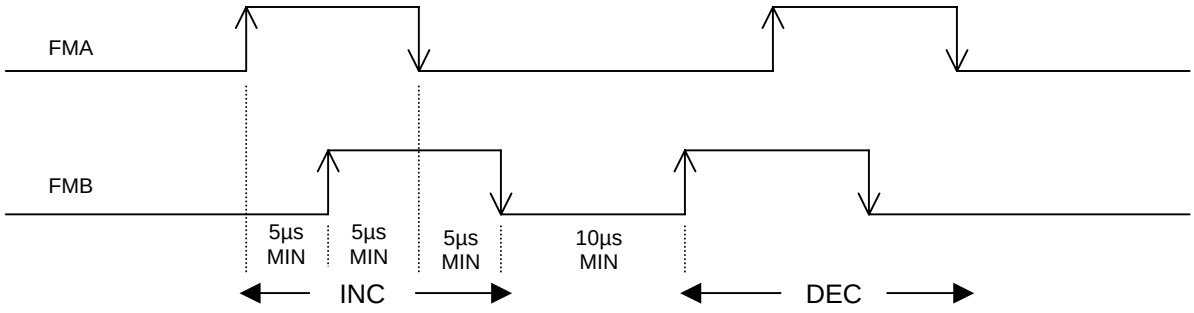


PULSE-PULSE DECODING (UP-18 = 10) where FMA decrements the command position and FMB increments the encoder position. Maximum frequency of FMA and FMB is 200 KHZ.

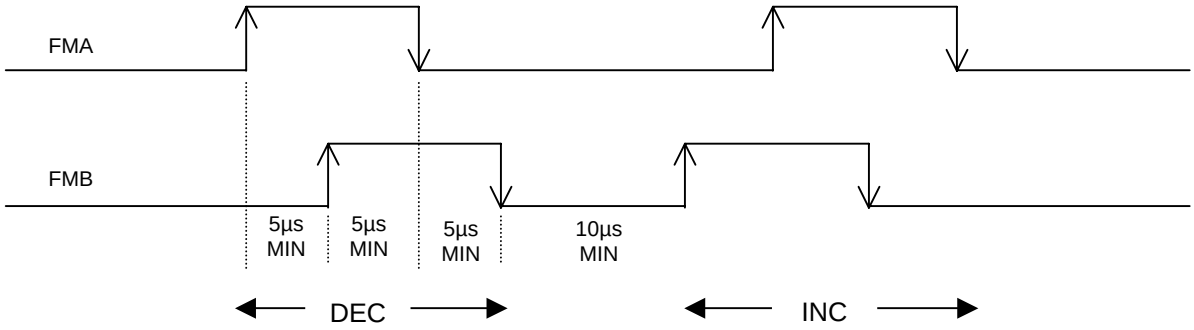


14.2.1 AUXILIARY ENCODER PULSE INPUTS FMA & FMB (cont'd)

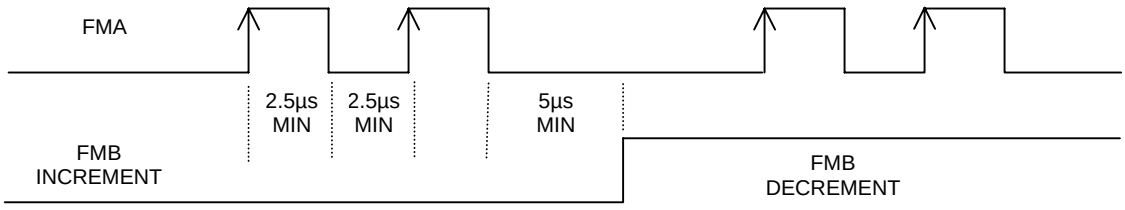
AB QUADRATURE DECODING (UP-18 = 01) where FMA leading FMB increments the command position, FMB leading FMA decrements the encoder position. Maximum frequency of FMA and FMB is 50 KHZ.



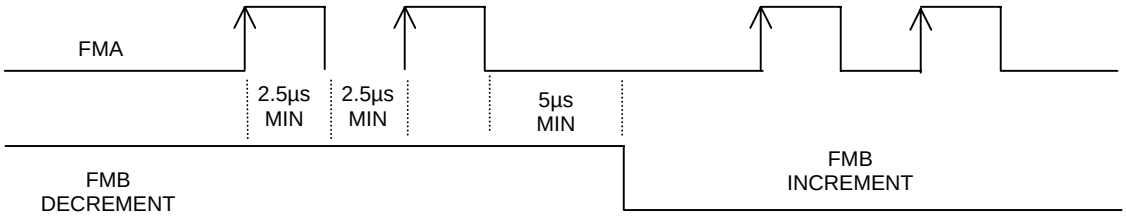
AB QUADRATURE DECODING (UP-18 = 11) where FMB leading FMA increments the command position, FMA leading FMB decrements the encoder position. Maximum frequency of FMA and FMB is 50 KHZ.



PULSE AND DIRECTION DECODING (UP-18 = 02) where FMA is pulse count and FMB is direction. Maximum frequency of FMA is 200 KHZ.



PULSE AND DIRECTION DECODING (UP-18 = 12) where FMA is pulse count and FMB is direction. Maximum frequency of FMA is 200 KHZ.

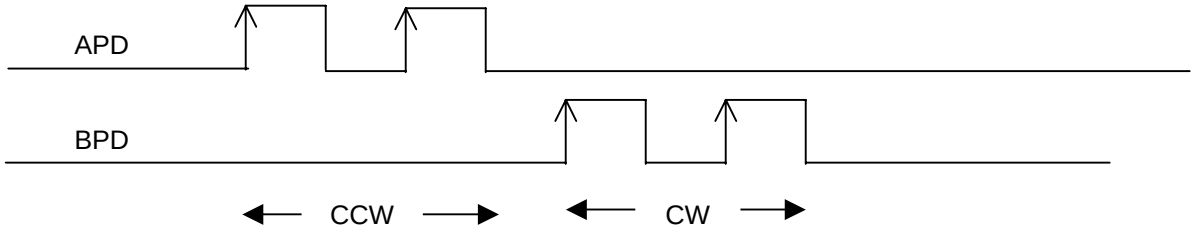


14.2.2 PULSE OUTPUTS APD, BPD & ZPD

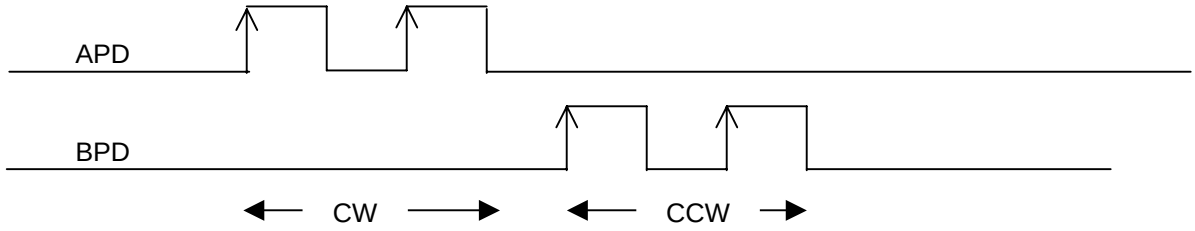
The pulse outputs of the Delta S driver, APD, BPD & ZPD, are used primarily to provide motor position to an external controller. The APD, BPD & ZPD outputs are RS422 compatible and are driven by a 26LS31 driver or equivalent. The width of the pulses is dependant on motor speed, resolver resolution and the setting of UP-04 and UP-05.

The ZPD pulse occurs when the motor's resolver is at 0 degrees. The Delta motors have various configurations of resolvers that provide 1, 2 or 3 electrical cycles per rotation of the motor shaft. Each resolver electrical cycle causes a 0 degree position and therefore a ZPD pulse. See individual motor data sheets for details. The ZPD pulse spacing will be (360º of motor rotation / # of resolver cycles) and the ZPD pulse width will be a multiple of 400µsec.

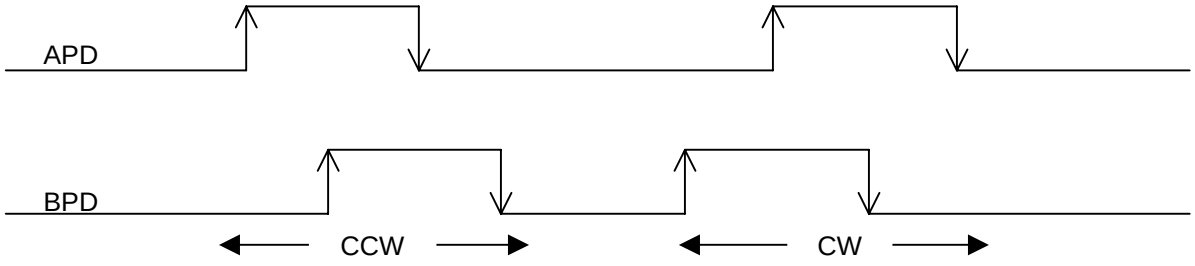
PULSE-PULSE DECODING (UP-19 = 00) where APD pulses when the motor actual position moves CCW and BDP pulses when the motor actual position moves CW. Maximum frequency of FMA and FMB is 400 KHZ.



PULSE-PULSE DECODING (UP-19 = 10) where APD pulses when the motor actual position moves CW and BDP pulses when the motor actual position moves CCW. Maximum frequency of FMA and FMB is 400 KHZ.

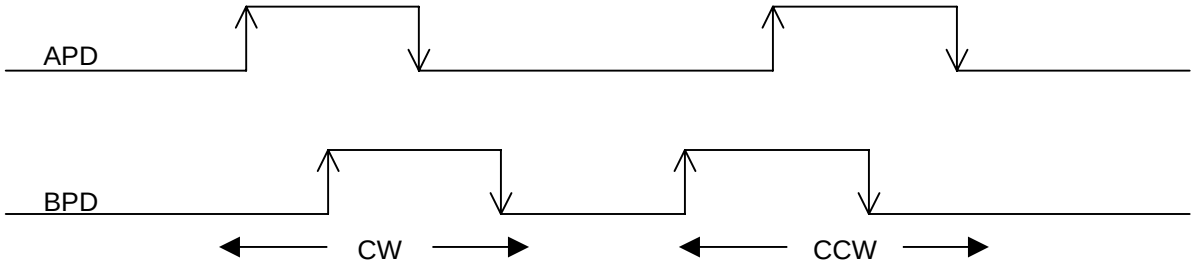


AB QUADRATURE DECODING (UP-19 = 01) where APD leads BPD for CCW motor rotation. Maximum frequency of APD and BPD is 100 KHZ. This mode simulates an encoder output being read as 4X.



14.2.2 PULSE OUTPUTS APD, BPD & ZPD (cont'd)

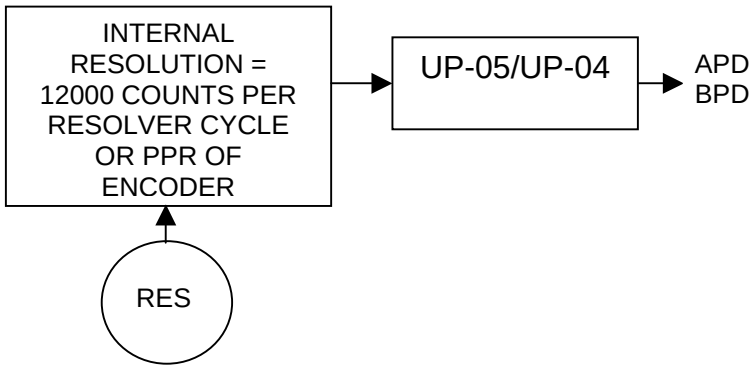
AB QUADRATURE DECODING (UP-19 = 11) where BPD leads APD for CCW motor rotation. Maximum frequency of APD and BPD is 100 KHZ. This mode simulates an encoder output being read as 4X.



14.2.3 SETTING THE RESOLUTION OF THE PULSE OUTPUTS

The feedback resolver in the motor determines the internal resolution of the Delta S driver. The driver resolution is 12000 counts per resolver electrical cycle. The Delta motors have one cycle (1X), two cycle (2X) or three cycle (3X) resolvers. (i.e. a 2X resolver has 2 electrical cycles per 1 rotation of the motor shaft). Delta driver can also have various encoder options with a different number of pulses per motor revolution (PPR).

The resolution of the pulse outputs is set by parameters UP-04 and UP-05.



Example: It is desired to output 8192 pulses/revolution of the motor shaft. A motor with a 2x resolver would have an internal resolution of 2 x 12000 = 24000 counts/rev of the motor. The internal driver resolution must be multiplied by 8192/24000. Set UP-04 to 24000 and UP-05 to 8192. Any ratio equivalent to 8192/24000 will also work like 4096/12000, 128/375, etc.