PE theory

A.C. squirrel cage induction motors are characterized as being "constant-speed" when they are run from of a typical 50Hz or 60Hz power source. If the power source frequency (Hz) can be adjusted, the motor speed can be varied and the actual running speed of the motor and other functions can be controlled.
This is where Power Electronics International, Inc. comes in.

Simply put, Micro-Speed® variable speed crane drive uses the existing A.C. (alternating current) and changes it into D.C. (direct current) then via an electronic technique called PWM (pulse width modulation) the D.C. is then turned back into Variable Frequency Alternating Current (V.F.A.C.). By varying the frequency (Hz) the motor speed can be controlled. And by adding modern state of the art microprocessor computer technology, all types of extra features are added to make your crane, through the Micro-Speed® drive, have an "intelligence" of its own. Older retrofit cranes and new cranes can be inexpensively converted to have almost "Star Wars" type of robotic control. All with just a standard, off the shelf, a.c. motor which already comes on your a.c. bridge/trolley or hoist! **These drives, through many hardware and software features, have become the single most productive and cost effective method for updating industrial, government and commercial job sites.**

Micro-Speed® series MULT-VECTOR®, CX® & SMART-MOVE® drives are the the key components of your future crane electronic drive system. Incredibly robust, PE equipment is well known to be the **most reliable, easiest to use and install** and the "**gold standard**" for crane control.

Join the many users of Power Electronics International, Inc.
Here are just a few names you might recognize:

- RJ Reynolds
- Georgia Pacific
- Alcoa
- University of Arizona
- Sea World
- Ford & GM
- Fermi Labs
- General Electric
- Morton Thiokol
- USS Kobe Steel
- NASA
- Volvo
- TVA
- USX
- Boeing
- American Airlines
- US Navy
- US Air Force
- Caterpillar
- Moen
- Duke-Power
- Martin-Marietta
- Kimberly-Clark
- Lockheed Martin
- Mittal Steel

FEATURES & OPERATIONAL BENEFITS

SELECTED FEATURES	OUTSTANDING BENEFITS
GANG-SET™ User Friendly and MORE!	Exclusive GANG-SET™ instant programming of 38 PLUS basic crane/hoist parameters. A push of a button in GANG-SET™ mode and the Micro-Speed® "self-programs" for 99% of crane applications in less than 3-seconds! Simply "plug and play"! **In many cases you don't even have to have the manual to be up and running! The GOLD-STANDARD OF CRANE CONTROL!**
POWER TO SPARE! ✔ **Worry free from PE!**	Tough and powerful, all Micro-speed® drives will give up to 300% current or more when you need it the most. Other types of systems may instantly fault out in the middle of your crane or hoist run, at anywhere between 150 and 250% current - instantly. YOU NEED MICRO-SPEED®!
STANDARD A.C. MOTORS	Use existing motors or use economical and readily available standard motors for most applications (certain hoists with Multi-Vector® drive require quadrature encoder feedback). Even wound rotor motors with slip-rings can be utilized with simple modifications.
MULTI-MOTOR USE!	Multiple motors on same motion can be controlled for all horizontal applications. No need to de-rate motors for most applications.
SOFT-STARTING ✔ SOFT-TRANSITIONS ✔ SOFT-REVERSING ✔ SOFT STOPPING	Increase life of bearings, drive trains and dramatically decrease crane maintenance. Product breakage is dramatically reduced.
PRECISION SPOTTING & INCHING	Speeds are settable along with acceleration and deceleration rates. Depending on crane system down to 40:1 or greater speed range is possible with encoder feedback on the Multi-Vector® units! Production is more efficient and safe! This feature alone can save thousands of dollars per year.
MULTI-SPEED	Up to five independent field adjustable and "repeatable" speeds FROM 1-SPEED MOTORS with adjustable acceleration and deceleration rate. Includes QUIK-STOP™ and QUIK-PLUG™ safety reversal. Smart-Move® units have 3 speed inputs, CX® styles have up to 7 speed inputs and Multi-Vector® have up to 9 independently adjustable speed inputs available for special application uses.
Vari-Easy-Speed **2**™ Vari-Easy-Speed **3**™ SPEED CONTROL	Utilizing 2 or 3-speed pendant (or radio control) any infinite speed range can be selected. The crane operator can easily select any speed within the range of operation as easy as a push of a button! Infinitely variable Vari-Easy-Speed™ modes are available on both hoist (vertical) and travel (horizontal) motions (see detailed description inside). **Available on all models!**
DIAGNOSTICS for CRANE PROBLEMS ✔ pendant/radio functions ✔ Brake operation test ✔ Motor electrical/mechanical ✔ 13+ basic analysis codes ✔ Overload trips are displayed ✔ ***And So Much More…***	Unique "CRANE DIAGNOSTICS" help crane service technicians diagnose many crane maintenance needs with a push of a button! Includes memory storage up to 396 messages (including history). Wear on hoist Weston load brakes can also be detected in many applications using PE crane diagnostics – ***a PE exclusive!*** Multi-Vector® models have extensive external encoder diagnostics – ***another MUST HAVE PE EXCLUSIVE FEATURE !***
QUIK-JOG™	***Exclusive PE function***, which does not allow damage to brake system via "machine gunning-on-off-on-off" of the brakes via the pushbutton station by crane operators. This feature alone can pay for itself by eliminating just one brake repair job.
INTEGRATED INTERFACE™ ***(No add on boards to come loose!)***	Crane control inputs are designed right into the main printed circuit board. Say no more to unreliable after-market "interface /option cards" or poor performance relay logic inputs to raffle loose or fall off.
115vac opto-isolated END OF TRAVEL LIMIT SWITCH INPUTS FOR EASE OF USE	Left and Right limit switch inputs require no external "logic" or isolation for operation. Simply connect limit switch wires to the appropriate terminals. Two basic functions can be selected: 1.) Immediate stop or brake setting. 2.) Adjustable Ramp-Down to stop. Internal logic only allows motion in opposite direction until limit switch is disengaged.

SELECTED FEATURES	OUTSTANDING BENEFITS
DC INJECTION BRAKING	DC current is momentarily injected into the a.c. motor, which effectively freezes the motor into position without the use of a mechanical brake. This feature allows a mechanical brake (if used) to see little or no wear. This feature can also decrease or completely eliminate brake failures. On motions without mechanical brakes, "electronic braking" increases crane safety and performance.
SAFETY- START™ ***You need this!***	Crane motion can ***never*** be started without a control input signal to the drive. No chance of accidental starting and running of the crane as in other types of systems. ***Another PE Exclusive***, "must have" safety feature!
INTEGRATED REGENERATION™ No external Dynamic Brake transistors needed-ever!	**All Micro-Speed® models regardless of horsepower** have built in regeneration circuitry outputs. NO add-ons needed. Simply connect dynamic brake resistors on p1, p2 terminals with no additional costs involved! All Smart-Move® models & CX® through 5hp 460vac have regeneration resistors built-inside for heavy-duty CMMA D crane duty cycles. Class C duty cranes get the added bonus of increased reliability – ability to get your crane out of the tough spots that always happen when you least expect it!
UPGRADE-PATH™ ✔ **Learn it once and learn it forever!** ✔ **Your control future is secure!** ✔ **Upgrade in future without worry!** ✔ **Physical sizes compatible** ✔ **Electrical connections compatible** ✔ **Software - Similiar programming is a cinch!** ✔ **Worry free from PE!**	After installation of PE drives on your equipment, you will not lose past training knowledge as a result of our exclusive UP-GRADE PATH™ philosophy. It is our, unique to the industry, concept to engineer our equipment for quick easy UPGRADE or future replacement in the field. This includes both Physical sizes, Electrical connections and basic software settings. The present and future methods of programming remain "supersets" of previous drive models! In the future some NEW state of the art features will be offered which can in many cases be added "in the field" when they are introduced. Years from now you can be confident that your crane, investment and company will not be left behind! CX®, SMART-MOVE® AND MULTI-VECTOR® units set up and program similarly – how much easier can it get! Your technicians will love it! And your future technical and service personnel, now and many years down the road, will be pleased you chose PE the only 100% crane designed drive.
LOCKOUT & SAFE-PARAMETER BLOCKING™	Unauthorized resetting of the crane parameters can be 100% locked out with the LOCKOUT SETTING. With SAFE-PARAMETER-BLOCKING™ the setting ranges can be limited. Individual adjustments, for different crane uses, can be set quickly, on-site, yet only within predetermined safe operating parameters for that crane.
CMAA CLASS D duty cycles (Standard) Class E & F available ✔ **Worry free from PE!**	CMAA CLASS D duty cycles are standard. Standard Micro-speed® drives will handle heavy-duty cranes. This is an added bonus on CLASS C medium duty cycle cranes for added safety and reliability - No more faults or trip outs during high usage or critcal production runs! No more need to settle for less or to "take a chance". Your crane works every time not only when "going slow"! Quicker deceleration times possible on lower duty cycle cranes!
QUIK-STOP™ 2nd quick-smooth decel to stop when you need it the most!	Fully adjustable, fast and smooth *deceleration to stopping*. This is a separate function besides the deceleration rate between speeds. Gives incredible control!
QUIK-PLUG™ Reverse smoothly and very quickly when required.	Fully adjustable ***fast reverse*** gets crane down to zero speed quickly. Crane operator can either set the brake or continue accelerating in the reverse direction normal rates. ***Another PE Exclusive!***
	All Micro-speed® include a large high intensity LED display which includes an anti-glare filter. The display is designed for ease in reading in various lighting conditions. This is especially useful in dark or out of the way locations for easy readibility even at a distance.

Specifications may change without notice.

POWER ELECTRONICS® INTERNATIONAL, INC.

Micro-Speed®

Customize your crane!

Robotic control at the tip of your fingers

Micro-Speed® drives are specifically designed for hoist and bridge/trolley/monorail or similar applications. Both hardware and software are designed exclusively for the overhead crane and hoist industry.

Over 35 years of hoist & crane control engineering experience have been invested in Micro-Speed CX®, Smart-Move® & Multi-Vector® drives. PE drives are known worldwide for their high quality and reliability.

These drives, through many hardware and software features, have become the single most productive and cost effective method for updating industrial, government and commercial job sites.

Save thousands of dollars each year in increased productivity, safety and reduce crane maintenance. No complicated wiring is needed. Micro-Speed® drives self-configure when connected according to standard electrical drawings.

Power Electronics® International, Inc.
– Over 40 Years of Quality Manufactured Crane Controls –
561-8 Plate Drive, East Dundee, Illinois 60118-2467 USA
Phone: (847) 428-9494 • Fax: (847) 428-7744 • www.PEinfo.com

Micro-Speed® Multi-Vector® Smart-Move® & CX®

Power Electronics® International, Inc.

– Over 40 Years of Quality Manufactured Crane Controls –

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Vari-Easy-Speed 2™ & ADVANCED Vari-Easy Speed 2™

2-step Infinitely Variable Speed Control

ANY SPEED YOU DESIRE!

Imagine using a simple and inexpensive 2-speed push-button and obtaining hundreds of different speeds effortlessly on your crane! Use a Micro-speed® and any 2-step pushbutton (or radio control) and you've got it!!!

The Vari-Easy-Speed 2™ 2-step infinite variable speed control feature does just as described! The internal microprocessor intelligently locks in any speed that the crane operator accelerates or decelerates to - ***effortlessly!***

Essentially the pendant control acts like a motorized potentiometer. In other words, on horizontal travel motions such as a bridge or trolley, what would normally be the 2nd speed point becomes an ACCELERATION command and the 1st step on the button becomes the HOLD THAT SPEED command. A simple push of the button to 2nd step (accelerate) and back to the 1st step (hold) will incrementally accelerate the crane and run at that new speed! As long as the operator stays on the 1st position that new speed can be held constant or varied "at will" throughout the crane run. To "slow down" or decelerate the operator simply "lets go" of the button until the crane slows to the point they like. By pushing back to the 1st position (1st step) the Micro-speed® drive will then keep the crane running at that new intermediate speed. When the motor is at a stop, the selection of the first step on both hoisting and trolley modes "intelligently" tells the Micro-Speed® that it should run your crane at your user selectable low speed setting. The crane operator now has complete control of the crane!

In standard Vari-Easy-Speed 2™ hoist mode, "letting go" of the button will normally instantly set the hoist electromechanical brake instead of decelerating the hoist. The acceleration is the same as described above. The hoist is stopped and re-accelerated to the desired speed and held (go to step 2 then back off to step 1).

Exclusive NEW PE Feature
ADVANCED Vari-Easy-Speed 2™ for Hoisting

NEW!

Micro-speed® drives (version 2.1 and greater) & the Multi-Vector® drive have "ADVANCED Vari-Easy-Speed 2™ ***Hoist Control***" which allows setting of both acceleration and deceleration to a stop with spotting control. The hoist will be infinitely variable speed and have both acceleration and deceleration. Deceleration is available during a predetermined (settable) speed range. This "hoist with complete variability in both the acceleration and deceleration" is a solution to using all standard two-step buttons on all motions with high control. Nothing could be simpler or easier! ADVANCED Vari-Easy-Speed 2™ for hoisting is nothing but ***superb!***

Remember, all this control with a standard 1-speed a.c. motor. These features can simply and inexpensively turn your crane or hoist into an even bigger asset for your company!

GANG-SET™ #2 for horizontal bridge/trolley
GANG-SET™ #8 for hoist motion

BRIDGE or TROLLEY		HOIST
GANG-SET™ #2 Accelerate **or** Decelerate to any speed desired!	Standard 2-Step Push-Button (or Radio Control)	**GANG-SET™ #8** Accelerate to any speed desired! *"Advanced mode" allows deceleration
LET GO of Button - DECELERATE		**LET GO of Button - standard = stop**
Motor is decelerated and then stopped with DC Electronic braking. Electromechanical brake is then "Set". Deceleration will ultimately go to stopping the motor if no other STEP is energized.		***NEW! "Advanced Vari-Easy-Speed 2™ for Hoisting"** allows *both* acceleration and deceleration of the hoist to any speed desired -without a "stop". Standard mode "stops" the hoist when the pushbutton is completely released.
HOLD THAT SPEED	1st Step	**HOLD THAT SPEED**
(initially goes to low speed if motor is at rest)		(initially goes to low speed if motor is at rest)
ACCELERATE to any speed or up to the highest speed *you* set!	2nd Step	**ACCELERATE** to any speed or up to the highest speed *you* set!

Multi-Speeds from a 1-speed motor

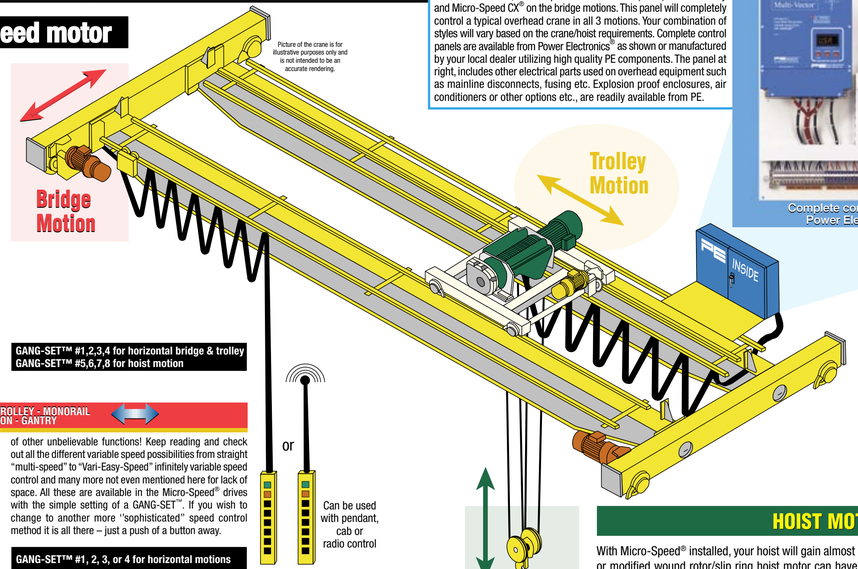
FOR BOTH HORIZONTAL & HOIST MOTIONS

From a standard one-speed crane you can achieve variable 1, 2, 3, 4 or 5 speeds (or more). Smart-Move® has up to 3 speed points, CX® up to 7 speed points and Multi-Vector™ up to 9 speed points (if needed). Speed control with each speed level is independently adjustable to your exact needs.

Simply add the Micro-speed® and a multi-speed push-button station or radio control having the appropriate speed points. Acceleration and deceleration rates (3 Plus types) are fully adjustable along with many other crane specific parameters. Potentiometer "analog" control is also available.

Acceleration and deceleration between speeds is beautifully smooth in all bridge/trolley and hoist motor speed transitions. Standard 1 -speed motors, or even a modified wound rotor/slip ring motors can have nearly load insensitive and repeatable speeds - instantly! Multiple motors can be controlled on horizontal motions with only one drive.

The setting of the Micro-Speed® is also very simple. Just choose a Gang-Set™ # on the display and you're ready to go! Each speed setting can be separately adjusted along with many other crane specific parameters to make your crane operate perfectly for your exact application!



GANG-SET™ #1,2,3,4 for horizontal bridge & trolley
GANG-SET™ #5,6,7,8 for hoist motion

HORIZONTAL MOTIONS

BRIDGE - TROLLEY - MONORAIL
JIB ROTATION - GANTRY

With Micro-Speed® installed, your crane becomes a "virtual" extension of the crane operator. It has been termed "robot-like control" which is often used to describe the incredible increase in precision and productivity gains which become apparent after only a short time of use. Your bridge/trolley motion will be smooth, soft and have an added degree of precision. Crane maintenance will decrease because your crane won't experience the "jerking and jumping" it used to do! Even brake wear decreases. Product breakage and damage is reduced, safety concerns are decreased and productivity and throughput are dramatically increased - even on light duty cranes! You now have computerized a.c. motor control, speed control, acceleration and deceleration control, brake control and hundreds of other unbelievable functions! Keep reading and check out all the different variable speed possibilities from straight "multi-speed" to "Vari-Easy-Speed" infinitely variable speed control and many more not even mentioned here for lack of space. All these are available in the Micro-Speed® drives with the simple setting of a GANG-SET™. If you wish to change to another more "sophisticated" speed control method it is all there – just a push of a button away.

GANG-SET™ #1, 2, 3, or 4 for horizontal motions

DC ELECTRONIC BRAKING

With DC electronic braking, the Micro-Speed® control actually electronically stops the motor from rotating as it approaches zero speed. This incredible feature **will extend mechanical brake life almost indefinitely** since the mechanical crane may never have to stop the crane. The mechanical brake becomes relegated to merely a "holding" brake. Imagine the hundreds and even thousands of dollars which will be saved over the life of a crane with little or no mechanical brake wear! In addition, those motions without any brake mechanism (trolleys for example) get the extra benefit of electronic braking automatically.

CRANE DIAGNOSTICS™

PE CRANE DIAGNOSTICS™ will actually help your crane technician test crane functions along with drive functions. The large LED lighted display can show whether the push-button station is sending proper signals to the drive. Have a mechanical brake problem? The CRANE DIAGNOSTICS™ system can help the technician test the crane or hoist brake - all from the Micro-Speed® keypad! On hoisting, internal load brake wear can sometimes also be detected. With over 13 Plus basic different crane Diagnostic codes a technician will be able to quickly pinpoint areas of concern for further checking. Micro-Speed® is more than a drive, it is an invaluable tool to the trained crane mechanic which can save thousands of dollars in labor charges and replacement parts over the life of your crane. ***Another PE exclusive!***

Three-motion variable speed crane control panel

is shown with a representative from each PE style drive utilizing a Micro-Speed® Multi-Vector®(MMV) closed loop style variable speed drive on the hoist, Micro-speed Smart-Move® (MSM) on the trolley and Micro-Speed CX® on the bridge motions. This panel will completely control a typical overhead crane in all 3 motions. Your combination of styles will vary based on the crane/hoist requirements. Complete control panels are available from Power Electronics® as shown or manufactured by your local dealer utilizing high quality PE components. The panel at right, includes other electrical parts used on overhead equipment such as mainline disconnects, fusing etc. Explosion proof enclosures, air conditioners or other options etc., are readily available from PE.

Complete control panels are available from Power Electronics International, Inc.

High Temperature 60° C

MADE IN USA

HOIST MOTION

With Micro-Speed® installed, your hoist will gain almost robot-like qualities. A standard 1-speed motor or modified wound rotor/slip ring hoist motor can have nearly load insensitive and repeatable lifting speeds - instantly! Efficiency will increase along with greater safety and reliability. The small investment in a Micro-Speed® system will have an enormous payoff in hoist safety and productivity gains. Most hoists require either a mechanical load brake (or similar) or worm gearing for safety when using the Smart-Move® or CX® style drive to safeguard against electromechanical brake failure and other reasons.

Micro-Speed® Multi-Vector® drives are the finest, state of the art, NO LOAD BRAKE (closed loop) hoist controls available. It is the only completely hoist designed drive in the world. All other types are simply modified "multi-purpose" drives. In the Multi-Vector® both the hardware and all the software have been totally designed for hoist control (which is not true of any other drive brand in the industry). Not only is the Multi-Vector® drive robust, it is the easiest to install and use. Famous Gang-Set™ system is fully incorporated. Set up and installation, in many cases, has been done without even having to read the manual (although highly recommended). Your equipment and installation are up and running in as low as 5% of the time! All with Power Electronics International, Inc., reliability and quality. ***WORRY FREE FROM PE!***

Decrease load swing, increasing crane accuracy and safety

GANG-SET™ TECHNOLOGY… *You Need This!*

EASY 1-2-3 Hassle Free programming system *No Ph.D. necessary…*

Exclusive GANG-SET™ technology allows the user to set up the Micro-Speed® drive with **little or no training**! A few key strokes and the operator is able to have the Micro-Speed® drive practically self-program for the specific type of crane application that it is being applied to. ***Don't be fooled…only from Power Electronics!***

Step #1

Just hold down 3 buttons for 3 seconds to get to Pb 0 Initial GANG-SET™.

Step #2 Choose a GANG-SET™

Choose a number 1,2,3 or 4 (Pb 0) for bridge/trolley or 5,6,7 or 8 (Pb 0) for hoist modes. Pushing the scroll button once for each increment. This automatically pulls in all the proper drive functions from the microprocessor and all the general settings you will need to run your crane or hoist.

Step #3 Load your choice

Press once the "LOAD" BUTTON and 3 SECONDS LATER RUN YOUR CRANE! It only takes a few seconds to do what usually would be hours of programming time (not to mention reading long manuals). Individual settings of speed, acceleration and deceleration can be changed just as easily if necessary.

Vari-Easy-Speed 3™

3-step Infinitely Variable Speed Control

Vari-Easy-Speed 3™ is the more "sophisticated" version of the already described Vari-Easy-Speed 2™. Using an additional pushbutton step (3rd step) instructs the internal microprocessor that the crane operator wants finer deceleration control on hoisting. Or on travel motions for a "Quik-Stop™" fast smooth stop down to zero speed. Complete acceleration and deceleration control is available at all times without ever setting the brake, for both hoisting and travel motions. ***Here is how it works:*** Third step is the ACCELERATION command with the 2nd (middle) step being the HOLD THAT SPEED step. The 1st step is the DECELERATE command.When taking the finger off of the button completely in horizontal travel mode (bridge/trolley) the **Quik-Stop™** feature is engaged which decelerates quickly down to zero speed, in a smooth and controlled fashion, and sets the brake. The **Quik-Plug™** ***fast safety reverse*** mode also becomes operational on bridge/trolley motions (descriptions on back). The compelling advantage of the 3-step method on hoisting is that the hoist operator can smoothly accelerate or decelerate the hoist to any speed desired at any time without ever stopping - incredible! Common, but not required, the Vari-Easy-Speed 3™ 3-step variable mode on bridge/trolley is used in conjunction with a hoist also using Vari-Easy-Speed 3™. The 3-step button gives an increase in actual control of the bridge/trolley or hoist increasing productivity gains over the *standard* 2-step button variable system as previously described.

GANG-SET™ #3 for the bridge/trolley
GANG-SET™ #5 for hoisting

BRIDGE or TROLLEY		HOIST
GANG-SET™ #3 Accelerate **or** Decelerate to any speed desired! Including Quik-Stop™ & Quik-Plug™ features	Standard 3-Step Push-Button (or Radio Control)	**GANG-SET™ #5** Accelerate **or** Decelerate to any speed desired!
LET GO of button - DECELERATE to stop		**LET GO of button - Instant stop**
Motor is decelerated and then stopped with DC Electronic braking. Electromechanical brake is then "Set". Quik-Stop™ for faster stopping and Quik-Plug™ fast safety reverse are both adjustable.		Electromechanical brake is instantly set & Hoist is stopped.
DECELERATE to low speed	1st Step	**DECELERATE to low speed**
(initially drives motor to low speed if motor is at rest)		(initially drives motor to low speed if motor is at rest)
HOLD THAT SPEED	2nd Step	**HOLD THAT SPEED**
ACCELERATE to High Speed	3rd Step	**ACCELERATE** to High Speed