INSTALLING, OPERATING AND MAINTAINING

THE MODEL D1029

BI-DIRECTIONAL GENERATOR

FIELD REGULATOR

REVISION: 3.0
OCTOBER 2003

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SECTION 1
GENERAL INFORMATION

INTRODUCTION

Thank you for purchasing an ***IPC*** **Automation** elevator control.

At ***IPC*** we are committed to designing and manufacturing high quality controls that meet or exceed our customers needs. This manual provides the information you will need in order to properly install, operate and troubleshoot the **Model D1029 Bi-Directional Field Regulator**. It provides a general overview of the operation of the control, along with detailed descriptions of the diagnostic indicators, status indicators, adjustments and connections. Also included is a step by step start-up procedure, troubleshooting information, and applications. Please read this manual completely before attempting to install or operate the **Model D1029.**

Please feel free to call ***IPC*** **Automation** with any questions you may have **BEFORE** performing installation or start-up.

IPC **Automation**
441 Industrial Drive
Lexington, South Carolina 29072

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1.1 SAFETY

There are certain fundamental warnings which must be kept in mind at all times. These include:

WARNING **THE BI-DIRECTIONAL FIELD REGULATOR SHOULD BE INSTALLED, ADJUSTED AND SERVICED BY QUALIFIED ELECTRICAL MAINTENANCE PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL EQUIPMENT IN THE ELEVATOR SYSTEM: PERSONAL INJURY AND/OR EQUIPMENT DAMAGE MAY OCCUR IF INDIVIDUALS ARE NOT FAMILIAR WITH THE HAZARDS RESULTING FROM IMPROPER OPERATION.**

WARNING **CONTROLLER EQUIPMENT IS AT LINE VOLTAGE WHEN AC POWER IS CONNECTED AND INTERNAL CAPACITORS REMAIN CHARGED AFTER POWER IS REMOVED FROM THE BI-DIRECTIONAL FIELD REGULATOR. IT IS IMPORTANT THAT AC POWER IS REMOVED FROM THE UNIT FOR A MINIMUM OF FIVE MINUTES BEFORE IT IS SAFE TO TOUCH THE INTERNAL PARTS OF THE CONTROL. PERSONAL INJURY MAY RESULT UNLESS POWER IS REMOVED.**

WARNING **THE USER IS RESPONSIBLE FOR CONFORMING WITH THE NATIONAL ELECTRICAL CODE WITH RESPECT TO MOTOR, CONTROLLER AND OPERATOR DEVICE INSTALLATION, WIRING AND START-UP. THE USER IS ALSO RESPONSIBLE FOR UNDERSTANDING AND APPLYING ALL OTHER APPLICABLE LOCAL CODES WHICH GOVERN SUCH PRACTICES AS WIRING PROTECTION, GROUNDING, DISCONNECTS AND OVER CURRENT PROTECTION.**

WARNING **THE FAULT CIRCUITS DESCRIBED IN SECTION 3.3 ARE DESIGNED TO PROTECT THE CIRCUITRY AND PROVIDE INDICATION OF RELIABLE OPERATION OF THE CONTROLLER. <u>THE FAULT CIRCUITS SHOULD NOT BE USED AS A SAFETY DEVICE FOR PROTECTING PERSONNEL.</u> THE FAULT CIRCUITS IN THE CONTROL ARE NOT REDUNDANT CIRCUITS; THEY MAY RELY UPON THE OPERATION OF THE CONTROL TO INDICATE FAULTY OPERATING CONDITIONS. THEREFORE, THE ELEVATOR COMPANY SHOULD ALWAYS USE REDUNDANT SAFETY DETECTORS AND BACK-UP DEVICES TO PROVIDE SAFETY FOR PERSONNEL. THE FAULT CIRCUITS ARE NOT INTENDED TO MEET ELEVATOR CODE FOR THE PROTECTION OF PERSONNEL AND SHOULD NOT BE USED TO MEET ELEVATOR CODES.**

1.2 WARRANTY

Standard conditions of sale for the company include a Statement of Warranty which covers the control equipment. This Statement of Warranty covers all new equipment.

The Model D1029 Bi-Directional Field Regulator has been designed as a standard product to meet the general criteria for controlling a motor-generator set in conjunction with an elevator. IPC does not warrant that the Model D1029 will meet all application requirements, codes and safety standards.

1.3 Q.C. TESTING

Quality is an important factor of each phase of the manufacturing and development process. Each unit must pass rigorous quality tests as well as static and dynamic performance checks and a final inspection for quality of workmanship. A unit is allowed to ship only after acceptance of all aspects of Q.C. testing and inspection. This assures that you receive only those controls that meet our demanding quality standards.

1.5 STORAGE

Please take the following precautions if it should be necessary to store the control for any length of time.

☞ Store the control in a clean, dry (non-corrosive) environment that is protected from sudden variations in temperature and high levels of moisture, shock and vibration.

☞ The ambient temperature where the control is stored should be maintained between zero (0) and 65 degrees Centigrade.

☞ The control should be stored in the original package in order to protect from dust and dirt contamination.

SECTION 2
PRODUCT SPECIFICATIONS

2.1 GENERAL DESCRIPTION

The Model D1029 Bi-Directional Field Regulator was designed to control the Generator Field of a motor generator-driven geared or gearless Hoist Motor. Tachometer feedback is used to provide a closed loop speed regulated system. Armature feedback is used to provide fast response and added stability and an "S" Shaped Curve Reference is provided for smooth take offs and landings. These all combine to provide a high gain fast response system to precisely control armature voltage. The net result is precise control of the generator field current that will provide speed regulation to within point five percent (0.5%) of contract speed.

2.2 CONTROL SPECIFICATIONS

TRANSFORMER INPUT SUPPLY:	208/220 VAC 50/60 HZ
CONTROL INPUT SUPPLY:	208/220 VAC 50/60 HZ single phase 5 AMP Selected by minilink jumper located below F1 (lower PC board)
FIELD POWER SUPPLY (ACF-ACF) ISOLATED :	Adjustable at Transformer Secondary 110/130/150/165 VAC 7.5 AMP
FIELD POWER OUTPUT:	Zero (0) to ± 230 VDC 7.5 AMP
SPEED RANGE**:**	Greater than 500:1
SPEED REGULATION:	0.5% of contract speed (subject to tachometer specifications and RPM)
RESPONSE TIME:	One millisecond (1 ms)

2.3 CONTROL FEATURES OVERVIEW

The key features of the Model D1029 Bi-Directional Field Regulator are summarized here. Like all IPC Automation Bi-Directional Regulators, the D1029 offers superior control of the elevator's speed.

- ✓ Fully isolated control and power sections
- ✓ Four independent "S" curve adjustments
- ✓ Set Up Mode switch
- ✓ Four-turn potentiometer adjustments for accuracy
- ✓ Indicator lights for all inputs and diagnostics
- ✓ Independent adjustments for:

  6 Speed Settings
  2 Acceleration Rates
  4 Deceleration Rates

- ✓ Fault protection including independent indicators for each of the following:

  Tach loss
  Over Speed trip
  Over Current trip
  Direction fault
  Power Relay failure
  Leveling limit speed trip

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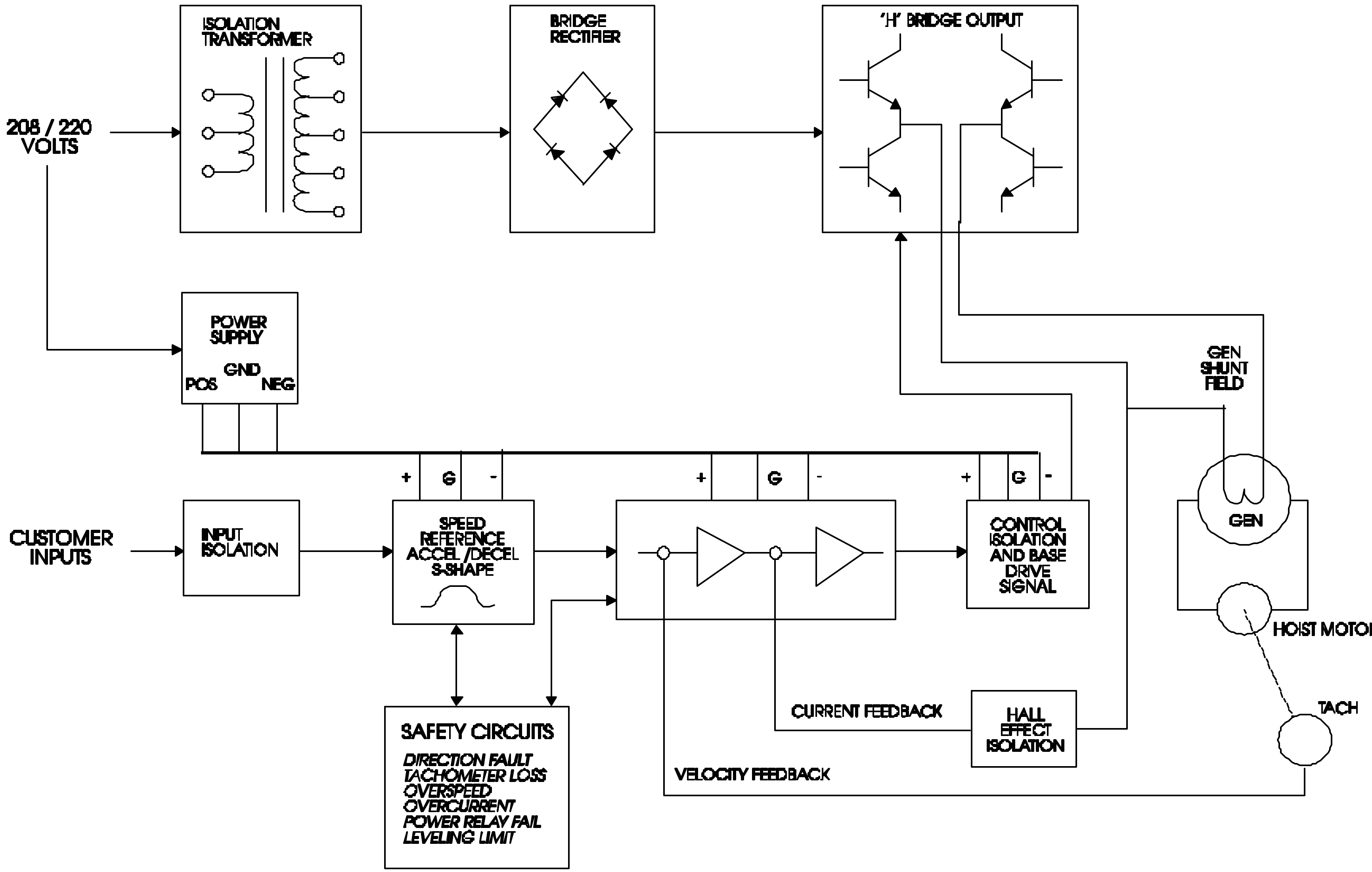
2.4 HIGH SPEED OPTION BOARD D1046

The Model D1046 is an optional board designed to facilitate customers who require more flexibility and control of their elevator system. The D1046 integrates easily with the D1029 through the use of a ribbon cable jumper. Once installed, the D1046 provides four (4) additional speed selections and four additional deceleration adjustments. This option is recommended for elevators with speeds above 600 FPM.

D1046 FEATURES

- ✓ Fully isolated control section
- ✓ Four (4) additional speed selections SP6 through SP9
- ✓ Four additional deceleration adjustments DCC5 through DCC8
- ✓ Speed select/DECEL select lock-out. Only the highest selected speed input and DECEL input is used, even when two or more are selected.
- ✓ Seamless integration with the Model D1029

BLOCK DIAGRAM MODEL D1029 BI-DIRECTIONAL GENERATOR FIELD CONTROL



SECTION 3
THE FRONT PANEL

3.1 DIAGNOSTIC INDICATORS

The Model D1029 features a variety of color-coded indication lights to allow a quick assessment of control performance and status. Green lights indicate normal functionality and show what speed reference inputs, rate adjustments and input commands are called in at any time. Yellow lights indicate an area of concern such as an out of regulation condition, relevel limit or control disable. Red lights indicate a fault or trip condition and shut down the control.

3.2 STATUS INDICATORS

CONTROL POWER (GREEN): Indicates the control power is on and that there is sufficient power to operate the control.

FIELD POWER (GREEN): Indicates that the CR1 Field Power relay is pulled in and the secondary voltage ACF is being applied at TB5 to the field power bridge.

RUN INPUT (GREEN): Indicates that the control has a run contact input. Field power output is now enabled.

U/D INPUT(GREEN): Indicates that UP or DN is pulled in and the control logic is correct for that direction.

OUT OF REG(YELLOW): Indicates that the tachometer voltage is not equal to the reference voltage. Required speed cannot be maintained when the control is producing full output.

RELEVEL LIMITATION (YELLOW): Indicates that the releveling over speed circuit is enabled and the relevel over speed trip limit is set to 10% of contract speed.

AUTO RESET(YELLOW): Indicates the auto reset circuit is energized by the AR contact. The auto reset cycle is initiated when the RUN contact is removed and the AR contact is energized. The auto reset will take approximately two seconds.

3.3 FAULT CONDITIONS

The control monitors certain conditions that may cause faulty operation of the machine. An instantaneous shut down will occur when a fault condition is detected. To aid in set up and troubleshooting, the fault circuits will latch. You may reset the control after a trip condition has occurred by pulling in the Auto Reset (after removing RUN) or by disconnecting the control power. The direction, tach loss, overspeed and leveling limit trips can be disabled by placing a jumper across the trip disable test points during set up.

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IT IS DANGEROUS TO RUN WITH THE DISABLE TESTPOINTS JUMPERED. REMOVE THE DISABLE JUMPER BEFORE PUTTING THE CAR IN SERVICE.

DIRECTION (RED): Indicates and disables the control when the tachometer's direction is different from the direction called for by the UP/DN relays. A direction fault trip will occur if, for example, the UP relay is energized and the car should move at more than 10% of contract speed in the DN direction.

TACH LOSS (RED): The Tach Loss circuit is designed to detect a complete loss of tachometer feedback voltage when the armature voltage is approximately equal to contract loop voltage. Problems that will not be detected by this circuit such as slippage of the Tach or other Tach malfunctions may cause a reduction in tach feedback voltage causing an overspeed condition. This circuit relies on proper setting of the armature feedback. The tach loss circuit is designed to shut down the control in case of zero tachometer voltage as long as the armature voltage exceeds ± 3 volts at the armature FB testpoint.

OVER SPEED (RED): The over speed trip is set at 110% of the speed reference or at 10% of the speed reference when the LL contact is pulled in. The over speed circuit will latch if the tachometer feedback exceeds the speed reference by 1.00 volt. During re-leveling, when the "LL" contact is pulled in, the over speed circuit will latch if the scaled tachometer feedback exceeds 1.00 volt.

OVER CURRENT (RED): The control will trip instantaneously on over current if the output exceeds the control rating by more than 50%. The maximum output of the control should never exceed the output rating of the control (7.5 Amps) during normal operation.

POWER RELAY FAILURE (RED): Indicates that the CR1 field power relay has failed. The CR1 relay disconnects the AC power from the field power bridge while in its normally open state. The control will not be enabled the next time the RUN contact is pulled in if the CR1 relay should weld closed. When this fault exists the FIELD POWER and POWER RELAY FAILURE lights will indicate a welded relay.

CAUTION: The CR1 relay on the control board is a secondary field power disconnect relay. Any fault condition will drop out the enable relay and the CR1 field power relay to disconnect AC field power. The CR1 relay should not be used as a primary field power "make" contact. **The RUN contact should always be energized before the customer AC power relay is energized in order to protect the CR1 relay.**

NOTE: POWER RELAY FAILURE is NOT resettable. The CR1 Field Power Relay must be replaced if this fault should occur.

CONTROL DISABLE (YELLOW): The control disable light indicates that one of the fault circuits has tripped and that the control is disabled. A set of enable contacts are available for use in customer enable circuitry. The enable contacts will open when the control is disabled and a fault condition has occurred. These contacts are rated at 110 volts AC at 1 amp.

3.4 ADJUSTMENTS

SPEEDS - SP1 THROUGH SP5

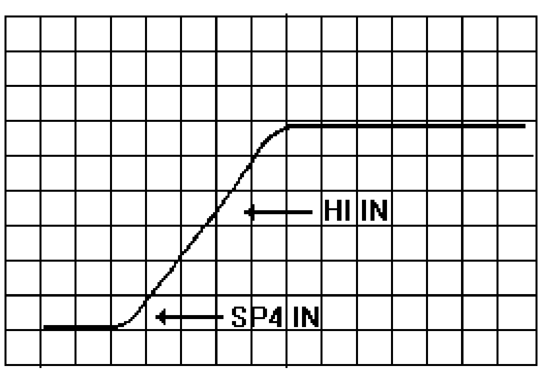
These potentiometers are used to set the speeds that will be used by the elevator. All speed settings will be referred to as a percentage of contract speed. The Model D1029 uses a speed setting of ten (10.00) volts at the REF IN testpoint to represent a contract speed call. The speed ranges are described as follows:

SPEED	RANGE OF POTENTIOMETER (% Contract Speed)	RANGE OF VOLTAGE AT REF IN TESTPOINT
SP1	0 to 15 %	0 to 1.5 Volts
SP2	0 to 25 %	0 to 2.5 Volts
SP3	0 to 50 %	0 to 5.0 Volts
SP4	0 to 99 %	0 to 9.9 Volts
SP5	0 to 99 %	0 to 9.9 Volts
HI	FIXED 100%	10.00 Volts

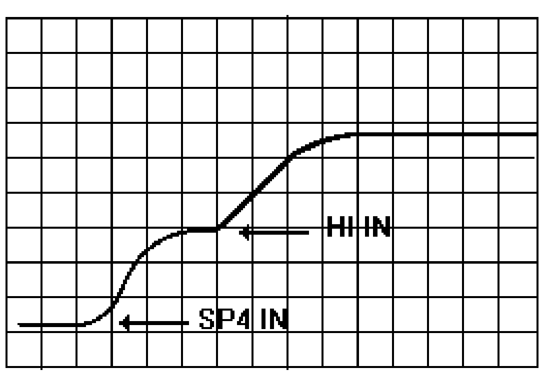
TABLE ONE

Speed points can be preset by closing the respective speed contact and measuring the voltage at the REF IN testpoint.

The control will respond to the highest speed selected when multiple speed contacts are closed. This allows for the overlapping of contacts when selecting speeds. If multiple speeds are to be used during acceleration, the higher speed should be selected prior to reaching the previously selected speed setpoint. This procedure will minimize the possibility of a transitional bump occurring. The following curves represent a properly sequenced speed selection and an improperly sequenced speed selection.



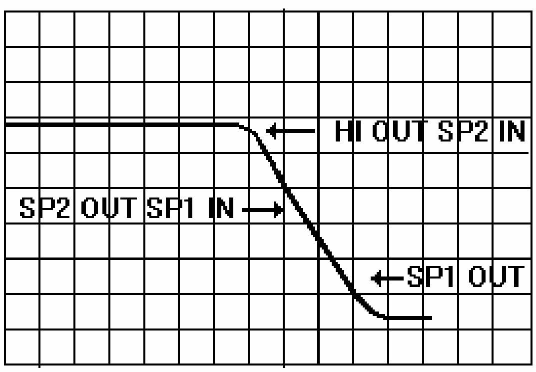
Properly Sequenced Selection



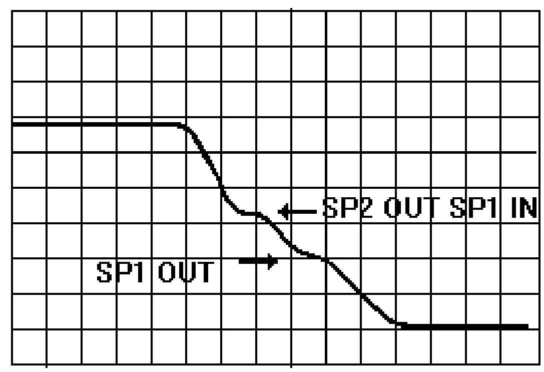
Improperly Sequenced Selection

MULTIPLE SPEEDS DURING DECELERATION

To maintain a smooth deceleration curve, slow down speeds should be dropped out prior to actually reaching that speed on the deceleration ramp of the S-curve. A transitional bump will occur if a slow down speed is dropped after its speed has already been reached. The following curves represent a properly sequenced speed selection and an improperly sequenced speed selection.



Properly Sequenced Selection



Improperly Sequenced Selection

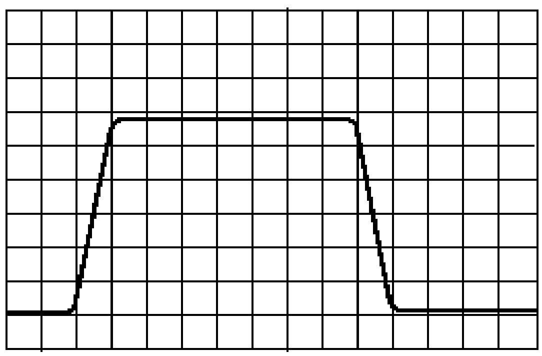
FIGURE TWO

RATES - ACC1,2 AND DCC1 - 4

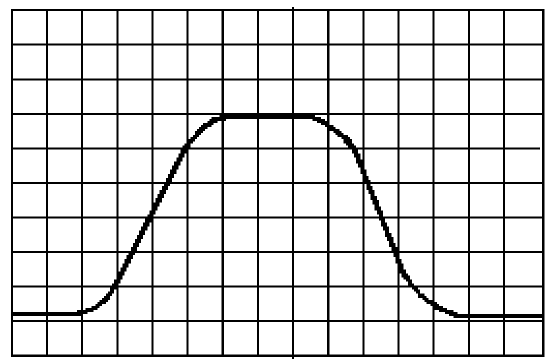
Two acceleration rates and four deceleration rates are available on the Model D1029 Bi-Directional Field Regulator. ACC1 and DCC1 will be followed if no rate contacts are closed. The rates are adjustable from approximately eight (8) seconds with the potentiometer fully counterclockwise (CCW) to one (1) second with the potentiometer fully clockwise (CW). The time intervals are defined from zero speed to contract speed on acceleration and contract speed to zero speed on deceleration.

S-SHAPED CURVE - ACC START, ACC END, DCC START, DCC END

The transitional *knees* of the S-curve are independently adjustable by their associated potentiometers. A clockwise rotation (CW) will make the *knee* sharper and a counterclockwise rotation (CCW) will make the *knee* smoother.



Sharp S-Curve All Pots Full CW



Smooth S-Curve All Pots Full CCW

FIGURE THREE

DEAD ZONE TIME DELAY

The DEAD ZONE TIME DELAY is initiated by opening the UP or DN contact when the RUN contact at TB1 is energized. The time delay is adjustable from 0.5 seconds with the DEAD ZONE TIME DELAY potentiometer fully counterclockwise (CCW) to 0 seconds with the potentiometer fully clockwise (CW). The REF OUT and TACH signals will continue to follow the deceleration ramp during the time delay. The REF OUT and TACH signals will rapidly discharge to zero volts at the end of the delay (see Figure Four).

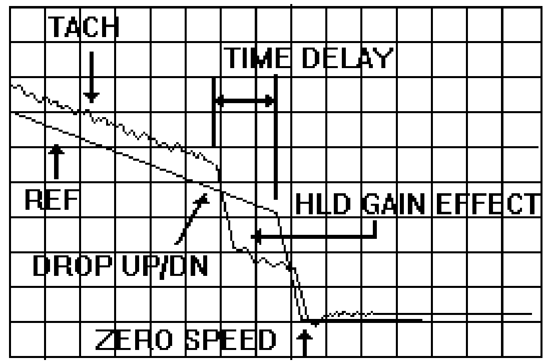
HOLD GAIN

The HOLD GAIN is used in conjunction with the DEAD ZONE TIME DELAY. The HOLD GAIN is initiated by opening the UP or DN contact when the RUN contact at TB1 is energized. The gain of the tachometer feedback is increased by a factor of two with the HOLD GAIN potentiometer fully counterclockwise (CCW) to a factor of ten with the potentiometer fully clockwise (CW). This effectively drives the tachometer signal closer to zero speed to produce a hard stop (see Figure Four C).

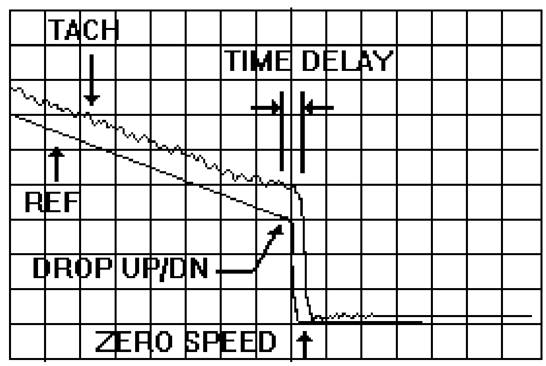
WARNING: AN OSCILLATION AROUND ZERO SPEED INDICATES THAT THE HOLD GAIN IS SET TOO HIGH. THIS POTENTIOMETER SHOULD BE SET JUST HIGH ENOUGH TO ELIMINATE DRIFT AS THE BRAKE SETS.

DEAD ZONE TIME DELAY AND HOLD GAIN

A. **Dead Zone Time Delay** - long (CCW)
Hold Gain - low (CCW)
NOTE: When UP/DN is dropped:
TACH is pushed slightly closer to zero by hold gain.
Both TACH & REF follow DECEL ramp during time delay.
Both TACH & REF drop to zero at the end of the delay.



B. **Dead Zone Time Delay** - short (CW)
Hold Gain - low (CCW)
NOTE: When "UP"/"DN" is dropped:
Both TACH & REF drop t zero almost immediately
Hold gain effect is minimal.



C. **Dead Zone Time Delay** - long (CCW)
Hold Gain - maximum (CW)
NOTE: When "UP"/"DN" is dropped:
TACH is pushed too quickly to zero by hold gain causing oscillation around zero speed.

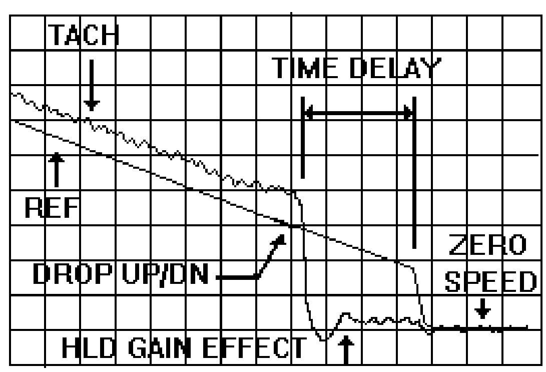


FIGURE FOUR

GAIN

The GAIN setting determines how quickly the control will correct for errors in the speed feedback loop (TACH vs REF OUT). The GAIN adjustment should be used to fine tune the system for regulation and stability. If the system tends to be too responsive the GAIN should be reduced by turning the potentiometer counterclockwise (CCW). If the control is slow to respond then the GAIN should be increased by turning the potentiometer clockwise (CW).

CONTRACT SPEED

The CONTRACT SPEED potentiometer scales the amount of tachometer feedback which the control uses to regulate the speed of the car. The CONTRACT SPEED potentiometer must be adjusted to obtain contract speed. This adjustment ensures proper calibration of the tachometer signal to the reference signal.

Note: The REF IN, REF OUT, and TACH testpoints **must** measure approximately10V at contract speed for proper operation of the control.

ARMATURE FEEDBACK

The armature feedback signal is used for stability. The ARM FEEDBACK potentiometer should be adjusted for 7.5 volts (measured at the ARM FB testpoint) when the car is running at contract speed. The system may be sluggish if there is too much armature feedback and over responsive if there is too little armature feedback. The armature feedback should never be set above 10 volts or below 4 volts when running at contract speed.

CAUTION: **A setting below ± 4V at contract speed can cause the tach loss circuit to become inoperative. Do not set the ARM FB testpoint below ± 4V at contract speed.**

STABILITY GAIN

The stability gain setting determines how quickly the control will correct for changes in the armature feedback signal versus changes in the reference signal (change in ARM FB vs change in REF OUT). This adjustment should be used to fine tune the stability of the system after the armature feedback signal has been properly adjusted. The system may be sluggish if the STB GAIN is set too high and unstable if the STB GAIN is set too low.

CURRENT

This potentiometer sets the range of current that the control can regulate and should be adjusted just high enough to assure that contract speed is obtained under all load conditions. Full speed may not be obtained due to current limiting if the CURRENT potentiometer is set too low. Instability in the system could also occur if the CURRENT potentiometer is set too low.

The adjustment of the CURRENT potentiometer is outlined in section five. However, some suggestions may be helpful.

1. The control cannot provide more current than the resistance of the load and bus voltage will permit. As shown by the following formula:

I (max) = [E (field power) x 1.4] / R (field)

Example: My AC Secondary Voltage (E field power) while using the X1 to X2 tap is 110 VAC
The resistance of my field (R field) is 40 Ohms.
The maximum current (I max) the control can provide with this configuration is
(110 VAC x 1.4) / 40 Ohms which equals 3.85 Amps

2. The control is current limited at 7.5 amps. This current limit point is determined by the setting of the CURRENT potentiometer (full clockwise equals current limiting at 7.5 amps).

3. Field connections are important to the response of the system. The lower the inductance of the field usually means the faster the response of the system. Parallel field connections are therefore desirable. However, paralleling the field windings decreases the resistance of the generator field and increases the field current for a given maximum field voltage. This may cause the current requirements of the generator field to exceed the maximum current rating of the control. MG sets with four fields should be connected in a series parallel configuration for best results.

4. Field voltage directly affects the field current. The maximum field voltage will be 1.4 times the secondary voltage of the field power isolation transformer connected to TB5. This voltage should be enough to supply adequate field current. If an insufficient amount of field current is supplied, you will not be able to obtain contract speed at full load.

5. The current required for contract speed can be determined during set up and initial test runs under **full load**. Calculate the secondary voltage for the AC Field Power Supply by using the following formula:

E (field power) = [I (max) x R (field)] / 1.414

Example: The maximum current I require with a fully loaded car going down is five amps (5A).
The resistance of my generator field is 34 Ohms.
I calculate my required secondary voltage to be:
5 Amps x 34 Ohms which equals 170 volts DC.
I calculate my AC voltage as 170 VDC / 1.4 which equals 120.2 VAC

The secondary voltage should be adjusted to select the nearest value transformer tap. This keeps the maximum DC field voltage within the calculated range and makes the system safer by limiting the maximum field current. In cases where the transformer tap falls between the calculated AC voltage, the next higher tap must be used to achieve the contract speed under all conditions. When this is the case, a resistance should be added in series with the shunt field to limit the field current, as shown in Figure Six as R3. In the example above, the required secondary voltage is 120.2 volts AC. The isolation transformer has taps for 110 volts AC and 130 volts AC. In this case I will want to use the 130 volt AC tap. This tap can be used safely by adding a resistance (R3) in series with the field. This resistance should be sized to limit the maximum field current to the value necessary to reach contract speed. The total resistance may be calculated by the following formula:

R(total) = [E(secondary tap voltage) x 1.4] - E (field power) /I(max)

Example: Since I have chosen to use the 130 volt AC transformer tap, I will first calculate the DC equivalent voltage by multiplying by 1.4 as follows. 130 volts AC x 1.414 equals 183.82 volts DC. Next, I subtract the DC field power voltage from the available DC voltage (from the transformer tap chosen). This voltage must now be dropped across the resistor I will add 183.82 volts DC minus 170 volts DC equals 13.82 volts DC. I then divide this voltage by my maximum field current of 5 Amps. 13.82 volts DC/5 Amps equals 2.76 Ohms
This is the value of the resistor that I should put in series with the generator field.

5. The field voltage and any added resistance will definitely affect the system performance. While it is good practice to limit the AC voltage to be just high enough to reach contract speed at full loads, the performance may be limited under certain conditions. A low line voltage may prevent the machine from reaching contract speed. Low line voltage may also prevent fast acceleration ramps and round off the top of the curve. This low line voltage will limit the maximum current to the field, which will limit the maximum loop voltage and ultimately limit the system torque at higher speed. On the other hand, if the voltage is too high, the control must limit the current and this can cause system instability. ***The AC voltage tap selected on the transformer should never exceed the calculated value by more than 30%.***

3.5 TEST POINTS

Test points are available as aids for set up and adjustment of the control.

COMMON

All of the measurements made during the set up and adjustment of the control should be referenced to this testpoint unless otherwise noted. The negative lead of the multimeter should be connected to this testpoint for all measurements.

TACH

This testpoint monitors the tachometer feedback. The tachometer feedback should be set to positive 10.00 volts while running at contract speed in the UP direction. This testpoint is also used to monitor the tachometer pattern on an oscilloscope.

ARM FB

This testpoint is used to set the scale of the armature feedback used in the stability circuits. The armature feedback should be set to positive 7.5 volts while running at contact speed in the UP direction. The armature feedback may be fine tuned for maximum stability of the system after the elevator system is fully functional. It is important that the armature feedback signal is positive in the UP direction and negative in the DN direction.

CAUTION: **The armature feedback voltage should never be set for less than 4 volts at contract speed. The tach loss circuit may become inoperative if the armature feedback is set too low.**

REF IN

The REF IN testpoint can be used to preset speed points SP1 through SP5. Any speed point can be adjusted simply by closing its respective contact and reading the voltage at the REF IN testpoint. The RUN and UP/DN contacts do not have to be energized for this adjustment. The D1029 uses 10.00 volts at the REF IN testpoint to represent contract speed. To set a speed point to 50% of contract speed, you would set the voltage at the REF IN testpoint to 5 volts.

FIELD CURRENT

The FIELD CURRENT testpoint monitors field current and is calibrated so one (1) volt is equal to one (1) amp of field current. Like all of the other testpoints the voltage will be positive in the UP direction and negative in the DN direction.

REF OUT

This testpoint monitors the reference out of the S-Shaped Curve circuit, which is the ultimate reference the system will follow. This testpoint is used to monitor the reference pattern on an oscilloscope.

DISABLE

The DISABLE testpoints are available for use by the set up person to aid in the initial set up and inspection of the control. The DISABLE testpoints (TP7 & TP8) are located in the top right hand corner of the control board (top board) to the right of the fault condition LED indicators. A clip lead placed across the DISABLE testpoints will prevent a control shut down caused by the DIRECTION, TACH LOSS and OVER SPEED faults. The fault condition indicators will still be functional to aid in detecting and adjusting for faults during set up.

When setting up the control, two misadjustments that commonly cause the unit to trip are:

- ✓ Pulling in the leveling contact too early
- ✓ Rapid reversing of the UP and DN inputs before the car has stopped.

The control will trip on OVER SPEED if the LL contact is pulled in prior to reaching a leveling speed. It is important to note that the over speed trip point is preset to 10% of contract speed when the LL contact is pulled in.

The control will trip on a DIRECTION fault if there is a rapid reversal of the UP and DN inputs before the car has stopped. Releveling before stopping will cause a direction fault trip.

WARNING: **IT IS DANGEROUS TO OPERATE THE CAR WITH THE DISABLE TEST POINTS JUMPERED AND SAFETY SHUT DOWNS DISABLED. THE DISABLED JUMPER MUST BE REMOVED BEFORE PUTTING THE CAR INTO SERVICE.**

THE JUMPER ACROSS THE DISABLE TEST POINTS SHOULD BE USED IN THE SET UP MODE BY AN AUTHORIZED SERVICE PERSON AND <u>MUST</u> BE REMOVED BEFORE THE CAR IS PUT INTO SERVICE.

3.6 AUTO/SET UP SWITCH

The AUTO/SET UP switch is used as a set up and troubleshooting aid. During normal operation of the control, the switch should be left in the AUTO position. Setting the switch to the SET UP position allows the elevator to run without using the tachometer feedback signal to regulate speed. When the control is in the SET UP mode the speed regulation will be poor, all of the fault trips will be operational except for TACH LOSS. This will allow you to troubleshoot tachometer signal problems, which may be the cause of poor regulation, or fault trip problems.

WARNING : **THE ELEVATOR SYSTEM SHOULD NEVER BE PUT IN SERVICE WITH THE D1029 IN SET UP MODE. THE TACH LOSS CIRCUIT IS INOPERATIVE IN THE SET UP MODE. THE SET UP/AUTO SWITCH MUST BE SET TO AUTO BEFORE THE CAR IS PUT IN SERVICE.**

SECTION FOUR
INSTALLATION INSTRUCTIONS

4.1 CONTROL INPUTS

The control circuitry is fully isolated from the input contact circuitry making the D1029 highly immune to external noise. The contact circuitry operates from 24 volts DC supplied from the V+ terminal on TB1. The contacts are low voltage and conduct approximately 0.01 amps. Fully enclosed relays with good wiping action are suggested for selection contacts, to protect against malfunctions due to dirt or dust.

WARNING: **THE BI-DIRECTIONAL FIELD REGULATOR SHOULD BE INSTALLED, ADJUSTED AND SERVICED BY QUALIFIED ELECTRICAL MAINTENANCE PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL EQUIPMENT IN THE ELEVATOR SYSTEM; PERSONAL INJURY AND/OR EQUIPMENT DAMAGE MAY OCCUR IF INDIVIDUALS ARE NOT FAMILIAR WITH THE HAZARDS RESULTING FROM IMPROPER OPERATION.**

WARNING: **CONTROLLER EQUIPMENT IS AT LINE VOLTAGE WHEN AC POWER IS CONNECTED AND INTERNAL CAPACITORS REMAIN CHARGED AFTER POWER IS REMOVED FROM THE BI-DIRECTIONAL FIELD REGULATOR. IT IS IMPORTANT THAT AC POWER IS REMOVED FROM THE UNIT FOR A MINIMUM OF FIVE MINUTES BEFORE IT IS SAFE TO TOUCH THE INTERNAL PARTS OF THE CONTROL. PERSONAL INJURY MAY RESULT UNLESS POWER IS REMOVED.**

WARNING: **THE USER IS RESPONSIBLE FOR CONFORMING WITH THE NATIONAL ELECTRICAL CODE WITH RESPECT TO MOTOR, CONTROLLER AND OPERATOR DEVICE INSTALLATION, WIRING AND START-UP. THE USER IS ALSO RESPONSIBLE FOR UNDERSTANDING AND APPLYING ALL OTHER APPLICABLE LOCAL CODES WHICH GOVERN SUCH PRACTICES AS WIRING PROTECTION, GROUNDING, DISCONNECTS AND OVER CURRENT PROTECTION.**

RUN CONTACT

The RUN contact at TB1 must be closed in order to enable the control. The control's output will be immediately disabled if the RUN contact is opened. The RUN contact must be closed before the customer AC power relay is pulled in. **The RUN contact should be opened whenever the car is stopped or the doors are opened.**

UP/DN

Either the UP contact or the DN contact must be energized to call for a direction. The control will not be enabled if both UP and DN are energized.

SPEED CONTACTS SP1-SP5 AND HI

These contacts are internally controlled by logic to respond to the highest speed contact closed. The control will only respond to the highest speed and transfer to the next highest upon dropping out of the higher numbered contact. For example, if SP1, SP2, SP4 and HI are pulled in, the control will respond to HI and operate at contract speed. When HI drops out with SP1, SP2 and SP4 still in, the control will respond to SP4 and will operate at the speed set at SP4.

ACC/DCC

These contacts select the acceleration and deceleration rates. The control will respond to ACC1 or DCC1 if no acceleration or deceleration contacts are closed. These contacts are also internally controlled by logic to respond to the highest ACC and DCC contact closed. For example if DCC2, DCC3 and DCC4 are pulled in, the control will respond to the rate set by DCC4. When DCC4 drops out, with DCC2 and DCC3 still in, the control will respond to DCC3.

L.L.

The Leveling Limit contact will scale the over speed trip point to 10% of the initial trip point setting. This is provided so that an over speed condition can be detected during leveling when speeds are typically 10% of contract speed.

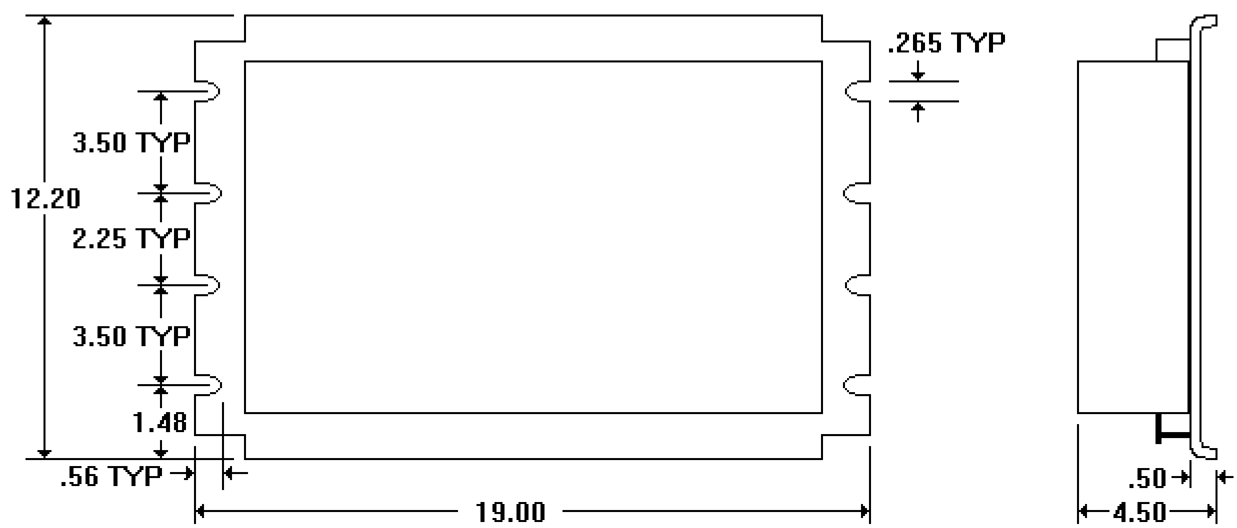
AUTO RESET

When this contact is closed, the control will enter into an auto reset mode. All fault conditions except POWER RELAY FAILURE will reset by dropping the RUN contact for approximately three seconds.

TACHOMETER

The control will accept a clean tachometer signal from 15 to 150 volts DC at full speed. The tachometer-input signal must be free of noise to get acceptable regulation. For best results, the tachometer should be coupled directly with the hoist motor shaft and properly aligned for minimal noise. It is also important to shield the tachometer wire at the D1029 control end only.

Note: It is not advisable to use any material that is flexible, such as rubber or soft plastics when coupling the tachometer to the motor shaft. These materials tend to create a noise or oscillation problem in the car by introducing ripple on the tachometer signal.



REGULATOR PHYSICAL DIMENSIONS

Length: 19.00 inches **Width:** 12.20 inches **Height:** 4.50 inches

FIGURE FIVE

4.2 POWER CONNECTIONS

The following section describes the connections to be made in order to properly connect the control to the elevator system power connections.

OVER VOLTAGE BUSS RESISTOR

A 50 Ohm 250 Watt resistor (typically supplied by IPC) must be connected to the terminals marked RES on TB201. This resistor protects the D1029 field power buss from over voltage conditions, which are caused by sudden power loss or a drastic change in direction.

WARNING: **THE OVER VOLTAGE RESISTOR MUST BE INSTALLED AT ALL TIMES DURING OPERATION OF THE CONTROL OTHERWISE, SEVERE DAMAGE TO THE CONTROL WILL OCCUR.**

F+ F-

Connect the positive side of the generator field to the F+ terminal on TB201. Connect the negative side of the generator field to the F- terminal on TB201. If these connections are reversed the direction of the car will usually reverse. Damage to the control could possibly occur from an improper connection.

A+ A-

Connect the positive motor armature feedback lead to the A+ terminal of TB4. Connect the negative motor armature feedback lead to the A- terminal of TB4. The connections should be polarized so a positive voltage appears on the ARM FB testpoint when running in the UP direction. Improper connection will cause oscillation and fault trips to occur.

AC CONTROL POWER

Apply 208 or 220 volts AC to the terminals marked AC on TB3. This is the AC power input for the control circuitry on the D1029. This input is not phase sensitive.

Note: The minilink jumper on the power board (bottom board) must be set to the appropriate control power voltage being supplied.

FIELD AC POWER

The connections to the ACF terminals on TB5 are from the customer's AC field power relays. These relays are attached to the secondary taps on the field power isolation transformer (typically supplied by IPC). These connections supply the AC power for the output section of the D1029. The maximum output voltage and current are determined by the secondary tap connections to the ACF terminals.

SECTION FIVE
SET-UP PROCEDURE

WARNING: **THE BI-DIRECTIONAL FIELD REGULATOR SHOULD BE INSTALLED, ADJUSTED AND SERVICED BY QUALIFIED ELECTRICAL MAINTENANCE PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL EQUIPMENT IN THE ELEVATOR SYSTEM; PERSONAL INJURY AND/OR EQUIPMENT DAMAGE MAY OCCUR IF INDIVIDUALS ARE NOT FAMILIAR WITH THE HAZARDS RESULTING FROM IMPROPER OPERATION.**

WARNING: **THE BI-DIRECTIONAL FIELD REGULATOR IS AT LINE VOLTAGE WHEN AC POWER IS CONNECTED AND INTERNAL CAPACITORS REMAIN CHARGED AFTER POWER IS REMOVED FROM THE UNIT. IT IS IMPORTANT THAT AC POWER IS REMOVED FROM THE UNIT FOR A MINIMUM OF FIVE MINUTES BEFORE TOUCHING THE INTERNAL PARTS OF THE REGULATOR. PERSONAL INJURY MAY RESULT UNLESS POWER IS REMOVED AND TIME IS ALLOWED FOR DISCHARGE.**

WARNING: **THE USER IS RESPONSIBLE FOR CONFORMING WITH THE NATIONAL ELECTRICAL CODE WITH RESPECT TO MOTOR, CONTROLLER AND OPERATOR DEVICE INSTALLATION, WIRING AND START-UP. THE USER IS ALSO RESPONSIBLE FOR UNDERSTANDING AND APPLYING ALL OTHER APPLICABLE LOCAL CODES WHICH GOVERN SUCH PRACTICES AS WIRING PROTECTION, GROUNDING DISCONNECTS AND OVERCURRENT PROTECTION.**

WARNING: **THE MACHINE SHOULD <u>NEVER</u> BE USED "IN SERVICE" WHILE IN THE SET UP MODE. THE SPEED WILL NOT BE ACCURATELY REGULATED AND THE TACH LOSS CIRCUIT IS DISABLED. WHILE RUNNING THE CAR IN THE SET UP MODE, KEEP A SAFE DISTANCE FROM THE TERMINAL LANDINGS, VISUALLY OBSERVING THE CAR AT ALL TIMES.**

NOTE:All adjustment potentiometers have a range of four (4) turns with a clutch (audible "click") at the end of the range to ensure accurate adjustment of the bi-directional field regulator.

5.1 STATIC TESTS: (*MG SET NOT RUNNING*)

In this section, an estimate of the armature voltage and the output voltage of the regulator will be calculated for several speeds. This will help to ensure a proper set up and calibration of the regulator.

5.1.1. Measure the generator field resistance attached to **F+** and **F-**. Check the fields for grounds with a megger or other instrument for this purpose. No grounds should occur in the field circuit.

Write measured resistance of the generator field here _____________ (ohms).

5.1.2. Use the table below to select the appropriate transformer secondary tap. Select the lowest AC tap available for the resistance you measured.

GENERATOR FIELD RESISTANCE	TRANSFORMER SECONDARY TAP	MAXIMUM DC FIELD VOLTAGE AVAILABLE
20 To 150 Ohms	**X1 To X2** 110 Volts AC	156 Volts DC
25 To 162 Ohms	**X1 To X3** 130 Volts AC	184 Volts DC
28 To 210 Ohms	**X1 To X4** 150 Volts AC	212 Volts DC
30 To 250 Ohms	**X1 To X5** 165 Volts AC	233 Volts DC

TABLE TWO

5.1.3. Change your selection only if you know that the DC field voltage available is not enough to reach contract speed.

A. **Write transformer tap you selected here: ___________.**

B. **Write the maximum DC field voltage available here: ___________VDC**

5.1.4. Table Three will be used to help determine the proper reference voltage setting you will need for a given elevator speed.

CONTRACT SPEED IN FEET PER MINUTE

% Of Contract Speed	250	300	350	400	450	500	550	600	700	800	Speed Setting (Volts)	Arm FB Setting (Volts)
5.00%	13	15	18	20	23	25	28	30	35	40	0.50	0.38
10.00%	25	30	35	40	45	50	55	60	70	80	1.00	0.75
15.00%	38	45	53	60	68	75	83	90	105	120	1.50	1.13
20.00%	50	60	70	80	90	100	110	120	140	160	2.00	1.50
25.00%	63	75	88	100	113	125	138	150	175	200	2.50	1.88
30.00%	75	90	105	120	135	150	165	180	210	240	3.00	2.25
35.00%	88	105	122	140	158	175	193	210	245	280	3.50	2.63
40.00%	100	120	140	160	180	200	220	240	280	320	4.00	3.00
45.00%	113	135	158	180	203	225	248	270	315	360	4.50	3.38
50.00%	125	150	175	200	225	250	275	300	350	400	5.00	3.75
55.00%	138	165	193	220	248	275	303	330	385	440	5.50	4.13
60.00%	150	180	210	240	270	300	330	360	420	480	6.00	4.50
65.00%	163	195	228	260	293	325	358	390	455	520	6.50	4.88
70.00%	175	210	245	280	315	350	385	420	490	560	7.00	5.25
75.00%	188	225	263	300	338	375	413	450	525	600	7.50	5.63
80.00%	200	240	280	320	360	400	440	480	560	640	8.00	6.00
85.00%	213	255	298	340	383	425	468	510	595	680	8.50	6.38
90.00%	225	270	315	360	405	450	495	540	630	720	9.00	6.75
95.00%	238	285	333	380	428	475	523	570	665	760	9.50	7.13
100.00%	250	300	350	400	450	500	550	600	700	800	10.00	7.50

TABLE THREE

Table Three will now be used to help determine the various voltage settings you will need to setup the control for your elevator.

A. **Write the contract speed here:** _____________**FPM.**

B. **Write the inspection speed here:** _____________**FPM.**

Find your contract speed in the first row of Table Three. Now read down the column that you just located until you find your inspection speed. Now read across the row to the right to the first shaded column. This is the speed reference voltage. The **SP3** pot is typically used for inspection speed. This is the voltage setting that you will adjust the **SP3** pot for.

C. **Write the speed reference voltage here:** ____________**VDC.**

Now read the rightmost shaded column. This is the Armature Feedback voltage setting.

D. **Write the armature feedback voltage here:** ____________**VDC.**

Now read across the row, which contains the inspection speed to the leftmost shaded column. This is the percentage of the contract speed or inspection speed percentage.

E. **Write the inspection speed percentage here:** ___________**%.**

5.1.5. Now locate any other speeds you may require for your application by reading up and down the same contract speed column and then reading across to the shaded columns to determine the corresponding speed reference voltage.

A. **Write the elevator speed for SP1 here:** ____________**FPM**

B. **Write the speed reference voltage for SP1 here:** _______**VDC.**

C. **Write the elevator speed for SP2 here:** ____________**FPM**

D. **Write the speed reference voltage for SP2 here:** _______**VDC.**

E. **Write the elevator speed for SP4 here:** ____________**FPM**

F. **Write the speed reference voltage for SP4 here:** _______**VDC.**

G. **Write the elevator speed for SP5 here:** ____________**FPM**

H. **Write the speed reference voltage for SP5 here:** **_______VDC.**

5.1.6. Find the resistance value of the field (measured in step 1) in the first column of Table Four. Read across to the column with the transformer tap you selected in step 5.1.3 to determine the estimated field current required for contract speed.

Write estimated field current for contract speed here___________AMPS.

ESTIMATED FIELD CURRENT (AMPS)

FIELD RESISTANCE IN OHMS	X1 TO X2 110 VAC	X1 TO X3 130 VAC	X1 TO X4 150 VAC	X1 TO X5 165 VAC
20	7.78	×	×	×
23	6.76	7.99	×	×
25	6.22	7.35	×	×
28	5.56	6.57	7.58	×
30	5.18	6.13	7.07	7.78
40	3.89	4.60	5.30	5.83
50	3.11	3.68	4.24	4.67
80	1.94	2.30	2.65	2.92
100	1.56	1.84	2.12	2.33
125	1.24	1.47	1.70	1.87
150	1.04	1.23	1.41	1.56
175	0.89	1.05	1.21	1.33
200	0.78	0.92	1.06	1.17
225	0.69	0.82	0.94	1.04

TABLE FOUR

YOU ARE NOW READY TO BEGIN SET UP

5.2 SET UP: (*MG SET NOT RUNNING*)

The following section will adjust the D1029 to the settings determined in the previous section.

5.2.1. Connect the regulator to system. Typical connections are shown in Figures Six and Seven. See warnings on page 1.

5.2.2. Switch the regulator to the **SET UP** mode; with the **MG set stopped** (See Figure Eight).

5.2.3. Turn all potentiometers on the front panel fully counter clockwise for minimum settings. Turn all S-Curve settings fully clockwise to sharp.

5.2.4. Set the minilink jumper on the control board (top board) to the appropriate voltage setting (208 or 220 Volts). Apply control and field power to the regulator.

5.2.5. Attach the positive lead of a digital voltmeter to the **REF IN** testpoint. Attach the negative lead of the voltmeter to the **COMMON** testpoint.

5.2.6. Close the **SP1** contact (jumper terminal **+V** to terminal **SP1**). Adjust the **SP1** potentiometer until you measure the voltage value you selected in step 5.1.5B.

5.2.7. Open the **SP1** contact and close the **SP2** contact (jumper terminal **+V** to terminal **SP2**). Adjust the **SP2** potentiometer until you measure the voltage value you selected in step 5.1.5D.

5.2.8. Open the **SP2** contact and close the **SP4** contact (jumper terminal **+V** to terminal **SP4**). Adjust the **SP4** potentiometer until you measure the voltage value you selected in step 5.1.5F.

5.2.9. Open the **SP4** contact and close the **SP5** contact (jumper terminal **+V** to terminal **SP5**). Adjust the **SP5** potentiometer until you measure the voltage value you selected in step 5.1.5H.

5.2.10. Open the **SP5** contact and close the **SP3** contact (jumper terminal **+V** to terminal **SP3**). Adjust the inspection speed pot (**SP3**) until you measure the voltage value you selected in step 5.1.4C.

5.2.11. Turn the **CURRENT** potentiometer two turns clockwise to mid-range. Turn the **CONTRACT SPEED** potentiometer two turns clockwise to mid range.

5.2.12. Turn the tachometer by hand in the direction that the tachometer will rotate while the car is traveling in the UP direction. Note the polarity of the tachometer signal.

5.2.13. Connect the positive lead of the tachometer to the **+UP** terminal of the D1029 (TB2). Connect the negative lead of the tachometer to the **-** (minus) terminal on the D1029 (TB2). Connect the shield of the tachometer cable to the **GND/SHD** terminal on the D1029 (TB2).

Note: The shield of the tachometer cable should be connected to the D1029 only. Do **not** connect the shield at the tachometer side.

5.3 SET-UP (*MG SET RUNNING*)

The following steps are to be performed with the elevator car in the middle of the shaft way. The D1029 should be in **SET UP** mode (**AUTO/SET UP** switch to the **SET UP** position). The Motor Generator set should be running and the car should be prepared to call for a run at inspection speed.

The proper sequencing of contact closure is essential for proper operation of the D1029. The following sequence is recommended:

1. AC control power is applied to the D1029.
2. The **RUN** contact is closed at TB1 of the D1029. Customer RUN contacts may also close at this time.
3. Customer's AC field power contacts are closed, applying secondary voltage from the isolation transformer to the D1029 AC Field Power terminals.
4. Call for a direction by closing either the **UP** or **DN** contact at TB1 of the D1029.
5. Call for a speed by closing a speed contact (**SP1** through **HI**) at TB1 of the D1029.

WARNING: THE FOLLOWING STEPS SHOULD BE ACCOMPLISHED IN THE SET UP MODE WITH THE SW1 SWITCH IN THE SET UP POSITION. DO NOT ATTEMPT THIS PROCEDURE IN THE NORMAL RUNNING OR AUTO MODE.

5.3.1 Call for a run at inspection speed in the **UP** direction.

5.3.2 Determine the actual speed of the car with a hand-held tachometer.

5.3.3 Call for a run at inspection speed in the **DN** direction. Adjust the inspection speed by turning the **CURRENT** potentiometer clockwise until the speed is approximately equal to the speed in the UP direction.

5.3.4 Call for a run at inspection speed. Monitor the tachometer feedback voltage by placing the positive lead of a multimeter on the **TACH** testpoint and the negative lead of the multimeter on the **COMMON** testpoint. Adjust the **CONTRACT SPEED** potentiometer until the voltage is equal to the voltage at the **REF IN** testpoint.

5.3.5 Move the positive lead of the multimeter to the **ARM FB** testpoint. Call for a run in the **UP** direction at inspection speed. ***The voltage at the ARM FB testpoint must be positive***. If the voltage is negative, you must reverse the leads to **A+** and **A-** on TB4.

5.3.6 Adjust the **ARM FEEDBACK** potentiometer until the voltage is equal to the voltage value selected in step **5.1.4 D**. This voltage should be equal to the voltage at the **REF IN** testpoint multiplied by 0.75.

5.4 NORMAL RUNNING MODE

In this section, the D1029 will be put into the **AUTO** mode. The tachometer feedback and armature feedback voltages will be fine-tuned to achieve complete closed loop operation. The following steps require the use of a dual trace storage oscilloscope for maximum precision.

5.4.1 Open the customer RUN contacts. Open the customer AC Field Power contacts. Open the **RUN** contact at TB1 on the D1029. Turn off the control AC power and switch **SW1** to the **AUTO** position.

5.4.2 Adjust **ACC1**, **DCC1**, **ACC START**, **ACC END**, **DCC START**, and **DCC END** two turns clockwise to the center position.

5.4.3 Turn the **GAIN** potentiometer two turns clockwise to the center position.

5.4.4 Set up the oscilloscope as follows:

- Connect scope gnd (floating) to the **COMMON** test point.
- Connect the Channel 1 probe to the **REF OUT** test point.
- Connect Channel 2 probe to the **TACH** test point.
- Set the Volts/Division to 2V/division for both Channel 1 and Channel 2.
- Set the Time base to 0.1 sec/div.
- Set the display mode to Dual Trace (Ch1 & Ch2).
- Set the Storage mode to roll.
- Set both traces at one division above bottom graticule.

CURRENT AND CONTRACT SPEED CALIBRATION

5.4.5 Call for a run at low speed (i.e. **SP1**) in the **UP** direction. Observe the **REF OUT** and **TACH** signals on the oscilloscope. Both should be positive for the **UP** direction.

5.4.6 Call for a run at low speed in the **DN** direction. Observe the **REF OUT** and **TACH** signals on the oscilloscope. Both signals should be negative and of the same magnitude as in step 5.4.5.

5.4.7 Call for a run at high speed.

A. Monitor the **TACH** testpoint with a voltmeter.

B. Slowly adjust the **CURRENT** potentiometer clockwise (increasing the field current), until the voltage at the **TACH** testpoint stops increasing.

At this point the control is properly regulating speed and current. Turn the **CURRENT** potentiometer ½ turn more clockwise for headroom.

C. The signal at the **TACH** testpoint should now be equal in amplitude to the signal at the **REF OUT** testpoint at all speeds.

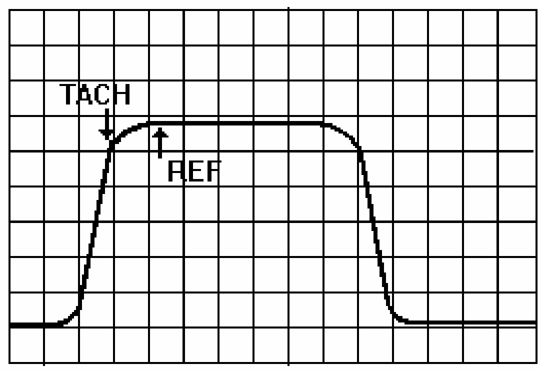
D. Using a hand-held tachometer, measure the actual **HI** speed on the sheave. The voltage at the **TACH** testpoint should be equal to 10 volts and the car should be running at contract speed.

E. Readjust the **CONTRACT SPEED** potentiometer to obtain the exact contract speed equal to 10V at the **TACH** testpoint, if necessary.

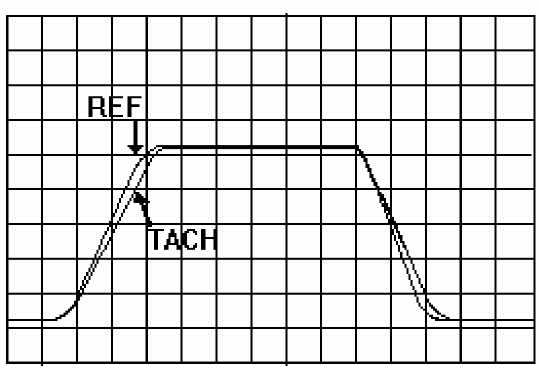
F. Check the **ARM FB** testpoint and verify that the voltage reading is 7.5V at contract speed.

5.4.8 Make a few long runs and a few short runs in both the **UP** and **DN** directions. Observe the oscilloscope and adjust the acceleration rates, deceleration rates, and transitional knees of the S-curve as required.

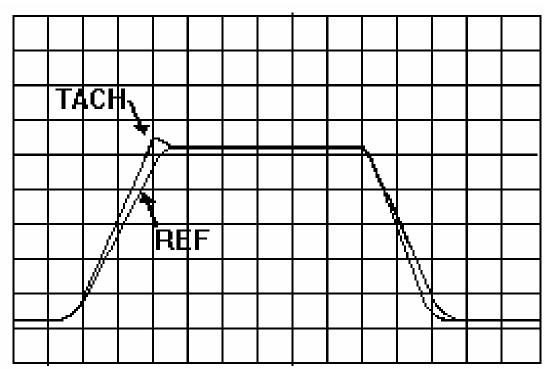
5.4.9 The following oscilloscope plots show the **TACH** (channel 2) and **REF OUT** (channel 1) testpoint signals. An ideal trace occurs when the tachometer and the reference signals track on top of each other over the entire run.



Ideal Trace - Properly Regulated



Sluggish / Slow Response



Oscillating / Over Response

FIGURE FIVE

5.5. FINE TUNING ADJUSTMENTS

Fine tuning the performance of the D1029 requires a good deal of trial and error. The following suggestions are to be used only as a guide. There are often many combinations of **ACCELERATION/ DECELERATION, GAIN, ARMATURE FEEDBACK**, and **STABILITY GAIN** settings that will produce a properly regulated **TACH** vs **REF OUT** pattern.

SLUGGISH RESPONSE

The **TACH** signal is lagging far behind the **REF OUT** signal. This is causing an **OUT OF REG** (out of regulation) condition. The elevator is slow reaching top speed and may take too long to reach the floor during deceleration.

TUNING PROCEDURE FOR SLUGGISH/SLOW RESPONSE:

1. Check and adjust the acceleration and deceleration rates because they may be too long.
2. Increase the **GAIN** potentiometer clockwise as required, observing the pattern.
3. If the **GAIN** potentiometer is full clockwise and the response is still sluggish, reset the **GAIN** potentiometer to the center position.
4. Monitor the **ARM FB** testpoint with a voltmeter.
5. Decrease the **ARM FEEDBACK** potentiometer by turning the pot counterclockwise slightly (½ volt on the **ARM FB** testpoint), observing the pattern.
6. Increase the **STB GAIN** potentiometer clockwise if the pattern becomes unstable.
7. Repeat steps 4 through 6 as required.

CAUTION: **AN ARMATURE FEEDBACK SETTING BELOW ± 4.0V AT CONTRACT SPEED CAN CAUSE THE TACH LOSS CIRCUIT TO BE INOPERATIVE DO NOT SET THE ARMATURE FEEDBACK TESTPOINT BELOW ± 4.0V AT CONTRACT SPEED.**

OVERSHOOT/INSTABILITY

In this case the **TACH** signal is often leading the **REF OUT** signal or oscillating around it. The control is correcting too quickly for changes causing the elevator to be unstable.

TUNING PROCEDURE FOR OSCILLATING/OVER RESPONSE

1. Check and adjust the acceleration rates because they may be too short.

2. Decrease the **GAIN** potentiometer counterclockwise as required, observing the pattern.

3. If the **GAIN** potentiometer is fully counterclockwise and the response is still too fast reset the **GAIN** potentiometer to the center position.

4. Increase the **STB GAIN** potentiometer clockwise, observing the pattern.

5. If the **STB GAIN** potentiometer is fully clockwise and the response is still unstable reset the **STB GAIN** potentiometer fully counterclockwise.

6. Monitor the **ARM FB** testpoint with a voltmeter.

7. Increase the **ARM FEEDBACK** potentiometer clockwise slightly, (½ volt on the **ARM FB** testpoint), observing the pattern.

8. Increase the **STB GAIN** potentiometer clockwise if the pattern becomes unstable.

9. Repeat steps 4 through 8 as required.

CAUTION: **THE ARM FB TESTPOINT SHOULD NEVER BE GREATER THAN ±10 VOLTS AT CONTRACT SPEED.**

DEAD ZONE TIME DELAY

The **DEAD ZONE TIME DELAY** potentiometer may be used to fine-tune the ride of the car during stopping. This circuit when coupled with the **HOLD GAIN** circuit will enable you to maintain control of the car during the critical time when the car has reached the landing zone and the brake must be set. The **DEAD ZONE TIME DELAY** circuit is active when **UP/DN** opens with the **RUN** contact at TB1 energized. The **REF OUT** and **TACH** signals will continue to follow the decel ramp for a period of time based on the setting of the **DEAD ZONE TIME DELAY** potentiometer. When the **UP/DN** contacts at TB1 drop and the **DEAD ZONE TIME DELAY** potentiometer is fully counterclockwise, the **TACH** and **REF OUT** will follow the deceleration ramp for 0.5 seconds. If the potentiometer is turned fully clockwise, the delay will be reduced to 0 seconds.

DEAD ZONE TIME DELAY ADJUSTMENT

START: Turn the **DEAD ZONE TIME DELAY** potentiometer fully counterclockwise.

INCREASE: When the stop is too long after **UP/DN** is opened.

DECREASE: When the stop is too hard after **UP/DN** is opened.

HOLD GAIN

The **HOLD GAIN** circuit is active when **UP/DN** opens at TB1 with the **RUN** contact at TB1 energized. This circuit increases the effect of the tachometer feedback signal when approaching zero speed to enable regulation of zero speed until the brake has set.

HOLD GAIN ADJUSTMENT

START: Turn the **HOLD GAIN** potentiometer fully counterclockwise.

INCREASE: When the car drifts at close to zero speed as the brake sets.

DECREASE: When the car oscillates around zero speed.

WARNING: **AN OSCILLATION AROUND ZERO SPEED WOULD INDICATE THE HOLD GAIN IS SET TOO HIGH. THIS POTENTIOMETER SHOULD BE SET JUST HIGH ENOUGH TO ELIMINATE DRIFT AS THE BRAKE SETS.**

5.6. SELECTING A HIGH SPEED CURRENT LIMITING RESISTOR

The maximum speed of the elevator is dependent on the amount of current available to the generator field. By limiting the amount of current available to the generator field, we can limit the maximum speed of the elevator. There are two methods of limiting the maximum current available. The first method is to select a tap of the Field Power Isolation Transformer (typically supplied by IPC) which supplies just enough voltage to the field and allows the car to attain contract speed in a worst case high speed run (empty car down or full car up). The second method is necessary when you must move to a higher tap on the transformer and now have more than enough voltage/current available and can exceed the contract speed in a worst case high speed run. When this is the case, you must insert a resistor in series with the generator field to limit the maximum current available.

The following pages contain tables that will be used to determine the value of the **HIGH SPEED CURRENT LIMITING RESISTOR** you must use to safely limit the current. In order to use the tables you will need to know the following:

A. The Field Power Isolation Transformer secondary tap selected in step 5.1.3 A.

B. The Generator Field Current at contract speed. This may be determined by placing the positive lead of a voltmeter on the **FIELD CURRENT** testpoint and measuring the voltage during a worst case high speed run. The field current is equal to the voltage measured at the testpoint (1V = 1A).

C. The Maximum DC Field Voltage at contract speed. This may be measured at the **F+** and **F-** terminals during a worst case high speed run.

After you have selected the proper table, read down the left-hand column and find your field current at contract speed. Next, read across to the column that indicates your field voltage at contract speed. The value listed at the cell you just located is the resistance for the **HIGH-SPEED CURRENT LIMITING RESISTOR (R3)** (See Figure 1). This value should be adjusted as necessary to make sure you still reach contract speed and to account for a drop in line voltage.

If your transformer tap is **X1** to **X2** **USE TABLE FIVE**

If your transformer tap is **X1** to **X3** **USE TABLE SIX**

If your transformer tap is **X1** to **X4** **USE TABLE SEVEN**

If your transformer tap is **X1** to **X5** **USE TABLE EIGHT**

DETERMINE THE VALUE OF THE HIGH SPEED CURRENT LIMITING RESISTOR
ISOLATION TRANSFORMER TAPS X1 TO X2 (110 VAC)

	FIELD VOLTAGE AT CONTRACT SPEED (Volts DC)										
FIELD I (Amps)	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**
1.00	55.54	50.54	45.54	40.54	35.54	30.54	25.54	20.54	15.54	10.54	5.54
1.25	44.43	40.43	36.43	32.43	28.43	24.43	20.43	16.43	12.43	8.43	4.43
1.50	37.03	33.69	30.36	27.03	23.69	20.36	17.03	13.69	10.36	7.03	3.69
1.75	31.74	28.88	26.02	23.17	20.31	17.45	14.59	11.74	8.88	6.02	3.17
2.00	27.77	25.27	22.77	20.27	17.77	15.27	12.77	10.27	7.77	5.27	2.77
2.25	24.68	22.46	20.24	18.02	15.80	13.57	11.35	9.13	6.91	4.68	2.46
2.50	22.22	20.22	18.22	16.22	14.22	12.22	10.22	8.22	6.22	4.22	2.22
2.75	20.20	18.38	16.56	14.74	12.92	11.11	9.29	7.47	5.65	3.83	2.01
3.00	18.51	16.85	15.18	13.51	11.85	10.18	8.51	6.85	5.18	3.51	1.85
3.25	17.09	15.55	14.01	12.47	10.94	9.40	7.86	6.32	4.78	3.24	1.70
3.50	15.87	14.44	13.01	11.58	10.15	8.73	7.30	5.87	4.44	3.01	1.58
3.75	14.81	13.48	12.14	10.81	9.48	8.14	6.81	5.48	4.14	2.81	1.48
4.00	13.89	12.64	11.39	10.14	8.89	7.64	6.39	5.14	3.89	2.64	1.39
4.25	13.07	11.89	10.72	9.54	8.36	7.19	6.01	4.83	3.66	2.48	1.30
4.50	12.34	11.23	10.12	9.01	7.90	6.79	5.68	4.56	3.45	2.34	1.23
4.75	11.69	10.64	9.59	8.53	7.48	6.43	5.38	4.32	3.27	2.22	1.17
5.00	11.11	10.11	9.11	8.11	7.11	6.11	5.11	4.11	3.11	2.11	1.11
5.25	10.58	9.63	8.67	7.72	6.77	5.82	4.86	3.91	2.96	2.01	1.06
5.50	10.10	9.19	8.28	7.37	6.46	5.55	4.64	3.73	2.83	1.92	1.01
5.75	9.66	8.79	7.92	7.05	6.18	5.31	4.44	3.57	2.70	1.83	0.96
6.00	9.26	8.42	7.59	6.76	5.92	5.09	4.26	3.42	2.59	1.76	0.92
6.25	8.89	8.09	7.29	6.49	5.69	4.89	4.09	3.29	2.49	1.69	0.89
6.50	8.54	7.78	7.01	6.24	5.47	4.70	3.93	3.16	2.39	1.62	0.85
6.75	8.23	7.49	6.75	6.01	5.27	4.52	3.78	3.04	2.30	1.56	0.82
7.00	7.93	7.22	6.51	5.79	5.08	4.36	3.65	2.93	2.22	1.51	0.79
7.25	7.66	6.97	6.28	5.59	4.90	4.21	3.52	2.83	2.14	1.45	0.76

7.50	7.41	6.74	6.07	5.41	4.74	4.07	3.41	2.74	2.07	1.41	0.74

TABLE FIVE

DETERMINE THE VALUE OF THE HIGH SPEED CURRENT LIMITING RESISTOR
ISOLATION TRANSFORMER TAPS X1 TO X3 (130 VAC)

FIELD VOLTAGE AT CONTRACT SPEED (Volts DC)

FIELD I (Amps)	130	135	140	145	150	155	160	165	170	175	180
1.00	53.82	48.82	43.82	38.82	33.82	28.82	23.82	18.82	13.82	8.82	3.82
1.25	43.06	39.06	35.06	31.06	27.06	23.06	19.06	15.06	11.06	7.06	3.06
1.50	35.88	32.55	29.21	25.88	22.55	19.21	15.88	12.55	9.21	5.88	2.55
1.75	30.75	27.90	25.04	22.18	19.33	16.47	13.61	10.75	7.90	5.04	2.18
2.00	26.91	24.41	21.91	19.41	16.91	14.41	11.91	9.41	6.91	4.41	1.91
2.25	23.92	21.70	19.48	17.25	15.03	12.81	10.59	8.36	6.14	3.92	1.70
2.50	21.53	19.53	17.53	15.53	13.53	11.53	9.53	7.53	5.53	3.53	1.53
2.75	19.57	17.75	15.93	14.12	12.30	10.48	8.66	6.84	5.03	3.21	1.39
3.00	17.94	16.27	14.61	12.94	11.27	9.61	7.94	6.27	4.61	2.94	1.27
3.25	16.56	15.02	13.48	11.94	10.41	8.87	7.33	5.79	4.25	2.71	1.18
3.50	15.38	13.95	12.52	11.09	9.66	8.23	6.81	5.38	3.95	2.52	1.09
3.75	14.35	13.02	11.69	10.35	9.02	7.69	6.35	5.02	3.69	2.35	1.02
4.00	13.46	12.21	10.96	9.71	8.46	7.21	5.96	4.71	3.46	2.21	0.96
4.25	12.66	11.49	10.31	9.13	7.96	6.78	5.60	4.43	3.25	2.08	0.90
4.50	11.96	10.85	9.74	8.63	7.52	6.40	5.29	4.18	3.07	1.96	0.85
4.75	11.33	10.28	9.23	8.17	7.12	6.07	5.01	3.96	2.91	1.86	0.80
5.00	10.76	9.76	8.76	7.76	6.76	5.76	4.76	3.76	2.76	1.76	0.76
5.25	10.25	9.30	8.35	7.39	6.44	5.49	4.54	3.58	2.63	1.68	0.73
5.50	9.79	8.88	7.97	7.06	6.15	5.24	4.33	3.42	2.51	1.60	0.69
5.75	9.36	8.49	7.62	6.75	5.88	5.01	4.14	3.27	2.40	1.53	0.66
6.00	8.97	8.14	7.30	6.47	5.64	4.80	3.97	3.14	2.30	1.47	0.64
6.25	8.61	7.81	7.01	6.21	5.41	4.61	3.81	3.01	2.21	1.41	0.61
6.50	8.28	7.51	6.74	5.97	5.20	4.43	3.66	2.90	2.13	1.36	0.59
6.75	7.97	7.23	6.49	5.75	5.01	4.27	3.53	2.79	2.05	1.31	0.57
7.00	7.69	6.97	6.26	5.55	4.83	4.12	3.40	2.69	1.97	1.26	0.55
7.25	7.42	6.73	6.04	5.35	4.66	3.98	3.29	2.60	1.91	1.22	0.53

7.50	7.18	6.51	5.84	5.18	4.51	3.84	3.18	2.51	1.84	1.18	0.51

TABLE SIX

DETERMINE THE VALUE OF THE HIGH SPEED CURRENT LIMITING RESISTOR
ISOLATION TRANSFORMER TAPS X1 TO X4 (150 VAC)

	FIELD VOLTAGE AT CONTRACT SPEED (Volts DC)										
FIELD I (Amps)	**160**	**165**	**170**	**175**	**180**	**185**	**190**	**195**	**200**	**205**	**210**
1.00	52.10	47.10	42.10	37.10	32.10	27.10	22.10	17.10	12.10	7.10	2.10
1.25	41.68	37.68	33.68	29.68	25.68	21.68	17.68	13.68	9.68	5.68	1.68
1.50	34.73	31.40	28.07	24.73	21.40	18.07	14.73	11.40	8.07	4.73	1.40
1.75	29.77	26.91	24.06	21.20	18.34	15.49	12.63	9.77	6.91	4.06	1.20
2.00	26.05	23.55	21.05	18.55	16.05	13.55	11.05	8.55	6.05	3.55	1.05
2.25	23.16	20.93	18.71	16.49	14.27	12.04	9.82	7.60	5.38	3.16	0.93
2.50	20.84	18.84	16.84	14.84	12.84	10.84	8.84	6.84	4.84	2.84	0.84
2.75	18.95	17.13	15.31	13.49	11.67	9.85	8.04	6.22	4.40	2.58	0.76
3.00	17.37	15.70	14.03	12.37	10.70	9.03	7.37	5.70	4.03	2.37	0.70
3.25	16.03	14.49	12.95	11.42	9.88	8.34	6.80	5.26	3.72	2.18	0.65
3.50	14.89	13.46	12.03	10.60	9.17	7.74	6.31	4.89	3.46	2.03	0.60
3.75	13.89	12.56	11.23	9.89	8.56	7.23	5.89	4.56	3.23	1.89	0.56
4.00	13.03	11.78	10.53	9.28	8.03	6.78	5.53	4.28	3.03	1.78	0.53
4.25	12.26	11.08	9.91	8.73	7.55	6.38	5.20	4.02	2.85	1.67	0.49
4.50	11.58	10.47	9.36	8.24	7.13	6.02	4.91	3.80	2.69	1.58	0.47
4.75	10.97	9.92	8.86	7.81	6.76	5.71	4.65	3.60	2.55	1.49	0.44
5.00	10.42	9.42	8.42	7.42	6.42	5.42	4.42	3.42	2.42	1.42	0.42
5.25	9.92	8.97	8.02	7.07	6.11	5.16	4.21	3.26	2.30	1.35	0.40
5.50	9.47	8.56	7.65	6.75	5.84	4.93	4.02	3.11	2.20	1.29	0.38
5.75	9.06	8.19	7.32	6.45	5.58	4.71	3.84	2.97	2.10	1.23	0.37
6.00	8.68	7.85	7.02	6.18	5.35	4.52	3.68	2.85	2.02	1.18	0.35
6.25	8.34	7.54	6.74	5.94	5.14	4.34	3.54	2.74	1.94	1.14	0.34
6.50	8.02	7.25	6.48	5.71	4.94	4.17	3.40	2.63	1.86	1.09	0.32
6.75	7.72	6.98	6.24	5.50	4.76	4.01	3.27	2.53	1.79	1.05	0.31
7.00	7.44	6.73	6.01	5.30	4.59	3.87	3.16	2.44	1.73	1.01	0.30
7.25	7.19	6.50	5.81	5.12	4.43	3.74	3.05	2.36	1.67	0.98	0.29

7.50	6.95	6.28	5.61	4.95	4.28	3.61	2.95	2.28	1.61	0.95	0.28

TABLE SEVEN

DETERMINE THE VALUE OF THE HIGH SPEED CURRENT LIMITING RESISTOR
ISOLATION TRANSFORMER TAPS X1 TO X5 (165 VAC)

FIELD VOLTAGE AT CONTRACT SPEED (Volts DC)

FIELD (Amps)	190	195	200	205	210	215	220	225	230
1.00	43.31	38.31	33.31	28.31	23.31	18.31	13.31	8.31	3.31
1.25	190.00	30.65	26.65	22.65	18.65	14.65	10.65	6.65	2.65
1.50	43.31	25.54	22.21	18.87	15.54	12.21	8.87	5.54	2.21
1.75	190.00	21.89	19.03	16.18	13.32	10.46	7.61	4.75	1.89
2.00	43.31	19.16	16.66	14.16	11.66	9.16	6.66	4.16	1.66
2.25	190.00	17.03	14.80	12.58	10.36	8.14	5.92	3.69	1.47
2.50	43.31	15.32	13.32	11.32	9.32	7.32	5.32	3.32	1.32
2.75	190.00	13.93	12.11	10.29	8.48	6.66	4.84	3.02	1.20
3.00	43.31	12.77	11.10	9.44	7.77	6.10	4.44	2.77	1.10
3.25	190.00	11.79	10.25	8.71	7.17	5.63	4.10	2.56	1.02
3.50	43.31	10.95	9.52	8.09	6.66	5.23	3.80	2.37	0.95
3.75	190.00	10.22	8.88	7.55	6.22	4.88	3.55	2.22	0.88
4.00	43.31	9.58	8.33	7.08	5.83	4.58	3.33	2.08	0.83
4.25	190.00	9.01	7.84	6.66	5.48	4.31	3.13	1.96	0.78
4.50	43.31	8.51	7.40	6.29	5.18	4.07	2.96	1.85	0.74
4.75	190.00	8.07	7.01	5.96	4.91	3.85	2.80	1.75	0.70
5.00	43.31	7.66	6.66	5.66	4.66	3.66	2.66	1.66	0.66
5.25	190.00	7.30	6.34	5.39	4.44	3.49	2.54	1.58	0.63
5.50	43.31	6.97	6.06	5.15	4.24	3.33	2.42	1.51	0.60
5.75	190.00	6.66	5.79	4.92	4.05	3.18	2.31	1.45	0.58
6.00	43.31	6.39	5.55	4.72	3.89	3.05	2.22	1.39	0.55
6.25	190.00	6.13	5.33	4.53	3.73	2.93	2.13	1.33	0.53
6.50	43.31	5.89	5.12	4.36	3.59	2.82	2.05	1.28	0.51
6.75	190.00	5.68	4.93	4.19	3.45	2.71	1.97	1.23	0.49
7.00	43.31	5.47	4.76	4.04	3.33	2.62	1.90	1.19	0.47
7.25	190.00	5.28	4.59	3.90	3.22	2.53	1.84	1.15	0.46

7.50	43.31	5.11	4.44	3.77	3.11	2.44	1.77	1.11	0.44

TABLE EIGHT

5.7. SELECTING A LEVELING/RE-LEVELING CURRENT LIMITING RESISTOR

A LEVELING/RE-LEVELING CURRENT LIMITING RESISTOR is <u>absolutely necessary</u> to ensure safe performance of the elevator. The purpose of this resistor is to limit the maximum speed that the elevator could reach while leveling/re-leveling if the control was to fail in a fully on state. This resistor is labeled **R1** on both the hook-up print and Figure 6. ***Without a* LEVELING/RE-LEVELING CURRENT LIMITING RESISTOR, *If the D1029 was to fail fully on, the elevator car would take-off and run at full (contract) speed.***

The following pages contain tables which will be used to determine the value of the **LEVELING/RE-LEVELING CURRENT LIMITING RESISTOR** you must use to safely limit the current. In order to use the tables you will need to know the following:

A. The Field Power Isolation Transformer secondary tap selected in step 5.1.3 A.

B. The Generator Field Current at leveling/re-leveling speed. This may be determined by placing the positive lead of a voltmeter on the **FIELD CURRENT** testpoint and measuring the voltage for a worst case run during leveling. The field current is equal to the voltage measured at the testpoint (1V = 1A).

C. The Maximum DC Field Voltage at leveling speed. This may be measured at the **F+** and **F-** terminals during a worst case leveling speed run.

After you have selected the proper table, read down the left-hand column and find your field current at contract speed. Next, read across to the column that indicates your field voltage at contract speed. The value listed at the cell you just located is the resistance for the **LEVELING/RE-LEVELING CURRENT LIMITING RESISTOR (R3)** (See Figure Six). This value should be adjusted as necessary to make sure you still reach leveling speed and to account for a drop in line voltage.

If your transformer tap is **X1** to **X2** **USE TABLE NINE**

If your transformer tap is **X1** to **X3** **USE TABLE TEN**

If your transformer tap is **X1** to **X4** **USE TABLE ELEVEN**

If your transformer tap is **X1** to **X5** **USE TABLE TWELVE**

DETERMINE THE LEVELING SPEED CURRENT LIMITING RESISTOR (Ohms)
FOR ISOLATION TRANSFORMER TAPS X1 TO X2 (110 VAC)

FIELD VOLTAGE AT LEVELING SPEED (Volts DC)

FIELD (Amps)	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
0.05	3010.80	2990.80	2970.80	2950.80	2930.80	2910.80	2890.80	2870.80	2850.80	2830.80	2810.80
0.08	2007.20	1993.87	1980.53	1967.20	1953.87	1940.53	1927.20	1913.87	1900.53	1887.20	1873.87
0.10	1505.40	1495.40	1485.40	1475.40	1465.40	1455.40	1445.40	1435.40	1425.40	1415.40	1405.40
0.13	1204.32	1196.32	1188.32	1180.32	1172.32	1164.32	1156.32	1148.32	1140.32	1132.32	1124.32
0.15	1003.60	996.93	990.27	983.60	976.93	970.27	963.60	956.93	950.27	943.60	936.93
0.18	860.23	854.51	848.80	843.09	837.37	831.66	825.94	820.23	814.51	808.80	803.09
0.20	752.70	747.70	742.70	737.70	732.70	727.70	722.70	717.70	712.70	707.70	702.70
0.23	669.07	664.62	660.18	655.73	651.29	646.84	642.40	637.96	633.51	629.07	624.62
0.25	602.16	598.16	594.16	590.16	586.16	582.16	578.16	574.16	570.16	566.16	562.16
0.28	547.42	543.78	540.15	536.51	532.87	529.24	525.60	521.96	518.33	514.69	511.05
0.30	501.80	498.47	495.13	491.80	488.47	485.13	481.80	478.47	475.13	471.80	468.47
0.33	463.20	460.12	457.05	453.97	450.89	447.82	444.74	441.66	438.58	435.51	432.43
0.35	430.11	427.26	424.40	421.54	418.69	415.83	412.97	410.11	407.26	404.40	401.54
0.38	401.44	398.77	396.11	393.44	390.77	388.11	385.44	382.77	380.11	377.44	374.77
0.40	376.35	373.85	371.35	368.85	366.35	363.85	361.35	358.85	356.35	353.85	351.35
0.43	354.21	351.86	349.51	347.15	344.80	342.45	340.09	337.74	335.39	333.04	330.68
0.45	334.53	332.31	330.09	327.87	325.64	323.42	321.20	318.98	316.76	314.53	312.31
0.48	316.93	314.82	312.72	310.61	308.51	306.40	304.29	302.19	300.08	297.98	295.87
0.50	301.08	299.08	297.08	295.08	293.08	291.08	289.08	287.08	285.08	283.08	281.08
0.53	286.74	284.84	282.93	281.03	279.12	277.22	275.31	273.41	271.50	269.60	267.70
0.55	273.71	271.89	270.07	268.25	266.44	264.62	262.80	260.98	259.16	257.35	255.53
0.58	261.81	260.07	258.33	256.59	254.85	253.11	251.37	249.63	247.90	246.16	244.42
0.60	250.90	249.23	247.57	245.90	244.23	242.57	240.90	239.23	237.57	235.90	234.23
0.63	240.86	239.26	237.66	236.06	234.46	232.86	231.26	229.66	228.06	226.46	224.86
0.65	231.60	230.06	228.52	226.98	225.45	223.91	222.37	220.83	219.29	217.75	216.22
0.68	223.02	221.54	220.06	218.58	217.10	215.61	214.13	212.65	211.17	209.69	208.21

0.70	215.06	213.63	212.20	210.77	209.34	207.91	206.49	205.06	203.63	202.20	200.77

TABLE NINE

DETERMINE THE LEVELING SPEED CURRENT LIMITING RESISTOR (Ohms)
FOR ISOLATION TRANSFORMER TAPS X1 TO X3 (130 VAC)

	FIELD VOLTAGE AT LEVELING SPEED (Volts DC)										
FIELD (Amps)	**8.00**	**9.00**	**10.00**	**11.00**	**12.00**	**13.00**	**14.00**	**15.00**	**16.00**	**17.00**	**18.00**
0.05	3516.40	3496.40	3476.40	3456.40	3436.40	3416.40	3396.40	3376.40	3356.40	3336.40	3316.40
0.08	2344.27	2330.93	2317.60	2304.27	2290.93	2277.60	2264.27	2250.93	2237.60	2224.27	2210.93
0.10	1758.20	1748.20	1738.20	1728.20	1718.20	1708.20	1698.20	1688.20	1678.20	1668.20	1658.20
0.13	1406.56	1398.56	1390.56	1382.56	1374.56	1366.56	1358.56	1350.56	1342.56	1334.56	1326.56
0.15	1172.13	1165.47	1158.80	1152.13	1145.47	1138.80	1132.13	1125.47	1118.80	1112.13	1105.47
0.18	1004.69	998.97	993.26	987.54	981.83	976.11	970.40	964.69	958.97	953.26	947.54
0.20	879.10	874.10	869.10	864.10	859.10	854.10	849.10	844.10	839.10	834.10	829.10
0.23	781.42	776.98	772.53	768.09	763.64	759.20	754.76	750.31	745.87	741.42	736.98
0.25	703.28	699.28	695.28	691.28	687.28	683.28	679.28	675.28	671.28	667.28	663.28
0.28	639.35	635.71	632.07	628.44	624.80	621.16	617.53	613.89	610.25	606.62	602.98
0.30	586.07	582.73	579.40	576.07	572.73	569.40	566.07	562.73	559.40	556.07	552.73
0.33	540.98	537.91	534.83	531.75	528.68	525.60	522.52	519.45	516.37	513.29	510.22
0.35	502.34	499.49	496.63	493.77	490.91	488.06	485.20	482.34	479.49	476.63	473.77
0.38	468.85	466.19	463.52	460.85	458.19	455.52	452.85	450.19	447.52	444.85	442.19
0.40	439.55	437.05	434.55	432.05	429.55	427.05	424.55	422.05	419.55	417.05	414.55
0.43	413.69	411.34	408.99	406.64	404.28	401.93	399.58	397.22	394.87	392.52	390.16
0.45	390.71	388.49	386.27	384.04	381.82	379.60	377.38	375.16	372.93	370.71	368.49
0.48	370.15	368.04	365.94	363.83	361.73	359.62	357.52	355.41	353.31	351.20	349.09
0.50	351.64	349.64	347.64	345.64	343.64	341.64	339.64	337.64	335.64	333.64	331.64
0.53	334.90	332.99	331.09	329.18	327.28	325.37	323.47	321.56	319.66	317.75	315.85
0.55	319.67	317.85	316.04	314.22	312.40	310.58	308.76	306.95	305.13	303.31	301.49
0.58	305.77	304.03	302.30	300.56	298.82	297.08	295.34	293.60	291.86	290.12	288.38
0.60	293.03	291.37	289.70	288.03	286.37	284.70	283.03	281.37	279.70	278.03	276.37
0.63	281.31	279.71	278.11	276.51	274.91	273.31	271.71	270.11	268.51	266.91	265.31
0.65	270.49	268.95	267.42	265.88	264.34	262.80	261.26	259.72	258.18	256.65	255.11
0.68	260.47	258.99	257.51	256.03	254.55	253.07	251.59	250.10	248.62	247.14	245.66

0.70	251.17	249.74	248.31	246.89	245.46	244.03	242.60	241.17	239.74	238.31	236.89

TABLE TEN

DETERMINE THE LEVELING SPEED CURRENT LIMITING RESISTOR (Ohms)
FOR ISOLATION TRANSFORMER TAPS X1 TO X4 (150 VAC)

FIELD VOLTAGE AT LEVELING SPEED (Volts DC)

FIELD (Amps)	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00
0.05	4022.00	4002.00	3982.00	3962.00	3942.00	3922.00	3902.00	3882.00	3862.00	3842.00	3822.00
0.08	2681.33	2668.00	2654.67	2641.33	2628.00	2614.67	2601.33	2588.00	2574.67	2561.33	2548.00
0.10	2011.00	2001.00	1991.00	1981.00	1971.00	1961.00	1951.00	1941.00	1931.00	1921.00	1911.00
0.13	1608.80	1600.80	1592.80	1584.80	1576.80	1568.80	1560.80	1552.80	1544.80	1536.80	1528.80
0.15	1340.67	1334.00	1327.33	1320.67	1314.00	1307.33	1300.67	1294.00	1287.33	1280.67	1274.00
0.18	1149.14	1143.43	1137.71	1132.00	1126.29	1120.57	1114.86	1109.14	1103.43	1097.71	1092.00
0.20	1005.50	1000.50	995.50	990.50	985.50	980.50	975.50	970.50	965.50	960.50	955.50
0.23	893.78	889.33	884.89	880.44	876.00	871.56	867.11	862.67	858.22	853.78	849.33
0.25	804.40	800.40	796.40	792.40	788.40	784.40	780.40	776.40	772.40	768.40	764.40
0.28	731.27	727.64	724.00	720.36	716.73	713.09	709.45	705.82	702.18	698.55	694.91
0.30	670.33	667.00	663.67	660.33	657.00	653.67	650.33	647.00	643.67	640.33	637.00
0.33	618.77	615.69	612.62	609.54	606.46	603.38	600.31	597.23	594.15	591.08	588.00
0.35	574.57	571.71	568.86	566.00	563.14	560.29	557.43	554.57	551.71	548.86	546.00
0.38	536.27	533.60	530.93	528.27	525.60	522.93	520.27	517.60	514.93	512.27	509.60
0.40	502.75	500.25	497.75	495.25	492.75	490.25	487.75	485.25	482.75	480.25	477.75
0.43	473.18	470.82	468.47	466.12	463.76	461.41	459.06	456.71	454.35	452.00	449.65
0.45	446.89	444.67	442.44	440.22	438.00	435.78	433.56	431.33	429.11	426.89	424.67
0.48	423.37	421.26	419.16	417.05	414.95	412.84	410.74	408.63	406.53	404.42	402.32
0.50	402.20	400.20	398.20	396.20	394.20	392.20	390.20	388.20	386.20	384.20	382.20
0.53	383.05	381.14	379.24	377.33	375.43	373.52	371.62	369.71	367.81	365.90	364.00
0.55	365.64	363.82	362.00	360.18	358.36	356.55	354.73	352.91	351.09	349.27	347.45
0.58	349.74	348.00	346.26	344.52	342.78	341.04	339.30	337.57	335.83	334.09	332.35
0.60	335.17	333.50	331.83	330.17	328.50	326.83	325.17	323.50	321.83	320.17	318.50
0.63	321.76	320.16	318.56	316.96	315.36	313.76	312.16	310.56	308.96	307.36	305.76
0.65	309.38	307.85	306.31	304.77	303.23	301.69	300.15	298.62	297.08	295.54	294.00
0.68	297.93	296.44	294.96	293.48	292.00	290.52	289.04	287.56	286.07	284.59	283.11

0.70	287.29	285.86	284.43	283.00	281.57	280.14	278.71	277.29	275.86	274.43	273.00

TABLE ELEVEN

DETERMINE THE LEVELING SPEED CURRENT LIMITING RESISTOR (Ohms)
FOR ISOLATION TRANSFORMER TAPS X1 TO X5 (165 VAC)

FIELD VOLTAGE AT LEVELING SPEED (Volts DC)

FIELD (Amps)	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00	25.00
0.05	4366.20	4346.20	4326.20	4306.20	4286.20	4266.20	4246.20	4226.20	4206.20	4186.20	4166.20
0.08	2910.80	2897.47	2884.13	2870.80	2857.47	2844.13	2830.80	2817.47	2804.13	2790.80	2777.47
0.10	2183.10	2173.10	2163.10	2153.10	2143.10	2133.10	2123.10	2113.10	2103.10	2093.10	2083.10
0.13	1746.48	1738.48	1730.48	1722.48	1714.48	1706.48	1698.48	1690.48	1682.48	1674.48	1666.48
0.15	1455.40	1448.73	1442.07	1435.40	1428.73	1422.07	1415.40	1408.73	1402.07	1395.40	1388.73
0.18	1247.49	1241.77	1236.06	1230.34	1224.63	1218.91	1213.20	1207.49	1201.77	1196.06	1190.34
0.20	1091.55	1086.55	1081.55	1076.55	1071.55	1066.55	1061.55	1056.55	1051.55	1046.55	1041.55
0.23	970.27	965.82	961.38	956.93	952.49	948.04	943.60	939.16	934.71	930.27	925.82
0.25	873.24	869.24	865.24	861.24	857.24	853.24	849.24	845.24	841.24	837.24	833.24
0.28	793.85	790.22	786.58	782.95	779.31	775.67	772.04	768.40	764.76	761.13	757.49
0.30	727.70	724.37	721.03	717.70	714.37	711.03	707.70	704.37	701.03	697.70	694.37
0.33	671.72	668.65	665.57	662.49	659.42	656.34	653.26	650.18	647.11	644.03	640.95
0.35	623.74	620.89	618.03	615.17	612.31	609.46	606.60	603.74	600.89	598.03	595.17
0.38	582.16	579.49	576.83	574.16	571.49	568.83	566.16	563.49	560.83	558.16	555.49
0.40	545.78	543.28	540.78	538.28	535.78	533.28	530.78	528.28	525.78	523.28	520.78
0.43	513.67	511.32	508.96	506.61	504.26	501.91	499.55	497.20	494.85	492.49	490.14
0.45	485.13	482.91	480.69	478.47	476.24	474.02	471.80	469.58	467.36	465.13	462.91
0.48	459.60	457.49	455.39	453.28	451.18	449.07	446.97	444.86	442.76	440.65	438.55
0.50	436.62	434.62	432.62	430.62	428.62	426.62	424.62	422.62	420.62	418.62	416.62
0.53	415.83	413.92	412.02	410.11	408.21	406.30	404.40	402.50	400.59	398.69	396.78
0.55	396.93	395.11	393.29	391.47	389.65	387.84	386.02	384.20	382.38	380.56	378.75
0.58	379.67	377.93	376.19	374.45	372.71	370.97	369.23	367.50	365.76	364.02	362.28
0.60	363.85	362.18	360.52	358.85	357.18	355.52	353.85	352.18	350.52	348.85	347.18
0.63	349.30	347.70	346.10	344.50	342.90	341.30	339.70	338.10	336.50	334.90	333.30
0.65	335.86	334.32	332.78	331.25	329.71	328.17	326.63	325.09	323.55	322.02	320.48
0.68	323.42	321.94	320.46	318.98	317.50	316.01	314.53	313.05	311.57	310.09	308.61

0.70	311.87	310.44	309.01	307.59	306.16	304.73	303.30	301.87	300.44	299.01	297.59

TABLE TWELVE

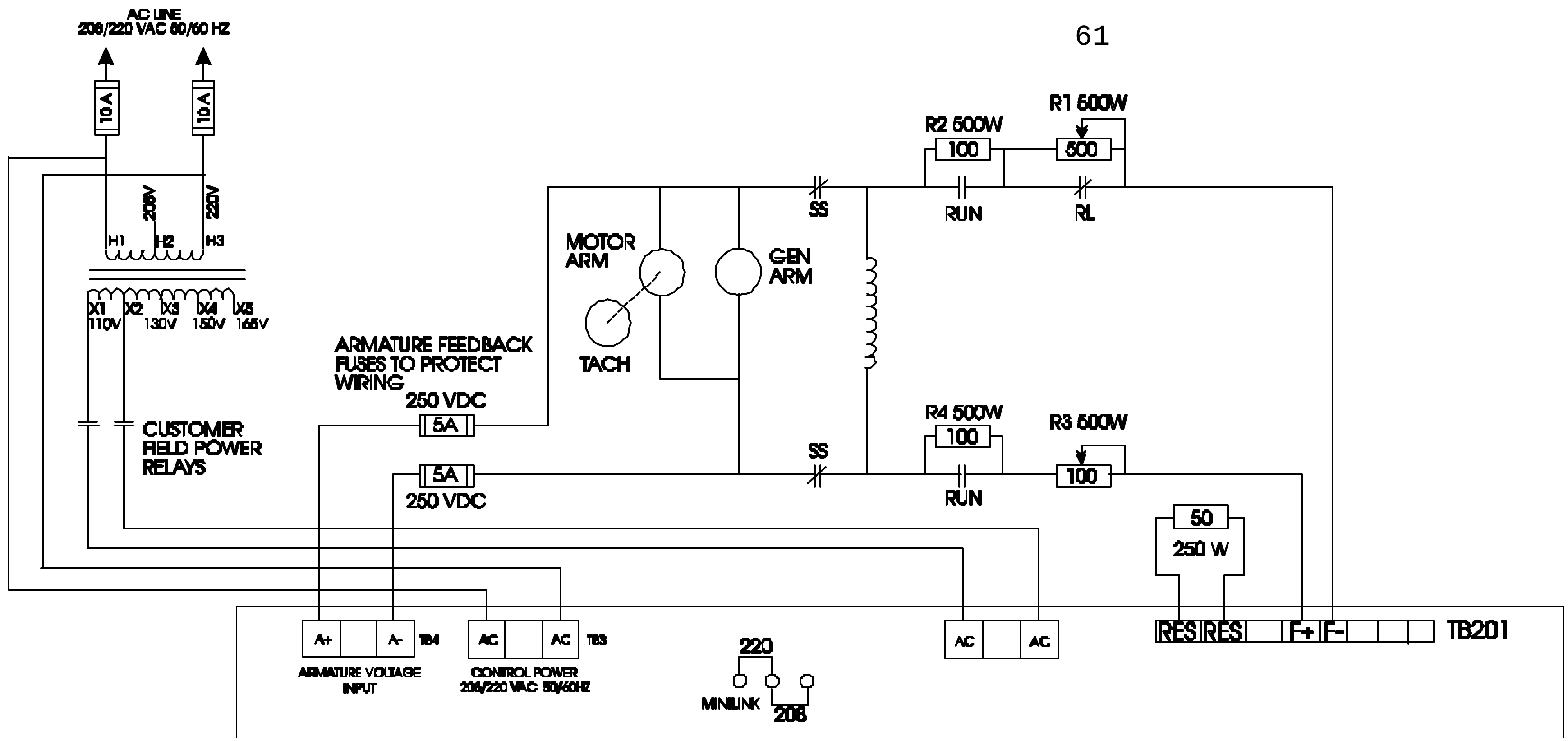
5.7. SUICIDE CIRCUIT

The suicide circuit disconnects the generator field from the controller and places the field across the Hoist Motor Armature. During the opening of the field contacts, any current flowing through the generator field must continue to flow. This will cause the contacts to arc until the field current decays.

It is absolutely necessary that the arcing is extinguished and the field contacts are completely open before the suicide contacts close. Any overlapping of these contacts will cause damage to the control. Therefore, the suicide contacts must be delayed in closing even under power loss conditions.

The suicide contacts should not be back, or auxiliary, contacts of the* RUN *relay since there will not be a sufficient time delay between the contacts making/braking.

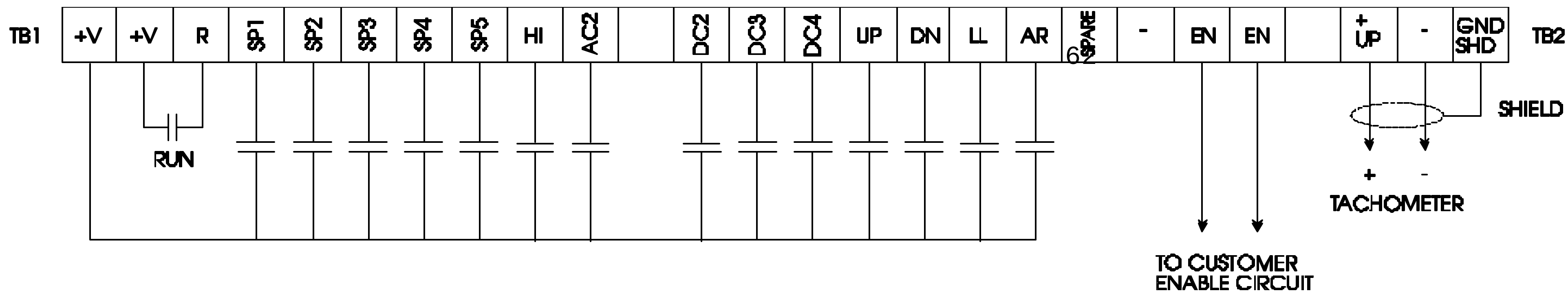
The time delay will depend on the duration of the arc across the field contacts. For this reason, we have shown resistors **R2** and **R4** in Figure Six, across the field contacts to permit some current flow during the opening of the **RUN** contacts. **R2** and **R4** will provide a discharge path through the control for the field current, preventing damage to the control caused by the closing of the suicide contact.



NOTE: The control AC power may be set to either 208 or 220 volts AC by placing the minilink jumper in the appropriate position. This jumper is located on the lower PC board, directly below fuse F1.

The CR1 relay serves as a secondary disconnect relay. This relay, along with the enable relay, will drop out with any fault condition. The customer logic should be sequenced so that CR1 is <u>never</u> used as a primary connect or disconnect relay. Improper sequencing will cause CR1 to exceed its rating and fail.

FIGURE SIX



SP1: Speed One, adjustable from zero (0) to fifteen percent (15%) of contract speed

SP2: Speed Two, adjustable from zero (0) to twenty five percent (25%) of contract speed

SP3: Speed Three, adjustable from zero (0) to fifty percent (50%) of contract speed. This speed select is typically used for inspection speed.

SP4: Speed Four, adjustable from zero (0) to ninety nine percent (99%) of contract speed

SP5: Speed Five, adjustable from zero (0) to ninety nine percent (99%) of contract speed

HI: High Speed, non-adjustable, pre-set to one hundred percent (100%) of contract speed. This speed select is typically used for contract speed.

AC2: Acceleration rate 2. Fully adjustable from one (1) second, fully clockwise, to eight (8) seconds fully counterclockwise.

DC2: Deceleration rate 2. Fully adjustable from one (1) second, fully clockwise, to eight (8) seconds fully counterclockwise.

DC3: Deceleration rate 3. Fully adjustable from one (1) second, fully clockwise, to eight (8) seconds fully counterclockwise.

DC4: Deceleration rate 4. Fully adjustable from one (1) second, fully clockwise, to eight (8) seconds fully counterclockwise.

UP: Up direction select. When this contact is closed the D1029 will produce a positive voltage at F+ and F-.

DN: Down direction select. When this contact is closed the D1029 will produce a negative voltage at F+ and F-.

LL: Level limit select. When this contact is closed the overspeed trip point is scaled down by ten percent (10%).

AR: Auto Reset select. When this contact is closed, the control will be in auto-reset mode. The control will auto-reset from a trip condition when the RUN contact is dropped.

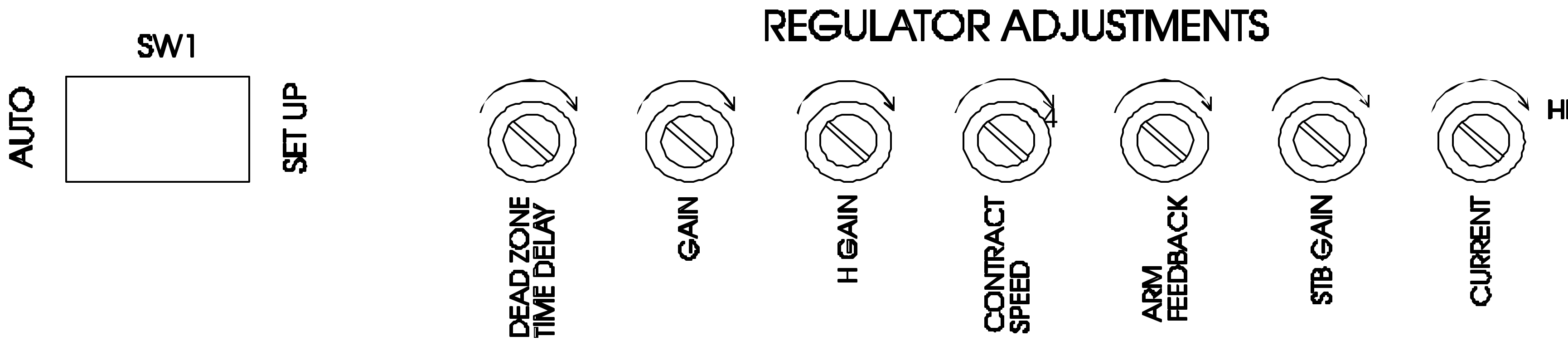
EN: Enable contacts. These normally open contacts will be closed when control power is present. These contacts will open on a fault trip.

+UP: Positive tachometer connection. Connect the positive tachometer lead to this terminal.

-: Negative tachometer connection. Connect the negative lead of the tachometer to this terminal.

GND SHD: Tachometer cable shield. The shield from the tachometer cable should be connected at the D1029 side only.

FIGURE SEVEN



SW1-AUTO: The control acts as a speed and current regulator. This is the position for normal operation of the D1029.

SW1-SET UP: The control acts as a current regulator only. This position is used for set up and troubleshooting purposes.

DEAD ZONE TIME DELAY: The delay set by this potentiometer becomes active when UP/DN is dropped with RUN energized. The REF and TACH continue to follow the decel ramp for up to one half second (pot fully CCW).

Too Much: car stops hard *Too Little:* car is slow to reach zero speed

GAIN: This potentiometer controls how quickly the control will correct for a TACH vs REFERENCE error.

Too Much: overshoot (corrects too quickly) *Too Little:* sluggish (corrects too slow)

HOLD GAIN: This potentiometer increases the effect of the TACH feedback signal when UP/DN is dropped with RUN energized. The TACH feedback is boosted to increase zero speed regulation.

Too Much: car oscillates around zero speed *Too Little:* car drifts at zero speed

CONTRACT SPEED: This potentiometer scales the TACH feedback signal to obtain contract speed calibration.

Too Much: overspeed trip *Too Little:* out of regulation

ARM FEEDBACK: This potentiometer controls the ARMATURE feedback signal used for stability. The potentiometer is initially adjusted for 7.5 volts at contract speed and then fine-tuned.

Too Much: sluggish (unresponsive) *Too Little:* overshoot (too responsive)

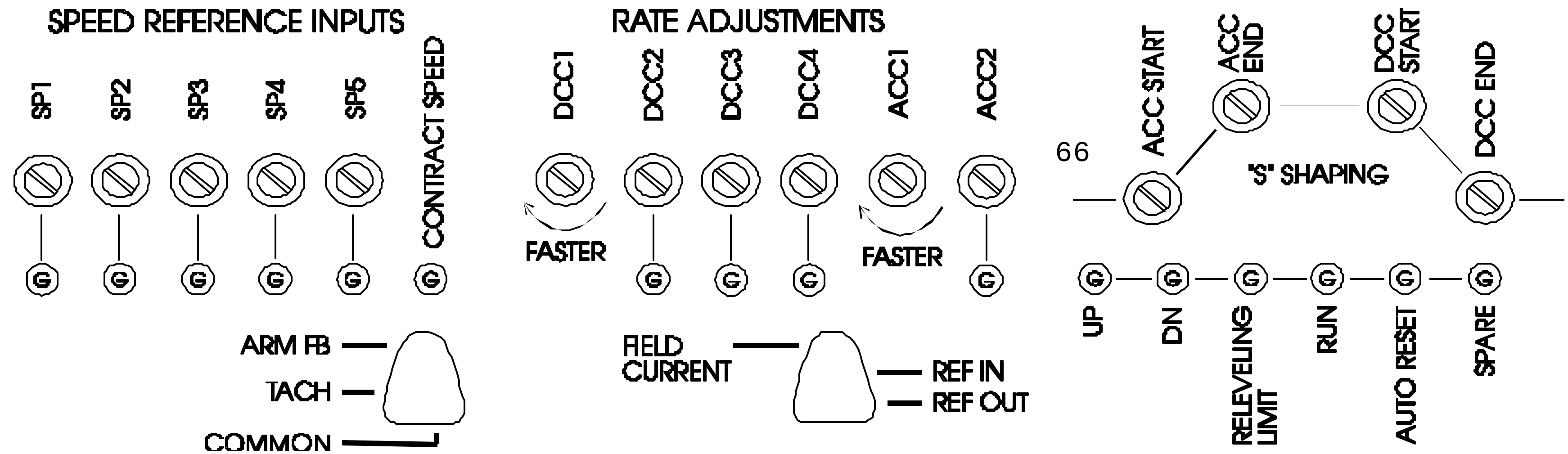
STB GAIN: This potentiometer controls how quickly the control will correct for a change in ARMATURE feedback vs REFERENCE voltage.

Too Much: sluggish (unresponsive) *Too Little:* overshoot (too responsive)

CURRENT: This potentiometer sets the operating current range for the control.

Too Much: excessive current available *Too Little:* insufficient current, can't reach contract speed

FIGURE EIGHT



SPEED REFERENCE INPUTS:
All specifications are for voltage readings taken from the REF IN testpoint to the COMMON testpoint.

SP1 RANGE: 0 volts fully counterclockwise to 1.5 volts fully clockwise.
SP2 RANGE: 0 volts fully counterclockwise to 2.5 volts fully clockwise.
SP3 RANGE: 0 volts fully counterclockwise to 5.0 volts fully clockwise.
SP4 RANGE: 0 volts fully counterclockwise to 9.9 volts fully clockwise.
SP5 RANGE: 0 volts fully counterclockwise to 9.9 volts fully clockwise.
CONTRACT SPEED: 10.0 volts fixed.

RATE ADJUSTMENTS:

DCC1 - DCC4: 1 second fully counterclockwise to 8 seconds fully clockwise
ACC1, ACC2: 1 second fully counterclockwise to 8 seconds fully clockwise

"S" SHAPING:
These potentiometers control four distinct *knees* on the S-curve. When the potentiometer is fully counterclockwise, the *knee* will be smooth. When the potentiometer is fully clockwise, the knee will be sharp.

TEST POINTS:

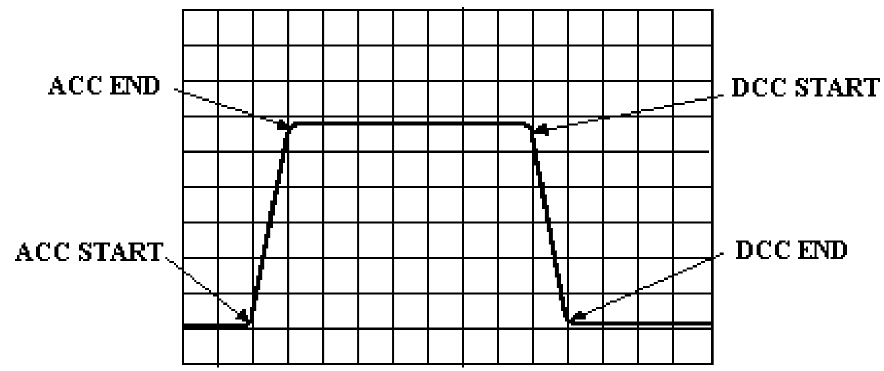
ARM FB: Scaled armature feedback signal. This testpoint should measure 7.5 volts at contract speed.
TACH: Scaled tachometer feedback signal. This testpoint should measure 10.0 volts at contract speed. Connect channel two of the oscilloscope here when monitoring the response of the control.
COMMON: The negative lead of the multimeter and the ground lead of the oscilloscope should be connected to this testpoint. All measurements are referenced to this testpoint.
FIELD CURRENT: This testpoint represents the amount of current being produced by the control. One volt at this testpoint represents one amp of field current. Maximum field current is 7.5 amps.
REF IN: This testpoint represents the unshaped speed input currently selected.
REF OUT: This testpoint represents the S-Shaped speed input currently selected. Connect channel one of the oscilloscope here when monitoring the response of the control.

FIGURE NINE

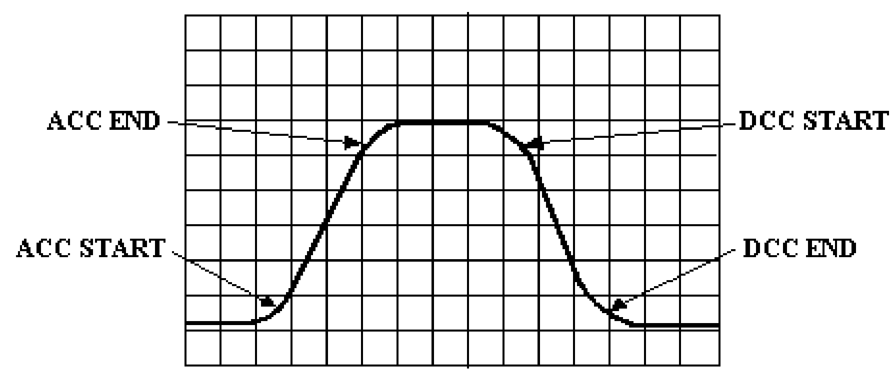
S SHAPED CURVES

The following pictures show the S Shaped Curves that would occur when the knee pots are at the extreme positions. These plots were measured at the REF OUT testpoint.

A.) SHARP: **All of the *knee* potentiometers have been turned fully clockwise. The transitional points of the S-Curve are short and severe.**



B.) SMOOTH: **All of the *knee* potentiometers have been turned fully counterclockwise. The transitional points of the S-Curve are long and drawn out.**



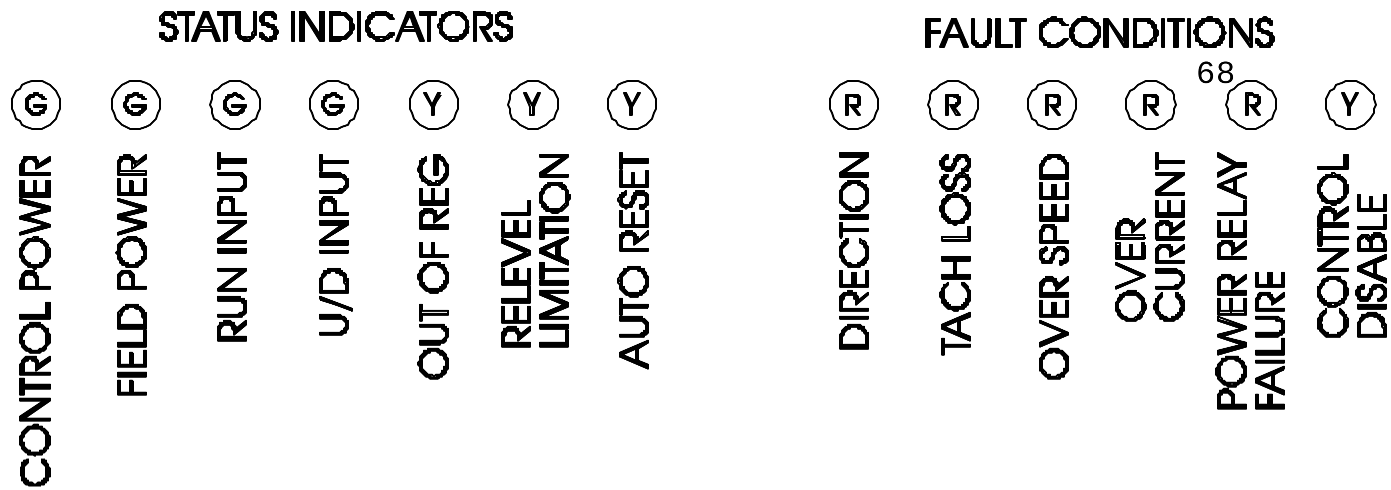


FIGURE TEN

CONTROL POWER: AC power (208-230 VAC) has been applied to

FIELD POWER: The CR1 Field Power Relay is closed. Field power is being applied at TB5.

RUN INPUT: The RUN contact at TB1 is closed. The field power section of the control is enabled.

U/D INPUT: The UP or DN contact is closed at TB1.

OUT OF REG: The control is not regulating. The tachometer feedback signal differs from the reference signal.

RELEVEL LIMIT: The overspeed trip point has been reduced by 10% for releveling.

AUTO RESET: The control is in auto reset mode. Any fault trip (except power relay failure) will be reset after the RUN contact is dropped for three seconds.

DIRECTION: The tachometer signal indicated that the car was trying to run in the opposite direction than called for by the UP/DN relays.

TACH LOSS: No tachometer feedback signal was present when trying to run.

OVER SPEED: The tachometer signal exceeded the reference signal by 10%.

OVER CURRENT: The current requirement has exceeded the rating of the control by more than 50%.

POWER RELAY FAILURE: The CR1 relay has failed and must be replaced.

CONTROL DISABLE: The RUN contact at TB1 is not closed OR a fault condition exists and the control has tripped.

FIGURE ELEVEN

SECTION SIX
TROUBLESHOOTING

The following pages contain tables which list common problems that may be encountered during set up and operation of the model D1029 Bi-Directional Generator Field Control. The probable cause column contains the most likely reason for the problem. The corrective action column contains steps, which may be taken to correct the problem.

WARNING: **THE BI-DIRECTIONAL FIELD REGULATOR SHOULD BE INSTALLED, ADJUSTED AND SERVICED BY QUALIFIED ELECTRICAL MAINTENANCE PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL EQUIPMENT IN THE ELEVATOR SYSTEM; PERSONAL INJURY AND/OR EQUIPMENT DAMAGE MAY OCCUR IF INDIVIDUALS ARE NOT FAMILIAR WITH THE HAZARDS RESULTING FROM IMPROPER OPERATION.**

WARNING: **CONTROLLER EQUIPMENT IS AT LINE VOLTAGE WHEN AC POWER IS CONNECTED AND INTERNAL CAPACITORS REMAIN CHARGED AFTER POWER IS REMOVED FROM THE BI-DIRECTIONAL FIELD REGULATOR. IT IS IMPORTANT THAT AC POWER IS REMOVED FROM THE UNIT FOR A MINIMUM OF FIVE MINUTES BEFORE IT IS SAFE TO TOUCH THE INTERNAL PARTS OF THE CONTROL. PERSONAL INJURY MAY RESULT UNLESS POWER IS REMOVED.**

WARNING: **THE USER IS RESPONSIBLE FOR CONFORMING WITH THE NATIONAL ELECTRICAL CODE WITH RESPECT TO MOTOR, CONTROLLER AND OPERATOR DEVICE INSTALLATION, WIRING AND START UP. THE USER IS ALSO RESPONSIBLE FOR UNDERSTANDING AND APPLYING ALL OTHER APPLICABLE LOCAL CODES WHICH GOVERN SUCH PRACTICES AS WIRING PROTECTION, GROUNDING, DISCONNECTS AND OVERCURRENT PROTECTION.**

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
CONTROL TRIPS ON DIRECTION FAULT	Tachometer wiring error	Check the tachometer wiring. The tachometer signal at the TACH testpoint should be positive when the car is traveling in the UP direction.
	Long delay between the Brake lifting and RUN signal application is causing the elevator to roll back before accelerating away from the floor.	Correct the controller logic to remove delays between the picking of the brake and the application of the RUN signal.
	Rapid reversal of the UP and DN contacts prior to stopping	Releveling before the car has stopped will cause a direction fault. Correct the controller logic as required.
CONTROL TRIPS ON TACH LOSS	Tachometer signal is not present or intermittent	Check the mechanical and electrical connections of the tachometer.
	The tachometer feedback signal is the wrong polarity or too small.	Spin the tachometer by hand and measure the voltage at the +UP and - terminals at TB2. The voltage should increase as the tach spins faster. The polarity of the tachometer voltage should reverse as the tach is spun in the opposite direction. Verify that the tachometer feedback signal at the TACH testpoint is positive in the UP direction and is 10 volts at contract speed.
	The Armature Feedback voltage is set too high.	Too much Armature Feedback will make the TACH LOSS circuit too sensitive. Re-adjust the Armature Feedback potentiometer for 7.5 volts on the ARM FB testpoint at contract speed.
	The picking of the brake is delayed during take off from the floor	If the Armature Feedback voltage is allowed to build up before the tachometer starts turning, the control will trip on tach loss. Check controller logic and brake release.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
CONTROL TRIPS ON OVERSPEED	The Level Limit (LL) contact at TB1 is closed during a normal run	Make sure that the LL contact is open during a normal run and closes during leveling and releveling only.
	The tachometer feedback voltage has exceeded the reference voltage	Compare the signal at the TACH testpoint to the REF OUT testpoint . The TACH testpoint should never go higher than 10 volts and should not exceed the REF OUT voltage. Test in both UP and DN directions.
	Weak Hoist Motor Field	If you are using field weakening at contract speed, remove it and try running at contract speed. If no trip occurs, you are weakening too much. Also, the weakening of the field should occur after the REF OUT testpoint has passed the ACC END knee and leveled out, otherwise you may get a surge (bump) at the ACC END knee which will cause a trip.
	The CONTRACT SPEED potentiometer is set too low	Adjust the CONTRACT SPEED potentiometer to obtain contract speed exactly. The TACH testpoint should read 10 volts when running at contract speed.
	Loose tachometer connection or tach wheel is skipping / slipping.	Ensure that the tachometer is mounted securely. Check the coupling of the tachometer to the motor, or the connection to the roller wheel. Make sure that the surface that the roller wheel rides upon is smooth and free from bumps. Make sure that the tachometer mount places enough pressure on the roller wheel to keep it on the surface it is reading.
CONTROL TRIPS ON OVERCURRENT AT CONTRACT SPEED	Output DC current is exceeding the control rating	Measure the field current at the FIELD CURRENT testpoint. The voltage should never exceed 7.5 volts during a worst case run.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
CONTROL TRIPS ON OVERCURRENT AT CONTRACT SPEED	The Generator Field resistance is too low.	The minimum resistance of the generator field must be 21 ohms or greater (measured at F+ and F- on TB201). Run the car at a lower speed and see if the trip occurs. If the field resistance is too low, either rewire the fields or add resistance in series with the field. If possible step down to the next lower transformer tap.
	Contract speed is being exceeded	Measure the speed of the car with a hand held tach. Adjust the CONTRACT SPEED pot as required. Adjust the CURRENT potentiometer as required.
CONTROL TRIPS ON OVERCURRENT AT LOW END OF A RUN	Insufficient delay exists when the suicide circuit closes.	Ensure that an adequate delay exists between the dropping of the RUN contacts and the making of the suicide contacts.
	Incorrect control or power wiring	Check all control and power connections against the hook-up diagram (figure six).
	Field wiring is shorted to ground	Check the Generator Field wiring for shorts to ground.
POWER RELAY FAILURE	The CR1 relay has failed	Disconnect power from the control. Remove the CR1 relay and inspect it for damage. Replace if necessary. If this problem re-occurs, check the controller logic to make sure that the CR1 relay is not being used to make or brake the full field voltage.
	Field power is being applied before the RUN contact at TB1 is closed.	Change the controller logic so that the RUN contact at TB1 closes before the Field Power Relays close (see figure six). The customer RUN contacts at R2 and R4 should also open before the RUN contact at TB1 opens during power down of the field.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
NO OUTPUT FROM CONTROL	Input wiring error	Ensure that the proper control voltages exist at the D1029. Check all fuses.
	Bad connection at the Field Power connections.	If the Field Power indicator is not lit, check all connections that supply field power. Check the field power fuse, F2, on the D1029.
	The CR1 relay has failed	Check the CR1 relay. If the relay has failed, it must be replaced.
	A fault trip condition exists and the control is disabled.	Check the Fault Conditions indicators to see if a fault condition is present. Reset the control and correct the fault if it reoccurs.
	Wiring fault in the Generator	Measure the control output voltage at the F+ and F- terminals. If a voltage is present, the control is operating properly. Check for a voltage directly at the Generator Field.
CANNOT ACHIEVE CONTRACT SPEED	Too much series resistance (R3)	Lower the resistance of the high-speed current limiting resistor R3 (see figure six).
	The field power transformer tap selected is not sufficient.	Move to the next higher tap on the field power transformer.
CANNOT ACHIEVE CONTRACT SPEED	Not enough current to the Generator field.	Increase the CURRENT potentiometer clockwise to provide more current to the Generator field.
	Ripple/Noise on the tachometer signal.	Look at the signal at the TACH testpoint with an oscilloscope. The signal should be clean with no ripple at all. Any ripple shown indicates either electrical or mechanically induced noise. Check the tachometer connections, both electrical and mechanical for areas where noise could be introduced, such as improper alignment, tach wires next

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
		to power wires etc..
ELEVATOR IS UNSTABLE AT HIGH SPEED	Armature feedback is connected backwards	Check the voltage at the ARM FB testpoint. The voltage should be positive in the UP direction and negative in the DN direction. Reverse the leads at TB4 if the polarities are reversed (see figure six).
	The armature feedback signal is misadjusted	Set the armature feedback signal to 7.5 volts at the ARM FB testpoint when the car is running at contract speed. If the car is still unstable, reduce the STB GAIN potentiometer until the ride improves.
CAR OVERSHOOTS CONTRACT SPEED DURING ACCELERATION	Too much gain	Turn the GAIN potentiometer counterclockwise to reduce the gain
	ACC rates are set too fast	Turn the ACC potentiometer(s) counterclockwise to reduce the acceleration rate(s)
	Motor field too weak	Weakening the motor field too much will cause the car to overshoot contract speed. Increase the motor field voltage
SLOW RESPONSE AT HIGH SPEED	Not enough gain	Increase the gain by turning the GAIN potentiometer clockwise.
	Too much stability gain	Reduce the stability gain by turning the STB GAIN potentiometer counterclockwise
	Too much armature feedback	Reduce the armature feedback by turning the ARM FEEDBACK potentiometer counterclockwise

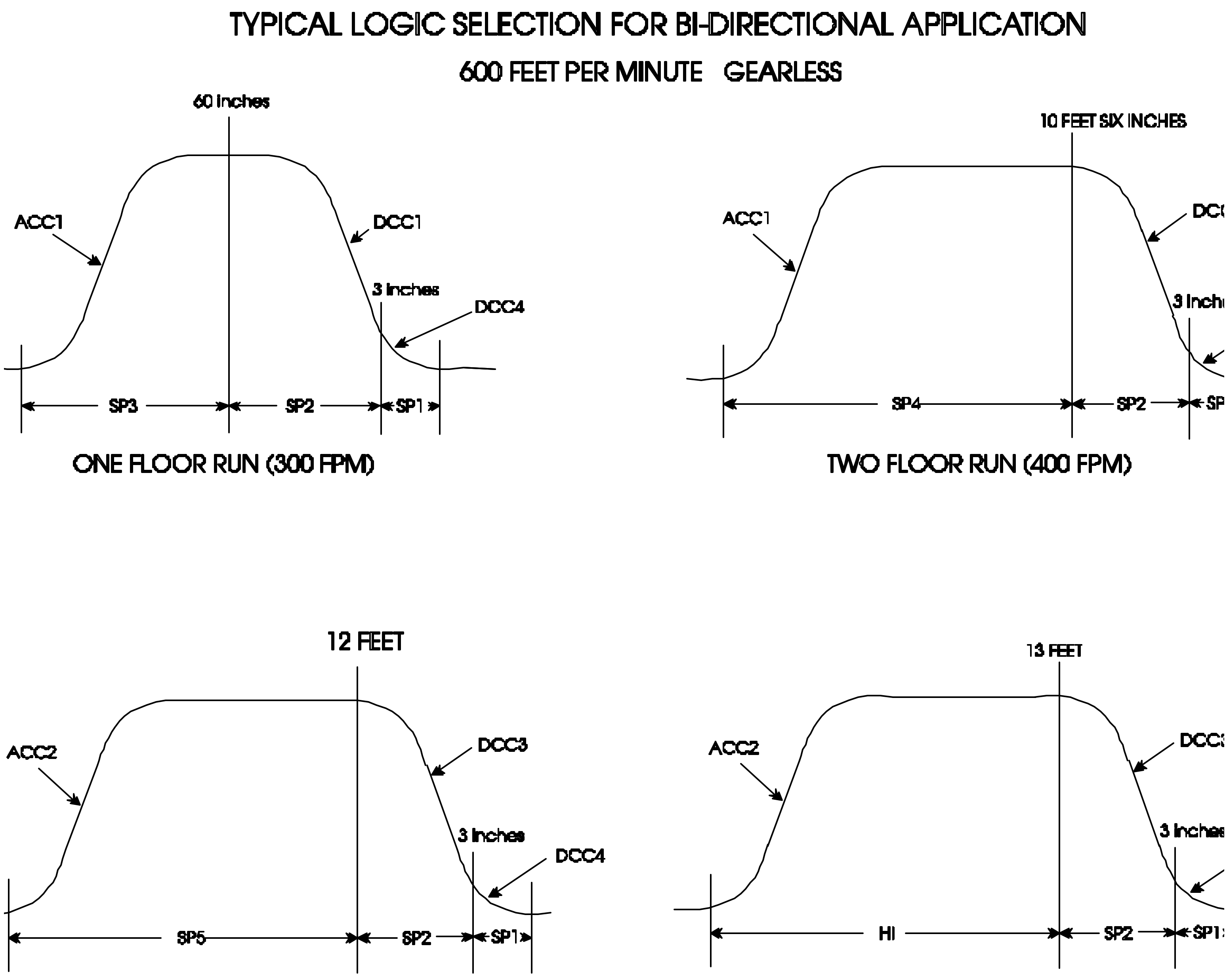
PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
	Not enough current	Increase the available current by turning the CURRENT potentiometer clockwise. If the potentiometer is fully clockwise, step up to the next higher tap on the field power transformer.
UP AND DOWN SPEEDS ARE NOT EQUAL	The control is out of regulation in the slower direction due to insufficient current available.	Turn the CURRENT potentiometer clockwise to increase the current available. Reduce the series resistance R3 to increase current to the generator field. If this does not work, step up to the next higher tap on the field power transformer.
	The control is in the SET UP mode	The UP and DN speeds will not be accurate when the control is in the SET UP mode because there is no tachometer feedback signal in this mode. Switch to AUTO mode (SW1).
OUT OF REGULATION LIGHT FLICKERS OR STAYS ON	Noise on the armature feedback or tachometer signals	Check the mechanical and electrical connections for both the tachometer and the armature feedback.
	The CONTRACT SPEED potentiometer is misadjusted	Adjust the CONTRACT SPEED potentiometer until the TACH testpoint reads 10 volts at contract speed
OUT OF REGULATION LIGHT FLICKERS OR STAYS ON	Armature feedback signal is set too high	Ensure that the armature feedback signal never exceeds 10 volts at contract speed. Readjust the ARM FEEDBACK potentiometer as necessary
INSTABILITY AT LOW SPEED / DECELERATING INTO THE FLOOR	Deceleration rates are too fast	Adjust the DCC potentiometer(s) counterclockwise to decrease the deceleration rates.
	The stability gain is set too high	Reduce the stability gain by turning the STB GAIN potentiometer counterclockwise. Reset to the previous setting if this has no effect

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
	Armature feedback signal is set too high	Decrease the armature feedback signal by turning the ARM FEEDBACK potentiometer counterclockwise. Do not decrease the signal at the ARM FB testpoint below 4 volts. Increase the STB GAIN potentiometer if high-speed instability occurs with the lowered armature feedback signal.
	The reference voltage is too far ahead of the tachometer feedback signal	Make sure that the motor field is not being forced too much. This will reduce the speed that the motor can spin at for a given voltage at the REF OUT testpoint. Remove field forcing to see if condition improves
THE CAR STOPS TOO HARD / OSCILLATES AROUND ZERO SPEED	The hold gain is set too high	Decrease the hold gain by turning the H GAIN potentiometer counterclockwise
	The dead zone time delay is too short	Increase the length of the dead zone time delay by turning the DEAD ZONE TIME DELAY potentiometer counterclockwise
	The Hoist motor field is being weakened before reaching a complete stop	Make sure that the motor field is not weakened until the motor has completely stopped and the brake is set

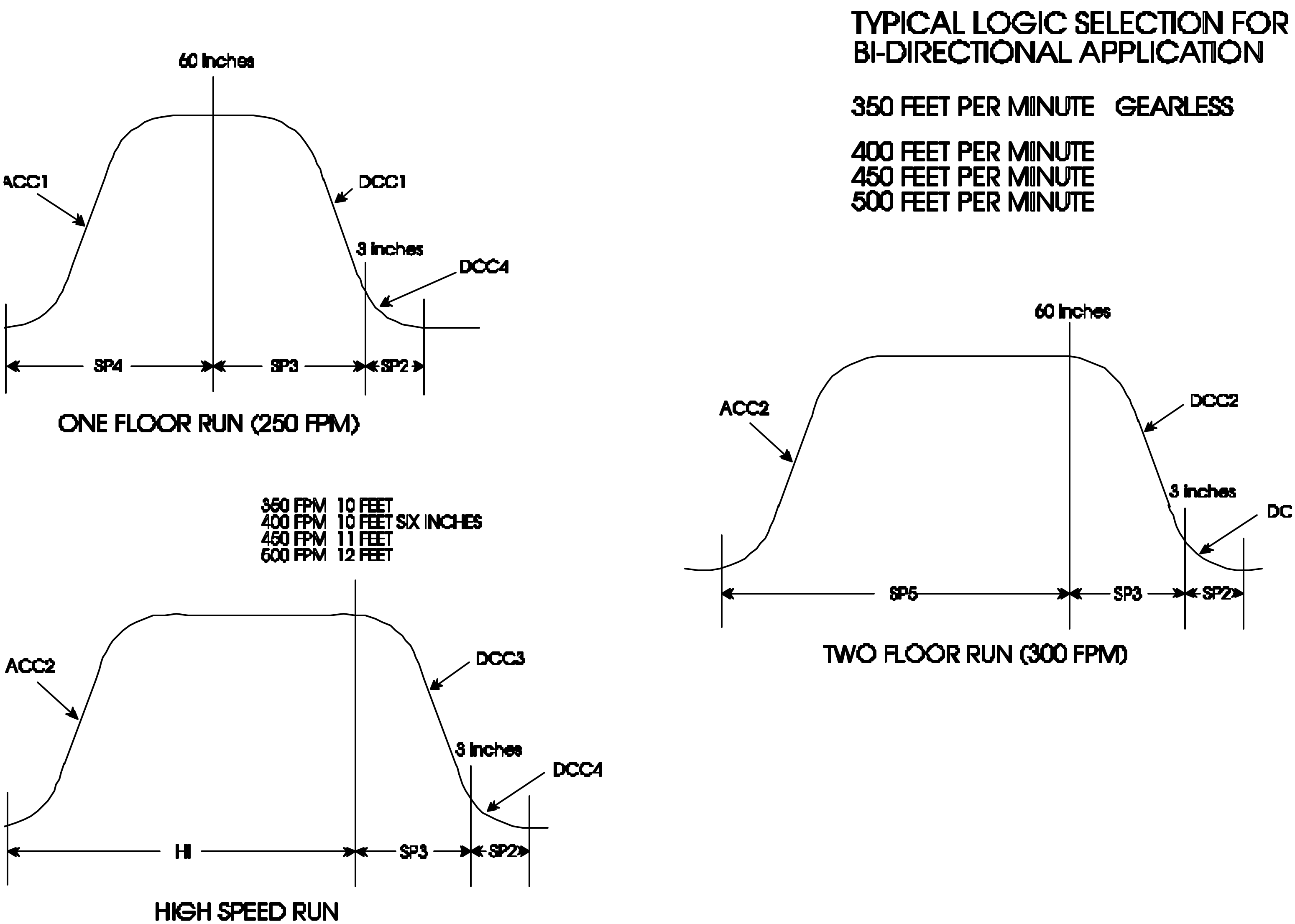
SECTION SEVEN
TYPICAL LOGIC SELECTION FOR BI-DIRECTIONAL APPLICATION

The curves on the following pages represent some suggested speed profiles for the D1029 Bi-Directional. These curves show suggested acceleration and deceleration selections, as well as the approximate distance from the floor when making speed transitions. Separate graphs are provided for geared and gearless applications from 350 to 800 feet per minute. Use of the high speed option card (model D1046) is recommended for jobs that are 700 FPM or greater. This card provides four additional speed settings along with four additional deceleration settings that are typically needed for the higher speed range.

NOTE: The following logic selection curves are to be used only as a guide. The actual



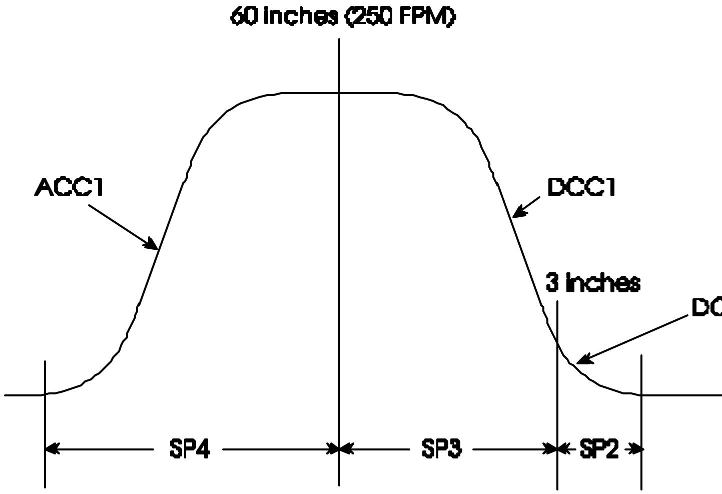
logic will depend upon standard practices and the experience of the system designer.



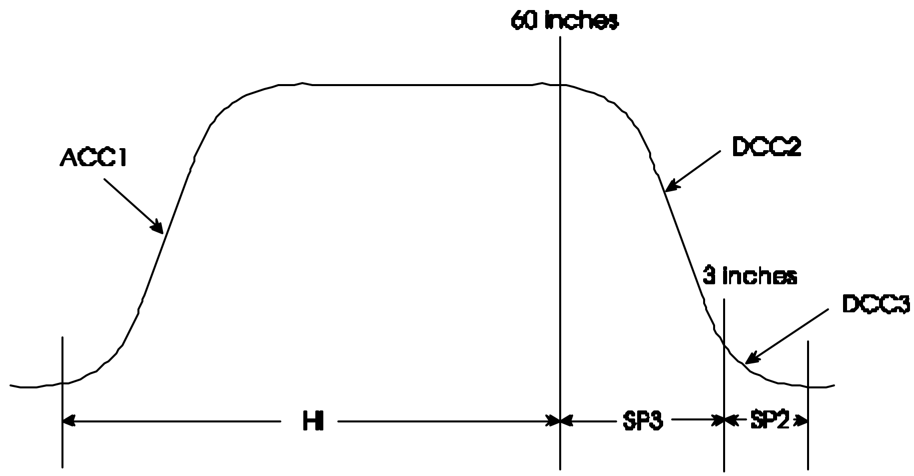
TYPICAL LOGIC SELECTION FOR BI-DIRECTIONAL APPLICATION

350 FEET PER MINUTE GEARED

400 / 450 FEET PER MINUTE GEARED



ONE FLOOR RUN

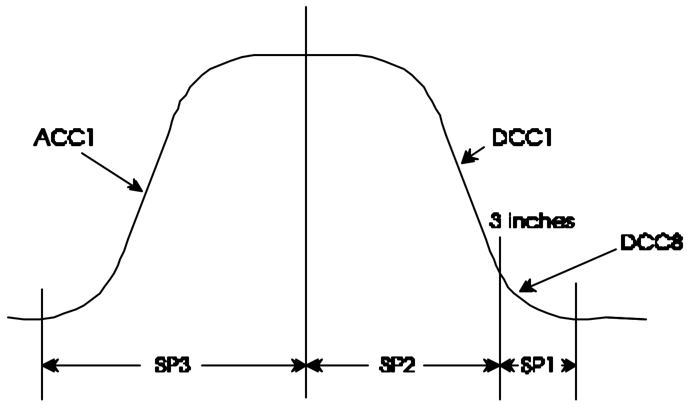


HIGH SPEED RUN

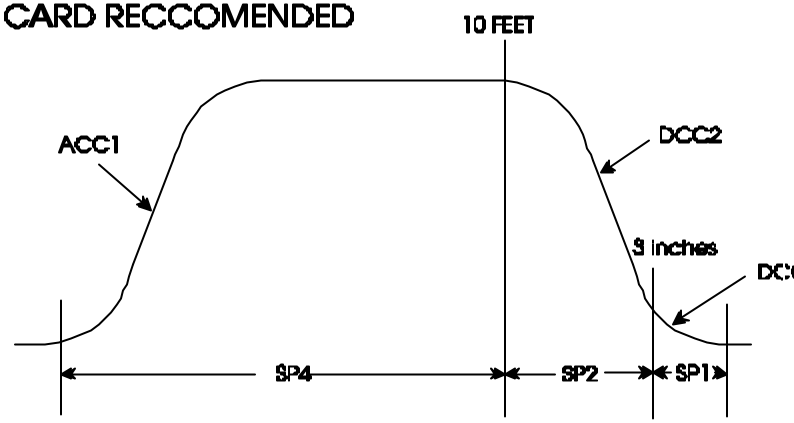
TYPICAL LOGIC SELECTION FOR BI-DIRECTIONAL APPLICATION

800 FEET PER MINUTE GEARLESS

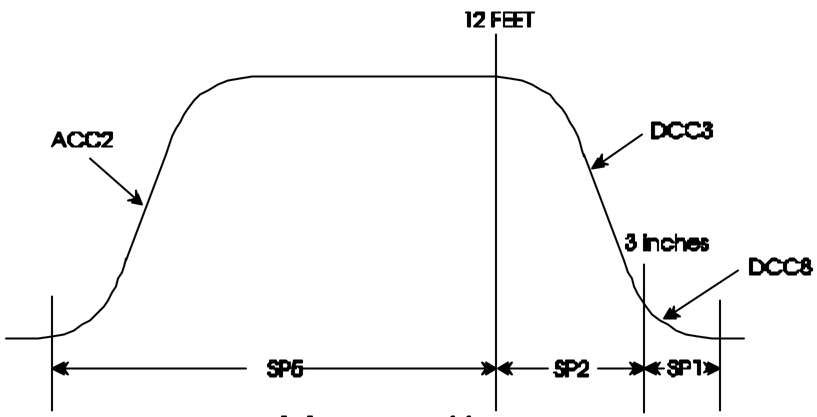
D1046 HIGH SPEED OPTION CARD RECCOMENDED



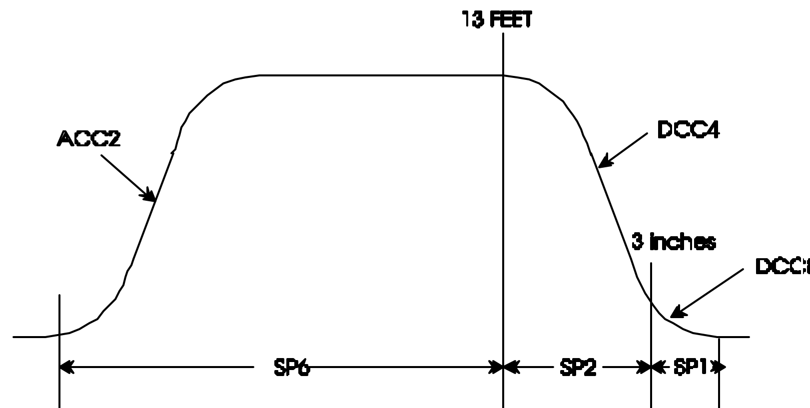
ONE FLOOR RUN (300 FPM)



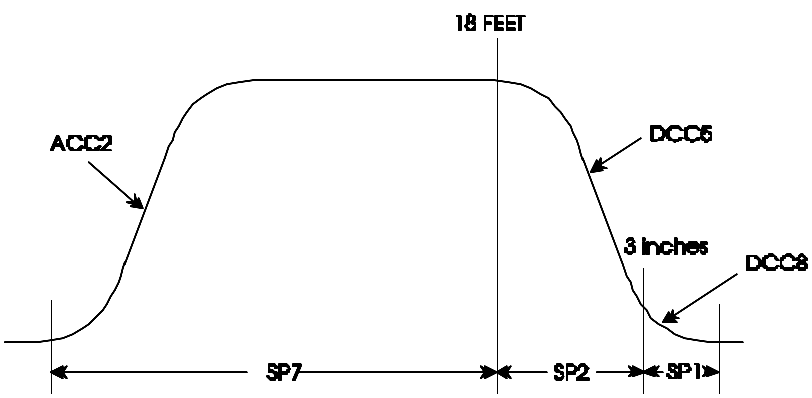
TWO FLOOR RUN (350 FPM)

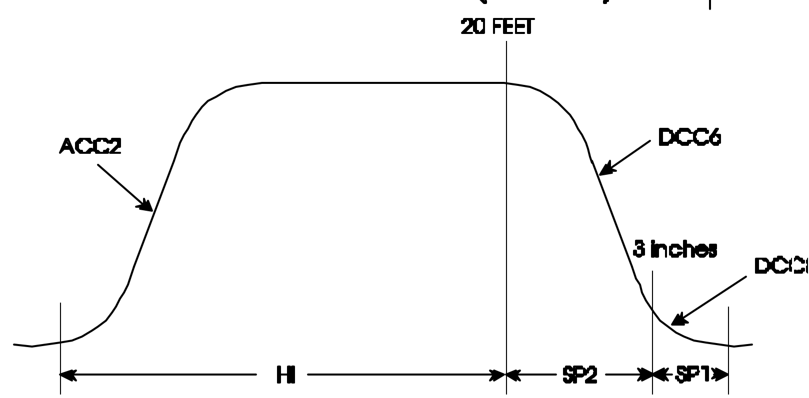


THREE FLOOR RUN (500 FPM)



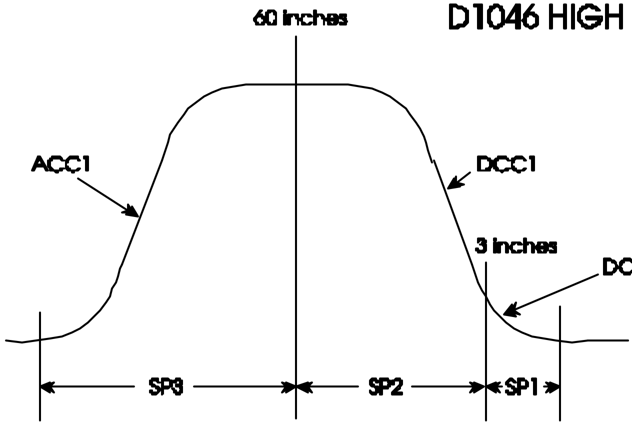
FOUR FLOOR RUN (600 FPM)



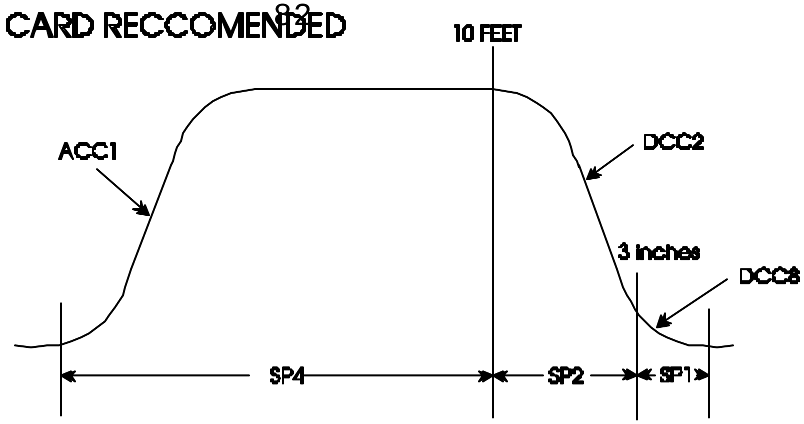


TYPICAL LOGIC SELECTION FOR BI-DIRECTIONAL APPLICATION 700 FEET PER MINUTE GEARLESS

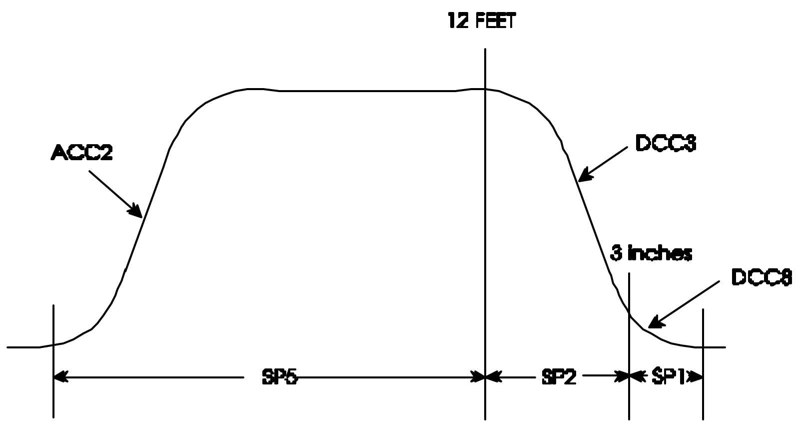
D1046 HIGH SPEED OPTION CARD RECCOMENDED



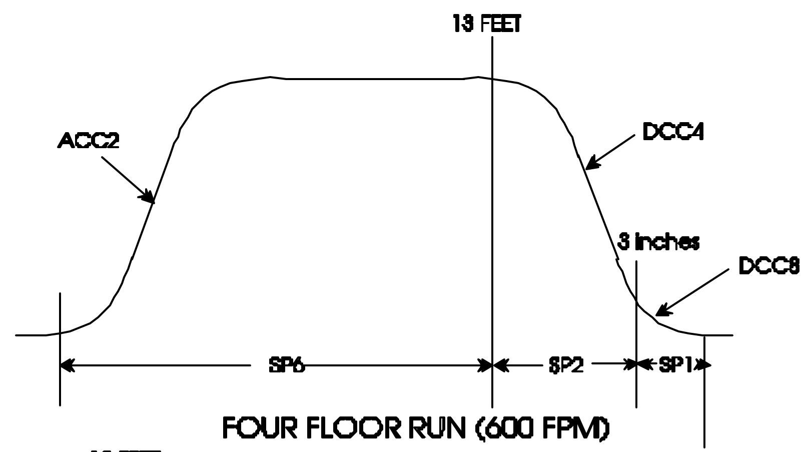
ONE FLOOR RUN (300 FPM)



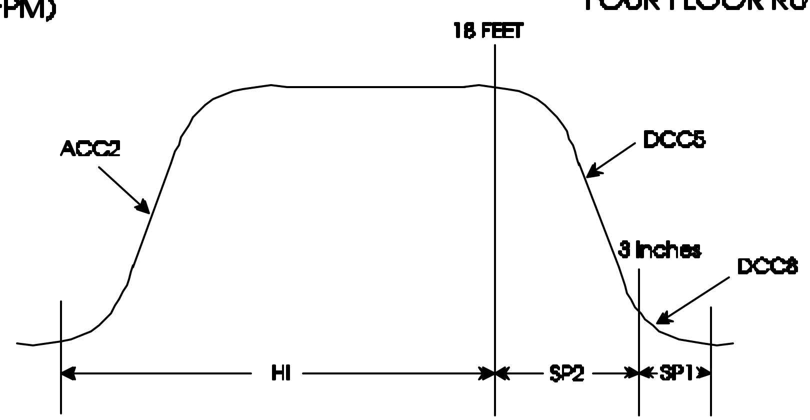
TWO FLOOR RUN (350 FPM)



THREE FLOOR RUN (500 FPM)



FOUR FLOOR RUN (600 FPM)



HIGH SPEED RUN