

TVL 171
ISSUE 1
07/93

**ACVV
2 SPEED
MKIII REGULATOR
MANUAL**



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Introduction To Control System

The system is designed to give closed loop control of lift motors, fitted with two separate windings, when used on lift applications of up to 1.8 m/s (350 FPM).

The flow chart of the system is given in TVLD 348.

The lift motor, a two speed high slip motor drives a tacho generator giving a precision speed feed back signal to minimise lift motor speed errors caused by differing load characteristics.

The speed pattern is derived from a regulated power supply to reduce target speed variations caused by supply voltage fluctuations. Target speeds are obtained from a refined "S" ramp giving stepless transitions between speeds.

An error summing junction compares the tacho generator voltage to the pattern voltage to give an error signal which is read and amplified by the error amplifier. A gain/stability network is applied to the error amplifier to ensure rate of change stability.

Dependent on polarity of the output of the error amplifier the appropriate drive or brake mode is selected. A control voltage governed by the output of the error amplifier is applied to the appropriate thyristor firing circuits giving full phase control. By varying the motors supply voltage and exploiting the motors speed torque characteristic, speed control of the motor is obtained.

Braking is achieved by injecting a DC current into a separate winding (normally the motors low speed winding). The degree of braking being determined by the magnitude of the error amplifier.

A small amount of overlap between drive and brake is provided to eliminate the control window ensuring smooth transition between brake and drive modes.

The motor is run under speed control during all movement cycles, therefore the maximum speed of the motor may be considered as FLRPM-20.

Sequence Of Events

Upon receipt of a direction signal on RG8 (UP) or RG9 (DN) plus a speed signal, the regulator checks the logic voltage and the phase detection circuitry and, if acceptable, signals relay IMC (card ACR7) to operate. Contacts of IMC operate the MC contactor so connecting the regulator to the motor.

At a time determined by potentiometer "P2" (card ACR7) the instruction is given for the brake to lift via relay IBK (card ACR7).

On receipt of a brake lifted signal the pattern is enabled, rising to its target value initially under the influence of potentiometer "SS" (card ACR4) then potentiometer "ACC" (card ACR4) and lastly via potentiometer "RND OFF" (card ACR4).

The lift accelerates up to target high speed (initiated by off board relays) and continues at high speed until slow down is called for where upon the appropriate HS LED (card ACR3) will extinguish.

Upon loss of high speed the pattern will ramp down under the influence of potentiometer "DEC" (card ACR4) until "Approach Speed" is obtained. The lift will run at this speed until the levelling vane is detected where upon it will decelerate under the influence of the potentiometer "DEC" until "Levelling Speed" is obtained.

Upon detection of floor level, signalled by off board relays, "Levelling Speed" will be lost and the lift will target for zero speed.

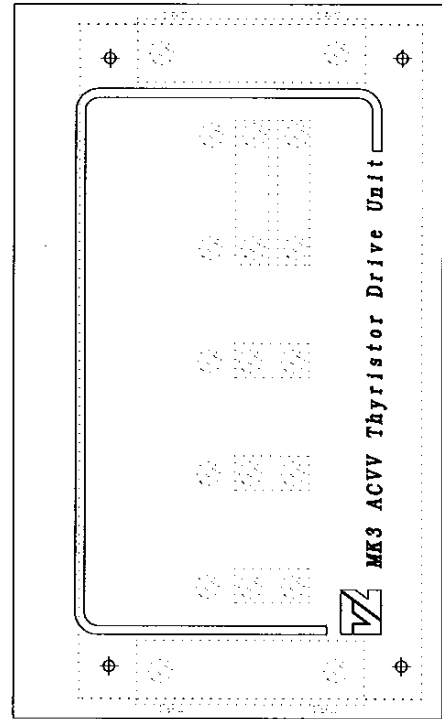
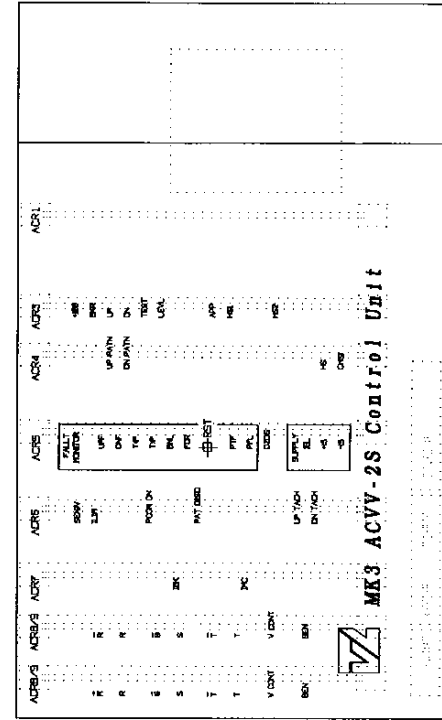
After a period of time set by potentiometer DLT1 (card DCR7) relay IBK is released, thus allowing the brake to set.

After a second period of time set by potentiometer DLT2 (card ACR7) which times out from the loss of relay IBK (card ACR7) the thyristors are disabled and relay IMC (card ACR7) released. Loss of relay IMC releases contactor MC, thus disconnecting the motor from the drive.

Contacts of relay FDR are to be placed in the safety chain in order for the direction to be lost immediately.

12.500"

12.500"

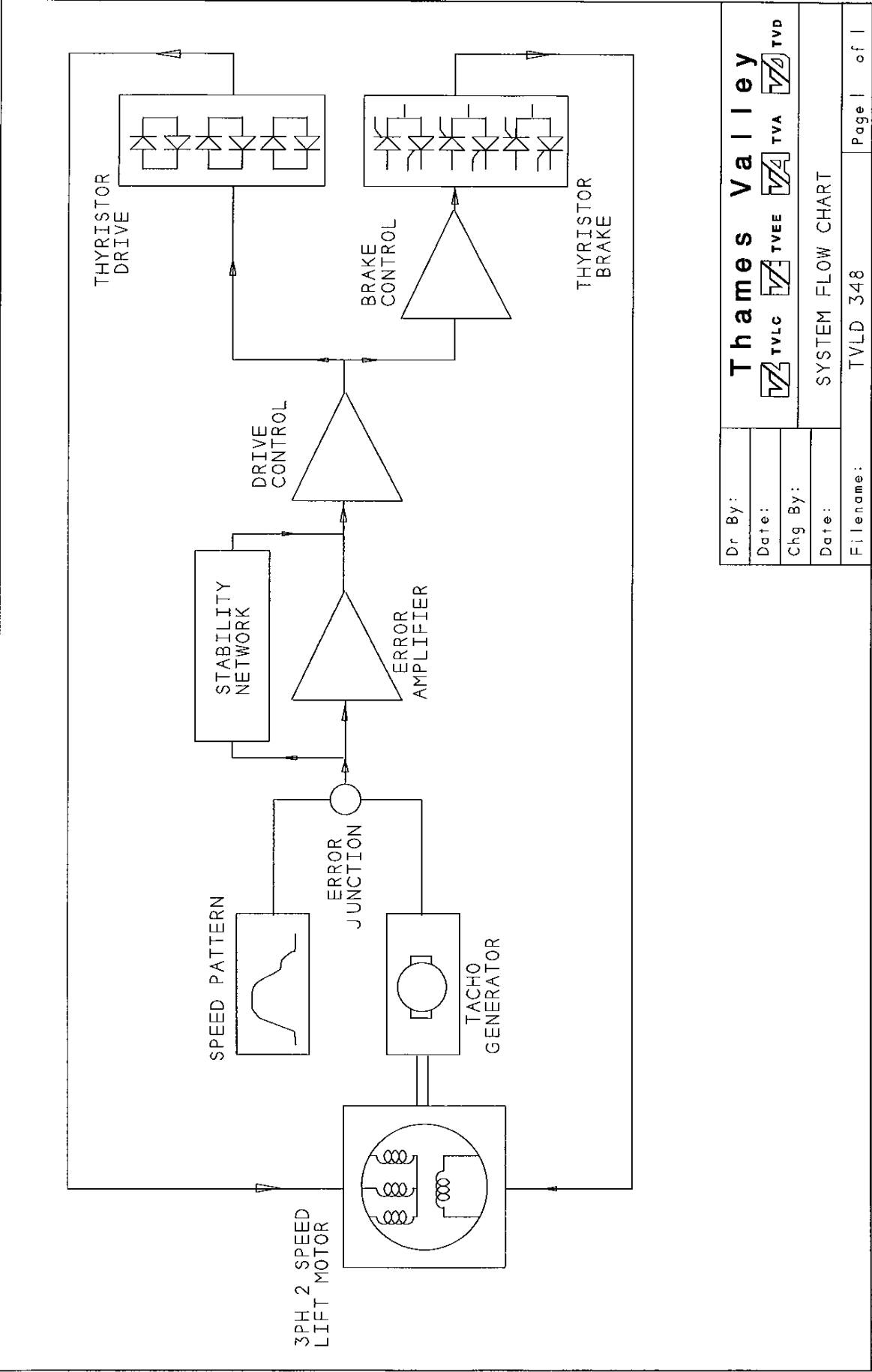


7.500"

CONTROL UNIT

THYRISTOR/HEATSINK ASSEMBLY
 BOTH ASSEMBLIES ARE MOUNTED ON THE BACKPLATE
 AND ARE FRONT ACCESS.
 ILLUSTRATION IS NOT TO SCALE

Dr By: DFC		Thames Valley	
Date: 28.6.93			
Chg By:			
Date:	FRONT ELEVATION--MK3 AC REGULATOR		
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Dr By:	Thames Valley			
Date:				
Chg By:	SYSTEM FLOW CHART			
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General Data

The Mk 3 AC Regulator is manufactured as two separate modules, connected together by a pair of ribbon cables.

The modules are: a) The control unit, which contains all of the electronic circuitry and adjustments and indicators, and

b) The thyristor heatsink assembly.

Both modules are mounted on the Controller backplate and can be mounted either side-by-side or one above the other to suit the convenience of general panel layout requirements.

General Parameters

Size	Both modules are the same overall size: 310mm Long x 190mm High x 180mm Deep.
Ambient temperature range	0°C to +40°C
Tacho inputs	10#/60/90/120/180V*
Power supply (std)	415V/3Ph/50Hz
Fusing	"Ultra Fast Blow" Thyristor Fuses. **
FDR, IMC, IBK contact rating	240VAC, 5 Amp res load.

* It is strongly recommended that a high quality tacho generator is used coupled to the AC motor in such a way as to avoid cyclic oscillations.

** Available from the factory.

+ Where single quadrant electronic tacho units are used two quadrant fault detection is not afforded by the regulator.

Purchasing Information

To assist in the selection of the units the following information is provided.

Current Rating

To accommodate the various motor F.L. currents the system is available to suit two speed lift motors preferred poles 4, synchronous speed 1500 R.P.M. at up to 70 Amps Full Load Current.

Speed Options

The standard system is offered with four speeds:-

- 1) High Speed 1
- 2) Approach
- 3) Levelling
- 4) Test

One additional high speed is available as an optional extra.

Speed Monitor Unit

An on board speed monitor unit for including in the door zone circuitry or any circuitry requiring sensing of low speed is offered as a standard.

An additional speed monitoring unit (SMU) for use with terminal speed checking circuitry, is offered as an optional extra.

NB: Included in the regulator as standard are phase sequence, phase failure, thermistor protection, inter-floor computer, speed error, brake error and fault logging circuitry.

Customer Adjustment Points

The finished unit has been factory tested and has all preset potentiometers set to initial run values.

To obtain the best performance from the unit some site trimming of the following potentiometer may be required. For location of the potentiometers please refer to TVLD 347.

<u>Card Ident</u>	<u>Identification</u>	<u>Function</u>
ACR4	TEST	Adjusts "Test" target speed. Turn CW to increase speed.
	LEV	Adjusts "Levelling" target speed. Turn CW to increase speed.
	APP	Adjusts "Approach" target speed. Turn CW to increase speed.
	HS1	Factory set unless 2 high speeds have been requested. If 2 high speeds requested will adjust HS1 target speed. Turn CW to increase speed.
	HS2	If 2 high speeds requested, then factory set, else not used.
	TH	Sealed at the factory.
	ACC	Adjusts the linear part of the acceleration rate. Turn CW to increase acceleration rate.
	DEC	Adjust the linear part of the deceleration rate. Turn clockwise to increase deceleration rate.

<u>Card Ident</u>	<u>Identification</u>	<u>Function</u>
ACR4	SS	Adjusts the initial acceleration rate. Used mainly to allow smooth starts on lifts where heavy stiction/friction is experienced on start. Turn CW to reduce the initial rate of acceleration i.e. increase the effect of soft start. Use with caution. If turned too far CW lift will fail to start.
	RND OFF	Adjusts the degree of pattern rounding during transition into the target speeds. Should be set to give comfortable speed changes with out interfering with stopping accuracy.
	HS*	Used to set up operating point of computer card. Factory set.
	** CHS*	Used to set the time for which the high speed is held by the computer circuitry. Adjust CW to increase time.
ACR5	DZOS	Adjust the tacho voltage level at which the door zone relay operates. Adjust CW to increase speed.

* See section - re-operating of computer circuitry.

** On some regulators CHSI

<u>Card Ident</u>	<u>Identification</u>	<u>Function</u>
ACR6	ISENS	Not used
	PCON	Adjusts the amount of drive applied to the motor before the brake lifts. Use carefully to minimise roll back on start. Turn CW to increase effect.
	PAT TIMER	Adjusts the length of time before the pattern will rise, if BKR signal is delayed due to it being a signal derived from a brake auxiliary contact. This delay timer is nullified when LED BKR is lit. Turn CW to increase time.
	SS STAB	Not used.
	2SP STAB	Adjusts the gain and hence the speed loop stability. Should be adjusted as far ACW as possible conducive with stable drive operation.
	TACH SCALE	Adjusts the speed of the lift. Adjusted for contract speed when the appropriate HS indicator is lit. Turn CW to increase speed.
	TACH BAL	Factory set. May be used to balance UP speeds to DN speeds where assymetry in tach generator input exists.
	DRIFT OFFSET	Compensates for drift within the error amplifier input circuitry. Factory sealed.

<u>Card Ident</u>	<u>Identification</u>	<u>Function</u>
ACR7	DLT1	Adjusts the time after calling for zero speed before the brake is allowed to set. Turn CW to increase time.
	P2	May be used to delay the brake lifting and the pattern rising in order for precon settings at start to establish. Turn CW to increase delay before brake is instructed to lift on start.
	DLT2	Adjusts the time after the brake has set before relay IMC requests the release of the main contactors. Turn CW to increase delay.

For the function of HS1 and HS2 on board ACR3, please refer to section "Site Trimming Procedures".

Visual Monitor Indicators

To assist in setting up or fault finding, the basic unit is fitted with "Tell Tale" LEDs shown in illustration TVLD 347 which monitor the following:

<u>Card Number</u>	<u>Identification</u>	<u>Function</u>
ACR3	100	(*) Lit to prove "on board" 100V source is available for "off board" speed selection contacts. (Output connector 8, ident 100V).
	BKR	Lit when "off Board" relay reports the brake is lifted. When lit any precondition value will be inhibited and both error amplifier and pattern will be enabled (input connector 8, ident BKR).
	UP	Lit when the lift is requested to travel up. When lit, IMC relay operates causing contactor MC to connect regulator to line. Also IBK relay will operate after a time determined by P2 on ACR7 requesting the brake to lift. (Input connector 8 ident RG8).
	DN	Lit when the lift is requested to travel down. Same actions as UP as regards IBK and IMC (input connector 8, ident RG14).

(*) Indicators lit with regulator in standby.

<u>Card Number</u>	<u>Identification</u>	<u>Function</u>
ACR3	TEST	Lit when the lift is requested to travel at "Test Speed". (Input connector 8, ident RG10).
	LEVL	Lit when the lift is requested to travel at "Levelling Speed". (Input connector 8, ident RG10).
	APP	Lit when the lift is travelling at "High Speed" and remains lit when the associated HS LED is extinguished. Extinguished when the lift is requested to run at "Levelling Speed", therefore offering default lift speed between "High Speed" and "Levelling Speed".
	HS1	Lit when the lift is requested to travel at "High Speed". (Ident connector 8, ident RG11).
	HS2	If 2 high speeds are requested lit when the higher of the 2 speeds is required. In such a case HS1 and HS2 will be lit simultaneously. (Input connector 8, ident RG12).

<u>Card Number</u>	<u>Identification</u>	<u>Function</u>
ACR4	UP PATN	Lit when the pattern is requesting the lift to travel in the up direction. Will only illuminate if PAT DIS'D LED is extinguished on board ACR6. Should illuminate in sympathy with "UP TACH" on ACR6 to give indication that tacho generator polarity is correct relative to pattern.
	DN	Lit when the pattern is requesting the lift to travel down. Similar comments as for UP PATN except DN TACH on ACR6 will illuminate.
	HS	Lit whilst "off board" relays request the lift to run at high speed.
	CHSI	Lit whilst on board relay HSI is maintained by the interfloor computer circuitry. For setting instructions see computer card set up procedures.
ACR5	UPF	Lit if a fault is registered when the UP direction is requested.
	DNF	Lit if a fault is registered when the down direction is requested.
	T<P	Lit if a fault is registered caused by the tacho voltage being less than the pattern i.e. the lift has been requested to move, but has failed to do so.

<u>Card Number</u>	<u>Identification</u>	<u>Function</u>
ACR5	T>P	Lit if a fault is registered caused by the tacho voltage being greater than the pattern i.e. the lift is not responding to the speed requested by the regulator.
	BNL	Lit if a fault is registered due to the "brake lifted signal" not being received after 5 seconds from the request to lift.
	FDR	Lit if a fault is registered. Will automatically reset after 5 seconds if link ARL is fitted on the ACR5 board.
	PTF	Lit if the thermistor protection circuitry has been activated or a phase fault has been detected.
	PLF	Lit if a phase fault has been detected.
	DZOS	Lit to indicate regulator relay DZR has operated and contacts between regulator terminals DZ1 and DZ2 are open. Indicates that lift is running at a greater speed than that set by potentiometer 'DZOS set'.
	15L (*)	Lit to indicate regulated supply exists for regulator IC logic circuitry.

(*) Indicators lit with regulator in standby.

<u>Card Number</u>	<u>Identification</u>	<u>Function</u>
ACR5	+15	(*) Lit to indicate +15V exists for regulator analogue circuitry.
	-15	(*) Lit to indicate -15V exists for regulator analogue circuitry.
ACR6	SE>9V	When lit indicates that the on board speed amplifier is working outside range. Should not be lit when lift runs at constant speed. Very brief illumination when lift accelerates under full load condition, car travelling up, is acceptable. (If lit at constant speed suspect TACH SCALE potentiometer on ACR6 board has been maladjusted.)
	ILIM	Will light in sympathy with SE>9V LED.
	PCON ON	Lit to indicate that a degree of drive adjustable by potentiometer PCON is available to the motor upon the regulator receiving a direction. Will extinguish as soon as pattern is allowed to rise and can be affected by the setting of P2 on board ACR7.
	PAT DIS'D (*)	Lit all the time the pattern is disabled from rising.
	DN TACH	Lit if the lift is travelling down. Used in conjunction with indicator "DN PATN". When both lit indicates pattern and tacho polarities are correct.

(*) Indicators lit with regulator in standby.

<u>Card Number</u>	<u>Identification</u>	<u>Function</u>
ACR6	UP TACH	Lit if the lift is travelling up. Used in conjunction with indicator "UP PATN". When both lit indicates pattern and tacho polarities are correct.
ACR7	IBK IMC	Lit when the regulator requests the brake to lift. Lit when the regulator requests the thyristors to be connected to line.
ACR8/9D	-R R -S S -T T	Lit when return drive thyristor is R phase is requested to conduct. Lit when forward drive thyristor in R phase is requested to conduct. Lit when return drive thyristor in S phase is requested to conduct. Lit when forward drive thyristor in S phase is requested to conduct. Lit when return drive thyristor in T phase is requested to conduct. Lit when forward drive thyristor in T phase is requested to conduct.

<u>Card Number</u>	<u>Identification</u>	<u>Function</u>
ACR8/9D	V CONT	(*)Illuminates proportionally to demanded firing angle i.e. when no conduction is required from the thyristors it will illuminate brightly. When full conduction is required from the thyristors it will be extinguished.
	BEN	Lit to indicate drive bridge is enabled.

(*) Indicator lit with regulator in standby.

<u>Card Number</u>	<u>Identification</u>	<u>Function</u>
ACR8/9B	-R	Used only on 3Ø DC bridge versions. Lit when return brake thyristor in R phase is requested to conduct.
	R	Used only on 3Ø DC bridge versions. Lit when forward brake thyristor in R phase is requested to conduct.
	-S	Used only on 3Ø DC bridge versions. Lit when return brake thyristor in S phase is requested to conduct.
	S	Used only on 3Ø DC bridge versions. Lit when forward brake thyristor in S phase is request to conduct.
	-T	Lit when return brake thyristor in T phase is requested to conduct.
	T	Lit when forward brake thyristor in T phase is requested to conduct.
	VCONT(*)	Illuminates proportionally to demand firing angle ie. when no conduction is required from the thyristors it will illuminate brightly. When full conduction is required from thyristor it will be extinguished.
	BEN	Lit to indicate brake bridge is enabled.

(*) Indicator lit with regulator on standby.

Recommended Service Equipment

The AC regulator uses on board visual monitoring devices to minimise the equipment required to monitor performance.

To assist in maintaining the unit the following tools and instruments are recommended.

- 1) Small screw driver or trimmer tool
- 2) High resistance (20K.OHM/V A.C./D.C. meter)
- 3) Tachometer 0-2000 RPM

SITE TRIMMING

The instructions which follow are intended as a guide to site testing and trimming.

The commissioning engineer has the sole responsibility for taking adequate safety precautions during the carrying out of these procedures.

A. Preliminary Work

- 1). Check all safety circuits and ensure all safety switches are in order.
- 2). Check all wiring to the lift motor, tacho-generator and controller.
- 3). Check that the mechanical brake mechanism is set up according to the installation instructions.
- 4). Check that the thermistor terminals, TH1 and TH2 are linked out if motor thermistors are not fitted.
- 5). Remove card ACR4 and ensure switch COMP is in the "OFF" position. (The switch is situated towards the lower back section of the board). Replace card firmly into the motherboard.
- 6). Link out the contacts of the FDR relay namely FDR1 and FDR2.

B. Power Up

- 1). With car top test mode selected, i.e. relay TTR energised, switch on and check tell tale LEDs. (Refer to section Visual Indicators).
- 2). Inspect "Phase Fault" LED and if lit, switch off and change over two input phases at the point of entering the controller.
- 3). Re-apply power and if correctly connected the "Phase Fault" LED will remain unlit. Switch off.

C. Pre-run Check

- 1). Ensure that lift doors are closed and remain closed by disconnecting "OL" in the controller.
- 2). Disconnect the levelling relays by disconnecting "LL" in the controller.

D. Tacho Polarity and Rotation Checks

Please read the following test procedure in its entirety before actioning.

1. With lift mid shaft insert a Test Down instruction (normally by connecting TD to TUD).
 - i. If the lift moves downwards use procedure iii.
 - ii. If the lift moves upwards change over two of the motor input phases and repeat D1.
 - iii. If the lift is requested to move down the monitor indicator "DN PATN" (card ACR4) must be lit. Ensure that when indicator "DN PATN" is lit monitor indicator "TACH DN" (card ACR6) illuminates. If monitor indicator "TACH UP" illuminates change over the tacho generator leads and repeat test D.

E. Preliminary Adjustment of Test Speed

To adjust the tacho generator scaling of the regulator correctly the lift needs to be able to run at contract speed. As this is not always feasible during installation the lift can be run at a controlled test speed by adopting the following procedure.

- 1). Adjust potentiometer "TACH SCALE" (card ACR6) fully A.C.W.
- 2). Request the lift to travel at test speed and adjust potentiometer "Test" (card ACR4) until the lift is travelling at the required test speed.

Note 1 If instability is present adjust potentiometer "2SP STAB" CW.

Note 2 Prolonged running of motor at low test speeds should be avoided as it leads to over-heating of motor.

- 3). Remove link from FDR1 - FDR2 and refer to section headed "FDR Adjustment" for further details.

F. Final Tacho Scaling and Speed Settings

When the lift has been correctly counterweighted and all shaft positioning, signalling and safety devices are deemed working the following procedure is to be adopted.

- 1a. Adjust potentiometer DEC (card ACR4) to approximately 1/3 of the way from the front of the card.
- b. Link out FDR1 to FDR2 either at the regulator or in the panel.

2. High Speed

- a. With the lift on Normal control, register a call to a non terminal floor and adjust potentiometer "TACH SCALE" (card ACR6) until the lift travels at contract speed.

If contract speed cannot be obtained (ie. lift travels too slow when tacho scale pot is adjusted fully clockwise) move tacho scaling link, situated at rear of ACR6 board, to a higher scale eg. If link is in 60 move to 80 or above if necessary. If SE>9V indicator illuminates, when tacho scaling pot is adjusted fully anticlockwise, before contract speed is obtained the tacho scaling link should be moved to a lower scale.

- b. With empty car travelling down ensure that at no time during lift travel monitor indicator SE>9V (card ACR6) illuminates. If it illuminates when the lift is running at high speed turn potentiometer "TACH SCALE" until it no longer illuminates. If it illuminates during acceleration turn potentiometer "ACC" ACW until indicator remains extinguished.
- c. Repeat test but with 5% overloaded car in the up direction.

3. Approach Speed

- a. Enter a call to a penultimate floor and after approximately 2 seconds of lift travel switch off (upwards) switch HS1 (card ACR3).
- b. Adjust the lift speed to approximately 50 FPM (0.25m/s) via potentiometer "APP" (card ACR4).

Important: Return switch HS1 to the "ON" (down) position on completion of test.

4. Levelling Speed

- a. Enter a call to a penultimate floor and after approximately 2 seconds of lift travel switch off (upwards) switch HS1 (card ACR3).
- b. Upon approach speed being obtained depress push button "LEV" (card ACR4) and keep pressed whilst adjusting potentiometer "LEV" (card ACR4) until the lift is running approx 10FPM (0.05 m/s).

Important: Return switch HS1 to the "ON" (down) position on completion of test.

5. Zero Speed

- a. Enter a call to a penultimate floor and after approximately 2 seconds of lift travel switch off (upwards) switch HS1 (card ACR3).
- b. Push button LEV and release ensuring the lift targets for zero speed.

Important: Return switch HS1 to the "ON" (down) position on completion of test.

G. Ride Comfort

a. Starts

If the system has high stiction (ie if when the brake is lifted considerable force is needed to get the lift to move), the start can be improved by adopting the following procedure.

- i. Potentiometer "PCON" (card ACR6) should be turned fully anti-clockwise.
- ii. Potentiometer "SS" (card ACR4) should be gradually turned CW until a smooth start is obtained.

Note: Avoid turning potentiometer "SS" to far CW as the lift may fail to move.

If the system has low stiction (ie when the brake is lifted with the lift at the top penultimate floor roll back is experienced), the starts may be improved by adopting the following procedure.

- iii. Potentiometer "PCON" (card ACR6) should be adjusted to minimise roll back with empty car at top terminal floor.
- iv. Potentiometer "PAT TIMER" (card ACR6) should be adjusted gradually CW to increase the time, the precondition is maintained before the brake is instructed to lift.

If fierce starts are still experienced ensure the brake is lifting correctly when indicator IBK (card ACR7) illuminates.

b. **Acceleration**

Adjust potentiometer ACC (card ACR4) until the acceleration rate is deemed comfortable. (Normally 0.7 M/S²).

Note: Too high an acceleration rate may cause indicator SE>9 (card ACR6) to illuminate. Should this happen reduce the acceleration rate.

c. **Round Off**

Should the speed transitions into target speeds seem hard, improvements can be obtained by adopting the following procedure.

v. Adjust potentiometer "RND OFF" (card ACR4) until satisfactory transitions are obtained.

Note: If potentiometer "RND OFF" is adjusted too far CW floor levelling may be affected.

vi. If instability should occur adjust potentiometer "2SP STAB" CW.

H. **Decel Profile**

Should a virtually straight into floor profile be required please adopt the following procedure.

Gradually adjust potentiometer "DEC" (card ACR4) anti-clockwise until deceleration rate is as required. Should the approach speed intrude in the profile down to levelling speed, turn potentiometer "APP" (card ACR4) gradually ACW until no intrusion is noted.

I. **Adjusting Speed Monitor for Door Zone**

Adjust potentiometer "DZOS SET" until monitor indicator extinguishes when lift is running at the correct speed for the doors to be primed for opening.

(See any associated specification, or code of practice).

J. Adjusting Fault Detect Circuitry

Should the fault detect circuitry operate, indicated by monitor indicator FDR (card ACR5) illuminating depress push button RST (card ACR5) after first investigating reason for fault. Indicators to help in fault find are found on card ACR5.

- a. If indicators FDR, UPF and T>P are illuminated this indicates a fault took place when an up direction was set. The reason for the fault being the tacho generator signal was greater then the pattern.
- b. If indicators FDR, DNF and T<P are illuminated this indicates a fault took place when a down direction was set. The reason for the fault being the tacho generator signal was less than the pattern.

K. COMPUTER CIRCUIT ADJUSTMENT

The commissioning engineer has the sole responsibility for taking adequate safety precautions during the carrying out of these procedures.

1. When all speeds are set and the system is performing satisfactorily, place switch marked "COMP" on card ACR4 to the ON position. Replace card firmly.
2. Ensure lift doors are closed and remain closed by disconnecting "OL" on the controller.
3. Register single floor runs and adjust potentiometer CHS * until minimum dwell at approach/levelling speed is obtained. LED CHSI should go out very shortly after LED HS1.

Note: If the lift rushes the floor giving an abrupt stop, turn CHS anti-clockwise.

4. Check floor to floor runs for levelling at all floors and re-adjust potentiometer CHS as required for best performance.

Note: Where direct into floor profiles are used you are advised against the use of the computer card.

* On some regulators CHSI