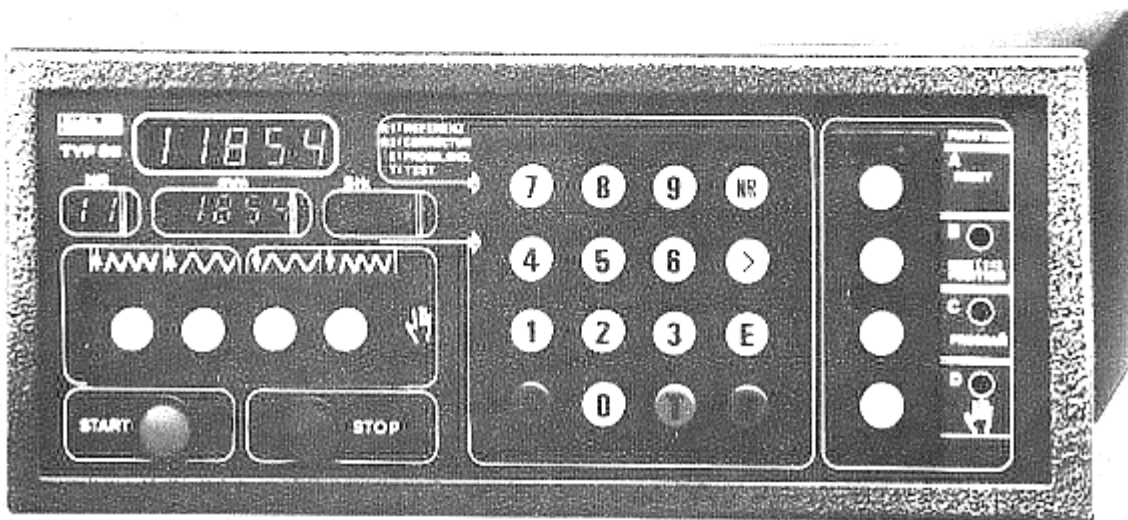**ELGO**
ELECTRIC

86P series

SINGLE AXIS POSITION CONTROLLER

- Large, dustproof Keyboard
- 99 Address Memory • Position/Quantity • Externally selectable
- Absolute/Incremental Operation • Automatic Backlash Compensation
- Completely plug-in construction
- Will operate with 2-speed AC or DC drives, Hydraulic cylinders, closed loop Servodrives or Stepper Motors

The automatic Position Controller 86P is a compact plug-in unit with self contained mains power supply and supply for the Encoder.
Its essential main features are :

- Large, dustproof Keyboard, suitable for operation with gloved hands.
- 99 Address Memory, which can be operated in a combination of Absolute and Incremental dimensions.
- Unlimited time memory of Programme and Actual position, on mains switch off.
- Facility for external Address selection.

Functions/Concepts
Absolute Mode
In absolute mode, the unit calculates the direction, speed and to be run from the instantaneous actual position, to the preset desired position.
Preset correction values (eg saw width) are not used as standard in absolute mode, but can be provided if needed.

Incremental Mode
The incremental address can be preset in 3 basic forms :

1. Incremental moves will basically take place from a high value, in the direction of zero.
2. Incremental moves will basically take place in the + direction, away from zero.
3.
(a) Without Incremental Error Compensation.
   A positioning error in one move, will not be compensated for in the next move, ie all steps are made with the same accuracy tolerance.
(b) With Incremental Error Compensation.
   Should one move have an error of say 0.2 mm then the following move will automatically compensate, ie the Absolute actual value will remain within accuracy tolerance.

Memory Address Allocations
Each Address comprises a 5 digit demanded position with fixed decimal point to 1 or 2 decimal places and a three digit repeat or quantity factor.

The 99 Addresses are allocated as standard as :
(a) Address 1 - 79 Absolute
    Address 80 - 99 Incremental
(b) Address 1 - 79 Incremental
    Address 80 - 99 Absolute
Version a. or b. can be selected at the rear of the unit. Other combinations are available to special order.

The Open Loop Control Switched Positioning
Most commercially available drives are suitable for control by the 86P.
Due to limited natural retardation of the mechanics, it is advisable to fit a Brake.

Slow Running Distance, Stop Correction
The Slow running distance can be preset between 1 and 99 at the rear of the unit by means of Coding Switches VS.
Should the delay in braking result in over-run, this can be corrected by means of Coding Switch KS, which gives a range of 0.1 - 9.9.

Automatic Backlash Compensation
Should backlash be present in Screw or Pinion, then the approach to position can be selected to be always from one direction. The required conditions are set on the T Potentiometer at the back of the unit.

Automatic Retract
Should it be necessary for the Backstop to retract during a cut operation, and then return to the same previous position, this can be effected by closing contact 20 and 12. Opening the contact returns Backstop to previous position.
The required retraction distance is set on the T Potentiometer at the back of the unit.

Datum Setting
The Machine is moved to a known mechanical datum point. The value of this position is noted and programmed into address R1. When the appropriate external contact is closed, this value is transferred to the Actual Value display.
It is possible to prefix a Switch on the machine that will operate at the datum point, so as to automatically datum the machine. The datum must be approached at slow speed.
The alternative method is to provide a key operated switch on the desk.

In principle, the machine need be datumed only during commissioning, since the actual value is always memorised on mains switch off.

Options
Closed Loop Control, Analogue Output
This option is to be used with 4 quadrant servo drives. Instead of bi-directional fast, slow, stop operation, the drive speed is controlled by an analogue signal in closed loop mode and ramped to zero as position is approached. This system is to be used only in machines without backlash.
When in position, the system jitters 1 bit. If the load attempts to move it out of position it will produce torque to resist the movement and if actually moved, will return into position.

Number of Strokes and Remaining Distance Calculation
Application : Sawing Machine with limited feed stroke mechanism
Example :
Maximum Cylinder Stroke 600.0mm
Demanded move   700.0mm
Saw width   4.0mm
Result : The feed mechanism is first of all moved 600 mm. On reaching the preset stop, the stroking cylinder moves back and the Feed mechanism moves again automatically, a distance of 104.0 mm. By this means the required distance of 700.0 mm is preset beyond the saw line.

External Address Selection
It is possible to programme all 99 addresses and select the destination from an external controller. For this option a 15 way D connector is fitted.
Details of interconnection are given on page 5.

Inch/Metric Selection
The unit can be fitted with a card for calculating inch/metric conversion. Selection is made at the rear of the unit.
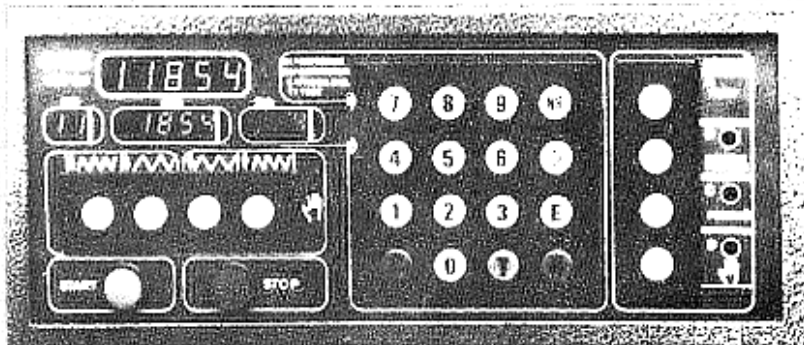
Over-run Security
In case of mains failure, Encoder and Controller are supplied for about 4 sec from a battery before storage of actual position.

Flexible Multiplier
To read output in meaningful figures it is sometimes necessary to multiply Encoder pulses by any ratio 0.9999 to 0.0001

INSTRUCTIONS FOR OPERATION

Switch-on Conditions

The Unit automatically assumes the first address number in the preset programme.

The value on Switch-off appears in Actual Value display, zero is displayed in the Required Value display. To activate the required programme, the START button must be pressed - the Required Value for the first address now appears.

Datum Setting

The Machine is moved to a known position eg 20.0mm.
- Press RESET
- Press R, then 1
- Enter 200 (fixed decimal point) by means of the numerical Keyboard. The Datum value will appear in the Reference value display as 20.0mm. Press E.
- Closing the external "datum" contact transfers this value to the Actual Value Display. The Machine is now datumed.

Saw Width Correction

Say Saw width is 4.0mm.
- Press RESET
- Press R, then 2.
- Enter 40 (fixed decimal point) by means of the numerical Keyboard. The value will appear in the display as 4.0.
- Press E - The Saw Width Correction is now memorised.

MODES OF OPERATION

Hand Operation

With this mode selected, the Drive can be positioned directly in pushbutton Jog mode using the Actual Value display. The pushbuttons have the following functions :
FAST forwards, SLOW forwards
FAST backwards, SLOW backwards
These buttons are cross interlocked

Single Position Operation

With this mode selected, the numerical Keyboard is used to instantly enter dimensions into required value display (Absolute dimensions). Press C, then value required, then START.

Reset

This button is mainly used to reset all inputs. It sets the programme to the Start point and has no latching function.

Programme

When this button is activated the input Keys are enabled.

NR	= Address number
>	= Cursor forwards
R	= Call up Datum and Saw Blade correction
T	= Programme Scan/correction
E	= Programme/Input end
C	= Independent clearing of the desired value chosen by means of the Cursor.

Programming always begins by pressing RESET! This gives a simple format.

NR () > (LENGTH) > (QUANTITY)
NR () > (LENGTH) > (QUANTITY)
NR () > (LENGTH) > (QUANTITY)
... to E = Programme End.

The illuminating Cursor Point indicates the value being inserted and this can be moved forwards by Key >.

Memory Designation

Switch 8 set to on (at rear)
Address 1 - 79 = Absolute
Address 80 - 99 = Incremental
Switch 8 set to off
Address 1 - 79 = Incremental
Address 80 - 99 = Absolute

Example of a Complete Programme (86P)

It is required to go to a position of Absolute dimension 1000.0mm then execute an Incremental programme of 10 pieces at 20.0mm.
Press RESET
Press NR (Cursor point illuminates in NR display)
Press C then 1 (where you can enter any absolute address 1 to 79)
Press > (Cursor point illuminates in Required Value display)
Press C and enter the desired value eg 10000. (1000.0mm)
Press > (Cursor point now illuminates in Quantity display)
Press C and 1 (The first address is now memorised)
Press NR (Cursor point illuminates in NR display)
Press C then 80 (Incremental address, which could also be 81-99)
Press > (Cursor point illuminates in Required Value display)
Press C and enter say 200 (20.0mm)
Press > (Cursor point illuminates in Quantity display)
Press C and enter the quantity required eg 10. (now the second address is memorised).
Press E = Programme End.
When the Start is now activated, the Machine will automatically first position to 1000.0 and then make 10 incremental moves of 20.0mm in the direction of zero.

Working with Memorised Values

It is possible for example to store all 99 addresses, or parts thereof, to which one can always return at will. It is not necessary to follow a numbered programme, but possible to create a running programme using the 99 address in any combination.

Input Checking, Test - Button T

The button T has two functions :
1. The entered programme can be checked Step by Step by pressing the T button. (When external address Selection is used the preset number is indicated in the address display).
2. When the drive is Stopped (Position reached or Stop actuated) the programme can be Stepped on by means of the T button. The required address can be selected from a programme or unwanted address as ommited by this means.

Pushbutton Inhibit

The functioning of the Keypad is inhibited during running. The inhibit is cancelled by pressing STOP or RESET.

Start Inhibit

The START is inhibited, when
a. The programme is finished, or
b. The next move (eg in Incremental mode) would take the Machine past zero position.
NB Quantity pulse signal must be activated after each move, to enable the next start. (Option-auto decrement).

CONNECTIONS/DIAGRAMS

Plug in terminal list
NB : Shown in de-energised conditions

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O

Input Signals

Command	Terminals	Function
Start	20 16	Activates calculating process for the distance and direction.
Stop	20 15	De-energises output signals. Stops calculating process which must be restarted.
Datum	20 14	The preset reference value will be transferred to the actual value display when this contact is closed (eg by means of an external keyswitch)
Quantity Pulse	20 13	The Quantity counter is reduced by 1 each time this contact is closed. On reaching zero, the next Start Signal enters the next address.
Automatic Retract	20 12	With this contact closed the Backstop will retract a distance Back and Forth again.

Output Signals

Command	Terminals	Function
Run Signal	5 4	Enable contact for the Drive, closed when Desired value is greater than Actual value. Opens when Stop preset point is reached.
Slowdown	6 7	Closed when distance is greater than the Slow running distance. Open when Slowdown point is reached.
Reverse	8 9	Closed when destination is less than Actual Value.
Stop (*Progr. End)	10 11	The contact closes (on-off pulse of 100mS) when the required position is reached. Alternatively, contact closes during a programme of moves and opens at end of programme.

Encoder Connection

	Terminals	
⊓	17	Forwards (Channel A) - Encoder Terminal 3
⊓	18	Backwards (Channel B) - Encoder Terminal 4
Power Supply	19	Power Supply (+ 12v) - Encoder Terminal 2
Power Supply	20	Zero line - Encoder Terminal 1

Mains Input

	Terminals	
⏚	1	Earth
P	2	Line 220v50/60Hz 0.16A internal fuse fitted
N	3	Neutral

Technical Data

Mains Supply
220v/50Hz+/−10%
alternatively 110v ac

Load
10VA

Encoder Power Supply
12v dc 100mA

Encoder Signal
NPN Switching (Other on request)

Actual Value Display
5 digit red LED 10mm high

Reference Address Nr
2 digit red LED 8mm high

Distance
5 digit red LED 8mm high

Quantity
53 digit red LED 8mm high

Memory on Mains Removal for Programme and Actual Value
ca 5 years

System Accuracy
+/− 1 increment

Positioning Speed
60m/min max with 0.1mm resolution

Acquisition time of Refererence
10mS from contact closure

Output Signals
Potential free n/o contacts rated at 250v/0.5A

Internal Heating
28°C

Ambient Temperature
-5° to 45° C

Connector
Plug-on Terminal block with orientation

Mounting Atitude
Any

Mechanical Data

Enclosure
Switchboard mounting, metal case

Front dimension
H:124mm, W:290mm

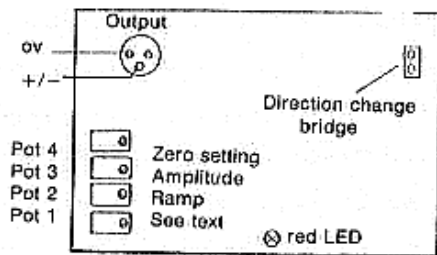**Cut-Out**
H:107mm, W:275mm

Depth
-160 mm including Connector -200 mm with external address selection Connector

Mass
1 kg.

4

Details of Analogue Module

Pot 4 : Zero Setting

Using this potentiometer, the output voltage can be set to 0v when in position, ie when required and actual position values are equal.

The red LED on the board must illuminate when in position. To set, disable drive, press front Reset button and monitor Analogue output on Digital meter. Turn Pot 4 to give zero reading.

Pot 3 : Amplitude

Setting for maximum positive and negative output voltage, ie maximum speed in the range available.
Clockwise increases voltage, anti-clock decreases volts.
Full clock gives +/- 10v.
Full anticlock gives 0v.
The voltages are equal in both directions.

Amplitude max +/- 10v
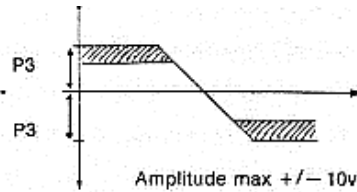
Pot 2 : Ramping Range (Positional Loop Gain)

Potentiometer for setting the ramp rate (proportional band).
The gentlest ramp is set when the break point is +/- 999 bits from the required position point.
The sharpest ramp is set when the breakpoint is approx +/- 100 bits away.
Turn the potentiometer clockwise to steepen the rate.
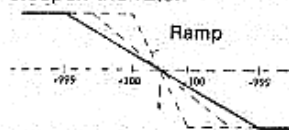
Too sharp a ramp causes instability; too long a ramp causes sloppy positioning.

### Pot 1 : Offset Voltage of D/A Converter

This potentiometer is normally set in the works and sealed.
The customer should not need to operate it.

An incorrect setting will upset the setting of the zero point of the regulator.

If it is absolutely essential that resetting must be done, proceed as follows :

(a) Disconnect encoder.

(b) Press reset pushbutton (Red LED on the analogue card must illuminate).

(c) Monitor analogue output voltage on digital meter.

(d) Plug out and in the direction bridge and note the voltage on the meter.

(e) Proceed carefully. Turning the potentiometer causes a considerable voltage change (in millivolts). The accuracy is dependent on the correct setting!

(f) The offset is correctly set, when changing the direction bridge produces no change in output voltage.

(g) Having reset the offset correctly, the zero setting (Pot 4) can be adjusted.

(h) On completion of this operation, reseal Pot 1 and check the direction bridge is firmly plugged in.

Switching Sequence
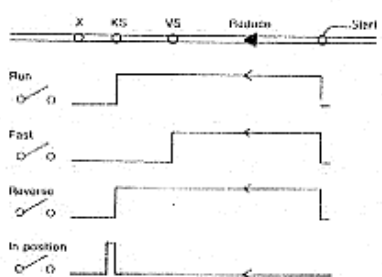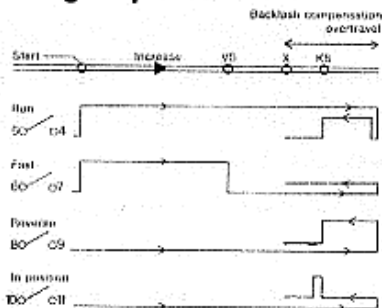
X = Required position
VS = Slowdown point
KS = Stop offset point

Connector for External Address Selection

Solderside
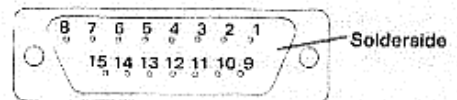
The programmed addresses 1-99 can be externally selected via this connector. Selection of address 0 inhibits the Start.

The standard input is NPN. If PNP is required this must must be specified at order stage.

An external 5v power supply is required. Any other voltage must be specified at order stage.

Pin Connections
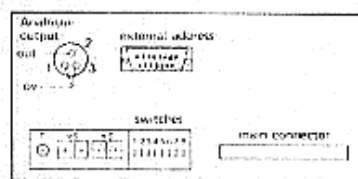2 decade, BCD code

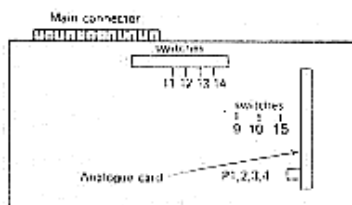| LSD		MSD	
	PIN		PIN
A(1)	5	A(10)	13
B(2)	4	B(20)	12
C(4)	3	C(40)	11
D(8)	2	D(80)	10
0v	1	0v	9
+5v	8	+5v	15

These pins to be connected to zero volts of the external power supply, to activate input

SETTINGS - TECHNICAL DATA

Layout - Settings and Connections

Rear View

Top View
(Lid removed)

Function List

T - Potentiometer
The following values can be preset by means of this potentiometer.
1. The over-run distance under Backlash compensation
2. Proportional time for the over-run w . r . t . the dwell time on reversal at the end of over-run (about 10:1).
3. Automatic retract distance.

V S Decade Switches
The slow running distance can be preset by means of these switches, between 01 and 99. Minimum value must be 01.

KS Decade Switches
The over-run distance to rest can be compensated for by means of these switches, between 0.1 and 9.9.

Function Switches S1 - S14
Switch down = closed (on).
Switch up = open (off).

Switch Nr	Switch down (on)	Switch up (off)
1	Decimal point before 1 digit	No decimal point
2	Decimal point before 2 digits	No decimal point
3	mm	inch
4	----	----
5	Output Relay on terminals 10/11 operates as 'programme end'.	
6	Output Relay on terminal 10/11 operates as 'stop' pulse.	
7	Without incremental mode error compensation.	With incremental mode error compensation.
8	Address 1 - 79 Absolute Address 80 - 99 Incremental	Address 1 - 79 Incremental Address 80 - 99 Absolute
9	Incremental mode in direction away from zero	Incremental mode in direction of zero
10	Without backlash compensation	With backlash compensation
11	Encoder pulse x 1	
12	Encoder pulse x 2	
13	Encoder pulse x 4	
14	Encoder direction	
15	With analogue control	Without analogue control

NB Switches 9 to 15 are located inside the unit

Options

Inch/Metric Switching

An external switch can be connected to the unit to select inch or mm operation.

N.B. On switching over, the unit must be given the appropriate reference datum point in correct dimensions. Also VS and KS must be reset.

External Address Selection

See connections on page 4.

Analogue Output

Settings, characteristics and connections are shown on page 4.

Hints for Use :

The controller is designed for use as an industrial panel mounting unit. The components used are the most up to date available and protected against the external environment.

Mounting Situation

- This electronic unit should be mounted away from inductive or capacitive radiation
- Avoid the warmest spots.

Mains Input

- Keep within tolerance, protect by over voltage relays.

Power Cabling

- Keep low voltage signal cabling away from power cabling.
- Screen input and Encoder cables.

Output Contacts

- Output relay contacts are protected internally by Varistors. Neverthless protect all coils and contacts with Suppressors.

Ordering Code

The basic unit gives the flexibility to the customer to select the functions by means of switches 1 - 14. It is only necessary to select the required switches to the 'on' position.

Example :
Type 86.1.5.7.13/Option mm/inch
Set switches to 'On' 1.5.7. and 13.
Set all other switches to 'Off'.

Commissioning

Without Analogue Closed Loop Control

A simple guide to putting the unit into operation is as follows :

1. Switch out of operation
(a) incremental error compensation (sw7 on)
(b) backlash compensation (sw10 on)
(c) saw blade compensation (set to 0.0)

2. Rotate Encoder in manual mode (function D) to check that Encoder gives correct direction of count. Change switch 14 if incorrect.

3. Set datum. Either put machine to mechanical zero or to a measurable position and set datum as per instructions.

4. Set Overrun distance (KS) to 0.0

5. Set Slowdown distance (VS) to some fairly large number, eg 50.

6. Work in absolute mode. Select function B (single position) on keypad.

7. Key in a position eg 100.0 Press start and note machine runs at fast speed, slow speed and stops on a reading other than 100.0 in actual value display. Note this reading eg 101.3 and the error ie 1.3 mm.

Repeat at 200.0, 300.0 etc in the upward direction and then the same positions in downward direction. Note the error at each position. It should be consistent to +/− 0.1

Take an average of this error and set KS to this value. Repeat the positions and note that machine stops accurately to +/− 0.1. You may need to trim KS another + or − 0.1 to get best results.

If stopping error is **not** consistent to +/− 0.1 in all positions, then accuracy of +/− 0.1 cannot be achieved. The problem is that friction is not constant throughout and improvement can only be made by reducing the slow (creep) speed, till consistent errors are seen.
8. When accuracy has been achieved, the slow speed point can be reduced so that cycle times are improved. Progressively reduce value of VS until the machine creeps only for the shortest time, before KS (stop) is activated.

NB: VS must never be set to 00

If VS is reduced too far, errors in positioning will now start appearing.

9. You may now select the mode of operation (if required) ie:
(a) Incremental error compensation
(b) Backlash compensation
(c) Saw blade compensation

10. You may now operate a programme and operate in incremental mode.

NB : To operate in programme mode you need to activate Quantity pulse signal.

With Analogue Closed Loop Control

First of all it is necessary to set up the 4 quadrant drive on its own such that it is stable and gives correct full speed for +/−10v reference signal. The drive and 86P can now be coupled.

Proceed commissioning as follows
1.
Set machine slide in mid position. Set P3 on analogue card to 90% anticlock.
2.
Switch power on.
The drive should stand still. If it runs away, switch off immediately. Reverse direction of Encoder channels A and B.
Switch on again and note drive stands still.
3.
Turn P3 to full clockwise.
Set KS to 1.0
Ensure slide is still in middle.
4.
Switch on.
Set datum to 0.0 (see instructions). This is an arbitary datum, for initial commissioning only.
Select "single position".
Key in a reasonable position eg 100.0

Press start. Note that drive moves towards 100.0. Check that this is in correct sense for your machine for increasing values. If not, switch off and reverse Encoder, Armature and Tacho.

5.
Switch on.
Select "single position"
Key in position 0.0
Press Start.
Note correct sense of direction.
When correctly set, the drive will run firmly into position without overshoot and the actual value display will jitter 0-1-0-1 etc.

6.
If drive fails to reach zero position:
(a) Press reset.
(b) Press single position.
(c) Increase gain pot P2, 2 turns clockwise.
(d) Key in 100.0
(e) Press start.
If it does not reach position repeat (a) to (e) keying in 0.0 and 100.0 alternately, until position is reached.

7.
The rate of deceleration is set on Pot 2. Too low gain gives exponential and long time to position. Too high gain produces position overshoot. The ideal setting is when position is achieved with just a hint of exponential. The correct conditions are reached when jitter is 0-1-0-1 and not 0-999-0-999.

8.
It is now permissable to set the proper datum. A programme of positions can be tried and accuracy of positioning noted.

Final trimming can be effected using top speed pot P3, gain pot P2 and also offset, pot P4.

NB: To operate in programme mode you need to activate quantity pulse signal.