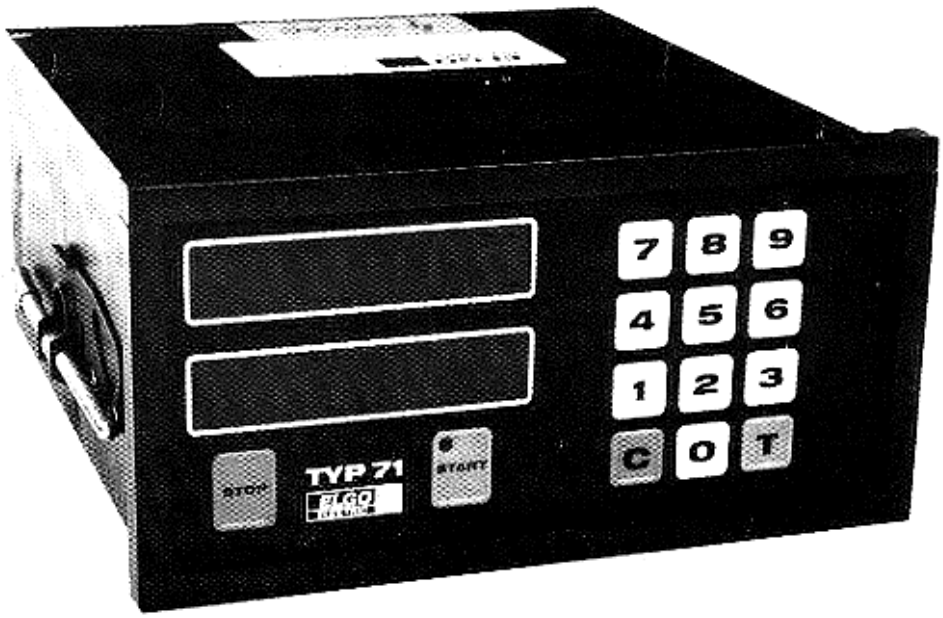
71P series

Single Axis Position Controller

- Single dimension selection by means of keypad
- Software controlled readout
- Fast/slow/stop operating mode for two speed drives
- Absolute and incremental operation
- Backlash compensation
- To position machinery and feed materials



ELGO - Electric - GmbH
Measure - Control - Position
Carl - Benz - Straße 1, D-78239 Rielasingen
phone.: 0049-7731/93 39 - 0, Fax: 2 88 03
Internet: www.elgo.de, Mail: info@elgo.de

General

The primary purpose of this simple controller is to position machine heads, tools or guides to required dimensions.

It is intended for use with non-precision mechanics and bidirectional 2 speed drives. The drives can be dc, ac or hydraulic. Backlash compensation is available, so that approach to position is always from one direction. It will operate equally well on precision machinery and with servo motors.

A second function is to feed materials through a process, again by means of fast/slow/stop drives.

In both cases accuracies of 0.1 mm or 1 mm are the normal requirements of the machines. 0.01 is possible with careful choice of drive and speed.

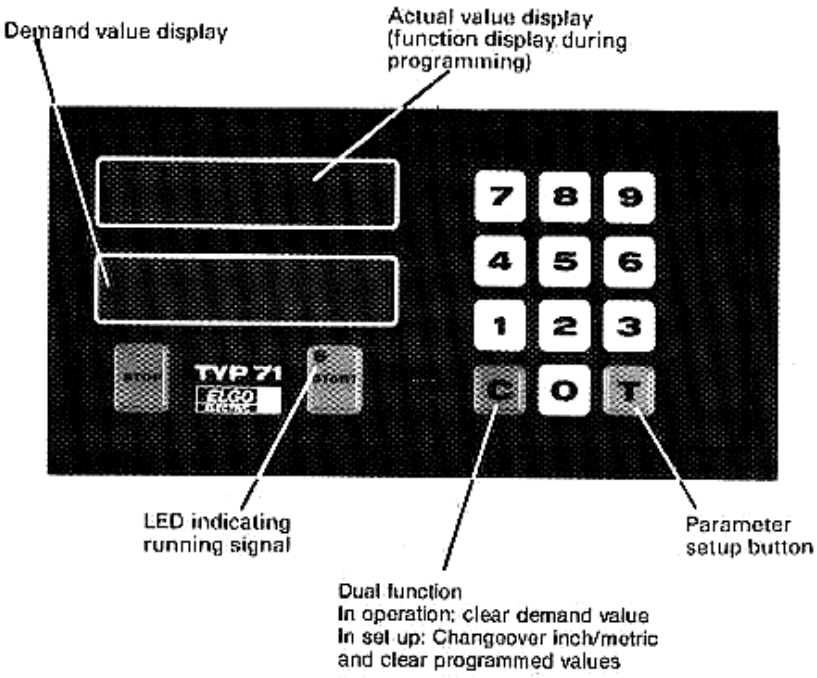
Actual position readout is always displayed and battery backed during power down. Required dimensions are entered by means of a sealed foil tactile keypad and displayed in a second indicator.

Start and stop buttons are provided.

The output of the unit is in relay form to drive contactors, relays or solenoids.

The unit is set during commissioning to give the required slow-down point and stop offset point, to give a consistent accuracy.

Position is measured using an incremental encoder giving twin channel output. Rotary or linear encoders can be used.



Applications

Essentially, for positioning, the 71P is intended for presetting position in applications where the timing is not critical.

Sheet metal and woodworking industries are ideal applications for this controller. Similarly many manual machines can be inexpensively automated to give better accuracy and improved productivity.
Mechanics need not be redesigned and backlash can be accommodated. This makes the 71P very attractive for many applications.

The controller has been successful in applications such as Shears, Guillotines, Saws, Edge guides, Planers and Moulders, Tennoners etc.

When used to feed material into a process, the 71P can be applied to cut-to-length , punching, drilling, boring lines. All forms of material can be used - metal, plastic, paper textile, wood, etc.

Detailed Functions

Absolute Mode

In absolute measurement mode, the unit calculates the direction, speed and distance to move from the actual position to the selected destination.

Incremental Mode

In incremental measurement mode, the unit calculates the desired destination from the demanded incremental input and the actual position. The direction of movement can be selected.

(a) Incremental in direction zero.
The actual value displays the absolute position and the machine moves the preset incremental distance each time start is activated. The machine is prevented from moving past zero.

(b) Incremental in forward direction (special software).
The actual value displays the total length of material processed. The material moves the preset incremental distance each time start is activated.

Saw Width Compensation
When operating in incremental mode, it is sometimes necessary to feed material a distance equal to the preset, plus a length cropped or sawn out during the cut operation.

The Tool width can be preset into the unit using the keypad.

Switch Mode Positioning
The 71P controller is intended for operation with two speed drives. This gives accurate positioning and good speed of response. For accurate positioning, as low a slow speed as possible should be chosen. It is essential that this is a consistent speed at all times and in all positions on a machine bed. A mechanical brake should be fitted to the motor for better accuracy. It is preferable that the slow speed does not exceed 50Hz for best accuracy, although good results are possible with much higher speeds.

Whilst the 71P is designed to operate with two speed motors, for some applications where overall travel is short or accuracy of +/-1 bit is not essential, single speed motors are quite adequate. In the case of short distance, a single slow speed can be chosen without causing long delays during repositioning, or sacrificing accuracy.

DC motors with thyristor controllers or asynchronous AC motors with simple inverters are ideal variable speed drives for use with the 71P controller.
Hydraulic motors with valves are also a very successful power source.
Hydraulic cylinders with valves can also be used.

Elgo Electric will be pleased to assist in the choice of drive.

Backlash Compensation
Any preset position can be reached from either direction. In cases of machines with backlash in their transmission system, backlash compensation, in the form of unidirectional approach to position, is available. In one direction the machine runs directly to position and in the other direction it overruns the position, reverses and returns.

Normally the overrun is in the direction of greater value. The destination point is overrun by a distance equal to the slowdown point. The drive then stops for preset time, reverses and moves to final position at slow speed.

Backlash compensation in the other direction is available as a software option.

Automatic retract
(absolute mode only)
Should it be necessary to retract the backgauge during cutting, this can be effected by closing an external contact. Opening the contact again returns the backgauge to its demanded position.

The retract distance is determined by the preset software timer.

Datum Setting
The machine is set to any convenient position and this position is accurately measured. This value is now entered as the demand position and an external keyswitch is closed. This transfers the datum dimension into the actual value display.

The unit need in principle be datumed once only during commissioning, since the actual value has a battery backed memory on power removal.

Inch/Metric Operation
The basic unit operation is in metric dimensions, ie the screw and encoder must have a metric resolution.
There is a built-in conversion that enables the operator to select the indication to be either in metric or imperial units.

Error Blanking
Where precise accuracy to +/-1 bit is not essential, but the acceptable error worries the operator, it is possible to switch in error blanking. This is done internally on a jumper switch.

With error blanking selected, the actual position readout will display the demanded value so long as the actual position is within the stop offset dimension; ie if stop offset (T2) is set to 0.2mm, any position with +/- 0.2mm will be displayed as the previously demanded value.

Compatibility
The 71P replaces, and is a plug-compatible unit with the previous 70P controller.

Options
In addition to built-in options that can be selected internally, the following options are available. These are software options and require a different microprocessor. Some of the standard features are deleted, when these options are used.

Code Function

BC **Backlash compensation in either direction:**
This enables the user to select overrun in either greater (standard) or smaller direction of count.
Jumper J10 is used for selection.
Auto retract feature is deleted.

FB **Relay outputs as forward and backward:**
Run relay (terminals 4/5) is used as "forward" and reverse relay (terminals 8/9) as "backward". A time delay between changeover is set to allow motor to stop, before reversing takes place.

PP **End of programme pulse:**
Instead of relay, (terminals 10/11) remaining closed during positioning, the output is made into a 100mS pulse (relay closing) at end of movement. Auto retract feature is deleted.

PI **Memorised prefixed index value:**
During power removal, the demand value is lost. In processes where a fixed value of movement is required from day to day (generally incremental forward), the saw blade width memory (T3) can be used to store required value.
Auto retract feature is deleted.

OP **Positioning with offset proportional parameter:**
If length positioning is required depending on say the width of material or angle of a saw, then the saw width parameter (T3) is used to enter the variable value. The position will then be offset from that in the demand position by a factor proportional to the variable.
Auto retract feature is deleted.

IF **Incremental in forward direction:**
This is used for feeding materials into a process such as cut-to-length. Backlash compensation and auto retract are deleted.

NE **Incremental operation without cumulative error:**
When operating in either form of incremental mode, the position after each move can be +/−1 bit out. Normal operation is to use the actual position as reference for the next index. This is desirable in some applications and not in others. When this is not desired, the calculation of next move compensates for error in previous move, so that absolute position is always out no more than +/−1 bit.
Backlash compensation and auto retract are deleted.

When ordering unit to incorporate any of the above, it should be clearly stated on the order what is required.

The 71P is a microprocessor software driven device and many special features can be effected for customers. Elgo Electric will be pleased to examine all customer requirements.

Setting Up

All setting parameters are available via the front keypad. Programming is inhibited until a link at the back of the unit is opened.

The programming link is in the form of a two terminal plug-in block, with shorting wire. The customer has the options to use this as follows:

(a) Unplug to set in parameters. Re-plug-in to operate.

(b) Replace link by on/off toggle switch, mounted close to unit, but inside cabinet and not accessible to operator.

(c) Fit a key switch "Programme/Run" on panel front, remove shorting link on terminals and wire to key switch. Since reprogramming of parameters is seldom required, this is not an essential option.

With the link open, the controller will not run.

Setting of the parameters is achieved as follows:

Press [T]
Top display extinguishes, and "CH" is displayed.
This ensures that the operator knows when T button has been pressed (even by accident).

Enter functions [1] . . . [5]
"CH" is extinguished.
Title name is displayed in top window; value of parameter is displayed in bottom window.

Press [C] to clear existing value.
Enter required value.

Press [T] again to revert to operating mode.

The [T] functions/parameters are as follows:

[1] This sets the slowdown point during approach to position. "SLSP" is displayed.

[2] This sets the stop correction offset. "COR" is displayed.

[3] Saw width compensation is entered. "SABL" is displayed.

[4] Time at standstill during backlash overrun and delay in drop off of "In Position" relay after drive stop is initiated.
"Ti" is displayed. Time can be set from 00.0 to 15.9 seconds. Also sets the auto retract time (ie distance).

[5] This sets the decimal point position in the displays.
"DP" is displayed.
1 means units only (ie no decimal place)
2 means tenths displayed (ie 1 decimal place 0.0)
3 means hundredths displayed (ie 2 decimal places 0.00)

One [T] function is available with programme link either open or closed. That is inch/metric selection. This is used as follows:

Press [T] "CH" appears in display.

Press [O] "INCH" or "MM" appears in display.

Press [C] to changeover.

Press [T] to revert back to operation.
The decimal point is automatically moved and any actual value correctly recalculated. The set up parameters are also in the chosen units.

When [T] is pressed inadvertently, "CH" is displayed to warn operator that he has pressed the button. Simply pressing [T] again returns controller into operating mode.

Connections

Plug in terminal block

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

Encoder: (use screened cables, screen connected to 20)

Signal	Terminal	Function
	17	Backwards (channel B) :Encoder terminal 4
	18	Forwards (channel A) :Encoder terminal 3
power supply	19	+12V :Encoder terminal 2
power supply	20	0V :Encoder terminal 1

Input Signals: use potential free closing contacts (use screened cables, screen connected to 20)

Event	Terminal	Function
Start	20 16	Starts calculation process and sets output relays accordingly.
Stop	20 15	Stops operation.
Datum	20 14	Closing this contact transfers the preset desired position to actual value display.
Incremental	20 13	When this contact is closed unit operates in incremental mode (towards zero).
Auto retract	20 12	The drive will move back preset timed distance when closed. Returns to desired position when open again.

Output signals: Potential free relay contacts 220V 0.5A

Event	Terminal	Function
Run *	4 5	Enable contact for the drive, Closes when demand value is more or less than actual value. Opens at overrun during backlash compensation.
Fast	6 7	Contact closes when distance to be run is greater than the preset slowdown distance. Opens when slowdown point is reached.
Reverse *	8 9	Closes when destination is less than the actual position.
Programme *	10 11	Contact is closed so long as positioning is taking place. Remains closed during overrun. Opens after time Ti after run contact opens.

* See options for alternative functions.

Power Supply:

Terminal	Function
1	Earth
2	240, 220 or 110V 50/60Hz changeable internally
3	N

Hints for Operation in Electrical Panels

The 71P position controller is designed and constructed for use in arduous industrial applications and as immune to electrical interference as possible.

Care should however be taken when fitting electronic equipment into machinery.

1. Electronic units should be mounted away from inductive and capacitive interference.
2. Protect against overvoltage.
3. Protect against overtemperature.
4. Run low voltage cables separate to high voltage/high power cables.
5. Screen encoder cables and input signal cables. Tie screen to zero (terminal 20) at controller; leave insulated at other end.
6. Suppress all relays, contactors, solenoids, brakes and other coils in cabinet and on machine. Fit diodes across dc coils. Fit 0.1 µF + 100Ω across ac coils.

Failure to follow the above logical simple instructions could lead to maloperation of the electronic unit.

Battery

A Lithium battery, type BR2325, 3V, is fitted as memory back up on power off. It is not rechargeable and has a life of between 3-5 years.

Technical Data

Mains input
220, 240 or 110V +/- 10%, 50/60Hz
Linked internally. Other voltages on request.

Power consumption
15VA

Encoder supply
12V, 100mA dc max

Encoder signals
NPN switching. Other on request.

Actual value display
6 digit red LED, 10mm high.

Demand position display
6 digit red LED, 10mm high.

Memory of actual value
About 3 years from switch off.

System accuracy
+/- 1 bit.

Positioning speed
10 kHz (60m/min at 0.1mm resolution)

Output signals
Potential free contacts 220V 0.5A ac.

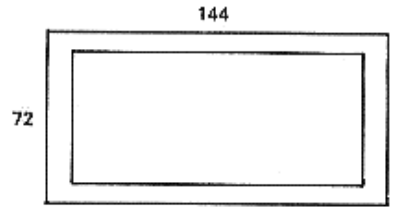
Self heating
15°C on electronics

Ambient temperature
-5°C to +45°C

Mechanical data
Polycarbonate glass fibre enclosure suitable for mounting into control panels. Enclosure IP00.

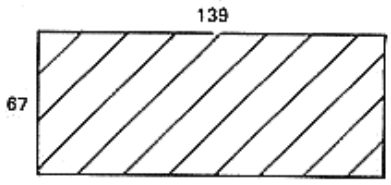
Keyboard
Dust and water tight IP55.

Dimensions



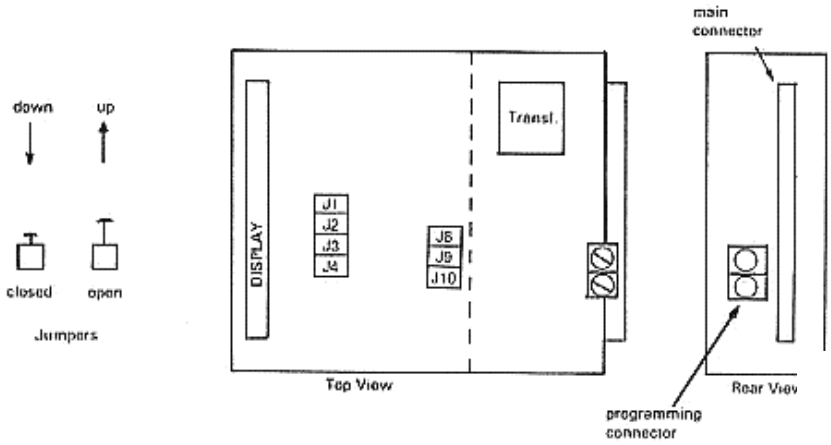
Dimensions

160 mm deep (including connectors)



Cut-out

Internal Jumper Switch Selection



Jumper Nr	State	Function/Operation	
1	open * closed	Clockwise rotation of Encoder Anticlockwise rotation of Encoder	
2	open * closed	No function x 4 multiplication	Pulses of Encoder
3	open * closed	No function x 2 multiplication	
4	open closed *	No function x 1 multiplication	
8	open * closed	Backlash compensation on No backlash	
9	open * closed	No error blanking With error blanking	
10	open * closed	Forward backlash Reverse backlash	Only used with special software.

* normal conditions set in factory, unless otherwise specified

Note
If all three switches J2, J3 and J4 are open, the two channel inputs will count in differential mode, ie terminal 18 - forwards, terminal 17 - backwards.

Programming Connector
Unplug or open-circuit to access parameters T1-5.

Internal Power Supply

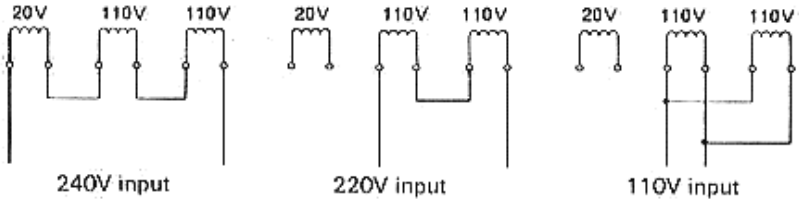
The internal power supplies are derived from a multiwinding transformer. The unit should be fed via an external fuse semi delay 0·5A

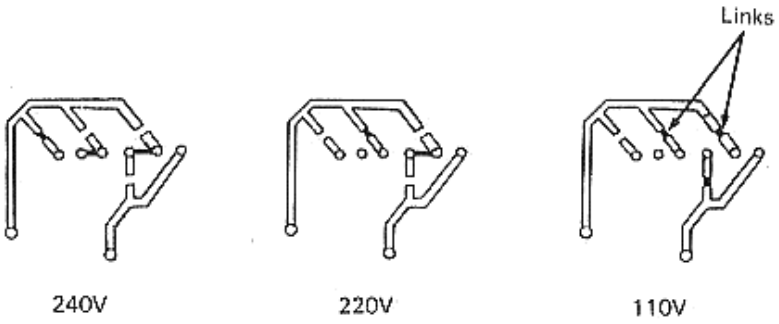
The primary has 3 windings, so that a universal input can be accommodated.

Unless otherwise specified, the units are delivered as 240V for UK, 220V for the rest of Europe.

The tappings can be changed at any time, by withdrawing the PC board and making links/cutting tracks as shown below. When cutting tracks, do so in the "waisted" section and cut out cleanly 2mm length of track. When making up links, use short lengths of tinned copper wire, to bridge gaps.

NB: German built transformers do not have 20V winding and links are different.





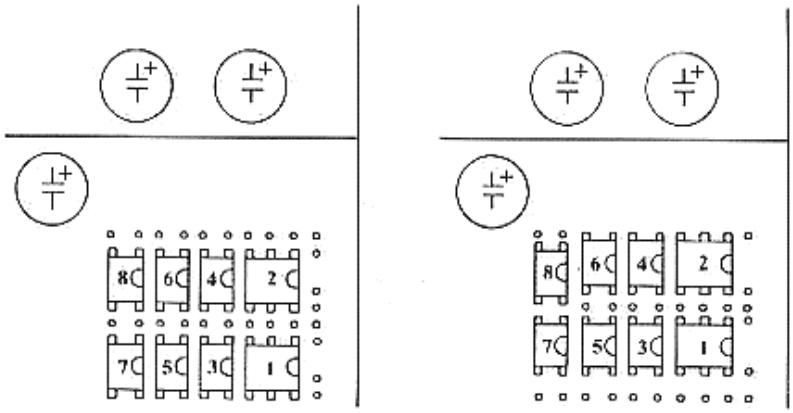
Signal Inputs

All inputs, encoder and contact signals, are fed to the unit via internal opto couplers for noise immunity.

The opto couplers are mounted in sockets and can be selected to give operation with NPN or PNP signals. When set for NPN, the input line is pulled down to zero to operate; when set to PNP, the input is pulled up to +V to operate.

The units are delivered suitable for NPN, unless otherwise specified.

It is possible to change to PNP by replugging the desired chips as shown.



Opto identification:

1 Encoder channel A
2 Encoder channel B
3 Start
4 Stop
5 Datum
6 Incremental
7 Auto retract
8 Programme/run switch (must always be NPN)

Commissioning

First of all it is necessary to set up the drive. If a variable speed drive is used, a consistent slow speed must be achieved, before proceeding with adjustment of position controller.

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

1. If a programme/run switch is not fitted, connect a temporary on/off switch. This will enable you to make alternate moves and changes very easily. Work in absolute mode.

2.1 Select metric mode of operation (T0).

2.2 Set slowdown point to some high value eg 50.0 (T1).

2.3 Set stop offset to zero (T2).

2.4 Set saw blade compensation to zero (T3).

2.5 Set standstill time to 5.0 seconds (T4).

2.6 Set decimal point to correct position (T5).

2.7 Select no backlash compensation (internal switch J8).

2.8 Select no error blanking (internal switch J9).

3. Set datum to zero at any arbitrary point. Rotate encoder in manual mode to check encoder gives correct direction of count for corresponding increasing and decreasing position.
Ensure that operation is not in negative mode of the unit.
Change A and B encoder channels if incorrect sense of count exists.

4. Set correct machine datum. Either put machine to mechanical zero or to a measured position and close datum keyswitch.

5. 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. If it is found that drive starts in wrong direction, press stop, change over external reversing relays/contactors to achieve correct direction. Repeat at 200.0, 300.0 etc in upwards direction and then the same positions in downwards direction. Note error at each position. It should be consistent to +/- 0.1. Take an average of this error and set T2 (stop offset) to this value.

Repeat the positions and note machine stops accurately to +/- 0.1.

You may need to trim T2 by another + or - 0.1 to get best results. If stopping error is not consistent to +/- 0.1 in all positions, the accuracy of +/- 0.1 cannot be achieved. The problem is that friction is not constant throughout and improvements can only be made by reducing the slow speed, till consistent errors are seen. The use of mechanical brake or regenerative braking give better results from higher slow speeds.

6. When accuracy has been achieved, the slowdown point (T1) can be reduced so that cycle times are improved.
Progressively reduce the distance until the machine creeps only for the shortest time, before stop is activated.
If slowdown point is reduced too far, errors in positioning will now start appearing.

7. You may now select the mode of operation, ie:
Incremental
Backlash compensation
Saw blade compensation
Error blanking

8. The time delay during reversals is set on T4. This has to be set to give time for motor to stop, before engaging reverse. The time is dependent on speed, inertia, friction and whether a brake is fitted. Reduce from the high level of 5 Sec to a level which gives a visible standstill before reversal. This time also holds the "In Position" relay to allow the motor to stop at end of positioning, before a cut (or similar) is signalled.

9. **Commissioning incremental forward applications.**
Work in incremental forward mode with special software.
Follow points 1-3.
Key in distance required, eg 1000.0.
Repeat several times and note overrun.
Set overrun distance into T2.
Follow points 5-6.
Set in saw blade compensation - if required.
Select distance required and note distance moved is that selected plus saw width.
Set timer T4.

10. The above procedure has been written on the basis of resolution of 0.1 mm. If a resolution of 1 mm or 0.01 mm is being used, then it is necessary to translate the values accordingly. The setting parameters always show the correct resolution.

Choice of Encoder Resolution

The Encoder should be chosen so that 1 bit represents the desired resolution of the system. The resolution must be metric.

Example 1:

Using 10 mm pitch screw:-

for resolution of 1 mm -
choose Encoder 10 p/rev

for resolution of 0.1 mm -
choose Encoder 100 p/rev

for resolution of 0.01 mm -
choose Encoder 1000 p/rev

Then set decimal point in appropriate position of the readout by means of T5.

Example 2:

Using measuring wheel 500 mm circumference:

for resolution of 1 mm -
choose Encoder 500 p/rev

for resolution of 0.1 mm -
choose Encoder 5000 p/rev

Enter appropriate decimal point position on T5.

It is sometimes more economic to choose an Encoder resolution with lower pulses per rev and use internal 2 or 4 times multiplier. eg, instead of Encoder 5000 p/rev, choose Encoder 1250 p/rev and use 4 times multiplier.

Example 3:

Using imperial screw, 4TPI - 0.25 inch pitch:
Use Encoder 635 p/rev to get 0.01 mm resolution.

Always consider that maximum internal operating frequency is 10 kHz -including multiplier, if used.

NB:

The resolution of the system is as chosen by Encoder and not by simply programming the decimal point.

Liability exclusion / Guarantee

We have checked the contents of this instruction manual carefully, to the best of our knowledge and belief for conformity with the described hardware and software. Nevertheless errors, mistakes or deviations can not be excluded, therefore we do not guarantee complete conformity. Necessary corrections will be included in the subsequent editions. We appreciate your ideas and improvement suggestions very much.

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The guarantee period is two calendar years (EC-Directive) from the date of delivery and includes the delivered unit with all components. ELGO Electric GmbH will at its option replace or repair without charge defects at the unit or the included parts, verifiable caused by faulty manufacturing and/or material in spite of proper handling and compliance to the instruction manual.

Damages verifiably not caused by ELGO Electric GmbH and due to improper handling are excluded from any guarantee e.g. by applying faulty voltage, diffusion of liquid into the interior of the engine, using force, scratching the surface, chemical influences etc.!

ELGO - Electric - GmbH
Measure - Control - Position
Carl - Benz - Straße 1, D-78239 Rielasingen
phone.: 0049-7731/93 39 - 0, Fax: 2 88 03
Internet: www.elgo.de, Mail: info@elgo.de

For further details visit
www.elgo.de