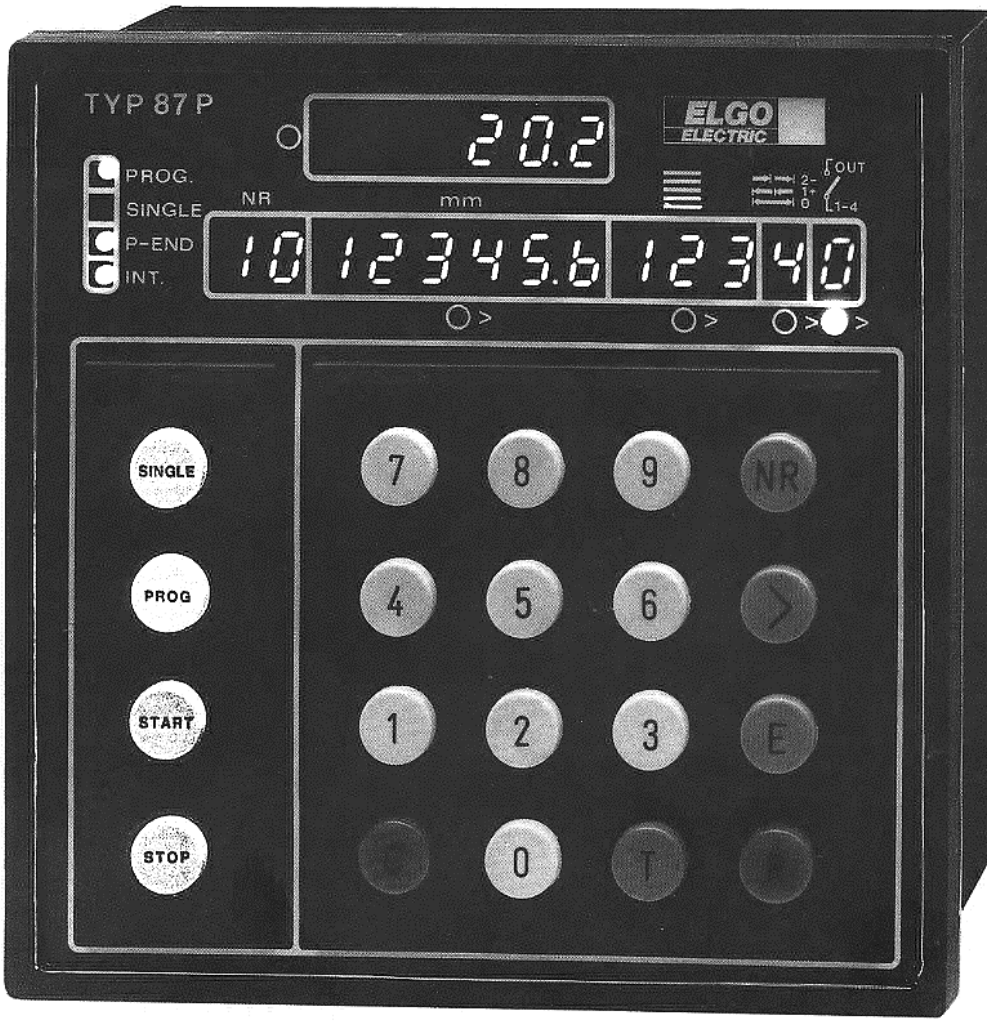
87 P series

Single axis, programmable position controller



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Position controller for a single axis Series 87 P

Important Features

The 87 P controller has been designed to incorporate the following.

Drive control
The drive control is on basis of FAST, SLOW, CREEP, STOP together with 4 auxiliary freely programmable outputs. As an option analogue output +/– 10 v (braking ramp) is available. (see fig. 1 and 2).

Enclosure
This is a compact unit (H: 144 mm, W: 144 mm, D: 54 mm) with large keypad operable with gloved hands.

Input
An essential feature of construction is »Simple two stage programming«.

Programming stage 1:
Setting of operating parameters and functions.
These values are set during commissioning based on machine parameters and customer requirements. They are protected from inadvertent operation by means of a security code.

Programming stage 2
This is designed for ease of operation (cursor principle). A definate contribution to simple use is selection of »single« or »programme« operation.

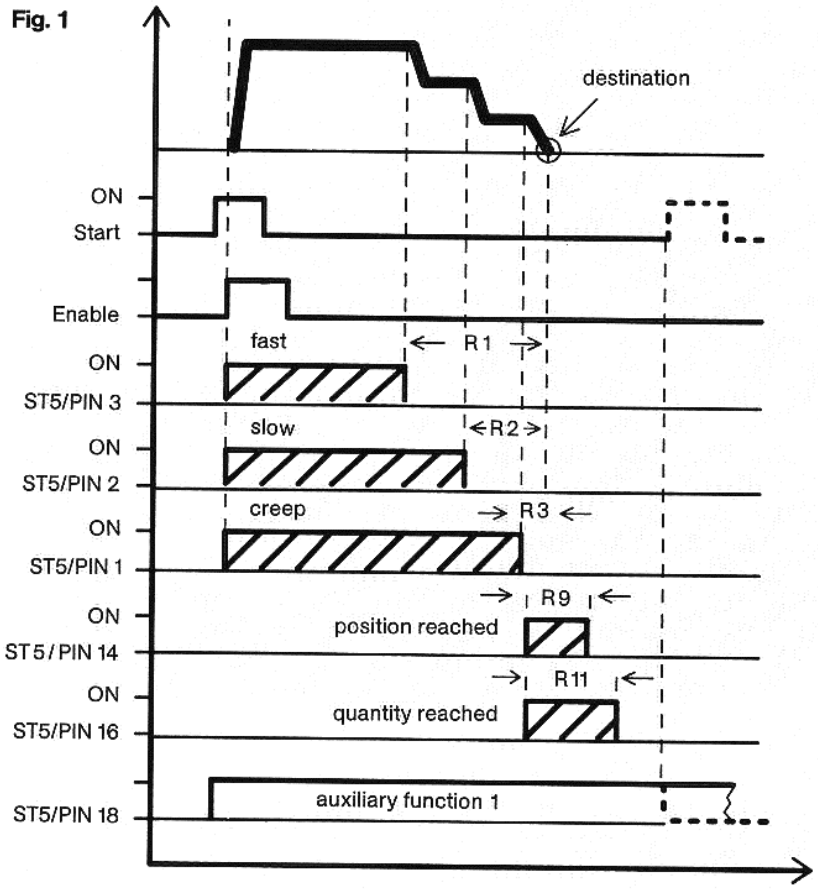
Memory
180 address lines can be stored, which can be operated by selection of address or as 9 sequential programmes each with 20 addresses. (Other combinations can be configured on request).
An address comprises a position, a quantity and any required auxiliary function, together with selection of absolute of incremental operation in either + ve or – ve direction.

Communication link
The controller can be supplied with serial interface by means of which full data can be loaded.

Measuring system
The system is based on incremental encoder (8–30 v) with direction sensing of quadrature signal. One, two or four times multiplication of the signal can be effected.

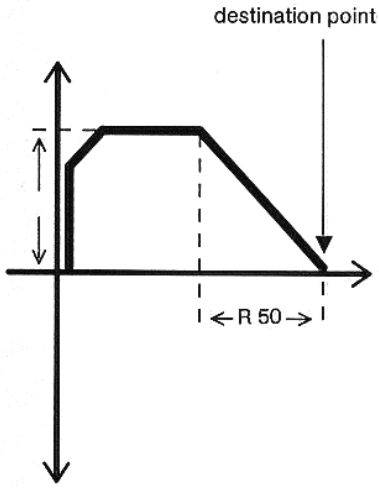
Absolute/incremental
The input, using cursor principle, allows the operator to set dimensions as an absolute position or incremental move in direction + ve or – ve.

Fig. 1



As standard 4 auxiliary functions are available. Each address can have one of these 4 selected. The output is energised so long as the address is selected, until the start for the next sentence is activated.

Fig. 2



R 50:
Set deceleration distance 0.1 to 999.9 mm by means of keypad

Function of the standard register addresses

R = Register Nr.
Selected by pushbutton »R«.

R1 Slow Speed Distance
This is the distance from required position at which the speed will drop from fast to slow. Ie output »Fast Speed« will be deactivated.
NB: Never enter »zero« in this register, even when not using this speed.

R2 Creep speed distance
This is the distance from the required position at which the speed would drop from slow to creep. Ie output »Slow Speed« will be deactivated.
NB: Never enter »zero« in this register, even when not using the speed.

R3 Stop offset distance
The stop offset distance can be set in the register, between 0.1 and 9.9 mm. Initially, during commissioning, set the value to 0.0. Note the overrun value. The overrun distance can be seen in the actual value display as a difference between that and the previously preset desired value.
Before this can be done, the correct creep speed and creep speed distance must be set. The overrun distance must be consistent on all points in the machine operating range.
Example: The desired position is overrun by 0.2 mm. Enter »2« into register R3.

R4 Backlash compensation overrun distance
If backlash is present in rack or screw then approach to position can be made undirectional. Selection is by means of R8. The distance by which the position is overrun is preset in Register R4. The direction of overrun in + ve or – ve direction can be selected.

R5 Auto retract distance
Should it be required to retract the backstop this can be achieved by pulsing an external contact.
To return the backstop to the original position, pulse the input once more.

R6 Saw blade correction
In this register a correction value (e.g. saw blade thickness) can be preset. This value will be automatically added to the preset demand value when operating in incremental mode.
In incremental mode, the material is fed across the saw line by the length required plus saw width compensation.

R7 Datum value
When the external input »Datum« is given, the preset value in the register R7 is set into the actual value display. This can be effected using a key-switch or a switch on the bed of the machine.

R8 Operating system parameter
In this register the selection of backlash, incremental error compensation and quantity counting format are preset. (See table 2 on page 7).

R9 Time of »in position« Signal
Set the required time of the pulse. (Max 9.9 sec)

R10 Standstill time
Set the delay time when reversing during backlash compensation. The value is dependent on time taken for motor to stop, before start in opposite direction is given. (Max 9.9 sec.)

R11 Time of »quantity reached« signal
Set the required time of the pulse, on reaching count zero. (Max 9.9 sec).

R12 Manipulation tolerance
Normal accuracy of this positioning system is +/–1 bit. Ie when it is required to go to 100.0 mm it is possible to stop at 99.9 or 100.1. Also due to different frictions at various points in the machine accuracy is not constant. Ie in some positions accuracy is –0.1, or 0.0 or + 0.1.
It is possible to enter a tolerance value such that if the actual position is within this value, the actual display will indicate the required value without the error.
Positioning accuracy is not impaired, because the control system internally registers the true actual position.

R13 Software limit, minimum
A position can be preset, below which the controller will not accept a start signal.

R14 Software limit, maximum
A position can be preset, above which the controller will not accept a start signal.

R20 Position of decimal point
The position of the decimal point is made physically and in itself does not set the resolution of the system. The resolution must be chosen by means of encoder pulse number to correctly display the resolution, the decimal point must be placed in a visually correct position.
Setting of values in this register, sets the position as follows:

Number of digits after decimal point	Code
0	3
1	0
2	1
3	2

R40 Memory block number
The memory for the required data for programme is as standard divided into 9 blocks of 20 addresses.
Using R40 register, the memory block can be selected 1–9.
Different programmes can be stored in each block and retrieved to suit.
Alternative software for different configuration can be provided on request.

R97 Operation mode
The controller can in basic form operate in 2 modes.
This can be selected as follows:
0 = Without multiplication factor
1 = With multiplication factor.
The value of multiplication factor is set in R96.

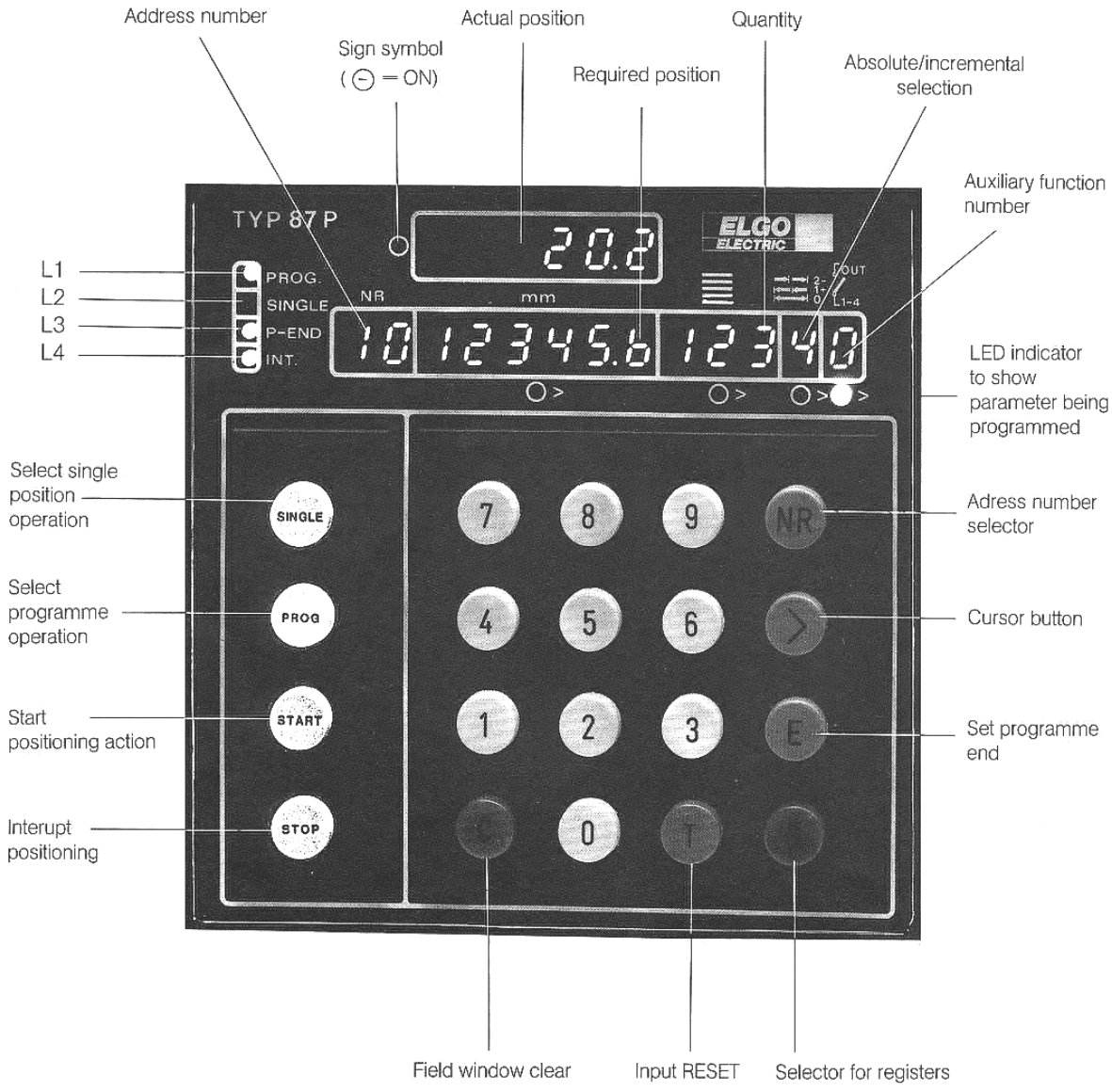
R98
This parameter provides a security code entry to alter all the above registers.

Optional registers

R96 Multiplication factor
Additional option feature.
Select R97, select 1. NB: Feature is not available when R97 is set to O.
The multiplication factor for encoder pulses can now be entered into register R96. The value can be calculated as in the following example: – The desired distance to be moved = 1000.0 mm. actual number of pulses recorded for the movement is 12000.
Set factor to $\frac{10000}{12000} = 0.83333$

R50–55
Registers for operation of analogue output (see following sections).

Display and Keypad assignments



Functions of keys an LED's

LED'S

L1: This lamp is illuminated when the selection »PROG« is made.

L2: This lamp is illuminated when the selection »SINGLE« is made.

L3: This lamp is illuminated when the last address in a programme is running.

L4: Faultlamp. This lamp is illuminated when there is an operating or programming fault.

After this button has been pressed, a required position can be immediately entered by means of the keypad. On pressing »start«, the machine will move to this position.

After this button has been pressed, the following possibilities are available:

1. Input of new programme or selection of operating block.
2. Check out the programme line by line.
3. Start cycle of operation.
   In normal programme mode, operating »START« will move the machine to the first address in the selected block. If operating in address selection mode, operating start will move the machine to the position as selected address number.

This is only active in operating mode. It is inhibited during programming. Pressing start initiates the positioning cycle.

Pressing »STOP« deactivates all output signals to the motor drive. The positioning process is interupted. Positioning can only recommence on pressing the start button again. This is not an emergency stop button.

This button is only active when »PROG« has been selected (L1 must be illuminated). The following functions can be carried out:

a) Entry of programme.
   Pressing the button brings up the next address (address 01 on initial activation) and illuminated cursor LED below the position display.
   By means of the numeric keypad and cursor button, the rest of the sentence can be entered.
b) Checking of external programme.
   Successive pressing of the button will display sequentially all programmed address sentences.
c) Selecting the required address, when operating in 99 address mode will display the required sentence. The sentence can now be altered by pressing the cursor button. Alternatively the start can be activated and the machine will run to the preset position.

Cursor button: This button is only active after »PROG« and »NR« have been pressed. The address sentence display fields can be selected sequentially using this button. Pressing the button again at the end of a sentence moves it automatically to the start of the next sentence.

This button enters the programme into memory. The unit is now ready to operate.

This button enables the setting up of all machine constants and internal controller functions. Data is entered into registers.

This button is used to reset programme to zero, both during programming or checking of programme. The button is inhibited during operation.

Pressing this button will clear the field, as indicated by cursor.

Programming levels

R-Button Programming stage 1

A) Programming of basic constants (see register description)

The registers must be set to give the required performance. They can be accessed via a security code, using the keypad.

1) Unlocking of registers

1. Press »PROG«
2. Press Ⓡ
3. Press Ⓒ
4. Enter 98
5. Press Ⓢ
6. Press Ⓒ
7. Enter security code 250565
8. Press Ⓔ

The registers are now unlocked and can be altered.

A2) Setting of registers

Eg.: The slow speed distance is required to be set to 20.0 mm. Proceed as follows:

1. Press »PROG«
2. Press Ⓡ
3. Press Ⓒ
4. Enter desired register ie 1
5. Press Ⓢ
6. Enter the desired value, ie 20.0
7. press Ⓔ

The register 1 which is the slowdown point, is loaded with a value of 20.0 mm.

A3) Locking of registers

When all settings have been made, the registers must be locked up again.

1. Press »PROG«
2. press Ⓡ
3. Press Ⓒ
4. Enter 98
5. Press Ⓢ
6. Press Ⓒ
7. Press Ⓔ

The controller will operate with R functions unlocked, so that adjustments can readily be made. Unless they are locked, it is possible for the operator to accidentaly alter values and cause operating errors.
The registers will in any case selflock on switching off the power.

Programming stage 2

B) Operating mode

The controller will operate in accordance with the setting of register R 8.

B 1) Operating with selected programme block

The unit has 9 blocks of memory, each with a maximum of 20 address lines.

Example:

It is required to operate with block 3.

1. Press Ⓣ
2. Press Ⓡ
3. Enter (register) 40
4. Enter the desired block number 3
5. Press Ⓢ
6. Press Ⓔ

The third block can now be programmed or put into operation.

B 2) Programming a sequence of operation

The required block is selected as in B 1.

1. Press »PROG«
2. press ⓃⓇ
3. Press Ⓒ
4. Enter desired position
5. Press Ⓢ
6. Press Ⓒ
7. Enter desired quantity
8. Press Ⓢ
9. Press Ⓒ
10. Enter required dimensioning mode
    0 = Absolute
    1 = Incremental +
    2 = Incremental –
11. Press Ⓢ
12. Press Ⓒ
13. Enter required auxiliary functions 0, 1, 2, 3 or 4

The sentence of address 1 is now complete. When the last line has been completed, Press »E«. This stores the programme in memory.
Should further sentences be added, press Ⓢ
The address number now increases by 1 and programming can be continued by returning to line 3 above.

C) Address selection mode

99 addresses can be programmed and a specified address selected for operation. Register R 8 is used to select this mode.

C1) Programming of 99 addresses.

The input is as given in B2).

C2) Operating with 99 addresses.

Example: Address NR 55 is required.
Press Ⓣ (Reset)
Press ⓃⓇ
Enter desired address ie 55
Press Ⓢ
When start is activated, the machine moves to the position as displayed in address 55.

D) Single position operation

Once the »Single« button has been pressed, it is possible to enter a position and a quantity. The position is an absolute value. (Can be converted to incremental by external connection – see ST 3).
In this mode, the 87 P acts in exactly the same way as the 85 P.

Registers / Parameters

Register addresses at a glance
NB: The registers (except R40) are locked by means of a security code.

Table 1

Register	Parameter	Resolution
R1	slowdown	0.1 mm
R2	Creep	0.1 mm
R3	Stop offset	0.1 mm
R4	Overrun	0.1 mm
R5	Auto retract	0.1 mm
R6	Saw blade	0.1 mm
R7	Datum	0.1 mm
R8	System parameter	see table 2
R9	Time of in position pulse	0.1 sec.
r10	Standstill time	0.1 sec.
r11	Time of quantity reached pulse	0.1 sec.
R12	Manipulation tolerance	0.1 mm
R13	Software limit, minimum	0.1 mm
R14	Software limit, maximum	0.1 mm
R20	Decimal point	0 – 1 digit after 1 – 2 digit after 2 – 3 digit after 3 – 0 digit after
R40	Programme block selection	1–9
R50–55	Analogue output (option)	
R96	Pulse multiplication factor (option)	0.00001 to 9.99999
R97	Selection of R96	0–out 1–in
R98	Security code	250565

R 8 Operating system paramters.

On pressing Ⓒ the first digit to be seen represents the operation mode.

0 = sequence programme
1 – 99 address selection

The second digit refers to the following list.

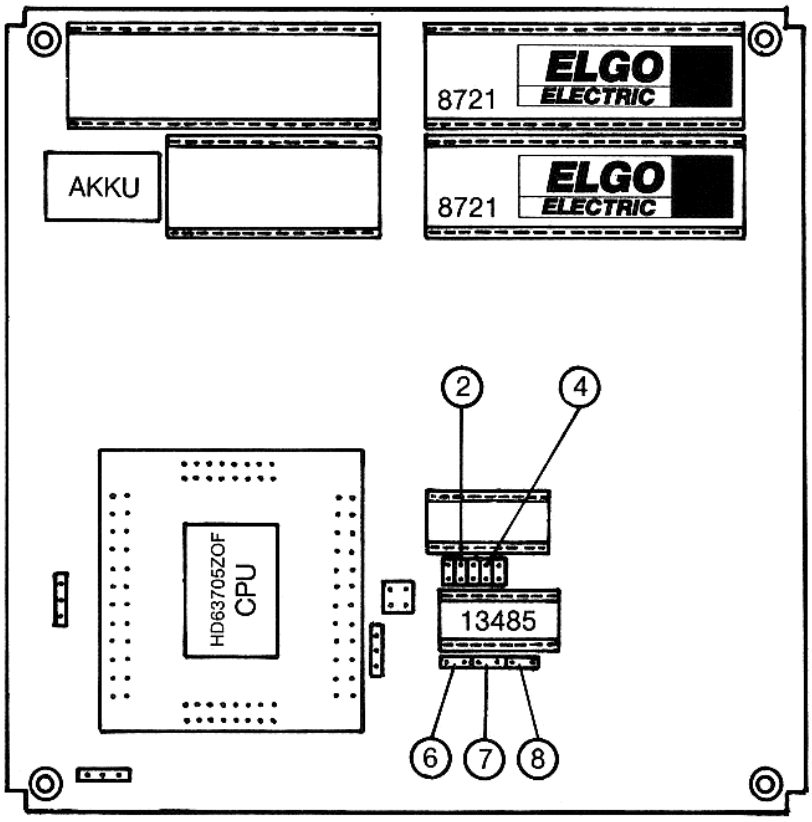
Table 2

No.	Function
0	with blacklash compensation with incremental error compensation with automatic quantity counting
1	without blacklash compensation with incremental error compensation with automatic quantity counting
2	with backlash compensation without incremental error compensation with automatic quantity counting
3	without backlash compensation without incremental error compensation with automatic quantity counting
4	with backlash compensation with incremental error compensation without automatic quantity counting
5	without backlash compensation with incremental error compensation without automatic quantity counting
6	with backlash compensation without incremental error compensation without automatic quantity counting
7	without backlash compensation without incremental error compensation without automatic quantity counting

Example:
It is required to set: »sequence programme operation with backlash compensation without incremental error compensation«.

1. Unlock Registers with security code
2. Press Ⓡ
3. Press Ⓑ
4. Press Ⓒ
5. Press Ⓞ (for programme operation)
6. Press Ⓒ (see table 2)
7. Press Ⓔ
8. Lock registers

Adjustment of the Multi Edge Counter



Encoder pulse multiplication

It is possible to operate with three pulse resolutions from a 2 channel encoder. The unit can be selected to give multiplication factors of x1, x2 or x4.

To select, proceed as follows:

1. Remove back of unit.
2. Remove top PC board (plug connected).
3. green jumpers are exposed (see plan)

The relevant jumpers are:

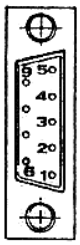
J 1	x 1
J 6	x 2
J 7	x 4

NB.: Only one of these jumpers must be made. The other two must be left open.

ST 1/ST 2 Encoder connection	Channel A Channel B 90° ±10%
ST 9 Power supply	9 v 900 mA dc 24 v 600 mA dc (from external source)
ST 3 Control and selection	PIN(1) npn PIN(23) PIN(1) pnp PIN(11)
ST 5 Control output	+24V 23 npn RL z.B.PIN 1 0V pnp 0V RL z.B:PIN1
ST 8 External position input (option)	1 2 3 5 4 6 CODE 0101 0100 0011 0010 0001 0000 DECADE 6 5 4 3 2 1

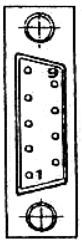
Connetions

ST 1 — Encoder connection



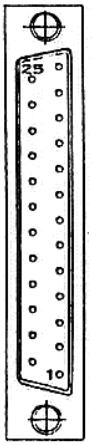
PIN 1 zero OV
PIN 2 power + 24 VDC
PIN 3 input A
PIN 4 input B
PIN 5 screen

ST 9 — Power supply unit



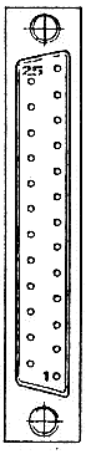
PIN 1 power input + 24 VDC
PIN 2 zero for 24 V OV
PIN 3 screen
PIN 4 power input + 9 VDC
PIN 5 zero for 9 V OV

ST 3 — Input signals/selection

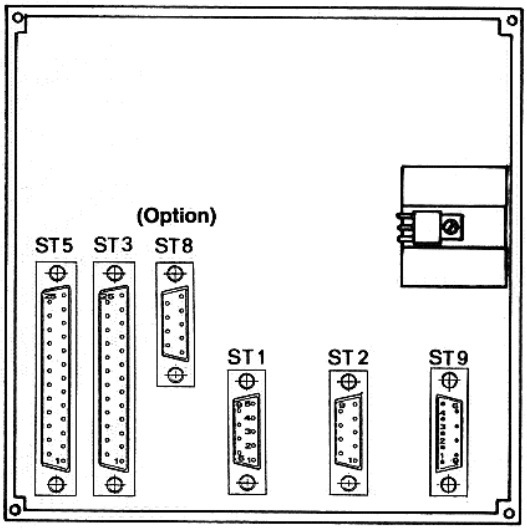


PIN 1 system reset
PIN 4 start
PIN 5 incremental operation in single mode
PIN 6 incremental positive in single mode
(Pin 5 must also be selected)
PIN 8 datum
PIN 9 screen
PIN 10 screen
PIN 11 internal + 24 v supply for input signals
PIN 14 stop
PIN 16 quantity decrement
PIN 18 auto retract
PIN 20 free run
PIN 23 zero voltage

ST 5 — Output signals



PIN 1 creep speed
PIN 2 slow speed
PIN 3 fast speed
PIN 4 reverse
PIN 9 screen
PIN 10 screen
PIN 11 zero voltage
PIN 14 position reached
PIN 16 quantity reached
PIN 18 auxiliary 1
PIN 19 auxiliary 2
PIN 20 auxiliary 3
PIN 21 auxiliary 4
PIN 23



To activate signals, pull input down to zero volts. By changing internal optocoupler, positive logic is available ie pull input up to 24 v dc.

General hints

Inputs
It is necessary always to activate one input at a time. The inputs must be pulsed with minimum time of 0.75 sec.

»Datum« input: An external switch is required.

Outputs
To set the drive control outputs one must ensure that the »FREE TO RUN« input is permanently activated. A sequence of control can be established with relays, PLC or PC.

Technical data

Power supply requirement	+ 24 v / 600 mA and + 9 v / 900 mA galvanically isolated. Use Elgo NG 13.0. If using any other, make sure it is compatible.
Encoder power supply	24 v DC 130 mA
Input signals:	Negative logic: connect to zero volts. (Option: positive logic: connect to + 24 volts:) Input 0.75 Sec min. 10 mA/pin max.
Output signals:	Open collector PNP (NPN on request). Output current 30 mA/output. Freewheel diodes integrated.
Memory:	Battery backed for about 5 years.
Indicators:	Red LED 8 mm.
Connectors:	D type.
Hardware:	Elgo counter chip plus 8 bit CMOS microprocessor with 32kbyte EPROM and 16 kbyte RAM.
System accuracy:	+ / – 1 bit.
Positioning speed:	10 KHZ (60 m/min with 0.1 mm resolution).
Enclosure:	Black polycarbonate, for fitting into control panel. Can be mounted in any attitude.
Dimensions:	144 mm H, 144 mm W, 54 mm D. Cut out 138 x 138 mm.

Hints for integration into electrical panels

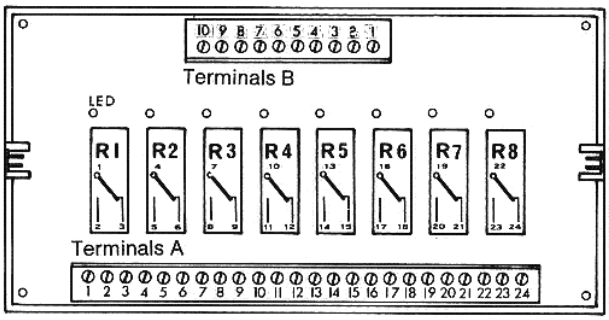
The 87 P position controller is designed and constructed for use in arduous industrial applications and as immune to electrical interference as possible.
Care should however be taken when fitting electronic equipment into machinery.

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 + 100 ohms across ac coils.

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

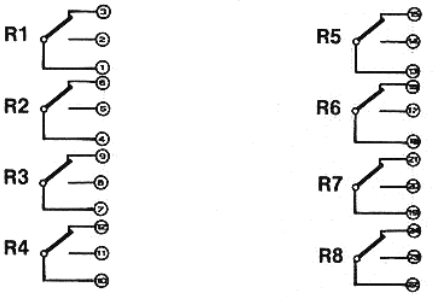
Options and Accessories

Option relay module RP8 (RK 984.0)



Compatibility to 85 P
A special adaptor relay board type RK 985.0 is available. This plugs into the back of the 87 P and has connectors directly compatible to the 85 P plugs.

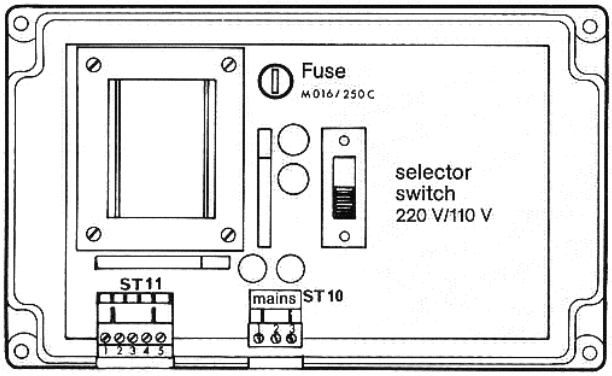
Terminal arrangement A (output contacts)

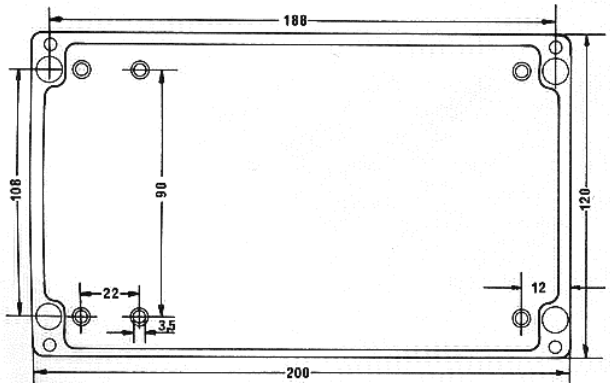


Terminal arrangement B (coils)

Terminal	1	R8	Connect to Pin 1 of ST5 = creep
Terminal	2	R7	Connect to Pin 2 of ST5 = slow
Terminal	3	R6	Connect to Pin 3 of St5 = fast
Terminal	4	R5	Connect to Pin 4 of ST5 = reserve
Terminal	5	R4	These relays may be used for:
Terminal	6	R3	Position reached
Terminal	7	R2	Quantity reached
Terminal	8	R1	Auxiliary functions
Terminal	9	NC	
Terminal	10	Zero voltage common for all coils	

Standard power supply NG 13.0





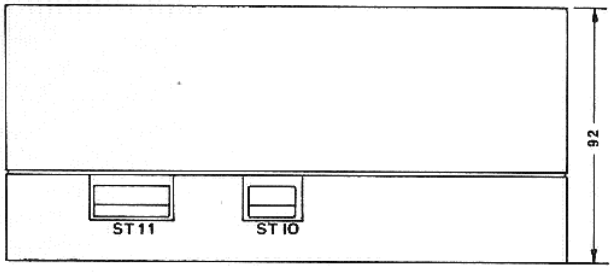
It is best to mount the power supply close to the position controller, to avoid volt drop in long cables.
Use screened cable for dc connections.

Connect ST 11 on PSU to ST 5 on controller:

Terminal 1	OV	Pin 5
Terminal 2	+ 9 V	Pin 4
Terminal 3		Pin 3
Terminal 4	OV	Pin 2
Terminal 5	+ 24 V	Pin 1

ST 10 in mains input

Terminal 1	N
Terminal 2	Earth
Terminal 3	220 V or 110 V
	+/– 5 % 50 Hz



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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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.!

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